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**Caffeine intake, influences and experiences: the development
of CaffCo - a New Zealand caffeine consumption habits
questionnaire.**

A thesis presented in partial fulfilment of the requirements for the degree of

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in

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Karli Rowe

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Abstract

Background: Caffeine is one of the most widely used psychoactive substances worldwide, and can be found in a wide variety of food and beverages. It is regularly used for mental and physical stimulation; however its use has also been linked to adverse effects such as uncontrollable tremors, headaches, hospitalisation and even death. The caffeine intake of New Zealanders is unknown. There is currently no comprehensive tool available to assess caffeine intake patterns, influences, and adverse experiences in the New Zealand adult population.

Aim: To develop a questionnaire that accurately evaluates caffeine intake patterns, influences on consumption, and positive and negative experiences across a range of caffeinated products in New Zealand adults aged 15 years and over.

Method: The caffeine consumption habits questionnaire (CaffCo) was developed in two stages. Firstly, seven focus groups (n=43) were conducted across a range of demographic groups to explore factors influencing the consumption of tea, coffee, chocolate, kola drinks, energy drinks, caffeinated alcoholic premixed beverage (RTDs), caffeinated sports supplements, and caffeine tablets. Focus groups were audio recorded and then transcribed. NVivo software was used for qualitative analysis of the transcripts. Sections of text were coded by inductive analysis into 4 key themes, each with their own set of theme descriptors. Findings from the thematic analysis were then used to develop a draft of the online CaffCo using Qualtrics online survey software. Online pilot testing of CaffCo was then undertaken among focus group participants, academic staff and community members (n=227). The pilot test participants provided feedback on the comprehensibility and ease of use of the questionnaire.

Results: From thematic analysis of the focus group transcripts four main themes which influenced caffeinated product intake were identified. These were social drivers, environmental opportunity, functional expectations and individual experiences. The questionnaire items were derived from associations of products with theme descriptors.

Conclusion: The caffeine consumption habits questionnaire CaffCo was successfully developed as a result of this study. CaffCo has the potential to be used in New Zealand-wide studies of adults aged 15 years and over, or adapted for use in different population groups / countries to identify potentially harmful patterns of caffeine consumption across a range of caffeinated products. Pilot testing of CaffCo demonstrated an accurate reflection of influences of caffeinated product consumption, and identified three additional influences on consumption. Pilot testing of the resultant questionnaire enabled demonstration of content validity, construct validity and inter-rater reliability. Further testing of the CaffCo to determine test-retest reliability is warranted.

Key words: focus groups, survey, stimulant, patterns

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Table of Contents

Abstract	i
Acknowledgements	iii
List of Tables	xi
List of Figures	xii
List of Abbreviations	xiii
List of Appendices	xiv
Chapter One	1
1. Introduction	1
1.1 Study justification	3
1.2 Statement of the research problem	7
1.3 Purpose of the research study	8
1.3.1 Aim	8
1.3.2 Objectives	8
1.4 Structure of the thesis	9
1.5 Researchers' contributions	10
Chapter Two	11
2. Literature Review	11
2.1 A short history of caffeine	11
2.2 Adenosine and adenosine receptors	14
2.3 Caffeine structure and metabolism	16
2.4 Central mechanisms	17
2.4.1 Central physiological actions	18
2.4.2 Sleep and fatigue	19
2.4.3 Cognition	20

2.4.4	Seizures and anxiety.....	21
2.4.5	Neuroprotection	21
2.5	Peripheral mechanisms	22
2.5.1	Physical performance.....	22
2.5.2	Cardiovascular implications	24
2.5.3	Effects on metabolism	24
2.5.4	Organ system effects	26
2.6	Differential responses to caffeine	26
2.6.1	Genetics.....	27
2.6.2	Dose adaptation.....	28
2.6.3	Dependency, withdrawal and intoxication	29
2.7	Sources of caffeine	32
2.8	Consumption levels and patterns	37
2.9	Legislation and regulations	38
2.10	Recommendations for caffeine intake	42
2.11	Factors influencing caffeine consumption	43
2.11.1	Functional qualities	43
2.11.2	Social and environmental influences	44
2.11.3	Mixing caffeine with alcohol	45
2.12	Existing caffeine questionnaires.....	47
2.13	Summary of the literature	48
Chapter Three	50
3.	Methods.....	50
3.1	Introduction.....	50
3.1.1	Ethical approval.....	50
3.2	Focus group methodology.....	51

3.2.1	Participants	51
3.2.2	Participant recruitment and pre-screening	53
3.2.3	Informed consent and confidentiality	54
3.2.4	Location.....	54
3.2.5	Focus group procedures.....	55
3.2.5.1	Role of the moderator	56
3.2.5.2	Questions and key topics	57
3.3	Data analysis.....	58
3.3.1	Thematic analysis	59
3.4	Questionnaire development methodology.....	61
3.4.1	Questionnaire theory and structure	62
3.4.2	Questionnaire items.....	65
3.4.3	Questionnaire pilot testing and refinement	74
Chapter Four	76
4.	Results.....	76
4.1	Part A: Qualitative focus group findings	76
4.1.1	Participants	76
4.1.2	Outline of findings.....	79
4.1.3	Theme One - Social Drivers	84
4.1.3.1	Socio-cultural background	84
4.1.3.2	Home hospitality.....	86
4.1.3.3	Socialising ‘out and about’	87
4.1.3.4	Socialising in the presence of alcohol.....	88
4.1.3.4.1	Caffeinated alcoholic RTDs.....	88
4.1.3.4.2	Non-alcoholic products	91
4.1.3.5	Peer pressure and social acceptability	92

4.1.4	Theme Two - Environmental Opportunity	94
4.1.4.1	Accessibility.....	94
4.1.4.2	Advertising	95
4.1.4.3	Food and smoking associations	96
4.1.4.4	Habit and personal rituals.....	97
4.1.4.5	Time of day	98
4.1.5	Theme Three - Functional Expectations	99
4.1.5.1	Waking up and staying up.....	99
4.1.5.2	Mental stimulation	100
4.1.5.3	Physical Stimulation.....	100
4.1.5.4	Emotional well being	102
4.1.5.6	Hedonic properties	103
4.1.5.7	Product substitution	104
4.1.5.8	Placebo Effect	104
4.1.6	Theme Four - Individual Experiences.....	106
4.1.6.1	Tolerance	106
4.1.6.2	Addiction and Dependence	107
4.1.6.3	Withdrawal	108
4.1.6.4	Intoxication	108
4.1.6.5	Additional Negative Effects	109
4.1.6.6	Caffeine Perceptions.....	110
4.1.6.7	Caffeine content perceptions	112
4.1.7	Summary of focus group findings	114
4.2	Part B: Questionnaire pilot testing.....	118
4.2.1	Participants	118
4.2.2	Questionnaire modification	118

Chapter Five	120
5. Discussion	120
5.1 Characteristics of focus group and pilot test participants	120
5.2 Overview of themes influencing caffeine consumption	121
5.2.1 Social drivers	121
5.2.2 Environmental Opportunity	124
5.2.3 Functional Expectations	125
5.2.4 Individual Experiences	126
5.3 Caffeine questionnaire (CaffCo)	128
5.4 Questionnaire validation and reliability	131
Chapter Six	134
6 Conclusion.....	134
6.1 Research problem and aims of the research study.....	134
6.2 Summary of results/ main findings	134
6.3 Strengths	135
6.4 Limitations	136
6.5 Use of the findings.....	137
6.6 Recommendations.....	138
References.....	139
Appendices.....	153

List of Tables

Table 1.1:	Tools and questionnaires available to measure caffeine.....	5
Table 1.2:	New Zealand studies that have included caffeinated products.....	7
Table 1.3:	Researchers' contributions to study.....	10
Table 2.1:	Caffeine content in New Zealand food and beverages.....	34
Table 2.2:	Caffeine limits for New Zealand products.....	37
Table 3.1:	Focus group spread.....	54
Table 3.2:	Example of transcription thematic coding.....	60
Table 3.3:	Parent nodes and their associations by product.....	66
Table 4.1:	Focus group participant characteristics for total sample and by focus groups.....	77
Table 4.2:	Caffeinated product variants identified during focus groups.....	79
Table 4.3:	Caffeinated products and associated product descriptor themes....	81
Table 4.4:	Parent nodes and associations by product.....	115

List of Figures

Figure 2.1:	Structure of caffeine and adenosine.....	16
Figure 3.1:	Progression of identification of key themes through transcription analysis and grouping of nodes.....	61
Figure 4.1:	Key themes and their theme descriptors.....	83

List of Abbreviations

AMP	Adenosine monophosphate
AR	Adenosine receptor
ATP	Adenosine triphosphate
CaffCo	Caffeine consumption habits questionnaire
CaffEQ	Caffeine expectancy questionnaire
cAMP	Cyclic AMP
CNS	Central nervous system
DSM-5	Diagnostic and statistical manual of mental disorders
EFSA	European Food Safety Authority
FFQ	Food frequency questionnaire
FSANZ	Food Standards Australia New Zealand
IDC-10	International Classification of Diseases
MELAA	Middle Eastern, Latin American and African
NZ	New Zealand
PNS	Peripheral nervous system
RTD	Ready to drink (alcoholic premixed drink)
UK	United Kingdom
USA	United States of America
WHO	World Health Organisation

List of Appendices

Appendix A:	MUHEC 15_006 approval conformation letter.....	156
Appendix B:	Focus group poster advertisement.....	157
Appendix C:	Focus group participant information sheet.....	158
Appendix D:	Focus group participant screening questionnaire.....	160
Appendix E:	Focus group parental consent form.....	161
Appendix F:	Focus group participant consent form.....	162
Appendix G:	Focus group moderator guide.....	163
Appendix H:	Confirmation of MTA voucher form.....	166
Appendix I:	Focus group resource.....	167
Appendix J:	Paper copy of final questionnaire.....	168
Appendix K:	Questionnaire pilot test information sheet.....	217
Appendix L:	Questionnaire pilot test parental consent form.....	219
Appendix M:	Questionnaire pilot test participant assent form.....	220

Chapter One

1. Introduction

Caffeine is one of the most widely used psychoactive drug in the world and occurs in many commonly consumed foods and beverages (coffee, tea, chocolate, kola drinks, energy drinks, caffeinated premixed alcoholic beverages (RTDs – with either a kola or energy drink base, or alternatively with added guarana or caffeine)), as well as some sports supplements, medicines and in tablet form (Thomson & Jones, 2013; The New Zealand Institute for Plant and Food Research Limited & New Zealand Ministry of Health, 2015). Caffeine is regularly used by individuals to combat fatigue and to provide both physical and mental energy (Lorist & Tops, 2003; Puckeridge, Fulcher, Phillips, & Robinson, 2011). Its use and over-use however, has been linked to adverse effects such as tremors, heart palpitations, higher levels of risk taking, hospitalisation and in some extreme cases, death (Ribeiro & Sebastião, 2010; Thelander *et al.*, 2010).

Caffeine intake levels of 400 mg·day⁻¹ (equivalent to around 5 cups of instant coffee or two double shot espresso coffees) have been listed as safe for the average person (excluding pregnant women and children) (US Food and Drug Administration Consumer Health Information, 2013; Cheng, Hu, Lu, Huang, & Gu, 2014; European Food Safety Authority, 2015). While 400 mg of caffeine is the accepted safe daily consumption limit, genetic variation between individuals also plays a part in consumption patterns, how caffeine is metabolised in the body, and the resulting physiological and psychological effects (Lopez, Miller, Greenblatt, Kaplan, & Shader, 1989; Luciano, Kirk, Heath, & Martin, 2005).

There are a number of factors influencing the caffeine content of caffeinated products. Organically occurring caffeine content will vary between batches of tea leaves (*Camellia sinensis*), coffee beans (*Coffea arabica* and *Coffea canephora*), cocoa (*Theobroma cacao*), yerba mate (*Ilex paraguariensis*) and kola (*Cola nitida*) due to

differing caffeine content from plant to plant and with differing environmental conditions (Desbrow, Henry, & Scheelings, 2012). Chemically manufactured caffeine added to products is more easily able to be monitored and controlled, which has aided in legislation placing limits on the amount of caffeine added to products. Caffeine in kola-type beverages and energy drinks is regulated at a maximum of $145 \text{ mg}\cdot\text{L}^{-1}$ for kola-type beverages and between $145\text{-}320 \text{ mg}\cdot\text{L}^{-1}$ caffeine for 'formulated caffeinated beverages'/energy drinks (Food Standards Australia New Zealand, 2013). Levels are not regulated in products such as sports supplements and caffeine tablets however, as they are classed as dietary supplements, which do not have associated caffeine content regulations (New Zealand Ministry of Health, 2010).

Caffeine's actions within the body and their resultant effects have had extensive coverage in the scientific literature. It is caffeine's structural similarity to the sleep-causing nucleoside adenosine (created through breakdown of adenosine monophosphate (AMP) and adenosine triphosphate (ATP), and accumulating with increased time awake) and blocking of adenosine receptors that gives caffeine its mental and physical energising properties (Lorist & Tops, 2003; Ribeiro & Sebastião, 2010). Other effects of caffeine consumption include increased cognition (Alsene, Deckert, Sand, & de Wit, 2003), neuroprotective effects (Gray, 1998), increased efficacy of pain relief medication (Curhan, Willett, Speizer, & Stampfer, 1998) increased anxiety and risk of seizures (Lorist & Tops, 2003; Ribeiro & Sebastião, 2010) and a risk of increased blood pressure and tachycardia (Noordzij *et al.*, 2005).

For some individuals, the body builds a physiological tolerance to caffeine and so over time higher intake levels are needed to achieve the same stimulating effects (Hughes, Oliveto, Liguori, Carpenter, & Howard 1998; Pelchovitz & Goldberger, 2011). This tolerance often comes with withdrawals when habitual caffeine consumption is abruptly stopped, symptoms of which range from headaches to uncontrollable tremors, insomnia and mood swings (Ferre, 2008; Hughes *et al.*, 1998). Caffeine withdrawal is classified by the American Psychiatric Association as a substance-induced disorder (as with caffeine intoxication), however caffeine dependence is not included in this list (American Psychiatric Association, 2013).

It is estimated that at least 73% of New Zealanders consume some form of caffeine each day, with average intakes estimated to be around 3.6 mg·kg⁻¹ body weight per day (Thomson & Schiess, 2010), which is similar to that in the United Kingdom, higher than the United States of America but lower than that of Europe and South America (Barone & Roberts, 1996).

Caffeine has been well studied in the scientific literature, but the emphasis has been more on its physiological functions, pharmacokinetic and pharmacodynamic role within the body, and less on the influences and drivers for consumption of the different caffeinated products on the market, especially in New Zealand. Foods and beverages are not only consumed for sustenance and energy, but also as a result of social and environmental influences (Baranowski, Cullen, & Baranowski, 1999); and so to gain an understanding of caffeine intake patterns, these social and environmental influences on consumption also need to be examined.

1.1 Study justification

The aim of the present research was to develop a questionnaire to investigate patterns and influences behind caffeine consumption across a broad range of caffeinated products.

Various tools (Table 1.1) have been developed to assess caffeine intake and subsequently been used in multiple studies, yet none of these align with the aim of the present study sufficiently well to use. Some examples include Landrum's Caffeine Consumption Questionnaire (Landrum, 1992), the Supplemental Beverages FFQ (Fred Hutchinson Cancer Research Centre, 2004) and 24 hour dietary recalls (Schliep *et al.*, 2013). However, these are centred around caffeine intake quantities rather than influences on consumption, and do not include all dietary sources of caffeine as a result of new products being introduced to the market in recent years. Questionnaires looking at caffeine intake that do address influences on consumption include the one developed by McIlvain (2008) which investigated beliefs, influences, perceived benefits

and adverse effects of caffeine consumption; however the questions are specific to college students in the United States of America, and products included are limited to tea, coffee, soft drinks and energy drinks and structurally this questionnaire did not conform to the best practices for questionnaire construction. Heinz, Kassel, and Smith (2009) and Huntley and Juliano (2012) have both developed caffeine expectancy questionnaires (CEQ and CaffEQ respectively). While the CEQ by Heinz *et al.* (2009) deals with consumption levels, expectancies and experiences, the CaffEQ (Huntley & Juliano, 2012) also addresses caffeine dependency, anxiety rating, sleep quality and alcohol intake. A questionnaire specifically addressing caffeine withdrawal symptoms in relation to consumption of different caffeinated products has also been developed by Juliano, Huntley, Harrell, and Westerman (2012).

Table 1.1: Tools and questionnaires available to measure caffeine

Reference	Tool	Measure	Products assessed
Landrum (1992)	Landrum's Caffeine Consumption Questionnaire (CCQ)	Caffeine intake levels and time of day of intake	Coffee, tea, chocolate, soft drinks, over-the-counter drugs
Fred Hutchinson Cancer Research Centre (2004)	Supplemental beverages FFQ	Intake frequency of caffeinated beverages	Coffee, tea, kola drinks, energy drinks
McIlvain (2008)	Caffeine questionnaire	Caffeine consumption levels, beliefs, perceived benefits, adverse effects, and influences on consumption	Tea, coffee, soft drinks, energy drinks
Heinz et al. (2009)	Caffeine expectancy questionnaire (CEQ)	Caffeine intake frequency , expectancies and experiences of caffeine consumption	Coffee, tea, soda and energy drinks
Huntley and Juliano (2012)	Caffeine expectancy questionnaire (CaffEQ)	Caffeine exposure, dependency, anxiety trait, sleep quality and alcohol intake	Coffee, tea, caffeinated soft drinks, energy drinks, chocolate, foods, and caffeine containing medications/dietary supplements
Juliano et al. (2012)	Caffeine withdrawal symptom questionnaire (CWSQ)	Caffeine withdrawal symptoms (fatigue, decreased alertness, mood changes, low motivation, nausea, flu-like feelings, headache)	Coffee, tea, caffeinated soft drinks, energy drinks, chocolate, foods, and caffeine containing medications/dietary supplements
American Psychiatric Association (2013)	DSM-IV criteria for dependence, abuse, intoxication and withdrawal in relation to caffeine	Caffeine dependence, abuse, intoxication and withdrawal	-
Schliep et al. (2013)	24 hour dietary recall	Caffeine intake levels	Coffee, tea, soft drinks, chocolate

Caffeine questionnaires employed in studies overseas, while not incorporating the entire aim of the present study, were able to partially incorporate aspects of the aim of the present study. Studies in New Zealand involving questionnaires which cover caffeine intake of the public are even more limited (Table 1.2). The relationships between caffeine, alcohol, cigarettes and risk taking was examined by Hughes (1993) in New Zealand University students; since then, data on caffeine intakes in New Zealand is limited to measures of soft drink and energy drink consumption from the New Zealand Adult Nutrition Survey (University of Otago and Ministry of Health, 2011), intake frequency of tea/coffee and sugar sweetened beverages of adolescents aged 14-18 years old in the New Zealand Adolescent Food Frequency Questionnaire (Wong, Parnell, Black, & Skidmore, 2012) and soft drink intake investigated in 'the diabetes, health and heart survey' (Sundborn, Gentles, & Metcalf, 2014). Data on caffeine intakes, patterns and influences of consumption as well as adverse effects experienced is lacking for the New Zealand population, as is an appropriate questionnaire.

Table 1.2: New Zealand studies that have included caffeinated products

Reference	Tool	Measure
Hughes (1993)	Sensation seeking scale (Zuckerman, Kolin, Price, & Zoob, 1964)	Relationships between caffeine, alcohol, cigarettes and risk taking in new Zealand university students
Univerity of Otago and Ministry of Health (2011)	The New Zealand Adult Nutrition Survey	Nutritional intake of New Zealand adults (aged 15 and above) – included measures of soft drink and energy drink consumption
Wong <i>et al.</i> (2012)	New Zealand adolescent FFQ (NZAFFQ)	Intake frequency of various food groups (including tea/coffee, sugar sweetened beverages) in New Zealand adolescents aged 14 – 18 year olds
Sundborn <i>et al.</i> (2014)	The diabetes, health and heart survey 2002/2003	Carbonated beverage consumption in New Zealand adults

1.2 Statement of the research problem

Caffeine is widely consumed in a variety of forms, and while for the majority of people consumption does not result in any negative effects some individuals are unable to tolerate caffeine. Caffeine consumption can lead to adverse effects in some individuals such as uncontrollable tremors, headaches, heart palpitations, and in extreme cases hospitalisation and death. These symptoms (uncontrollable tremors, headaches, hospitalisation and fatalities etc) may be indicative of overdoses of caffeine (Hughes *et al.*, 1998; American Psychiatric Association, 2013). While extensive research has been carried out on the physiological and psychological effects of caffeine, there is less data

on the factors influencing caffeine consumption, especially in the New Zealand population.

There is need for a New Zealand specific tool that is able to gauge factors influencing caffeine consumption (across a broad range of caffeinated products) in conjunction with patterns of intake and experiences, as none currently exists. Once developed, research carried out using this tool will be able to determine patterns and drivers of consumption. Patterns and influences for consumption of differing caffeinated products will then be able to be linked to negative experiences of consumption, and indicators of caffeine dependence, withdrawal and intoxication.

1.3 Purpose of the research study

1.3.1 Aim

To gain a qualitative insight into New Zealand caffeine use and to develop a questionnaire that accurately evaluates caffeine intake patterns, influences on consumption, and both positive and negative experiences across a range of caffeinated products in New Zealand adults aged 15 years and over.

1.3.2 Objectives

- To conduct qualitative focus groups to determine sources of caffeine consumption, factors influencing consumption, and both positive and negative caffeine related experiences in New Zealand adults 15 years and over.
- To develop a quantitative questionnaire to assess (in New Zealand adults aged 15 years and over):
 - Caffeinated product intake patterns

- Factors influencing caffeinated product consumption including expected outcomes
- Negative experiences upon consumption of caffeinated products
- To pilot test and refine the developed questionnaire.

1.4 Structure of the thesis

A review of the literature regarding the history of caffeine, its physiological role, content in food and beverages as well as factors influencing consumption and existing caffeine questionnaires will be given in Chapter Two. Chapter Three will outline the methods used to recruit for and conduct the qualitative focus groups, followed by the methods used to develop the quantitative CaffCo. Following this, Chapter Four will outline the results of the thematic analysis of the focus group transcripts, and pilot testing of the developed CaffCo. These results will be discussed in Chapter five, and finally in Chapter six the research project will be summarised, and the strengths and limitations of the study given, along with a conclusion and indications for future research outlined.

1.5 Researchers' contributions

Table 1.3: Researchers' contributions to study

Author	Contribution to thesis study
Karli Rowe	Research proposal, ethics application, literature review, subject recruitment, focus group conduction, data entry and analysis, interpretation of results, questionnaire development, pilot testing data collection and analysis, thesis manuscript preparation.
Dr Kay Rutherford-Marwick	Supervised the design and conduct of the research, ethics application and all chapters of the thesis including editing and manuscript preparation.
Dr Ajmol Ali	Supervised the design and conduct of the research, ethics application and all chapters of the thesis including editing and manuscript preparation.
Dr Carol Wham	Supervised the design and conduct of the research, ethics application and all chapters of the thesis including editing and manuscript preparation.

Chapter Two

2. Literature Review

Caffeine has a long history of use, as well as extensive investigations to determine the mechanisms behind its physical and cognitive effects. This chapter outlines how caffeine has come to play a part in the day to day routine of many people, as well as the physiological mechanisms behind caffeine's stimulant effects and how this may affect consumption patterns. How caffeine fosters dependence, withdrawals and intoxication is explored. Current caffeine consumption patterns, sources, legislation as well as recommendations for safe caffeine intake will also be covered. Finally, currently available caffeine questionnaires and their applications both overseas and in New Zealand will be outlined.

2.1 A short history of caffeine

Caffeine is the world's most widely used psychoactive drug, and it can be found naturally occurring in the seeds, fruits and leaves of more than 60 species of plants including coffee (*Coffea canephora* and *Coffea arabica*), tea (*Camellia sinensis*), cocoa (*Theobroma cacao*), yerba mate (*Ilex paraguariensis*) and kola (*Cola nitida*) as well as being produced artificially (Gray, 1998; Fredholm, 2011). Nowadays, consumption of tea, coffee and other caffeine containing products is part of the daily ritual for a large proportion of the world's population (Grigg, 2002). However, caffeine consumption has been taking place through organically occurring plant sources for centuries, including both tea and coffee which have long been used for medicinal purposes (Burnett, 2001; Pelchovitz & Goldberger, 2011). Before development of trade routes, consumption of tea and coffee was limited to the localities where the plants grew; its first use was in early Eastern civilisations (tea was likely first domesticated in south

China two thousand years ago (Grigg, 2002)) and South America before its introduction to the West in the 17th century (Burnett, 2001; Fredholm, 2011).

Caffeine and its associated foods and beverages hold a significant place in many cultures worldwide (Pelchovitz & Goldberger, 2011), however the exact origin of both tea and coffee consumption is steeped in mythology. Stories range from coffee beans being delivered by the archangel Gabriel, to the tea plant sprouting from the severed eyelids of a Buddhist monk (Burnett, 2001; Fredholm, 2011). Early accounts of caffeine consumption were of coffee beans being consumed whole or ground and mixed with fat to form an energising snack by native South Americans (Spanish Conquistadors first recorded use in the 16th century, however use had long been occurring before this (Spiller, 1998)), and tea leaves being steeped and used to give energy to the sickly in Asia (Fredholm, 2011; Pelchovitz & Goldberger, 2011). The cultivation of coffee beans for commercial use was first documented during the 15th century in Ethiopia and Yemen, with the use of coffee becoming more widespread with the introduction and popularity of upper-class Arab coffee houses throughout the middle east (Schivelbusch, 1993; Pelchovitz & Goldberger, 2011). The first recorded reference of tea use was in China in 750AD, and different forms of the drink developed in the following millennia (Pelchovitz & Goldberger, 2011). The introduction and popular use of coffee and tea (considered a luxury) throughout Europe came later, arriving in the 17th century (Gray, 1998). The availability of caffeine in the form of coffee, chocolate and tea increased over the following centuries, with increased production and wider distribution of both tea leaves and coffee beans increasing availability (Schivelbusch, 1993; Grigg, 2002; Pelchovitz & Goldberger, 2011). The development of instant coffee powder and inclusion of caffeine in an increasing range of highly available products (e.g. kola-type¹ drinks, energy drinks, caffeinated alcoholic premixed beverages (RTDs), some sports supplements, caffeine tablets and various medications) during the 20th century also played a part in the increasing availability of caffeine to the common consumer (Wells *et al.*, 2013).

¹ 'Kola' will be used for kola-flavoured drinks in place of 'Cola' to differentiate from the brand name Coca-Cola.

While caffeine consumption for the East and West was in the form of tea and coffee, those living in South America had begun to use caffeine-containing plants of their own such as cocoa (*Theobroma cacao*) and yerba maté (*Ilex paraguariensis*). Use and cultivation of the cocoa tree has been recorded as far back as the time of the Olmec people (1500-400BC), and its use was subsequently adopted by the Mayans, Toltecs and Aztecs before passing to the invading Spanish conquistadors (Fredholm, 2011). Cocoa was originally prepared as an invigorating drink, and was not adapted into food as chocolate until its arrival into Europe. In South America, the Spanish Conquistadors were a key reason for the commercialisation and spread of the drink Maté through South America after they observed its use by the people living along the Paraguay-Panama river system and its economic potential (Fredholm, 2011; Pelchovitz & Goldberger, 2011). The widespread use of Maté has not, however, ever spread much further than South America (Fredholm, 2011).

Coffee, tea and other forms of caffeine have been used for their stimulating properties for centuries, and it was in 1803 that Samuel C. Hahnemann, (creator of the practice of homeopathic medicine), documented both the stimulating effects following coffee consumption, as well as lethargy once the initial energy decreased (Weinberg & Bealer, 2001; Pelchovitz & Goldberger, 2011). Caffeine was subsequently chemically isolated in 1819 by the German chemist Friedrich Ferdinand Runge, at the request of Johann Wolf-Gang von Goethe, a German writer and statesman who had gifted Runge with a case of coffee beans (Ribeiro & Sebastião, 2010). Its chemical structure however, remained a mystery up until the late 19th century when, in 1895, the German chemist Hermann Fischer determined the structure of caffeine along with that of theobromine, during his work investigating the active properties of tea, coffee and cocoa (Ribeiro & Sebastião, 2010; Wells *et al.*, 2013). In recent years there has been an increased interest in caffeine, its physiological effects and potential therapeutic uses; for example Smith, Brockman, Flynn, Maben, and Thomas (1993) reported the benefits of coffee in asthma treatment, and controversy surrounded the 2004 removal of caffeine from the World Anti-Doping Agencies list of prohibited substances in competition (Salleh, 2008).

In the past century, caffeine has been found to have additional uses beyond combating

fatigue and providing stimulation. In 1971, Dr Erikson, a Danish physician, noticed unintentional weight loss in patients who were being treated for asthma with a combination of caffeine, ephedrine and phenobarbital. While the inclusion of phenobarbital was discontinued due to causing skin rashes, the combination of caffeine and ephedrine went on to become the most widely sold prescription weight loss medication in Denmark, and continues to be so (Greenway, 2001). Weight loss may not be accredited to the caffeine however, as ephedrine is a common constituent of weight loss supplements (Pittler & Ernst, 2004). Advancements in technology mean that caffeine can not only be removed from products (e.g. decaffeinated coffee), but also artificially added to others (Gray, 1998). Caffeine has been incorporated into aspirin, antidepressants, antihistamine and flu medications, as it combats the drowsiness often brought on as a result of these products (Hughes *et al.*, 1998). In addition to medications, caffeine is now added to energy drinks, sports supplements, and in some countries even chewing gum and crisps are becoming vectors for its use (Branum, Rossen, & Schoendorf, 2014). With increasing availability of caffeinated products, caffeine has now been identified as a potential concern for public health (Reyner & Horne, 1997).

2.2 Adenosine and adenosine receptors

Most of the effects seen in humans as a result of caffeine consumption come about from the binding of caffeine to adenosine receptors (ARs), and the blocking of adenosine effects on the body (Ribeiro & Sebastião, 2010). Therefore, to understand the mechanisms by which caffeine acts in the body, it is necessary to have an understanding of both adenosine and adenosine receptors, and their physiological roles.

Adenosine is a purine nucleoside resulting from the breakdown of adenine nucleotides, e.g. ATP and AMP and is abundant in the human body. Adenosine plays a role in maintaining brain homeostasis and the inhibition of the release of various neurotransmitters, including glutamate (the main excitatory neurotransmitter),

dopamine (involved in motor stimulation, emotion/mood and some hormone regulation), and acetylcholine (associated with learning, memory and mood) (Hughes *et al.*, 1998; Ribeiro & Sebastião, 2010) and so has roles in neurotransmission, energy production and sleep-cycle regulation.

Adenosine is also proposed to be a somnogen, otherwise known as a sleep-promoting agent (Lorist & Tops, 2003; Elmenhorst *et al.*, 2007). During waking hours, somnogens play a role in promoting the homeostatic drive to sleep, by accumulating in the basal forebrain as the day progresses and ATP breakdown products build up. This accumulation of adenosine results in a corresponding increase in adenosine binding to ARs, resulting in a gradual inhibition of neurotransmitters and cell activity with any increased time awake (Lorist & Tops, 2003; Puckeridge *et al.*, 2011). This, along with inherent circadian rhythms, produces fatigue and the drive to sleep (Puckeridge *et al.*, 2011).

The extent of the effects of adenosine depends greatly on the amount and availability of adenosine receptors (Hughes *et al.*, 1998). There are four subtypes of adenosine receptors; A1, A2a, A2b and A3; of these, A1 and A2a are expressed most commonly in the brain, and with the highest affinity for caffeine. Due to slightly differing distribution patterns of these two receptors in the brain, while both are involved, A1 is the adenosine receptor most associated with motor-activation (Ferre, 2008).

The actions of adenosine also inhibit long-term 'synaptic plasticity phenomena', which includes long-term potentiation, long-term depression and depotentiation in the hippocampus of the brain (Levy & Zylber-Katz, 1983; Pray, Pankevich, & Yaktine, 2014). This means that the nervous systems' ability to adapt, strengthen and change with time is potentially compromised by excess adenosine, and could contribute to memory disorders (Ribeiro & Sebastião, 2010).

2.3 Caffeine structure and metabolism

Caffeine is a xanthine that can be found occurring naturally in plants, or produced during the breakdown of purines. The chemical structure of caffeine was identified by Hermann Fischer as being 1,3,7-trimethylxanthine (Ribeiro & Sebastião, 2010), was found to have a similar double ring structure to that of adenosine (Ribeiro & Sebastião, 2010) (Figure 2.1).

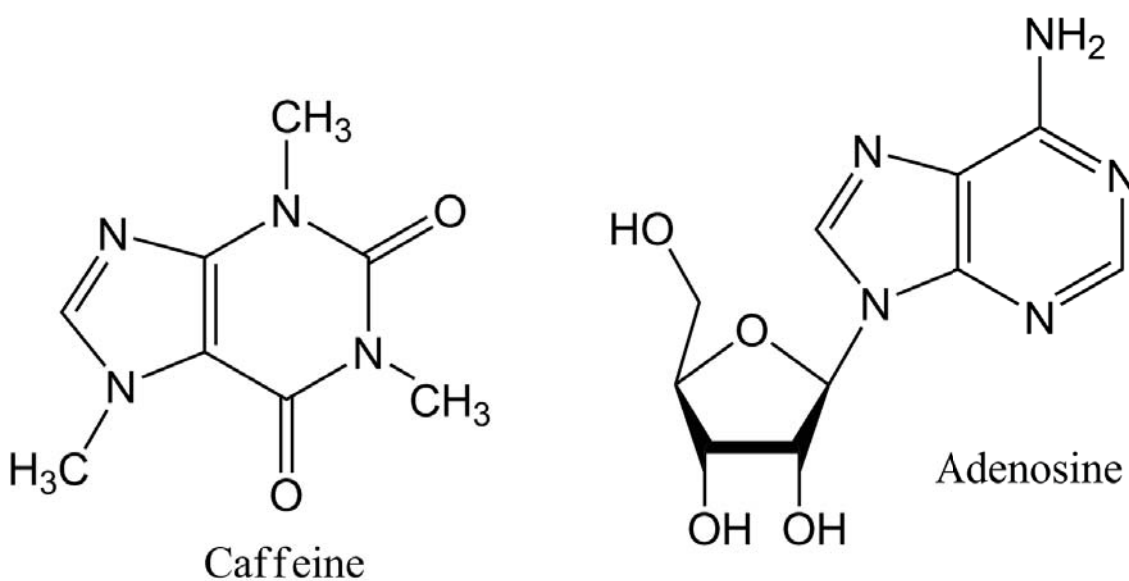


Figure 2.1: Structure of caffeine and adenosine

The similarity of caffeine's double-ring structure to that of adenosine is what makes caffeine able to interact with adenosine-mediated mechanisms within the body, and its subsequent stimulatory effects via de-inhibition of glutamine, dopamine and acetylcholine (Lorist & Tops, 2003). This similarity does not change whether the caffeine comes from a natural source or if it is produced pharmaceutically for addition to consumer products (Greenway, 2001).

Once ingested, caffeine is rapidly absorbed into the bloodstream. Concentrations peak at around 30-60 minutes following consumption, with caffeine having a half-life of

between 4-7 hours - this will differ depending on individual genetic makeup (explored in Section 2.6.1), physiological states and environmental factors (e.g. pregnancy and the use of oral contraceptives decrease the rate of caffeine metabolism, whereas the presence of nicotine will increase the rate of caffeine metabolism) (Gray, 1998; Lorist & Tops, 2003; Hughes *et al.*, 1998). Caffeine is eliminated from the body by breakdown in the liver and excretion via the urine (Levy & Zylber-Katz, 1983; Lorist & Tops, 2003). The timings of the peak, half-life and elimination of caffeine in the body coincide with physiological stimulation and reactions as explored later in Sections 2.4 and 2.5.

Caffeine metabolism in the liver is mainly carried out by the cytochrome P450 oxidase isoforms CYP1A2 and CYP2E1 (95% of primary caffeine metabolism) breaking caffeine into the dimethylxanthines paraxanthine, theobromine and theophylline (Ha, Chen, Krahenbuhl, & Follath, 1996; Krul & Hageman, 1998; Higdon & Frei, 2006; Ribeiro & Sebastião, 2010; Magkos & Kavouras, 2015). A small amount of caffeine (less than 5%) is excreted unchanged in the urine (Lorist & Tops, 2003). Clearance seems to be unaffected in lean versus obese people (Gray, 1998; Greenway, 2001).

Ingestion of caffeine and its subsequent psycho-stimulant effects (outlined in Sections 2.4-2.5) has been likened to the 'classical psycho-stimulants' (Ferre, 2008) cocaine and amphetamine. That is in animal studies, caffeine, cocaine and amphetamine have been shown to substitute for each other at behaviourally relevant dosages, and demonstrate the same psycho-stimulant effects (Ferre, 2008). These effects are mainly due to similar interactions with neurotransmitters and receptors in the brain, and are described in the following sections (Hughes *et al.*, 1998).

2.4 Central mechanisms

While anecdotal evidence of the invigorating effects of caffeine-containing plants has existed for centuries (Fredholm, 2011), there is now a large scientific base of evidence to support suggestions of caffeine increasing energy and alertness through actions on the central nervous system (CNS). Caffeine's effects have been shown to have an

‘inverted U-shape dose-response curve’ (Lorist & Tops, 2003). While lower doses have positive effects on subjective measures of mental performance – subjects in a study conducted by Curhan *et al.* (1998) reported feeling ‘energetic, imaginative, efficient, self-confident, alert ... able to concentrate and motivated to work ... had the desire to socialise’; doses > 500mg may be associated with increases in anxiety and tension in some people (Lorist & Tops, 2003). Extensive research has been undertaken on the actions of caffeine on the CNS, some of which are summarised in this section.

2.4.1 Central physiological actions

The effect of caffeine on the CNS is predominantly via antagonising and competitive binding of adenosine receptors in the brain (Curhan *et al.*, 1998; Puckeridge *et al.*, 2011). As outlined previously, adenosine plays a role in increasing fatigue and promoting the sleep cycle by binding to ARs, and so any blockage of this metabolic pathway results in the increased alertness and cognition that is observed with caffeine consumption (Hughes *et al.*, 1998). Subjectively, studies have shown individuals to report feeling more ‘alert, active, relaxed, and less nervous and irritable’ (Heishman & Henningfield, 1992) following caffeine ingestion.

Of the subtypes of adenosine receptors, caffeine has a higher affinity for types A1 and A2a than for types A2b and A3; and, with chronic caffeine intake, AR expression will be up-regulated (Fisone, Borgkvist, & Usiello, 2004; MacKenzie *et al.*, 2007; Hughes *et al.*, 1998; Ribeiro & Sebastião, 2010). There is a wide distribution of ARs in the body but particularly in the brain; caffeine is able to exert stimulatory effects to all brain areas. While A1 receptors are located throughout the brain, A2A subtypes are highly concentrated in the dopamine-rich striatum. Dopamine as a neurotransmitter is crucial in the control of motor behaviour, and intact post-synaptic transmission following de-inhibition by blockage of ARs has been shown to be a vital component in the motor-stimulatory effects of caffeine (Lorist & Tops, 2003). Electroencephalogram (EEG) readings– able to detect electrical activity in the brain including activation frequency and intensity – have shown that following caffeine administration, there are increased

measures of arousal and frequency of neurotransmission in the brain (Lorist & Tops, 2003). In addition to effects related to dopamine release and motor stimulation, caffeine it is also able to increase efficacy of sensory processing (Lorist & Tops, 2003).

2.4.2 Sleep and fatigue

Caffeine, being an AR antagonist, is able to prolong the period of wakefulness by partially blocking the somnogenic effect of adenosine (Ribeiro & Sebastião, 2010), 'masking' sleep drive and aiding in wake stability (Puckeridge *et al.*, 2011). While an individual does not need to be fatigued to experience the positive effects of caffeine, the stimulatory and mood effects may be more apparent in fatigued subjects (Lorist & Tops, 2003; Attwood, Rogers, Ataya, Adams, & Munafò, 2012).

After prolonged periods of wakefulness, there is up-regulation of ARs in the brain (an effect also produced by chronic caffeine use), and accumulation of adenosine (Elmenhorst *et al.*, 2007). Due to these increasing levels of adenosine and ARs with continued wakefulness (Elmenhorst *et al.*, 2007), the stimulatory effects of caffeine are reduced with time (combined with caffeine also being continuously cleared from the body) (Pray *et al.*, 2014). Those with a slower caffeine metabolism due to genetic or physiological factors will experience a longer period of wakefulness after caffeine ingestion (and subsequent increased adenosine levels), and a higher rate of sleep disruptions (Gray, 1998).

As well as delaying the onset of sleep, caffeine is also credited with decreasing sleep time; while sleep initiation times are temporarily delayed, the morning circadian wake cycle will drive the individual to wake before their usual hours of sleep are completed (Puckeridge *et al.*, 2011). The degree to which caffeine disturbs sleep is strongly correlated with both dosage and proximity of consumption to sleep time. The greatest sleep disruptions occur with high doses of caffeine consumed close to normal sleep time, with Puckeridge *et al.* (2011) reporting that small doses of caffeine (100mg, ≤ 1 cup instant coffee) at any time of the day will not result in significant sleep loss of

more than 15 minutes, however large doses (800mg, \approx 6 cups coffee) close to sleep time may cause up to one hour's loss of sleep. This is reflected by the link between caffeine consumption and both sleep deprivation and insomnia (Huntley & Juliano, 2012; Wesensten, 2014). While this change to sleep cycles may be disruptive to some individuals, Reyner and Horne (1997) demonstrated that in people wishing to stay awake for extended periods of time (e.g. sleepy drivers), consumption of two cups of coffee combined with a 10-minute nap was the most effective treatment to increase alertness and continue driving.

2.4.3 Cognition

Caffeine consumption has been demonstrated to improve overall cognition in a variety of manners (Ribeiro & Sebastião, 2010). Acting as an AR inhibitor, caffeine causes an increase in the rate of neurotransmitter firing (Puckeridge *et al.*, 2011) as well as diminishing the somnogenic effects of adenosine (see Section 2.2). Attention and performance in an array of cognitive tasks have been shown to significantly improve after caffeine administration (Alsene *et al.*, 2003; Lorist & Tops, 2003). These improvements in cognition can be observed after consumption of relatively low concentrations of caffeine such as a single cup of instant coffee which is equivalent to less than 100 mg of caffeine (Lorist & Tops, 2003). A review by Wesensten (2014) concluded that for the general population, intakes of up to 400 mg caffeine spaced out over the day was an effective and safe way of improving cognition.

It is believed that adenosine inhibitors such as caffeine and its actions upon ARs in the hippocampus and cortex (the main brain areas associated with cognition), may provide some benefits for short and long term memory and cognition (Levy & Zylber-Katz, 1983; Lorist & Tops, 2003). As well as caffeine's prospective effects on synaptic plasticity, positive effects on cognition may also be a result of actions such as the increases in alertness and arousal (outlined in Section 2.4). An increase in receptiveness to external stimuli, and increased rate of interpretation that comes with

caffeine ingestion, also contributes to cognition improvements (Lorist & Tops, 2003; Ribeiro & Sebastião, 2010).

2.4.4 Seizures and anxiety

Ingestion of caffeine has been associated with seizure occurrence in individuals both with epilepsy and without (Zagnoni & Albano, 2002), with AR antagonism being implicated as the main cause (Ribeiro & Sebastião, 2010). Adenosine is a natural anticonvulsant (due to its role in suppression of excessive neurotransmission), and so inhibition of this mechanism via AR blockage can contribute towards the occurrence of seizures (Ribeiro & Sebastião, 2010). Caffeine is also known to have precipitated panic attacks, and individuals suffering from panic disorders are documented to be highly sensitive to consumption of minimal amounts of caffeine (Ribeiro & Sebastião, 2010). As well as contributing to pre-existing anxiety disorders, long-term, excessive intake (>500 mg) of caffeine may also induce anxiety (Lorist & Tops, 2003; Ribeiro & Sebastião, 2010; Huntley & Juliano, 2012). Caffeine-induced anxiety will often mimic organically occurring mental disorders such as bipolar disorder, panic disorder, generalised anxiety disorder and schizophrenia (Hughes *et al.*, 1998). This may result in individuals with high caffeine intakes being misdiagnosed with mental disorders, where cessation of caffeine intake would have resolved some of their presenting condition (Ribeiro & Sebastião, 2010).

2.4.5 Neuroprotection

Clinical studies have established a negative correlation with long-term dietary caffeine intake and cognitive decline (Ribeiro & Sebastião, 2010). The association between long-term caffeine intake and a decrease in neurodegenerative disease was still present when adjusted for medical disorders and possible confounding habits (Gray, 1998). While the exact underlying neuroprotective mechanism is not entirely

understood, several pathways of neurodegeneration involve AR activation. This activation is down regulated by caffeine's AR-antagonising properties (Hughes *et al.*, 1998; Ribeiro & Sebastião, 2010). Cornelis, El-Sohemy, and Campos (2007) also suggested that increased levels of caffeine consumption lowers the risk of developing Parkinson's disease through antagonistic actions on ARs and subsequent increase in release of neurotransmitters. These neurotransmitters include dopamine, the main neurotransmitter involved in motor behaviour (Lorist & Tops, 2003). A2A receptor antagonists (e.g. caffeine) which have been used as additional therapy in conjunction with L-DOPA (L-3,4-dihydroxyphenylalanine – precursor to neurotransmitters dopamine, norepinephrine and epinephrine) therapy in the treatment of Parkinson's disease (Ferre, 2008). Caffeine-enabling synaptic plasticity, the ability of the brain to adapt and build new connections over time as outlined previously in Section 2.4, also plays a part in neuroprotection decreases the rate of neurodegeneration and diseases such as Parkinson's (Levy & Zylber-Katz, 1983; Lorist & Tops, 2003)

2.5 Peripheral mechanisms

Caffeine has been shown to not only have effects on the CNS (as outlined in Section 2.4) but also the peripheral nervous system (PNS), including effects on physical performance, metabolism, cardiovascular health and other organ systems. Similar to its action on the CNS, caffeine ingestion also shows an inverted U-shape dose-response curve to the PNS (Lorist & Tops, 2003).

2.5.1 Physical performance

Caffeine is commonly used as an ergogenic aid in athletes for its performance and endurance enhancing qualities (Gray, 1998; Lorist & Tops, 2003). The mechanisms behind these effects were initially proposed to be due to a so-called 'metabolic theory,' i.e. that the increased endurance effects of caffeine are due to increases in

circulating free fatty acids, and a sparing of muscle glycogen (Costill, Dalsky, & Fink, 1978). This 'metabolic theory' had high inter-individual variation however, and reviews of the evidence indicate that caffeine's ergogenic effects are much more likely to result from a decrease in perceived exertion and increased nervous system firing than increases in free fatty acids (Graham, Helge, MacLean, Kiens, & Richter, 2000; Burke & Deakin, 2012).

Levels of caffeine intake required to achieve improvements in performance have been shown to be as little as 1-3 mg·kg⁻¹ body weight. For the average person, this equates to 1-2 cups of instant coffee, with higher levels having minimal further positive effects and more likely to invoke negative effects such as tremors, headaches, disrupted sleep and jitters (Burke & Deakin, 2012). This demonstrates caffeine's inverted U shape dose-response curve as described by Lorist and Tops (2003). A review by Wesensten (2014) gave the optimal caffeine intake for the general population as being 400 mg·day⁻¹, to achieve safe and effective physical performance enhancement. In athletes who chronically consume caffeine for its performance-enhancing abilities, consumption may be needed to offset possible withdrawal symptoms (outlined in Section 2.6.3) that may negatively impact performance (Curhan, Willett, Rimm, Spiegelman, & Stampfer, 1996). The ergogenic effects of caffeine consumption caused it to be placed on the list of prohibited substances in sport by the World Anti-Doping Agency; however due to its presence in a wide array of foods and drinks and having a prominent place in the day to day lives of many individuals, it was removed from the list in 2004. However, urine concentrations of caffeine of over 12 mg·L⁻¹ are still prohibited (Burke & Deakin, 2012). As approximately 5% of caffeine is excreted in the urine (Lorist & Tops, 2003), urine caffeine results of over 12 mg·L⁻¹ would indicate caffeine intakes over and above levels found with normal dietary consumption, and would most likely suggest purposeful intake by concentrated oral supplements, suppositories or intravenous injections in order to gain an advantage over opponents (Lorist & Tops, 2003).

2.5.2 Cardiovascular implications

Caffeine is a vasodilator (Gray, 1998) and many medical professionals give the advice that excess caffeine may contribute towards arrhythmias and be harmful to cardiovascular health. However, a review by Bennett, Rodrigues, and Klein (2013) indicates that this advice is unnecessary for the general public, as any effects of caffeine on the cardiovascular system occur at concentrations much greater than those that arise from normal population caffeine-consumption patterns. There is conflicting evidence on the effects of caffeine on the cardiovascular system. At an epidemiological level, findings indicate that chronic consumption of caffeine shows a decreased risk of cardiovascular disease and high blood pressure and furthermore, ECG readings are unaffected by caffeine consumption (Greenway, 2001). This finding is reflected in a meta-analysis which demonstrates caffeine consumption at or above 400 mg per day does not increase risk of atrial fibrillation (Cheng *et al.*, 2014), with an intake of 300 mg per day being safe even for those with a history of hypertension (Mesas, Leon-Muñoz, Rodriguez-Artalejo, & Lopez-Garcia, 2011). However, a meta-analysis of randomised controlled trials by Noordzij *et al.*, 2005 found that there may be some individuals who do experience arrhythmic triggering with caffeine use, and for these people it is advisable to avoid ingesting caffeine, blood pressure increases with regular caffeine intake (though through coffee the effect is small). These discrepancies may be due to the differing research methods of epidemiological studies and clinical trials.

Cholesterol levels play a part in cardiovascular health, and while Greenway (2001) found a correlation between coffee intake and changes in cholesterol (decreased high density lipoprotein levels), this decrease in high density lipoprotein was thought to be due to compounds present in coffee other than caffeine, as well as the typical lifestyles associated with coffee consumption (higher alcohol and tobacco use) (Gray, 1998).

2.5.3 Effects on metabolism

Metabolic changes induced by the consumption of caffeine include an increase in resting oxygen consumption and fat oxidation, as well as an increase in the release of free fatty acids in blood (Greenway, 2001; MacKenzie *et al.*, 2007). These mechanisms are thought to play the main role in weight loss seen with supplementation of combined caffeine and ephedrine (Greenway, 2001).

Caffeine has also been shown to have an effect on both glucose metabolism and insulin sensitivity. In a randomised, double blind placebo controlled study, MacKenzie *et al.* (2007) demonstrated that short-term dosing of caffeine (over a period of one day), impaired glucose metabolism - insulin levels were significantly higher after caffeine intake than placebo, and with a significantly lower insulin sensitivity, an effect persisting for up to 7 days after caffeine intake. This occurred in both people with and without diabetes mellitus (MacKenzie *et al.*, 2007). While the exact mechanism still remains unclear, the observed insulin resistance may be a result of increased free fatty acid release associated with caffeine consumption (MacKenzie *et al.*, 2007), however this remains to be determined.

Caffeine is able to induce many other metabolic changes in the body, however, most of these occur at concentrations well above those which are able to be achieved through normal consumption patterns (Lorist & Tops, 2003; Ribeiro & Sebastião, 2010). One cup of coffee contains ~100mg of caffeine, which would give a maximum free circulating caffeine concentration of 10 μM (a level of 500 μM is associated with lethal intoxication), much lower than that required for effects other than mental and physical stimulation (Hughes *et al.*, 1998). Changes induced at higher than normal levels of caffeine consumption include an inhibition of phosphodiesterases, a release of intracellular calcium and interference with GABA-A (gamma-aminobutyric acid) receptors. The inhibition of phosphodiesterases causes an increase in the rate of lipolysis through the preservation of cAMP (normally metabolised by phosphodiesterases), which in turn activates c-AMP dependant protein kinase enzyme which phosphorylates hormone sensitive lipase, and activates lipolysis (Ribeiro & Sebastião, 2010). Serum caffeine levels much higher than those able to be achieved through normal dietary consumption patterns have also been reported to mediate

intracellular calcium release and may compromise skeletal calcium and structure by increased calcium clearance from the body (Greenway, 2001; Hughes *et al.*, 1998).

2.5.4 Organ system effects

Although ingestion of caffeine induces a mild diuretic effect, it does not cause dehydration (Maughan & Griffin, 2003); additionally, as caffeine intake normally occurs secondary to beverage consumption, there is often an associated fluid intake. The diuretic effect of caffeine results from vasodilation, increasing blood flow to the kidneys and subsequently decreasing sodium and water resorption (Gray, 1998). The increased blood flow and filtration rate is also thought to be the reason behind studies showing up to a 10% decrease in kidney stone occurrence (in 126,000 subjects) with each 200 mL of daily coffee consumed (Curhan *et al.*, 1998; Elmenhorst *et al.*, 2007). This vasodilator effect is also thought to have an influence on mitigation of migraines and headaches for some individuals (others report caffeine consumption as causing headaches) (Curhan *et al.*, 1998). Currently, caffeine is incorporated into many pain medications; the reason being an increase in efficacy of pain relief due to increased absorption rate when paired with caffeine (Curhan *et al.*, 1998; Gray, 1998).

2.6 Differential responses to caffeine

Due to the differing physiological makeup and state of individuals (including sex, age, pregnancy and genetics (Gray, 1998), covered in Section 2.3), the way that one person metabolises, reacts and excretes a specific caffeine dose may be very different to the way that another person reacts to the same amount (Levy & Zylber-Katz, 1983; Curhan *et al.*, 1996). Individual reaction to caffeine may also change as a result of consumption patterns and physiological dose adaptation.

2.6.1 Genetics

Genetic variation influences both caffeine metabolism as well as patterns of caffeine consumption (Lopez *et al.*, 1989; Luciano *et al.*, 2005; Childs *et al.*, 2008). Genes influencing how caffeine is metabolised within the body include CYP1A2 (cytochrome P450 gene), ADORA2A (adenosine A2A receptor gene) and AHR (aryl hydrocarbon receptor gene) (Yang, Palmer, & Wit, 2010; Sulem *et al.*, 2011; Renda *et al.*, 2012). The CYP1A2 gene is responsible for production of cytochrome P450 enzymes which break down the majority (95%) of caffeine in the liver. Genotypic variation between individuals in CYP1A2 can determine whether a person will be a slow caffeine metaboliser (at least one C type allele) or a fast caffeine metaboliser (A type alleles) (Lopez *et al.*, 1989; Cornelis, El-Soheymy, Kabagambe, & Campos, 2006; Palatini *et al.*, 2009; Yang *et al.*, 2010). Differences in CYP1A2 genotypes and slow versus fast caffeine metabolisers are also relevant as slow metabolisers of caffeine have been found to be at an increased risk of suffering a heart attack following consumption of two cups of coffee compared to fast metabolisers, who in contrast demonstrated a decreased risk of heart attacks with consumption of at least one cup of coffee per day (Cornelis *et al.*, 2006; Palatini *et al.*, 2009). ADORA2A gene variation contributes towards the effects of caffeine on sleep and anxiety by affecting AR expression; higher anxiety levels have been seen with increased A2a AR expression, and higher levels of sleep disruptions with increased A1 and A2a AR expression (Rétey *et al.*, 2007; Yang *et al.*, 2010). These genetic differences in AR expression do not however, have such marked effects on anxiety and sleep patterns in Asian populations (Childs *et al.*, 2008). Genetics also influences the consumption of caffeinated products. Higher coffee intakes have consistently been seen in individuals with the AA allele than the C allele of the CYP1A2 gene (SNP rs2472297) (Sulem *et al.*, 2011) as is also seen in carriers of the C allele of the AHR (aryl hydrocarbon receptor) gene SNP rs4410790 (Renda *et al.*, 2012). Carriers of the C genotype of the ADORA2A genotype are significantly less likely to consume high levels of caffeine compared to those with the TT genotype (Linden & Lau-Barraco, 2014).

2.6.2 Dose adaptation

The literature supports the view that individual responses to caffeine depend on patterns of habitual consumption, with higher chronic intakes related to decreased subjective measures of the stimulating effects of caffeine (Curhan *et al.*, 1996; Puckeridge *et al.*, 2011). Attwood *et al.* (2007) demonstrated that those who habitually consumed >200 mg of caffeine per day were more likely to show enhanced reaction times and increased perceived positive feelings when given a 400 mg dose of caffeine than those who habitually consumed <200 mg of caffeine per day (this however may have partially been as a result of amelioration of withdrawal symptoms associated with higher caffeine intakes). Acclimatisation to the wakefulness effects of regular caffeine intake was also shown, with a decreased period of time reported between caffeine consumption and time to sleep for consumers of high levels of caffeine versus low level consumers (Pelchovitz & Goldberger, 2011).

Tolerance to the stimulatory effects of caffeine develops after repeated exposure (Hughes *et al.*, 1998). This increased tolerance is mainly due to an up-regulation of A1 receptor expression, which results in higher doses of caffeine being needed to block the same proportion of ARs than previously (Ferre, 2008; Hughes *et al.*, 1998; Ribeiro & Sebastião, 2010). This up-regulation of A1 receptors leads to increased adenosine binding and decreased motor stimulation via A1 receptors, however can be overcome by administration of a higher caffeine dosage (Ferre, 2008). Due to differences in caffeine binding between A1 and A2A receptors, this tolerance does not develop with A2A receptors; which is perhaps why individuals who have grown accustomed to habitual caffeine intake may still experience some of the motor-activating effects (Ferre, 2008).

2.6.3 Dependency, withdrawal and intoxication

As well as tolerance, withdrawal symptoms associated with habitual caffeine consumption may develop quickly after beginning regular caffeine consumption (Fredholm, Bättig, Holmén, Nehlig, & Zvartau, 1999). Chronic daily doses as low as 100 mg of caffeine (the caffeine content of about 1 cup of drip-coffee) may be sufficient to develop a physical dependence and trigger withdrawal symptoms once caffeine is discontinued (Kendler, Myers, & Gardner, 2006; Ferre, 2008). While withdrawal symptoms present rapidly (in as little as 12-24 hours) they will generally cease within 1-5 days after cessation of caffeine consumption, correlating with the time taken for the number of ARs to return to pre-caffeine baseline levels (Griffiths & Woodson, 1988). Withdrawal symptoms in individuals with a developed caffeine tolerance will peak at around 24 hours following non-consumption, and symptoms can include headaches, an inability to concentrate, insomnia, drowsiness, irritability, gastrointestinal tract upset and upper body and joint pain (Griffiths & Woodson, 1988; Rétey *et al.*, 2007; Ferre, 2008; Hughes *et al.*, 1998; Ribeiro & Sebastião, 2010). Gradual caffeine reduction over a number of days is advised if wanting to wean off caffeine without aggravating withdrawal symptoms (Gray, 1998).

The American Psychiatric Association's DSM-5 (Diagnostic and Statistical Manual of Mental Disorders) classifies caffeine withdrawal and caffeine intoxication in its list of substance-induced disorders, however does not include caffeine dependence on its list of substance dependence disorders (American Psychiatric Association, 2013). The World Health Organisation's criteria for dependence syndrome in the ICD-10 (International Classification of Diseases) document however, does fit caffeine dependence under its wider classification of 'mental and behavioural disorders due to psychoactive substance use' (World Health Organisation, 2015).

Diagnostic criteria for an individual to experience dependency on caffeine is given by the WHO as having experienced three or more of the following symptoms concurrently within the past year (World Health Organisation, 2015):

- a strong desire or sense of compulsion to take the substance

- difficulties controlling substance-taking behaviour
- a physiological withdrawal state
- evidence of tolerance
- progressive neglect of alternative pleasures or interests
- persisting with substance use despite clear evidence of overtly harmful consequences.

Both the American Psychiatric Association (American Psychiatric Association, 2013) and WHO list withdrawals upon cessation of substance use as one of the defining characteristics of substance dependence diagnosis. Even though caffeine dependence is not recognised as such in DSM-5, 'Caffeine Withdrawal' is included as a substance use disorder, and DSM-5 provides specific parameters for diagnosis as follows:

- prolonged daily use of caffeine
- three or more of the following symptoms within 24 hours of the abrupt cessation / reduction in caffeine use:
 - o headache
 - o marked fatigue / drowsiness
 - o dysphoric mood, depressed mood or irritability
 - o difficulty concentrating
 - o flu-like symptoms (nausea, vomiting, muscle pain/stiffness)
- the above symptoms cause clinically significant distress or impairment in social / occupational / other important areas of functioning
- that the above symptoms are not associated with physiological effects of another medical or mental disorder including intoxication or withdrawal from another substance.

A withdrawal state as defined by the WHO is much broader however, with the main criteria being the presence of physiological symptoms such as depression, sleep disorders and anxiety associated with cessation of substance use, and that these symptoms are alleviated with further use of the substance (World Health Organisation, 2015).

Caffeine intoxication diagnostic criteria as given by the DSM-5 (American Psychiatric Association, 2013) are as follows:

- recent consumption of caffeine (typically a high dose well in excess of 250 mg)
- five or more of the following symptoms developed during or shortly after caffeine use:
 - Restlessness
 - Nervousness
 - Excitement
 - Insomnia
 - Flushed face
 - Diuresis
 - Gastrointestinal disturbance
 - Muscle twitching
 - Rambling flow of thought and speech
 - Tachycardia or cardiac arrhythmia
 - Periods of inexhaustibility
 - Psychomotor agitation
- These symptoms cause significant distress or impairment in social, occupation or other areas of functioning
- These symptoms are not attributable to other medical conditions and cannot be explained by other disorders or intoxications.

Intoxication symptoms such as these can lead to hospitalisation and fatality (Ribeiro & Sebastião, 2010; Thelander *et al.*, 2010). For example, an increase in the use of caffeine-dense energy drinks in the USA can be seen reflected in a doubling of energy drink related emergency department visits from 2007 to 2011 (Pennington, Johnson, Delany, & Blankenship, 2010; Ribeiro & Sebastião, 2010). This was highest in 18-25 year olds (mean age 16.4 years old (Cleary, Levine, & Hoffman, 2012)), with higher rates also seen in males compared to females and most commonly occurring when consumed in conjunction with illicit substances or large amounts of alcohol (Pennington *et al.*, 2010; Ribeiro & Sebastião, 2010). Higher rates of intoxication may also be experienced by younger age groups due to lower levels of tolerance to caffeine

(Pennington *et al.*, 2010). In New Zealand, a working group set up by Food Standards Australia New Zealand (FSANZ) to review caffeine literature found correlations between caffeine consumption and anxiety at caffeine consumption levels commonly found in the general population (95mg·day⁻¹ and 210 mg·day⁻¹ of caffeine consumption in children and adults, respectively, (Food Standards Australia New Zealand, 2000)).

While caffeine dependency, intoxication and withdrawal have all received international classification as disorders related to caffeine intake, caffeine does not have great addictive potential as at usual human consumption levels, caffeine is unable to activate reward centres in the brain (Greenway, 2001). Consumption is more likely to be maintained due to individuals not wanting to experience withdrawal symptoms, out of routine, or due to other social and environmental influences (explored in Section 2.11) (Greenway, 2001). In spite of this, Gurley, Steelman, and Thomas (2015) identified many caffeine users expressed a desire to quit its use (often due to concern over symptoms of intoxication or withdrawal (Fredholm *et al.*, 1999)) or to reduce amounts consumed, with higher consumption levels being associated with lower desire for complete cessation of caffeine consumption (Fredholm *et al.*, 1999). Fredholm *et al.* (1999) also documented that those seeking help with either psychological or physiological caffeine dependency (using generic DSM-IV-TR diagnostic criteria) consumed an average of 548 mg of caffeine daily, with the main reason for seeking help to quit resulting from advice given by medical professionals or not wishing to be dependent on caffeine.

2.7 Sources of caffeine

Advancements in technologies and subsequent pharmaceutical synthesis of caffeine means that in today's environment, caffeine is not only found in foods derived from caffeine-containing plants, but also added artificially into a wide array of foods and beverages (Gray, 1998). This includes the addition of caffeine-containing substances such as guarana into energy drinks (Gray, 1998; Thomson & Schiess, 2010). A summary

of the average caffeine content in commonly consumed New Zealand food and beverage products can be found in Table 2.1.

Table 2.1: Caffeine content in New Zealand food and beverages

Product	Caffeine content
Chocolate²	
Milk chocolate	~20 mg per 100 g
Dark chocolate	~60 mg per 100 g
Cocoa	~2 mg per 1 teaspoon powder
Tea²	
Green tea	~31 mg per 250 mL made with 1 teabag
Black tea	~57 mg per 250 mL made with 1 teabag
Decaffeinated black tea	~4.7 mg per 250 mL made with 1 teabag
Coffee²	
Plunger / drip coffee	~100 mg per 250 mL
Instant powder	~83 mg per 1 teaspoon powder
Single shot espresso	~120 mg
Double shot espresso	~210 mg
Decaffeinated instant powder	~1.9 mg per 1 teaspoon powder
Kola drinks²	
Regular kola	~9 – 13 mg per 100 mL
Diet kola (diet, max, zero etc)	~14 mg per 100 mL
Energy drinks^{2,3}	
	~29.2 - 31.6 mg per 100 mL
Caffeinated RTDs^{3,4}	
	~11.1 - 17.7 mg per 100 mL
Sports supplements⁴	
	~1.4 – 1690 mg per 100 g
Caffeine tablets⁴	
	~50 – 200 mg per capsule

² The New Zealand Institute for Plant and Food Research Limited and New Zealand Ministry of Health (2015)

³ Thomson and Jones (2013)

⁴ Beer Wine and Spirits Producers (2015)

Caffeine content in different types of chocolate (milk chocolate vs. dark chocolate) varies due to differing cocoa solid percentages contributing differing levels of caffeine. With all products, caffeine content will also vary between batches, especially since organically occurring caffeine levels vary from plant to plant and with environmental conditions (Desbrow *et al.*, 2012).

Caffeine values of energy drinks are also found in the 11th edition of The Concise New Zealand Food Composition Tables, aligning with caffeine content values reported in an analysis carried out by the New Zealand Ministry for Primary Industries in late 2013 (Thomson & Jones, 2013). Analysis by the New Zealand Ministry for Primary Industries investigated caffeine content of 35 different energy drinks, all reporting both caffeine and guarana as sources. The resulting average caffeine content per 250 mL of energy drink was 76 mg; very similar to the values reported in The Concise New Zealand Food Composition Tables (73-79 mg caffeine per 250 mL of product); the variance in values being between regular and sugar-free products.

The caffeine content of caffeinated alcoholic beverages or 'RTDs' is not included in The Concise New Zealand Food Composition Tables (2015), and is difficult to quantify due to the large quantity of products on the market and issues around labelling regulations - caffeine levels are not given on RTD labels (covered in Section 2.9). The 2013 Ministry for Primary industries technical report 'Caffeine in guarana-containing foods' (Thomson & Jones) covers caffeine levels in various caffeinated RTDs, and 'Alcohol Beverages Containing Stimulants' (Beer Wine and Spirits Producers, 2015) also provides the caffeine content of alcoholic beverages by the main producers of alcohol worldwide. Average caffeine content in caffeinated RTD products has high variability between products, with caffeine values for products reported by the Ministry for Primary Industries being between 10.2-32.3 mg per 100 mL (five products) (Thomson & Jones, 2013) and those reported by the Beer, Wine and Spirits Producers being between 7-18.5 mg per 100mL (35 products applicable to New Zealand) (Beer Wine and Spirits Producers, 2015). There are no apparent patterns of varying caffeine content between products containing both guarana and caffeine versus solely caffeine, or between different alcoholic mixes (e.g. rum and kola versus vodka and guarana premix). The mean caffeine content of New Zealand relevant products was 11.1 mg per

100 mL in the Beer, Wine and Spirits Producers report; however the average caffeine content reported by the Ministry for Primary Industries was 17.7 mg per 100 mL.

The term 'caffeinated sports supplements' describes both caffeinated pre-workout supplements, and sports gels containing caffeine. Like caffeinated RTDs, the caffeine content is difficult to report due to limited data, high variability between products and the large number of products on the market. Any available data on caffeine content is highly variable, as reflected by the Ministry for Primary Industries report identifying between 1.4 mg and 1690 mg of caffeine per 100 g sports supplement in different products (Thomson & Jones, 2013). Caffeine tablets also display large variance in caffeine content; it can range from 50-200 mg and above per pill or capsule, depending on the brand.

Additional products that contribute trace amounts of caffeine to the diet are identified in The Concise New Zealand Food Composition Tables (The New Zealand Institute for Plant and Food Research Limited & New Zealand Ministry of Health, 2015), and include a range of food products many of which contain chocolate. Any baked goods which contain chocolate or cocoa are likely to have small amounts of caffeine present, ranging from 0.5mg caffeine in a regular chocolate chip biscuit to 2 mg caffeine in a chocolate muffin and 7.4mg caffeine in a large Cookie Time chocolate chip biscuit (The New Zealand Institute for Plant and Food Research Limited & New Zealand Ministry of Health, 2015). Hot chocolate flavoured drinks prepared using cocoa normally contain about 2mg of caffeine per teaspoon of cocoa used, while chocolate flavoured drinking powder contains between 0.3 and 0.9 mg caffeine per teaspoon. Chocolate flavoured breakfast cereals, ice creams, yoghurts, muesli bars and puddings also contribute caffeine to the diet, however these amounts are low. Some medications also contain caffeine to increase the efficacy of the drug (Curhan *et al.*, 1996; Gray, 1998; Hughes *et al.*, 1998).

2.8 Consumption levels and patterns

Thompson and Schiess (2010) estimate that at least 73% of New Zealanders are exposed to caffeine daily, through consumption of tea, coffee, kola drinks and chocolate. This is consistent with caffeine exposure by analysis of FOODfiles data and results from the National Nutrition Survey (University of Otago and Ministry of Health, 2011) suggesting 71 - 96% of the New Zealand population (15 years and over) having daily exposure to caffeine (Thomson *et al.*, 2014) (similar to 90% of the USA population (Frery *et al.*, 2005)). However it was adults over 20 years old that had the highest caffeine intake in relation to body weight (Thomson *et al.*, 2014). Exact amounts of individual consumption are difficult to ascertain, as caffeine content of a certain type of food may vary across brands, within batches and from plant to plant (Desbrow *et al.*, 2012). Thompson and Schiess (2010) estimate that the average New Zealand adults' (20-64 years old) exposure to caffeine is $3.6 \text{ mg}\cdot\text{kg}^{-1}$ body weight per day (Thompson and Schiess (2010)); similar to that in the United Kingdom (UK) ($4 \text{ mg}\cdot\text{kg}^{-1}$ body weight per day (Barone & Roberts, 1996)), higher than those in the United States of America (USA) ($193 \text{ mg}\cdot\text{day}^{-1}$ or $1.2 \text{ mg}\cdot\text{kg}^{-1}$ body weight per day (Frery *et al.*, 2005)), but lower than European and South American Countries (Denmark: $7 \text{ mg}\cdot\text{kg}^{-1}$ body weight per day (Barone & Roberts, 1996), Argentina: 288 mg average daily intake (Olmos, Bardoni, Ridolfi, & Villaamil Lepori, 2009)).

In the USA, the mean level of caffeine consumption has been debated as either having increased or remained constant over the past 10 years, with the only population demonstrating a decrease in consumption being children (Wesensten, 2014). There has been a trend over the past 10 years for a decrease in the percentage of caffeine consumed from soda drinks, being replaced with caffeine from coffee and energy drinks (Chen *et al.*, 2001; Wesensten, 2014). The highest consumers of caffeine in the USA are 40-59 year olds, according to the National Health and Nutrition Examination Survey (Wesensten, 2014).

An Australian poll (Australian Beverages Council, 2013) demonstrated over 50% of dietary caffeine for Australian consumers came in the form of coffee, with kola-drinks

second at 18%, tea third at 14% and energy drinks at 5%. The results of the 2002 New Zealand National Children's Nutrition Survey (New Zealand Ministry of Health, 2003) gave weekly exposure of New Zealand children (5-14 years old) to kola drinks at 43%, Mountain Dew at 9%, tea at 21%, coffee at 6% and 'New Age' drinks (includes energy drinks) at 6%. Kola drinks, Mountain Dew, tea and coffee were all consumed in higher proportions by children living in lower socioeconomic deprivation index areas, and in higher proportions by Pacific and Maori children than New Zealand European children (New Zealand Ministry of Health, 2003). The equivalent adult survey of individuals 15 years and over (New Zealand Adult Nutrition Survey (University of Otago and Ministry of Health, 2011)) however, only contained caffeine measures in frequency of 'soft drinks or energy drink'. It was also evident that soft drink and energy drink consumption was higher in participants who lived in the most deprived areas (by New Zealand Deprivation Index) (University of Otago and Ministry of Health, 2011).

2.9 Legislation and regulations

Despite caffeine use of up to 400 mg·day⁻¹ being recognised as safe (European Food Safety Authority, 2015), regulations are in place to control the amount of caffeine in products, as well as to notify consumers of the presence and potential risk of caffeine consumption (Food Standards Australia New Zealand, 2000). Caffeine limits for products in New Zealand and the relevant regulatory bodies are summarised in Table 2.2.

Table 2.2: Caffeine limits for New Zealand products

Product	NZ caffeine limit	Regulation	Regulatory authority
Kola-drinks	$\leq 145 \text{ mg}\cdot\text{L}^{-1}$	Australia New Zealand Food Standards Code; standard 1.3.1 'Food additives'	Food Standards Australia New Zealand (2015)
Alcoholic products (RTDs)	$\leq 145 \text{ mg}\cdot\text{L}^{-1}$	Voluntary Industry Code for RTDs	Distilled Spirits Association of New Zealand (2013)
Energy drinks	$145\text{-}320 \text{ mg}\cdot\text{L}^{-1}$	Australia New Zealand Food Standards Code; standard 2.6.2, 'Formulated caffeinated beverages'	Food Standards Australia New Zealand (2015)
Energy shots	Na	Dietary Supplements Regulations of 1985	New Zealand Ministry of Health (2010)
Sports supplements	Na	Australia New Zealand Food Standards Code; standard 2.9.4 'formulated supplementary sports foods' Dietary Supplements Regulations of 1985	Food Standards Australia New Zealand (2015) New Zealand Ministry of Health (2010)

The Australia New Zealand Food Standards Code regulates the amount of caffeine added to various types of products such as kola-type drinks and energy drinks. Standard 1.3.1: 'Food additives', encompasses caffeine used for flavouring in kola-type

drinks, and states that caffeine levels in this type of product may not exceed 145 mg·L⁻¹ (Food Standards Australia New Zealand, 2015). In 2013, the Distilled Spirits Association of New Zealand created the 'Voluntary Industry Code for RTDs' and adopted the same limit of 145 mg·L⁻¹ caffeine as applies to kola-type drinks in the Australia New Zealand Food Standards Code Standard 1.3.1 for all alcoholic products (Distilled Spirits Association of New Zealand, 2013; Food Standards Australia New Zealand, 2015).

The Australia New Zealand Food Standards Code also contains a standard (Standard 2.6.2, 'Formulated caffeinated beverages') specifically for formulated caffeine beverages, which are defined as 'a non-alcoholic water-based flavoured beverage which contains caffeine and may contain carbohydrates, amino acids, vitamins and other substances, including other foods, for the purpose of enhancing mental performance'. This definition fits within the energy drink category included in this study. These beverages, in accordance with the food standards code must have a caffeine content of between 145-320 mg·L⁻¹ of product including that from guarana (Food Standards Australia New Zealand, 2015).

There is no mention of caffeine regulation in the food standards code in relation to sports supplements, so caffeine content may vary widely; some products fall instead under Standard 2.9.4 (Formulated Supplementary Sports Foods) or are classified under the Dietary Supplements Regulations of 1985 (New Zealand Ministry of Health, 2010); the same applies for energy shots.

The Dietary Supplements Regulations of 1985 makes no specific mention of caffeine allowance and regulation, instead being mainly applicable to these products through their labelling requirements; that the label must contain 'a warning in any case where a danger exists if an overdose is taken' and 'a method of preparation before use (where necessary)' (New Zealand Ministry of Health, 2010). In spite of this lack of regulation, all members of the New Zealand Juice and Beverage Association have undertaken a voluntary commitment to 'a range of best practice standards over and above legislative requirements' in relation to energy shots. As well as agreeing to market these products towards adults rather than youth, the voluntary code sets a

maximum level of caffeine per single energy shot as not exceeding 160 mg, and to specify maximum daily intake of energy shots together with advisory statements (being not recommended for pregnant or breastfeeding women, children or those who may be caffeine sensitive) on the product label (New Zealand Juice and Beverage Association, 2012). While this applies to energy shots produced by members of the association, there are many more energy shots produced by other companies not specialising in beverages, or imported into New Zealand from overseas, which therefore are not subject to these best-practice standards.

Labelling of caffeinated products also fits into the Food Standards Code under Standard 1.2.4 (labelling of ingredients); all added caffeine (that not occurring naturally in cocoa, coffee, tea etc.) must be included on the ingredient list (Food Standards Australia New Zealand, 2015). This also includes guarana; where caffeine occurs naturally but which caffeine content must be labelled, and kola-type drinks - caffeine must be declared on the label of both (Standard 1.2.3) (New Zealand Ministry of Agriculture and Forestry, 2011; Food Standards Australia New Zealand, 2015). Furthermore, advisory statements indicating that the product contains caffeine, and that it is not recommended for children, pregnant and lactating women and those who may be sensitive to caffeine must be included on the label of formulated caffeinated beverages (Standard 2.6.4), or when caffeine has been added to a level higher than required to 'achieve a technological function under conditions of good manufacturing practice' (Food Standards Australia New Zealand, 2013; New Zealand Ministry for Primary Industries, 2013; Food Standards Australia New Zealand, 2015).

In the US, the FDA limit for caffeine in 'kola-type' beverages is $\leq 0.02\%$ of the product (roughly $200 \text{ mg}\cdot\text{L}^{-1}$), and an overall 200 mg limit per dose for caffeine containing supplements. Internationally, the Codex Alimentarius Commission (a body operating under the United Nations and World Health Organisation to set international food safety standards) does not have specific caffeine guidelines, and so restrictions vary from country to country (Food Standards Australia New Zealand, 2000).

2.10 Recommendations for caffeine intake

In the United States, the FDA (Food and Drug Administration) gives caffeine consumption of $400 \text{ mg}\cdot\text{day}^{-1}$ as not generally resulting in negative or dangerous effects (US Food and Drug Administration Consumer Health Information, 2013). This aligns with data from reviews of caffeine safety including Pelchovitz and Goldberger (2011), Cheng *et al.* (2014), Wesensten (2014) and the European Food Safety Authority (2015), which all give caffeine intakes of $400 \text{ mg}\cdot\text{day}^{-1}$ as safe for the general population (excluding pregnant women). This level is safe for individuals with a history of atrial fibrillation, and a slightly lower level of 300 – 330 mg caffeine per day is considered safe for those with a history of hypertension (Mesas *et al.*, 2011; Cheng *et al.*, 2014). A lower level of 200 mg caffeine per single dose or $3 \text{ mg}\cdot\text{kg}^{-1}$ body weight is given by the European Food Safety Authority (2015) as ‘unlikely to induce clinically relevant changes in blood pressure, myocardial blood flow, hydration status or body temperature’. For pregnant women, the European Food Safety Authority (2015) gives a daily limit of 200 mg caffeine from all sources as not being a safety concern for the developing foetus; the New Zealand Ministry of Health also advises limiting caffeine intake during pregnancy (New Zealand Ministry for Primary Industries, 2010).

While the New Zealand Ministry for Primary Industries does not quantify a specific intake of caffeine per day, it rather recommends that consumption is limited to less than six cups of tea or instant coffee, or three single shot espresso coffees per day (New Zealand Ministry for Primary Industries, 2012). Furthermore, intakes of up to $400 \text{ mg}\cdot\text{day}^{-1}$ caffeine are recognised as the safe limit by Pelchovitz and Goldberger (2011), Cheng *et al.* (2014) and Wesensten (2014), with caffeine ‘overuse’ seen by the WHO as intakes of 500 mg of caffeine or more per day (Wesensten, 2014).

2.11 Factors influencing caffeine consumption

As with all foods and beverages, those containing caffeine have a complex number of factors contributing towards consumption; merely 'liking' the product is often not the main influencing factor (Baranowski *et al.*, 1999). Caffeine is consumed for its functional properties of cognitive and physical performance enhancement as outlined in Sections 2.4 and 2.5, however, due to its presence in many commonly consumed foods and beverages, consumption also stems from differing sociocultural and environmental influences as well as an additional genetic component (see Sections 2.6, 2.11).

2.11.1 Functional qualities

Caffeine has commonly been used for its functional properties of cognitive and physical performance enhancement, as outlined previously in Sections 2.4 and 2.5. Cognition and attention enhancement, as well as prolonging wake time (for driving long distances, studying for exams etc), combating fatigue and recuperating sleep loss were given as reasons behind caffeinated product consumption in both workers and college students (Griffiths & Woodson, 1988; Reyner & Horne, 1997; Pennington *et al.*, 2010). Caffeine is also used by both competitive and recreational athletes to increase speed and duration of training, however this use is difficult to quantify due to the large number of caffeinated supplements on the market and the common daily consumption of caffeinated products for reasons unrelated to performance enhancement (Graham, 2001).

Tea, coffee, chocolate, kola drinks, energy drinks and caffeinated alcoholic RTDs are frequently consumed for their intrinsic properties such as taste, temperature, and hedonic qualities (Kassem, Lee, Modeste, & Johnston, 2003; Lorist & Tops, 2003). In a qualitative New Zealand study by Bunting, Baggett, and Grigor (2013) taste was identified as the main contributing factor towards energy drink consumption.

2.11.2 Social and environmental influences

Higher consumption of energy drinks has been linked to lower socioeconomic status, male gender, diets high in energy density and younger generational groups (Griffiths & Woodson, 1988; Lovallo, Farag, Vincent, Thomas, & Wilson, 2006; Puckeridge *et al.*, 2011; Grandner *et al.*, 2014). Energy drinks are often marketed towards youth consumers, with beverage companies associating their consumption with risk-taking behaviours (e.g. sponsoring extreme sports) that appeal to this group (Griffiths & Woodson, 1988; Lovallo *et al.*, 2006; Cleary *et al.*, 2012; Gallimberti *et al.*, 2013), and high intake of energy drinks has been seen as one way in which risk-taking manifests itself (Miller, 2008; Wesensten, 2014). Consumption levels of energy drinks have been shown to decrease with an increasing awareness of the negative effects of consumption, often reflected in males with low nutrition knowledge making poor dietary choices (Gallimberti *et al.*, 2013).

Social-environmental cues such as friends or family consuming caffeinated products increases consumption levels, with individuals either wanting to feel accepted and part of a group, or products having ritualistic consumption patterns (Hattersley, Irwin, King, & Allman-Farinelli, 2009). This is especially true for adolescents wishing to maintain a desirable social image (Stead, McDermott, MacKintosh, & Adamson, 2011), an issue often exploited with energy drink marketing aimed at this group (Simon & Mosher, 2007; McEwan, Campbell, & Swain, 2010). Religious conventions may also dictate caffeinated product use, as some faiths (e.g. 7th Day Adventists, Jehovah Witness', Hindus, Mormons) consider caffeine to be similar to alcohol and nicotine (due to its psychoactive and stimulant effects), in that it may 'cloud the mind and over stimulate the senses' and so these groups are directed to abstain from its use (Ribeiro & Sebastião, 2010).

Due to differing socioeconomic status and associated living and working conditions, Reyner and Horne (1997) propose that energy drink consumption contributes towards a widening socioeconomic gap. They state that those who most commonly consume energy drinks to stave off sleep are shift workers and minority groups (Griffiths &

Woodson, 1988) and, with the high sugar content of these drinks contributes to obesity, diabetes and other co-morbidities, the addictive nature and positive stimulant properties of the caffeine in these products produces a vicious cycle of dependence and negative health outcomes. This is further compounded by energy drink use being associated with energy dense dietary patterns that are commonly found occurring with poverty (Lovallo *et al.*, 2006).

Tobacco use is correlated with high levels of caffeine use; smokers will often habitually drink coffee in conjunction with smoking cigarettes (de Castro & Taylor, 2008; Wesensten, 2014). Ease of access (price, convenience, availability) also plays a role in rates of consumption of caffeinated products. Soft drinks are often purchased in conjunction with fast foods, with preferential pricing, 'combo deals' and high accessibility at the site of food purchase making them the preferred choice (Hattersley *et al.*, 2009). Soft drinks and caffeinated alcoholic RTDs are marketed towards adolescents and young adults (Simon & Mosher, 2007; McEwan *et al.*, 2010), similar to energy drinks as mentioned previously.

2.11.3 Mixing caffeine with alcohol

The mixing of alcohol with caffeinated energy drinks or the consumption of premixed caffeinated 'ready to drink' (RTD) alcoholic beverages has become common among young adults, and has been linked to heavier or 'binge' drinking patterns (MacKenzie *et al.*, 2007; Weldy, 2010). When alcohol is normally consumed, it acts as a depressant and sedative, inducing sleepiness (Park, Jang, & Hong, 2007), decreasing inhibitions and impairing judgement (Griffiths & Woodson, 1988; Weldy, 2010). When mixed with caffeine, the sedative effects of alcohol are decreased due to antagonism of ARs, but other alcohol-induced behaviours are unaffected, and decreasing the sensation and appearance of intoxication. Increased time awake can in turn lead to longer, heavier drinking sessions and a higher rate of alcohol ingested in one session (MacKenzie *et al.*, 2007; Weldy, 2010), which paired with the impulsivity of intoxication has been dubbed 'wide-awake drunk' (Cleary *et al.*, 2012). The mixing of caffeine with alcohol has been

linked with negative drinking outcomes including driving while intoxicated, drug use and sexual risk taking (Griffiths & Woodson, 1988; Weldy, 2010). New Zealand has a high rate of hazardous drinking patterns, (19% of alcohol consumers displaying patterns of hazardous drinking) with higher rates in the 18-45 year old age group and in males (New Zealand Ministry of Health, 2013). RTD consumption in New Zealand is most prevalent within the 14-17 and 18-24 year old age groups, with females having higher consumption levels than males (Huckle, Sweetsur, Moyes, & Casswell, 2008). RTD consumption was a stronger predictor for binge-drinking patterns in females aged 14-17 years old than other alcoholic beverages (Huckle *et al.*, 2008).

Advertising of RTDs is typically directed towards adolescents, young adults and females (McEwan *et al.*, 2010). RTDs are also a source of cheap alcohol for younger age groups (individuals aged 15-24 years old have the lowest median weekly income compared to those in the 25-49 and 50+ years age brackets in New Zealand (Statistics New Zealand, 2013)), with each standard drink of RTD (10 mL ethanol) being between \$1.00 - \$1.50 (Guanasekara & Wilson, 2010). However social norms have a higher influence on alcohol consumption than price; in New Zealand alcohol content of beverages also have a significant effect on the choice of alcoholic product for consumption – higher percentages of alcohol consumption were preferred by consumers (Parsons & Stephenson, 2013).

Das *et al.* (2014) observed RTD consumption and hospitalisation rates in New Zealand over a two-week period at the Christchurch Hospital Emergency Department ; and all patients with alcohol-related admissions or recent alcohol consumption were invited to complete a questionnaire surrounding their alcohol consumption. RTD consumption was reported as being consumed in 21% of admissions related to alcohol consumption, with 79% of RTDs consumed coming from liquor stores. Hospital visits in conjunction with RTD consumption were higher in younger age groups (less than 30 years old), with a small peak in drinkers aged 41-55 years old (Das *et al.*, 2014). While RTDs do not always contain caffeine; no indication was given in this study of the type of RTDs consumed that contributed towards hospitalisation. Due to a wide variety of caffeinated alcoholic RTDs available however, it is likely that caffeinated RTDs made up a portion of those contributing to hospitalisation in the study by Das *et al.* (2014).

2.12 Existing caffeine questionnaires

Questionnaires surrounding caffeine consumption have long been used in research to gauge caffeine consumption of various population groups; however focus has been more on quantity, timing and negative effects of caffeine consumption rather than influencing factors on consumption. Table 1.1 outlines questionnaires and tools that are currently available to assess caffeine intake and have had a history of adaptation for use in various population groups.

The existing questionnaires included in Table 1.1 either do not measure influences on consumption, or in the case of the CEQ (Heinz *et al.*, 2009) and CaffEQ (Huntley & Juliano, 2012), only measure expectancy outcomes of consumption. The caffeine questionnaire by Heinz *et al.* (2009) investigates expectancy measures of caffeine consumption (CEQ), and Schliep *et al.* (2013) validates a variety of instruments investigating caffeine intake in pre-menopausal women. The CaffEQ and CWSQ were constructed around the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (Huntley & Juliano, 2012; Juliano *et al.*, 2012).

Mcllvain's caffeine questionnaire (Mcllvain, 2008) included expectancy outcomes of caffeine consumption as well as influences of consumption. However, Mcllvain's caffeine questionnaire (Mcllvain, 2008) was specific to first year college students in the US, limited to tea, coffee, soft drinks and energy drinks, and upon examination did not structurally fit best practices for questionnaire construction (as outlined in Section 3.4.1).

Questionnaires focusing on quantifying caffeine intake include Landrums Caffeine Consumption Questionnaire (CCQ) (Landrum, 1992), the supplemental beverages FFQ by the Fred Hutchinson Cancer Research Centre (2004), and caffeine questionnaires by Mcllvain (2008), Huntley and Juliano (2012) (CaffEQ), Juliano *et al.* (2012) (CEQ), as well as a 24 hour dietary recall by Schliep *et al.* (2013). The majority of the questionnaires are not inclusive of all caffeinated food and drink products on the market. Exceptions are Huntley and Juliano (2012) and Juliano *et al.* (2012); the CaffEQ

and CWSQ contain a large number of products available on the market. All of these questionnaires have been adapted for use in a number of additional research projects.

Tools that have examined some aspect of caffeine intake levels in New Zealand populations are limited, and displayed in Table 1.2.

There are no tools that have been used to specifically evaluate caffeine intakes, influences, or consumption patterns in New Zealand. Where a degree of caffeine intake has been able to be gauged, it is secondary to results found as an outcome of studies on general food and beverage consumption, for example FFQs or dietary habits questionnaires (University of Otago and Ministry of Health, 2011; Wong *et al.*, 2012; Sundborn *et al.*, 2014). Relationships between caffeine, alcohol, cigarettes and risk taking in New Zealand university students was investigated by Hughes (1993) using a sensation-seeking scale developed by Zuckerman *et al.* (1964). While these generic and specific FFQs that have been used in New Zealand (Wong *et al.*, 2012; Sundborn *et al.*, 2014) have resulted in some information on caffeine consumption, there is currently no tool comprehensively covering New Zealand specific influences of consumption, consumption frequency and associated negative experiences.

2.13 Summary of the literature

Caffeine has been used as a stimulant for centuries; however it is only relatively recently that its physiological mechanisms of action and chemical structure have been determined. Caffeine is mainly consumed through the diet via tea, coffee, chocolate, kola drinks, energy drinks, caffeinated alcoholic RTDs, caffeinated sports supplements and caffeine tablets, and consumption is influenced not only by stimulation expectancies but also social and environmental factors. Through its inhibitory actions on adenosine receptors, caffeine is able to aid in decreasing fatigue and improving cognition and physical performance, however it can also contribute towards negative effects such as headaches, uncontrollable shaking, and in extreme cases, fatalities. Negative effects of consumption may result from intoxication or withdrawals after

caffeine dependency is developed with chronic intakes. Reactions to caffeine ingestion are also determined by the amount of caffeine ingested and genetics. There is currently no caffeine tool available to evaluate caffeine intake patterns, influences and negative effects across a range of products in New Zealand adults.

Chapter Three

3. Methods

3.1 Introduction

The purpose of this research was to produce a questionnaire to examine caffeinated product consumption patterns in New Zealand adults (15 years and older), including quantity, influences on consumption and any caffeine effects experienced. This research was carried out in two separate stages.

Firstly, qualitative data was collected to investigate patterns of consumption of caffeine-containing products in New Zealand adults. This was achieved via a series of focus groups across different demographic groups. Data collected was then thematically analysed and used to formulate and refine a quantitative caffeine consumption questionnaire (CaffCo).

Sections 3.2 and 3.3 describe the focus groups procedures and thematic analysis of focus group transcriptions, with Section 3.4 describing the process of questionnaire development.

3.1.1 Ethical approval

This study was undertaken by the student researcher Karli Rowe at Massey University (School of Food and Nutrition, Albany, New Zealand). Ethical approval for conduction of focus groups was gained from the Massey University Human Ethics Committee: Northern (MUHECN15/006; see Appendix A for MUHEC approval letter). Participation

in the research was voluntary, and informed consent was gained from all participants. Where participants were aged between 15 and 17 years old, informed assent was gained from the participant and informed consent gained from their parent or legal caregiver.

Once the CaffCo had been finalised, a low risk notification was submitted to the Research Ethics Office of Massey University Albany campus. With acknowledgement of the low risk notification by the Research Ethics Office (low risk ethics notification number 4000015175), pilot testing of the CaffCo was able to be carried out.

3.2 Focus group methodology

3.2.1 Participants

Focus group participants were 15 years of age or older, and fluent in both written and spoken English. This age bracket was selected to align results with data on food and nutrient intake as well as nutritional status of New Zealand adults collected in the Ministry of Health's document 'A Focus on Nutrition: Key Findings of the 2008/2009 New Zealand Adult Nutrition Survey' (2011). Consumption of caffeinated products was not part of the inclusion criteria. It was initially proposed that five focus groups would be carried out, each consisting of between six to ten participants. This number of participants per group session was chosen as it has been determined to be best practice, with focus groups of more than ten participants often not achieving the depth of data sought after, people's opinions not given time to be heard or the groups become harder to control (Hennink, 2013; Krueger & Casey, 2015). Groups smaller than six may also fail to obtain depth of data as data is limited by participant experience i.e. fewer participants means fewer combined experiences (Krueger & Casey, 2015).

The goal was to reach data saturation at the culmination of these five group sessions. Data saturation was reached when there are no new themes or data being brought up by focus group participants on the topics presented; the researcher will have heard no new information (Krueger & Casey, 2015). After conducting the initial five focus groups however, data saturation had not been reached, and so a further two focus groups were conducted.

Participants were recruited from a variety of demographic groups, and this was further helped by the group sessions being run over two separate locations in New Zealand; urban (Auckland City) and more rural (Whakatane, Eastern Bay of Plenty) areas. As the purpose of the research was to identify in-depth patterns of caffeine product consumption, slightly different demographic groups were recruited for each focus group (Table 3.1).

Table 3.1 Focus group spread

Focus group	Location	Target participants
One	Whakatane	Teenagers (female)
Two	Whakatane	Provincial workers (male and female)
Three	Auckland	Pasifica community members and students (male and female)
Four	Auckland	Urban community members and workers (male and female)
Five	Auckland	University students (male and female)
Six	Auckland	University students (female)
Seven	Auckland	Apprentices and blue collar workers (male and female)

Some degree of demographic homogeneity between participants in each focus group was expected and experienced (due to each focus group being conducted in different areas). This has been shown to be advantageous in focus group settings, as it aids in building rapport between participants (Krueger & Casey, 2015).

Potential participants agreeing to, but failing to attend focus groups has often been a common occurrence (Krueger & Casey, 2015). In order to help ensure that focus group numbers would meet the required 6-10 participants even with no-shows, focus groups were aimed to be over-recruited to 12 participants. In the case of too many (more than 12) prospective participants, selection was based on a 'first-come first-served' basis. Those who were not to be part of the focus group were informed that they would be unable to participate due to all places having been filled (via email prior to the focus group), but were given the option of being placed on a waiting list in case of any cancellations, alerted to any other focus groups they were able to attend, or asked if they would like to be contacted in regards to pilot testing the questionnaire later in the year.

3.2.2 Participant recruitment and pre-screening

Participants were recruited using a variety of methods, including poster advertisements (Appendix B), word of mouth and social media. Posters were distributed around the Massey University campus in Albany, Auckland, places of work in Whakatane and public community centres in Glenfield, Auckland. Social media advertising consisted of advertising the study on Facebook community group pages using a poster. Prospective participants were given preliminary information via the poster (Appendix B) about the study as well as the contact details of the student researcher. Once initial contact between prospective participants and the student researcher was made, potential participants were emailed an information sheet (Appendix C) to fully inform them of the study and focus group procedures. Participants were also asked to complete a screening questionnaire (Appendix D) to determine their eligibility to participate in the study, and any questions they had about

the study were answered. The screening questionnaire also contained questions on gender and ethnic identification of participants, for descriptive demographics.

No prospective participants were deemed ineligible for the study. Participants were informed via email of the time and location of the focus groups, and given contact details to notify the researcher if they were unable to attend. If the participant was aged between 15 and 17 years old, parental consent forms (Appendix E) were also included in this email, to be completed and brought to the focus group. Two days before the focus group, participants received a confirmation email to remind them of the time and place of the focus group, which also gave them another opportunity to alert the student researcher if they were not able to attend. Sending of reminders prior to the focus group has been shown to reduce 'no-show' rates (Krueger & Casey, 2015).

3.2.3 Informed consent and confidentiality

Informed consent forms including confidentiality agreements (Appendix F) were provided at the beginning of each focus group for participants to sign. Information sheets (Appendix C) were also provided at this time for participants to re-read. Where participants were aged between 15 and 17 years, the parental consent forms (Appendix E) previously sent out for signing were requested, and these participants aged between 15 and 17 gave informed assent (Appendix F). All participants within this age bracket were able to obtain parental or legal caregiver consent, and so none were excluded from the study.

3.2.4 Location

Focus group locations were a combination of both public and private venues. These were chosen due to their proximity to and ease of access by participants or at venues

already available to participant groups. Venues were chosen which were wheelchair-accessible for any participants who may have had mobility issues.

Focus groups were held at the most convenient time for the majority of participants in each focus group. Depending on the focus group, this time varied, and so for some (e.g. workers) this was after work hours while for others (e.g. University students) this was during the day.

3.2.5 Focus group procedures

Focus groups were no longer than an hour in duration and were audio recorded. Two audio recording devices were used in each focus group discussion, an Olympus Voice Recorder (model VN-5500PC) and a Sony IC Recorder (model ICD-PX312). This was to ensure that if one audio device failed, audio recording of the focus group would still be available. The audio devices were positioned in different places during the focus group to help ensure that if one participant could not be heard on one device, they may be heard on the other.

The moderator arrived at the venue 15 minutes early to set up the room, organise refreshments, paperwork and seating for the participants. Participants were greeted upon arrival and given an opportunity to access light refreshments (which aided to create a more relaxed atmosphere) and chat amongst themselves as well as review the study information sheet. The study aims, objectives and methods were then explained verbally and participants given the chance to ask any questions. Once these had been answered, participants were asked to complete the consent form and confidentiality agreement (Appendix F). When these had been signed, ground rules for the focus group were given (included in the moderator guide; Appendix G).

A quick ice-breaker exercise was performed before the focus group discussion began. This involved a game of 'two truths and a lie'; each participant introducing themselves then stating two facts about themselves (pets, favourite colour etc.) and a lie; it was then up to the other participants to guess which one of the three was the lie. Ice-

breaker activities come first as a way to get group participants talking early on in the group session, as Krueger and Casey (2015) note that the longer it is before someone speaks in a group environment, the less likely it is that they will say anything. The ice-breaker activity also helps the participants to familiarise and connect with each other, thus aiding the coming conversation (Freeman, 2006).

Audio recording began once this ice breaker activity had taken place and discussion on the relevant topics began. Discussion followed the structure set out in Appendix G 'moderator guide' and Section 3.2.5. Audio recording was terminated at the end of each focus group when all of the participants had left, or the moderator determined that post focus group discussions between participants were irrelevant.

At the end of each focus group, participants were thanked for their time and each provided with a \$20 MTA petrol voucher for compensation of any travel costs incurred as a result of travel to and from the focus group. Signed confirmation of receipt of this voucher was also obtained from each participant (see Appendix H for form template).

3.2.5.1 Role of the moderator

The focus group moderator for all seven group sessions was a student researcher. The role of the moderator was to create a comfortable environment and aid in building rapport between participants while at the same time ensuring that all questions or topics needing to be covered were discussed. The moderator provided topics and questions for discussion and probed for more in-depth information when needed, while introducing minimal bias (no leading questions). If the conversation turned to unrelated topics, it was the moderator's job to bring the participants conversation back to the topic at hand. The moderator did not contribute to the group conversation as the interactions and discussion were aimed at being between participants.

While a framework of key topics and questions to be discussed were provided for the moderator in the moderator guide (Appendix G), using her own discretion, the moderator was able to deviate from this. For example the flow of conversation may

have covered topics in a different order from that on the guide, but still cover all key topics to adequate depth. As Krueger and Casey (2015) demonstrated, it was more important to allow flow of thought and discussion between participants that may deviate from the order set out in the guide, than to restrict participant conversation by structures that may have constrained conversation, interrupted flow of conversation and hindered rapport.

It was also the role of the moderator to determine when focus group content had been covered to an adequate depth and to bring the focus group to a close. Any additional unrelated interaction between the moderator and participants was left until after termination of the focus group.

3.2.5.2 *Questions and key topics*

In the focus group environment, both sequence and wording of questions played a large role in the depth and completeness of responses provided by the participants. Attention to the order of questions needed to be such that a natural flow between topics occurred, time was managed wisely and there was lead up to key questions, so that participants had time to think in depth about the topics being discussed. However, as mentioned previously in Section 3.2.5.1, the moderator may use their own discretion to deviate from the question order outlined below.

Questioning route went from basic open questions and transitioned to more specific questions as the focus group progressed; mirroring best practices for focus group conduction as set out in the literature and summarised in the following paragraph.

Introductory questions aimed to aid in building rapport while at the same time gaining some initial information (Krueger & Casey, 2015). These questions were basic, as they were still aiming to encourage people to talk and make them comfortable in the group environment (Hennink, 2013; Krueger & Casey, 2015), but at the same time beginning to commence participant thought processes about the topic at hand. Following introductory questions, 'transition' questions (expansions on the introductory

questions) were then used to begin to move the flow of conversation towards the key topics wanting to be addressed. These key topics were explored by participants through the use of key questions, with ample time given for detailed discussion between participants (Hennink, 2013; Krueger & Casey, 2015). Following the key questions, or when the moderator felt that these themes had been addressed sufficiently and participants will offer no more information, 'ending' questions were used - the participants were asked to summarise and the moderator fed-back summaries to check data gathered. This was an opportunity for participants to make any additional comments that they may have missed, or to clarify previous opinions (Krueger & Casey, 2015). The focus group was then brought to a close.

All questions needed to be able to evoke conversation, be clear, open-ended and one-dimensional (Krueger & Casey, 2015). If not, there were higher chances of misinterpretation, participant confusion or divergence from the research topic. A copy of the questions used in this focus group in the moderator guide (Appendix G).

3.3 Data analysis

Demographic data of the focus group participants (age group, gender and ethnic identification) was gathered as part of the participant screening process, and percentages given using Microsoft Office Excel 2007.

Audio recordings of the focus groups were transcribed verbatim by the student researcher. Where conversation turned to topics unrelated to the study, transcription was written as '(unrelated)'. The phrase '(inaudible)' was also used where participants spoke over one another and when after three attempts at deciphering the audio recording no sense could be made. Qualitative thematic analysis of the transcripts was then carried out using NVivo qualitative data analysis software version 10 (QSR International Pty Ltd, 2012).

3.3.1 Thematic analysis

NVivo software allows for the qualitative analysis of transcripts based on the researchers' coding of sections of text into themes, or 'nodes'. Main themes are classed as 'parent nodes', with sub-themes of these classed as 'child nodes'. Text sections were able to be coded to more than one node, and so once all transcripts had been coded, comparisons between different themes were able to be made and any correlations examined.

Preliminary nodes were created in NVivo from student researcher recall of the overall main themes that came up in each of the focus groups, as well as a 'Product' parent node where different caffeinated products discussed were created as child nodes. Transcripts were then coded under these child nodes and by inductive analysis, whereas new child nodes were added as new themes emerged from the transcripts - see Figure 3.1 for coding progression. The transcripts were each analysed twice in this manner, to ensure correct coding and that no themes were missed.

An example of coding at multiple nodes is given in Table 3.2 for the following quote from focus group four:

- "Coffee is a treat thing, and I like to go out. I don't have coffee at home that often, unless we are having people for breakfast or something like that, but coffee is something I do with my friends, or at work ... you know, if someone's had a bad day."

Table 3.2: Example of transcription thematic coding

'Coffee' coded for all of this content.			
Child Nodes	Parent Nodes	Theme descriptors	Key themes
Food associations	Food associations	Food and smoking associations	Environmental opportunity
Morning	Time of day	Time of day	
At work	Work environment or occupation	Accessibility	
Comforts			
Improves mood	Emotional comfort	Emotional wellbeing	Functional expectations
Treats	Hedonic properties	Hedonic properties	
Friends at home	Home life and Family	Home hospitality	Social drivers

When this coding had been completed, child nodes were condensed into adult nodes and overarching key themes were subsequently identified (Figure 3.1).

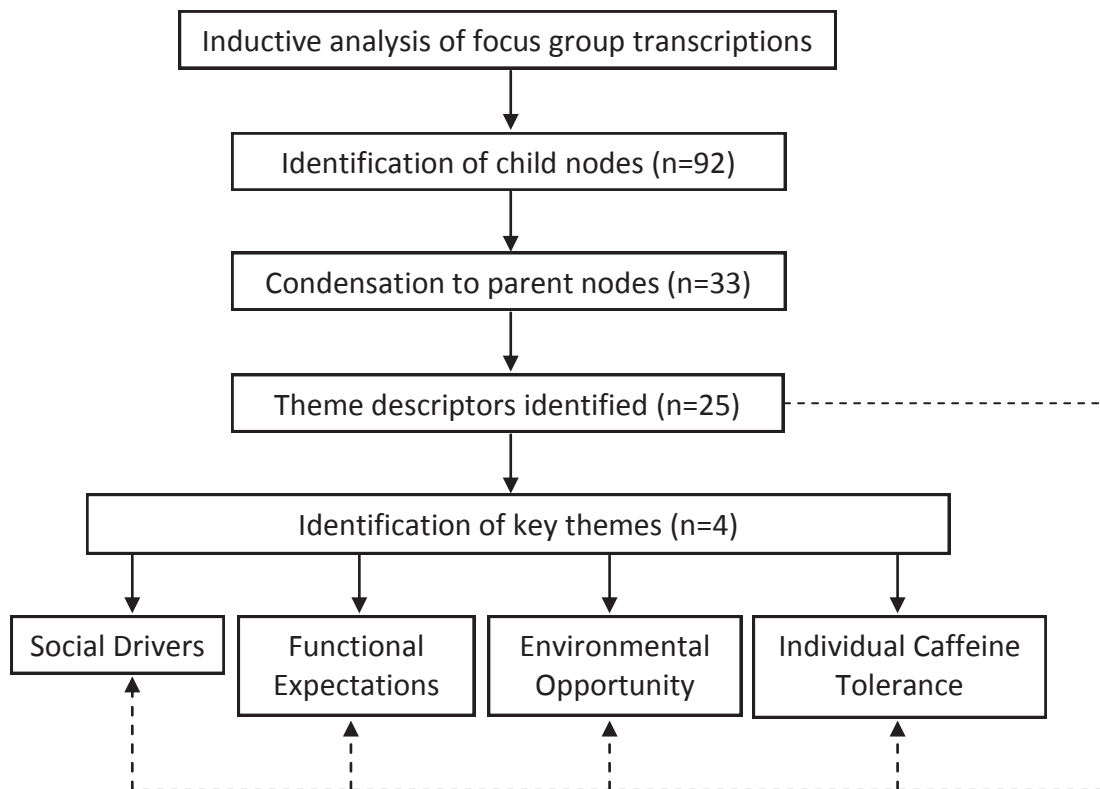


Figure 3.1: Progression of identification of key themes through transcription analysis and grouping of nodes

Once all transcripts had been coded adequately, the combined transcripts were analysed to compare where parent node and theme descriptors were associated with the different caffeinated products. This was done by running a ‘Query’ on NVivo that searched for where content was coded at both a caffeinated product as well as at a parent node or theme descriptor.

3.4 Questionnaire development methodology

The CaffCo was developed to be an online tool, but also being able to be administered as a paper copy for those individuals 15 years of age needing parental consent. Qualtrics online survey software (Qualtrics, 2015) was used for development of the

online CaffCo. Qualtrics was chosen for its broad range of capabilities including its survey item sequencing, options for question structure, and mobile device compatibility. Existing caffeine questionnaires were examined (Zuckerman *et al.*, 1964; Hughes, 1993; Shohet & Landrum, 2001; Fred Hutchinson Cancer Research Centre, 2004; McIlvain, 2008; Heinz *et al.*, 2009; Hendrick, Comber, Eastabrooks, Salva, & Davy, 2010; University of Otago and Ministry of Health, 2011; Huntley & Juliano, 2012; Nova, Hernandez, Ptolemy, & Zietzer, 2012; Wong *et al.*, 2012; Schliep *et al.*, 2013; Sundborn *et al.*, 2014), however none of these accurately captured the aim of this study, both through question content and the application of best practices for questionnaire structure.

3.4.1 Questionnaire theory and structure

To obtain high response rates and completion of questionnaires, questionnaires need to be engaging and limit any potential participant fatigue or burden; they need to be enjoyable and not frustrating (Krosnick & Presser, 2010; Pew Research Center, 2015). There is a wealth of literature on best practices in survey methodology to optimise response rates and accuracy, some of which was used in development of the CaffCo and summarised below.

For participants to engage with the questionnaire, they need to consider both the topic and study to be worthwhile, or be given sufficient incentive. To achieve this, the questionnaire began by outlining what the study was about, who was running it, why it was important and how it was pertinent to the potential participant. Consent and confidentiality were also addressed here, as this let the potential participant know that even if there are sensitive questions, their individual answers would not be linked back to them (Pew Research Center, 2015). Screening questions (determining either study eligibility or question inclusion) followed, with these being non-sensitive and non-obvious as screening questions, in order to lower the risk of respondents opting out of the questionnaire (Blair, Czaja, & Blair, 2014).

Once individuals had engaged with the questionnaire, they needed to have a low perception of burden. Attractive presentation, clear instructions, and appropriate language level use with no jargon (unless absolutely necessary) aided to decrease any perceived burden (Blair *et al.*, 2014). Making questions clear, direct and easy to understand (such that they can only be interpreted one way) so that participants had to do as little work as possible in answering also reduced recall error in responses (Krosnick & Presser, 2010; Blair *et al.*, 2014; Pew Research Center, 2015). To further lower the chance of misinterpretation, there were no double-barrelled questions included (those that ask after more than one issue yet only allow for one response), and word economy was applied (Pew Research Center, 2015).

Topic and question order also played a role in limiting participant fatigue and helping to optimise the accuracy of answers. Initial questions needed to be closed, and either factual or attitudinal to connect to the respondent and make the questionnaire feel personal (Krosnick & Presser, 2010). Questions on related topics were grouped together to ensure flow of the questionnaire and to aid participant cognitive processes (Krosnick & Presser, 2010). Within each topical grouping of questions, simple general questions that the majority of respondents would be able to answer appeared first to engage the participant with the topic and start cognitive processes (Blair *et al.*, 2014; Pew Research Center, 2015). To further engage the participants at this stage, questions were asked about their personal habits to make them feel their individual responses were pertinent to the study. More specific questions then followed; however the respondent should not feel burdened by having to answer many difficult questions one after the other (Krosnick & Presser, 2010; Pew Research Center, 2015). Having specific questions after the general questions also decreased the possibility of respondents being influenced by previous questions (Krosnick & Presser, 2010).

Order of response options within a question may also influence answers; for visual questionnaires such as those completed online, 'recency' effects can occur. This is where response rates for items are altered due to the order in which they are presented (Krosnick & Presser, 2010; Pew Research Center, 2015). 'Recency' effects refer to participants being more likely to choose from the last few options that they are exposed to; results will reflect a higher portion of these choices being selected

than would be a true representation. To counteract this, response options were randomised where possible (Krosnick & Presser, 2010).

Social desirability bias (where questions are answered in a manner as to be seen favourably by others) is also able to interfere with the accuracy of questionnaire responses; however this was reduced by the questionnaire being self-administered and their being assurances of confidentiality in the questionnaire (Krosnick & Presser, 2010; Pew Research Center, 2015). With online questionnaires, there is no interviewer and so no interviewer affects were introduced (i.e. participants answering with what they believe that the interviewer wants to hear) (Krosnick & Presser, 2010).

As questionnaires progress, participant fatigue is introduced; this may lead to satisficing (choosing answers which participants believe the researcher wants to hear (Blair *et al.*, 2014)), and other inaccuracies in reporting (Blair *et al.*, 2014). This can be combated by changing the question format, and keeping questions interesting and engaging to help maintain participant interest (Pew Research Center, 2015). Participant fatigue can also occur if it takes an extended amount of time to complete the questionnaire. Blair *et al.* (2014) suggest the optimal time for online questionnaires is around ten minutes, however, when longer than this participant fatigue can be combated by randomisation, visual aids, keeping the questions interesting and letting the participant know how long the questionnaire will take before they begin.

Demographic questions, unless being used earlier as a screening criteria, normally occur at the end of the questionnaire (Pew Research Center, 2015). This is due to the possibly sensitive nature of some of these questions which may put off participants completing the questionnaire if asked too early. By having these questions at the end participants would have had time to get comfortable with the questionnaire and what it is asking and therefore are more likely to complete these questions.

3.4.2 Questionnaire items

Questionnaire items for pilot testing of the CaffCo were based on the results of the qualitative thematic analysis of focus groups as described earlier in this chapter. The resulting associations of parent nodes with different caffeinated products (Table 3.3) were used to formulate the initial CaffCo items. While Table 3.3 shows associations arising from focus groups (that had reached data saturation), some associations such as tea consumption being linked to advertising that had not arisen in focus group analysis were included as being pertinent following discussion with supervisors.

For a paper copy of the CaffCo questionnaire, please refer to Appendix J.

Table 3.3: Parent nodes and their associations by product (cont. over page)

Parent node	a. Tea	b. Coffee	c. Chocolate	d. Kola Drinks	e. Energy Drinks	f. RTDs	g. Sports Supplements	h. Caffeine Tablets
1: Addiction and dependence	Yes	Yes	Yes	Yes	Yes	-	-	-
2: Advertising	-	Yes	Yes	Yes	Yes	Yes	Yes	-
3: Age differences (generational)	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
4: Alcohol content	-	-	-	Yes	Yes	Yes	-	-
5: Convenience	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6: Emotional comfort	Yes	Yes	Yes	-	Yes	Yes	-	-
7: Ethnic cultural practices	Yes	Yes	Yes	-	-	-	-	-
8: Food associations	Yes	Yes	Yes	Yes	Yes	-	-	-
9: Friends	Yes	Yes	Yes	Yes	-	Yes	Yes	-
10: Gender differences	-	-	-	-	Yes	Yes	Yes	-
11: General energy (to help stay awake or get through the day)	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
12: Habit, routine, personal ritual	Yes	Yes	Yes	Yes	Yes	Yes	-	-
13: Hedonic properties	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes
14: Home life and family	Yes	Yes	Yes	Yes	-	Yes	-	-

Table 3.3: Parent nodes and their associations by product (cont. from over page and cont. over page)

Parent Node	a.	b.	c.	d.	e.	f.	g.	h.
	Tea	Coffee	Chocolate	Kola Drinks	Energy Drinks	RTDs	Sports Supplements	Caffeine Tablets
15: Intoxication	-	Yes	Yes	Yes	Yes	-	Yes	-
16: Mental stimulation	Yes	Yes	-	-	Yes	-	Yes	Yes
17: Negative effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
18: Out and about (not at home)	Yes	Yes	Yes	Yes	-	Yes	-	-
19: Partying and drinking culture	-	-	-	Yes	Yes	Yes	Yes	Yes
20: Peer pressure	-	Yes	-	Yes	Yes	Yes	Yes	Yes
21: Physical activities	-	Yes	-	-	Yes	-	Yes	Yes
22: Physical stimulation	-	Yes	-	-	Yes	Yes	Yes	Yes
23: Product substitution	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes
24: Safer than spirits	-	-	-	Yes	-	Yes	-	-
25: Smoking associations	-	Yes	-	-	Yes	-	-	-
26: Social acceptance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
27: Socialising	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
28: Studying or students	Yes	Yes	-	-	Yes	Yes	-	Yes
29: Time of day	Yes	Yes	Yes	Yes	Yes	Yes	-	-

Table 3.3: Parent nodes and their associations by product (cont. from over page)

Parent node	a. Tea	b. Coffee	c. Chocolate	d. Kola Drinks	e. Energy Drinks	f. RTDs	g. Sports Supplements	h. Caffeine Tablets
30: To wake up	Yes	Yes	-	-	Yes	Yes	-	-
31: Tolerance levels	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
32: Withdrawals	Yes	Yes	-	Yes	Yes	-	-	-
33: Work environment and occupation	-	Yes	-	-	Yes	-	-	Yes

The CaffCo was arranged into a series of question blocks on similar topics; either by product, caffeine effects, or social conventions and attitudes. The blocks were as follows:

- 1- Introduction and consent
- 2- Screening questions
- 3- Tea
- 4- Coffee
- 5- Chocolate
- 6- Kola-flavoured drinks
- 7- Energy drinks / energy shots
- 8- Why some products used to replace foods
- 9- Caffeinated RTDs
- 10- Caffeinated pre-workout sport supplements and sports gels
- 11- Caffeine tablets
- 12- Dependency and intoxication
- 13- Why products are not consumed
- 14- Social conventions and attitudes
- 15- Demographics

Block 1 (introduction and consent) outlined what the CaffCo contained, why the survey was being conducted, how long it would take and how the information collected would be used. A downloadable information sheet was included with detailed information on the study as well as researcher contact details. This block also contained the Massey University low risk ethics notification statement and a confirmation question to ensure that the information sheet had been read and understood. Participants provided consent by selecting 'yes' to continue onto the survey. If 'yes' was not selected, the participant was directed to an automatic end of survey message that alerted them that they would not be able to continue due to not providing consent. Confidentiality of the study was also outlined in block 1; participants would not be identified and their answers would only be used to improve the CaffCo for future use.

Screening questions in block 2 included participant selection of caffeinated products consumed, age group and gender. Age group was used as a screening question, and reflected groupings in the 2008/09 New Zealand Adult Nutrition Survey (University of Otago and Ministry of Health, 2011). If '14 years or under' was selected, participants were redirected to a message notifying them that they were ineligible for the study. If '15 years old' was selected, participants were redirected to a page where they could select to receive a copy of the CaffCo via email or post; so that parental consent forms could be included and filled out appropriately, then either posted or scanned and emailed back to the researcher. For paper copies sent via post, prepaid return envelopes were included. If any of the age brackets over the '15 years old' category were selected, participants were able to continue with the CaffCo online. Selection of which caffeinated products the participant consumed allowed the questionnaire to be personalised to the individual participant; only blocks pertaining to those products selected would be displayed (using Qualtrics 'display logic' function). If the participant selected that none of these products were consumed, participants were still asked to answer blocks 13-15 which dealt with why products were not consumed, social attitudes towards products and demographic data. Gender (male, female, other) was also included in block 2 as a screening question due to some questions on product consumption relating to menstruation and use of oral contraceptives.

Questions in blocks 3-7 and 9-11 each focused on a particular caffeinated product, with each of these blocks only appearing if the respondent had previously indicated consuming that product in block 2. Within each product block, participants were questioned on the frequency of consumption of products and product variants as well as factors influencing consumption and patterns of consumption. Firstly, there was a food frequency questionnaire (FFQ) style component to determine the frequency of consumption of the product and its variants. Products or their variants were pictured to give the participant a visual reference, and ten frequency values were given (from 'never' to '6+ times a day'). These frequency values were based on nine frequency values used in FFQs of the Fred Hutchinson Cancer Research Centre (2004), and they are beverage specific and reflect the frequency values expressed by participants of focus groups (e.g. up to 10 cups of tea per day would not be reflected by a maximum

frequency value of '2 or more times a day'). It should be noted that the nine values were changed to 10 as 'never or less than once a month' was divided into two categories; 'never' and 'less than once a month', to allow for participants not consuming variants within a product category. Following this there was a question on personal influences and reasons behind consuming the various beverages. A 4-point Likert scale matrix was used following discussions with supervisors, with statements about product consumption given and the participant was able to select from 'strongly agree', 'agree', 'disagree' and 'strongly disagree'. Items selected to be included in the Likert matrix were ones where products demonstrated association with parent nodes (as seen in Table 3.3) as well as product associations that did not arise, but upon discussion with supervisors were included as still having possible associations (e.g. tea and advertising). Parent nodes irrelevant to particular products were not included in order to decrease questionnaire length and hence reduce participant burden.

Following the Likert matrix, a question was included on the time(s) of day the product was normally consumed. To allow for differences in timings of daily schedules (e.g. for shift workers), the hour of consumption was not quantified but rather consumption was based around meal times e.g. 'before breakfast', 'after breakfast', 'between breakfast and lunch', etc. Participants were able to select multiple times of day and the options 'all day' and 'at no particular time' were also included. The final question that was included in all product blocks was that of the environments in which the product was consumed; selection of these options was again determined by Table 3.3 and discussion with supervisors.

The question blocks for the products 'coffee' and 'pre-workout supplements / sports gels' both included an additional product-specific question. For coffee, a question was included if the respondent had indicated that they drank decaffeinated coffee; the question being a 4-point Likert matrix of reasons for consumption of decaffeinated coffee over regular coffee. Caffeinated pre-workout supplements and sports gels included a question on which type of physical activity each product was used with, as during the focus groups some participants had alluded to the use of different products for different activities.

Block 8 was included for participants who had indicated in previous questions that they either 'agreed' or 'strongly agreed' to consuming a product to replace food. They were questioned on the reasons behind this using a 4-point Likert matrix that had a series of statements based on information gained from the focus groups on why people may replace food with caffeinated products.

Signs and symptoms of caffeine withdrawal and intoxication were explored in block 12. Questions were designed to reflect the Diagnostic and Statistical Manual of Mental Disorders (DSM5) criteria for caffeine withdrawal and caffeine intoxication (American Psychiatric Association, 2013) giving subjective measures of symptoms; however this was not intended to be used for diagnostic purposes. Associations between specific products and each separate symptom were also investigated. Block 12 also asked if participants' product consumption had ever led to hospitalisation, applying or receiving first aid, and feelings of concern, help seeking or talking to someone about the effects experienced, including whom they had sought help from.

Block 13 addressed the reasons why products were not consumed. Due to there being more than one product variant within each product group, respondents who indicated that they consumed the product may not consume all variants, so this question was included for all respondents. For each product, participants were able to choose from a range of reasons for non-consumption which were taken from focus group statements or they were able to add their own reasons. This question did not have a forced response to allow for those that had no reasons to inhibit consumption.

Participant perception of various social conventions surrounding consumption of caffeinated products (that arose during focus groups) was analysed using a 5-point Likert matrix in block 14. A 5-point Likert scale was chosen due to attitudes rather than actions being investigated; 'unsure' was included as an option between the 'agree' and 'disagree' options. Participants were then asked to identify which age group and gender they saw as being the main users of each type of caffeinated product, with the age groups listed reflecting those used in the New Zealand National Nutrition Survey (University of Otago and Ministry of Health, 2011) and options for 'all or both' or 'unsure' included for both categories.

Finally, demographics (excluding those used previously for the screening questions in block 2) were included in the final section (block 15). These questions included ethnicity, employment status, living situation, highest level of education, whether a participant smoked, oral contraceptive use (for females), and weight and height (if known). Ethnic groupings were based on level 3 of the Statistics New Zealand ethnicity classification (2005), which can be condensed to reflect the New Zealand National Nutrition Survey ethnic groupings used in summary reports (University of Otago and Ministry of Health, 2011). The use of this Statistics New Zealand classification system also allows for classification of 'other' (when specified) ethnicities into one of the groups in the level 3 classification (Statistics New Zealand, 2005). Participants were able to select multiple ethnic groups. For those participants that indicated that they worked either full time or part time, a question was included on whether their work involved manual labour, long distance driving or shift work; all conditions which were identified during focus groups as influencing caffeinated product consumption. Questions on smoking and oral contraception were included as both of these are known to have an effect on caffeine metabolism within the body. Height and weight (if known) data was collected in order to be able to calculate approximate BMI of participants. Following this, the participants came to the end of the survey, and were thanked for their time.

Throughout the CaffCo, where response options did not follow any type of rank (e.g. time of day is ranked), randomisation of options were applied in an effort to counteract any 'recency' effect bias. While all questions were aimed to be in a closed format for quantitative analysis, some included an 'other' category; these were sections where it was decided after discussion with supervisors that focus groups may not have included all possible options. This 'other' option was not randomised and came at the end of each set of response options. For all questions involving Likert scales, white space was inserted between every 5th or 6th item, and headers repeated halfway down the list of response options to improve readability. To ensure that all questions were answered adequately, 'forced response' was selected for the majority of questions, so the participant needed to answer the question before moving onto the next section of the questionnaire. Some questions, such as height and weight were

not forced answers as participants may not know this information or choose not to answer. Initial testing showed the questionnaire (with all product options selected) taking around 20 minutes to complete, however this time is likely to vary due to number of products selected as being consumed and the reading speed of different participants. The CaffCo was programmed so that only individuals in New Zealand were able to participate.

Qualtrics results are able to be directly exported to both Microsoft Excel and SPSS software for qualitative analysis, each answer being previously coded by Qualtrics. Where questions contained the option of 'I do not consume this product' or 'I have not experienced these effects', if selected, this option became exclusive and subsequent coding and statistical output overrode any other options that may have been selected.

3.4.3 Questionnaire pilot testing and refinement

Following questionnaire development, the CaffCo was pilot tested to evaluate readability, inclusivity and ease of use. The pilot testing was to be carried out on approximately 50 participants; pilot testing on a higher number of individuals than this will give minimal additional responses (Ruel, Wagner, & Gillespie, 2015). Pilot test respondents were invited to complete the CaffCo and provide feedback as to whether the questionnaire items captured all opinions that had been expressed in the focus groups, and ease of use of the questionnaire. Feedback was given by a question at the end of each section block where participants indicated whether the questions in each block were easy to read and understand, and if they had any suggestions for improvement. This question was only included for this pilot testing phase, and was removed from the final questionnaire. Question numbers were also included for pilot testing so that participants were able to provide feedback for a specific question, which were removed from the final version of the CaffCo.

Previous focus group participants who had indicated their interest in pilot testing the questionnaire during the focus groups were contacted via email and given a direct

internet link to the CaffCo. The questionnaire was also pilot tested by Massey University academic staff, and members of the community. Recruitment for these participants was carried out via word of mouth and social media community pages, where potential participants were given a direct internet link to the CaffCo. The pilot test of the questionnaire included all confidentiality and study information as for in the final CaffCo, however notified participants that their responses to questions would not be used for statistical exploration or analysis; only to improve wording, ease of use of the questionnaire and lower any participant burden.

The internet link for the CaffCo used in the pilot test was left open for a minimum of 24 hours to account for differing daily schedules of potential respondents. Feedback from the pilot test was then collated and used to adjust questionnaire items. An information sheet was included at the beginning of the questionnaire explaining the purpose of the pilot test; this can be found as appendix K. For participants 15 years old where a paper version of the CaffCo needed to be completed, a parental consent form (Appendix L) and participant assent form (Appendix M) were included.

Chapter Four

4. Results

The results are presented in two parts; Part A provides data from the qualitative research and thematic analysis used to develop the CaffCo questionnaire, and Part B provides results from the pilot testing of the CaffCo.

4.1 Part A: Qualitative focus group findings

4.1.1 Participants

A total of 43 participants took part in seven focus groups. Participant numbers and demographic data (gender, age group and ethnic identification) are provided below for the total sample as well as for each focus group (Table 4.1).

The total sample number was 43, including 11 men (25.6%) and 32 females (74.4%). All participants were over 15 years old, with eight (18.6%) between 15 and 17 years old, 23 (53.3%) between 31 and 50 years old, seven (16.3%) between 31 and 50 years old and five (11.6%) participants 51 years or older. Ethnicity was analysed as per Statistics New Zealand (2015) recommendations; each time an individual identified with a particular ethnicity it was counted as one individual; participants were able to identify with more than one ethnic group if applicable and so the combined percentages for ethnic groups reached over 100%. Breakdown of the ethnic groups is included in Table 4.1. Using the Statistics New Zealand (2015) ethnic groupings, 65% (n=26) of participants identified as European (includes New Zealand European), 11.6% (n=5) as Maori, 13.9% (n=6) as Pasifica, 9.3% (n=4) as Asian and 6.9% (n=3) as Middle Eastern, Latin American and African (MELAA).

Table 4.1: Focus group participant characteristics for total sample and by focus groups (cont. over page)

	Focus group 1:	Focus group 2:	Focus group 3:	Focus group 4:	Focus group 5:	Focus group 6:	Focus group 7:
Total	group 1:	group 2:	group 3:	group 4:	group 5:	group 6:	group 7:
Number	Young	Provincial workers	Urban Pasifica	Urban community members	University students	Dietetic students	Apprentices and blue collar workers
(percentage of total)	adolescent females						
N	8	7	6	5	3	5	9
Gender							
Males	0	2 (28.6%)	2 (33.3%)	1 (20%)	1 (33.3%)	0	6 (66.7%)
Females	8 (100%)	5 (71.4%)	4 (66.7%)	4 (80%)	2 (66.7%)	5 (100%)	3 (33.3%)
Age							
15-17 years old	7 (87.5%)	1 (14.3%)	0	0	0	0	0
18-30 years old	1 (14.3%)	1 (14.3%)	5 (83.3%)	1 (20%)	2 (66.7%)	4 (80%)	9 (100%)
31-50 years old	0	1 (14.3%)	1 (16.7%)	4 (80%)	1 (33.3%)	1 (20%)	0
51 years and over	0	4 (57.1%)	0	0	0	0	0

Table 4.1: Focus group participant characteristics for total sample and by focus groups (cont. from over page)

	Total	Focus group 1:	Focus group 2:	Focus group 3:	Focus group 4:	Focus group 5:	Focus group 6:	Focus group 7:
Number (percentage of total)		group 1: Young adolescents females	group 2: Provincial workers	group 3: Urban Pasifica	group 4: Urban community members	group 5: University students	group 6: Dietetic students	group 7: Apprentices and blue collar workers
Ethnicity								
Maori	4 (9.3%)	1 (12.5%)	3 (42.9%)	0	0	0	0	0
NZ European	25 (58.1%)	6 (75%)	4 (57.1%)	0	4 (80%)	2 (66.7%)	4 (80%)	5 (55.6%)
Pasifica	5 (11.6%)	0	0	5 (83.3%)	0	0	0	0
Asian	3 (7%)	0	0	0	0	0	1 (20%)	2 (22.2%)
European	1 (2.3%)	0	0	0	1 (20%)	0	0	0
South African	2 (4.6%)	0	0	0	0	1 (33.3%)	0	1 (11.1%)
Latin American	1 (2.3%)	0	0	0	0	0	0	1 (11.1%)
Maori & NZ European	1 (2.3%)	1 (12.5%)	0	0	0	0	0	0
Pasifica, NZ European & Asian	1 (2.3%)	0	0	1 (16.7%)	0	0	0	0

4.1.2 Outline of findings

This section outlines findings from the thematic analysis of focus group transcriptions. This includes the product variants identified by participants, where products were mentioned in the context of each theme descriptor, and how theme descriptors were arranged into the four main themes.

The products and product variants identified by focus group participants are outlined in Table 4.2.

Table 4.2: Caffeinated product variants identified during focus groups

Product	Product variants
a. Tea	Black tea, green tea, iced tea
b. Coffee	Instant, plunger, drip, espresso (incl. flat white, cappuccino, mochaccino, latté etc.), iced coffee
c. Chocolate	Cadbury, Whittakers, dark/milk chocolate
d. Kola drinks	Coca-Cola, Pepsi, frozen Coke
e. Energy drinks / shots	V, Mother, Red Bull, Ammo
f. Alcoholic RTDs	Smirnoff Ice with guarana, Bourbon and kola (e.g. Woodstock, Codys), Jack Daniels and kola, Jim Beam and kola, Purple Goanna
g. Sports supplements (pre workout supplements and sports gels)	Sports gels and pre workout supplements
h. Caffeine tablets	No Doz

Section 3.3.1 outlined how child nodes, parent nodes and theme descriptors were created through inductive analysis. There were a total of 92 child nodes, which were then condensed into 36 parent nodes and then grouped into 25 theme descriptors as can be seen in Table 4.3.

Table 4.3: Caffeinated products and associated product descriptor themes (cont. over page)

Product descriptors	a.	b.	c.	d.	e.	f.	g.	h.
	Tea	Chocolate	Coffee	Kola drinks	Energy drinks	Caffeinated RTDs	Sports supplements	Caffeine tablets
1 : Accessibility	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2 : Advertising	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
3 : Caffeine content perceptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4 : Caffeine perceptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5 : Food and smoking associations	Yes	Yes	Yes	Yes	Yes	-	-	-
6 : Habit and personal ritual	Yes	Yes	Yes	Yes	Yes	Yes	-	-
7 : Time of day	Yes	Yes	Yes	Yes	Yes	Yes	-	-
8 : Emotional wellbeing	Yes	Yes	Yes	-	Yes	Yes	-	-
9 : Hedonic properties	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes
10 : Mental stimulation	Yes	-	Yes	-	Yes	Yes	Yes	Yes
11 : Physical stimulation	-	-	Yes	-	Yes	Yes	Yes	Yes
12 : Placebo effect	-	-	Yes	-	-	-	Yes	-
13 : Product substitution	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes
14 : Waking up and staying awake	Yes	-	Yes	Yes	Yes	Yes	Yes	Yes

Table 4.3: Caffeinated products and associated product descriptor themes (cont. from over page)

Product descriptors	a.	b.	c.	d.	e.	f.	g.	h.
	Tea	Chocolate	Coffee	Kola drinks	Energy drinks	Caffeinated RTDs	Sports supplements	Caffeine tablets
15 : Addiction and dependence	Yes	Yes	Yes	Yes	Yes	-	-	-
16 : Additional negative effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17 : Intoxication	Yes	Yes	Yes	Yes	Yes	-	Yes	-
18 : Tolerance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
19 : Withdrawals	Yes	-	Yes	Yes	Yes	-	-	-
20 : Home hospitality	Yes	Yes	Yes	Yes	-	Yes	Yes	-
21 : Peer pressure	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes
22 : Social acceptability	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
23 : Socialising in the presence of alcohol	-	-	-	Yes	Yes	Yes	Yes	Yes
24 : Socialising 'out and about'	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
25 : Socio-cultural background	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Using thematic analysis the 25 theme descriptors were condensed into four key themes as shown in Figure 4.1.

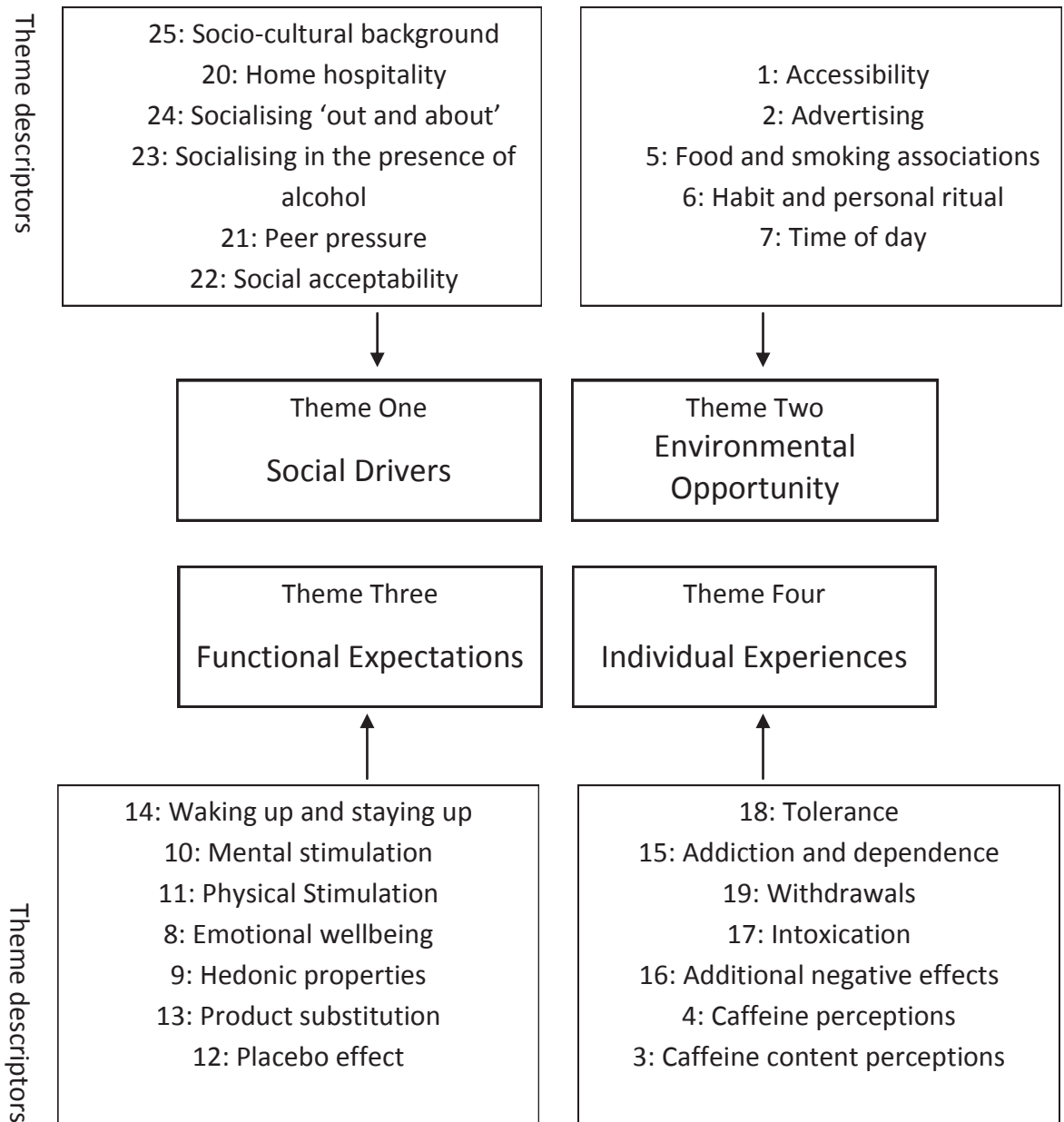


Figure 4.1: Key themes and their theme descriptors

4.1.3 Theme One - Social Drivers

Reported consumption of caffeinated products by focus group participants often took place against a backdrop of social gatherings and interactions. This section details patterns of consumption of caffeinated products during different social activities and as a response to social pressures and 'norms'. The six theme descriptors related to sociocultural background, home hospitality, socialising 'out and about', socialising in the presence of alcohol, the social acceptability of consumption practices and the effects of peer pressure.

4.1.3.1 *Socio-cultural background*

Ethnic and social backgrounds were named as factors influencing caffeinated product consumption patterns; participants attributed consumption patterns to their ethnicity and the way that they were raised. Ethnic cultural practices were credited for the frequent tea-drinking patterns of English, as well as Asian and Turkish cultures. Coffee was the only other caffeinated product whose patterns of use were identified as being influenced by ethnic heritage; European and South American (Colombian) cultures were identified by participants as having an increased level of coffee consumption. For Pasifica individuals, both tea and coffee were named as normally only being taken in the morning or evening, as consumption during the daytime would be considered to be outside of the social norm. Differences in upbringing (across different families and generations) were also credited with creating differences in consumption levels of tea, kola and energy drinks. Tea consumed at home was acknowledged as something that differed between generations. Tea was identified as being the preferred drink at home of 'older generations' i.e. parents and grandparents, especially when compared to coffee by focus group participants from the younger age brackets (young females, students, apprentices and other workers).

- “I think yeah, older people [tea]. I think my age [20’s] coffee is more the go to... seem to have more of a hit with it.”
- “Tea is more ... you think of more elderly people drinking tea.”
- “The older generation drink tea”

Although tea was suggested by these groups as a predominant drink consumed by the older generation and coffee as the predominant beverage of choice in the younger generation, there was no talk of coffee consumption in children; rather, focus group 1 participants (young females) explained that coffee began to be drunk when individuals reached a certain age and stage of life.

- “You get to an age where your friends are like ‘oh do you wanna go out and have coffee?’”

Dietetics students of differing age ranges (from the 18-30 year old age bracket to the 51 years and over age bracket) also identified a generational difference in energy drink and kola drinks patterns of consumption.

- “He’ll [participant’s father] drink juice and Coke and that. It’s like an older person’s kind of thing.’
- “Yeah, because I think that’s what we were brought up with [kola drinks] and you guys were brought up with this [energy drinks]. So that’s ... our go-to.”

Not being brought up with kola as a common beverage was also what non-regular consumers of kola drinks attributed their low rate of consumption to, with them citing it as having been a ‘treat’ food in their childhood and them still viewing its consumption in that way; that kola drinks would only be consumed for birthdays, special occasions and when they went out for dinner. Two young workers from focus group 7 explained their views as follows;

- “Might come down to if your parents had it [kola drinks] around. Like I drink fuck all of it, and my parents never – dad only ever had it with rum as well. That’s the only time I ever have it. Because it wasn’t in the house.”
- “Yeah that’s the same as us. Never in the house.”

These participants viewed kola drinks as treats and often recounted stories such as the ones above from their childhood. However, this was not reflected by all participants, with some young females and various other individuals observing frequent daily kola drinking and having it in the fridge at home as a socially normal practice.

4.1.3.2 *Home hospitality*

Coffee, tea and chocolate (both eating chocolate and the hot-chocolate drink) consumption were frequently mentioned by participants in the context of in-home hospitality, when either visiting someone or playing the host themselves. Focus group participants saw themselves drinking tea and coffee at home with friends and family, with the offering of tea and coffee to visitors being alluded to on various occasions as being the social norm and a practice of good hospitality as can be seen from quotes from workers and Pasifika individuals:

- “Just the thing you do, the first thing you ask, ‘Do you want a coffee?’”
- “Family gathering – gotta make everyone a coffee or a tea”
- “People come and visit your house and you [say] ‘do you want a cup of tea?’”

As outlined in Section 4.1.3.1, the preference for tea or coffee in the home environment differed between generations. At-home hospitality extended to including events such as funerals and family gatherings for participants who identified as Pasifika. This group named tea as more likely to be drunk than coffee in a home situation among Pacific Islanders, the main reasons being the price and affordability of coffee i.e. participants viewed tea as cheaper than coffee. While this was the specific example as to why tea was seen as more of an at-home drink by Pacific Islanders, other ethnic groups (English, Turkish, South African, Japanese and other Asian groups), also identified tea as a drink that was more likely to be consumed in a home environment than any other (e.g. at a cafe).

Chocolate was highlighted as being taken to houses of others when visiting, as well as

being provided for visitors at home as the majority of people like chocolate, as explained by one of the university students:

- “I don’t really know anyone that doesn’t like chocolate. It’s a good thing if people come over and you don’t know... well there’s chocolate, everyone likes chocolate...”

Buying chocolate as part of a social convention was more noticeable in female participants, and more so in younger age groups. How taste and other hedonic properties influence consumption will be discussed in Section 4.1.5.6.

4.1.3.3 *Socialising ‘out and about’*

Products like tea, coffee and chocolate were also included when focus group participants described socialising with family and friends away from the home environment (excluding those situations where alcohol was consumed). This mainly included socialising with friends in cafes and, while tea was mentioned, there was a much heavier emphasis on coffee as a preferred social drink when consumed away from home. One of the participants involved in the focus group of urban workers in Auckland described it as follows:

- “I drink coffee very occasionally at home, but I’m also a true liker of a really nice cappuccino; go out to a nice café ... with someone to have it with.”

The drinking of coffee in this cafe setting seemed to be further enabled by the wide variety of coffee drinks available, as one young female stated:

- “There’s heaps of different kinds of coffee ... so if you like, didn’t like standard latte ... you can get like a mocha ... whereas tea there’s like, not as much variety”.

‘Going out for coffee’ was given as a phrase used more for the social act of meeting up with someone (friends, family etc.), than the consumption of coffee. Participants recounted that though they would say they were ‘going out for coffee’, they may not

consume any coffee, rather tea, hot chocolate or energy drinks depending on personal preferences.

Consumption of kola drinks while out of the home environment for special occasions (birthdays, barbeques etc.), was given as the main reason for their consumption by participants who reported low levels of kola consumption. As mentioned previously these individuals related kola drinks as to being 'treat' drinks in their childhood, with consumption levels in the present day being influenced by their upbringing.

4.1.3.4 *Socialising in the presence of alcohol*

Caffeine was often identified as taking place in conjunction with alcohol, involving multiple environments; family gatherings, at home, parties, bars and night-clubs. Caffeine intake was either a result of caffeine being an ingredient in the alcoholic drink itself, or energy drinks / kola drinks / caffeine tablets being consumed in conjunction with alcohol. Peer pressure, social acceptance and other social influences associated with caffeinated RTDs, energy drinks, kola drinks and caffeine tablets were also contributing factors in their consumption.

4.1.3.4.1 *Caffeinated alcoholic RTDs*

Alcoholic RTDs were frequently mentioned as being consumed alongside other alcoholic drinks. For the most part, participants mainly reported drinking RTDs for their alcohol content, and were often unaware of any caffeine content of the beverage. Wanting to be intoxicated and under the influence of alcohol often dictated the use of these RTDs, with one young female in the first focus group discussion explaining her view that

- “...most people that drink them, drink them to get drunk”.

Participants also saw RTDs as having a higher alcohol content than other alcoholic drinks excluding spirits (e.g. beer), and so would choose them for this reason. Ease of drinking, due to high sugar content and sweet taste, contributed towards consumption of these RTDs compared to other alcoholic beverages; so much so that some participants said that they did not view them as alcohol, but rather more like soft drinks. RTDs were consumed across genders and all ages, with some of the main consumer groups being identified as older males (specifically the brand 'Woodstock' – a bourbon and kola premix), as well as young students and workers. When RTD consumption was discussed in greater detail, participants identified the taste (one older male participant stated he could never mix his own drinks to taste the same as premixes) and convenience of not having to pour your own drink were main factors in choosing caffeinated RTDs over other alcohol. Convenience in transportation (RTDs are often contained in a box) was also expressed by participants as an important factor when choosing RTDs over other alcohol containing beverages, especially when taking alcohol to a party as explained by a young student in focus group 1:

- “It’s hard to take a bottle of spirits and a drink to a house party... it’s easier to take a box of something [RTDs]”.

This ‘taking a box’ of RTDs over other types of alcohol was also a way to decrease the chance of someone else drinking a participant’s drinks; participants were able to carry the box with them at a party without anyone else helping themselves to them. Students in particular saw premixed caffeinated alcoholic RTDs as a cheap way to access alcohol. Price and accessibility of RTDs will be explored later in Section 4.1.4.1. Taking a box of RTDs rather than a bottle of spirits to events was expressed as being more socially acceptable by participants in the >30 years age bracket; by bringing spirits to a social event you would be ‘seen as a “drinker”’ but not so with premixed RTDs:

- “And it’s also kind of socially unacceptable these days, to rock around with a bottle of spirits. This [RTDs] is a lot more socially acceptable”.

However, as mentioned beforehand, RTDs, while still being alcoholic, were viewed as a ‘soft drink’ and also seen as safer than strong liquor. This safety aspect was raised on

several occasions, mainly with male participants who had the idea that by having a set percentage of alcohol in the drink, there would be a much lower chance of over-pouring drinks and becoming too intoxicated. During the group session with urban community members, one male gave the following reasoning:

- “I always want to make sure my mates get home safe at the end of it, and it only takes someone with a bottle of vodka, bourbon or something that’s high percentage to be silly. And you hear about these kids that are in hospital or dead because somebody pours it strong, I’ve been on the wrong end of that. It’s too easy to be silly. For me, I consider an RTD to be quite safe. I can drink them like they’re cokes, I don’t know how many. But you don’t feel like you’re drunk, or in danger or being silly.”

This was reaffirmed when speaking with young apprentices and workers, with one male sharing his view on the topic as follows:

- “You can’t over pour the RTDs because they are always the same percent. Whereas if *Jeremy’s* had a few and you go ask him to pour you one, spirits and coke, it’ll end up being 50:50. You’re on the floor in no time.”

In contrast to this idea of RTDs being a moderately safe way of drinking alcohol, other individuals mentioned consuming them when wanting to feel the effects of alcohol sooner. This idea was linked by the participants to that of caffeinated RTDs being easier to drink because of the high sugar content, and so a higher quantity was able to be consumed over a similar time period compared to other alcoholic drinks such as beer.

Having a caffeinated RTD to stay awake and ‘keep going’ at the end of a night’s drinking was also a frequently mentioned theme of consumption, together with choosing to drink RTDs before going out partying (relative to other alcohol) if individuals needed an energy boost. This theme was repeated in a wide range of participant demographics with the following explanation coming from a young male apprentice:

- “Sometimes, before when you’re starting on beers, you don’t really feel like going out so you buy a four-pack of Smirnoff Guarana, [RTDs] have them before town and you’re ready to go after that.”

However, participants did not attribute the stimulant effects of the RTDs to the caffeine but rather to the sugar ‘rush’ or sugar ‘hit’; the same apprentice who provided the above quote also stated the following:

- “I always drink beer, so you start feeling a bit tired after a while. So, just for the last hour at the pub or something, sugar hit and guarana... guarana I don’t really give a shit about, but the sugar keeps me going.”

4.1.3.4.2 Non-alcoholic products

Other caffeinated products were mentioned in the context of alcohol consumption as being used as a mixer for alcohol, consumed in conjunction with alcohol or simply used in situations where alcohol was being consumed by other individuals; these were kola drinks, energy drinks and caffeine tablets.

Both kola and energy drinks were used as a mixer for spirits in the home, at a party and/or within bar environments. Some of the most frequently mentioned mixes included ‘Jäger bombs’ (Red Bull mixed with Jägermeister), and whiskey with kola. The other main reason for consumption of kola and energy drinks in this environment was as a substitute for alcohol. This was due to not wanting or feeling like drinking alcohol, when a particular alcohol was unavailable, wanting to be sober (e.g. to be able to drive) or for health reasons where alcohol could not be consumed (e.g. pregnancy). With energy drinks and kola drinks, the setting for substitution varied slightly. When used as a replacement for alcohol, energy drinks were mentioned more frequently in the context of a party or bar environment, and avoided in others (such as pregnancy, where participants were highly aware of and avoided the caffeine content in these products). Kola drinks were also mentioned when avoiding caffeine, but more so in relaxed social gatherings such as barbeques with friends and family. One concept

mentioned by an urban community member as to why kola drinks were chosen over other beverages when looking for something to replace alcohol with, was that kola drinks did not draw so much attention to the fact that you were not drinking alcohol as some other beverages might:

- “New Zealanders are so bad at this, you’ve got to have something if you’re not drinking ... if you say to a bar tender ‘what have you got that’s not coke, and not alcoholic’, most of them are going to go ‘what?’... I find that if people are buying rounds, and you’re not drinking, and they go ‘what do you want’, you just go ‘grab me a coke’ and they’re like ‘yeah, ok’. And they don’t question it. But if you go like ‘can you get me a tonic and lime’ or whatever, or a lemon, lime and bitters, people will go ‘oh, you’re not drinking?’ It becomes more obvious.”

The use of caffeine tablets in environments where alcohol was being consumed mainly stemmed from them being seen as an alternative to taking illegal drugs; a legal high. Individuals were looking for the effects of these drugs – to ‘stay up all night and party, and be real awake’ but were either unable to access illegal drugs or not wanting to partake in illegal activities; a situation described as follows by a young female student:

- “We used to take ‘No Doz’ when we went out in Aussie. ... We used to call it *amateur E*. Because we didn’t want to take drugs so we took ‘No Doz’.”

4.1.3.5 *Peer pressure and social acceptability*

In situations where alcohol is being consumed (especially with young adults), peer pressure and a need to feel accepted was identified as one of the factors that drove caffeinated-RTD consumption. During a focus group with female teenagers, participants gave the following reasons for RTD consumption:

- “You feel like you’re missing out [if you don’t drink them]”

- “There are certain expectations around drinking alcohol, drinking RTDs ... there is not really an expectation for you to drink more hot chocolate, but if you’re in a social situation where other people are drinking [RTDs], then it’s expected of you”

Peer pressure was also expressed as influencing sports supplement consumption - more so with pre-workout supplements than sports gels. Sports supplements were seen as a status symbol in young men, with individuals using them to fit into a ‘gym-goer’ image, as expressed by one young student:

- “I think sometimes it could be a status thing ... I always see like guys with their new thing of sports supplements, and they’re like ‘look at me, I’m at the gym with my whey powder and I’m so cool’”

There were strong opinions about how consumption of sports supplements was more as a result of imitation of others in that individual’s social circle rather than as a result of physiological need for the product or having sound knowledge of its functionality. Peer pressure also came up when discussing kola drinks. A community member described the issue as follows;

- “In a social situation, it’s quite a peer pressure drink.”

During the focus groups, participants explored how the social acceptability of consumption patterns could have the effect of driving consumption by people wanting to fit in, but also by individuals wanting to ‘rebel’ and so adopting patterns of intake that would not be considered socially acceptable. Dietetics students identified that ‘No Doz’ consumption had a low social acceptability, and it was this that contributed towards its consumption; individuals wanting to elicit a reaction from others as a result of consumption. :

- “Taking a No Doz, I guess I thought of it as rebellious in a sense?”

4.1.4 Theme Two - Environmental Opportunity

Where social conventions and situations influenced the consumption of caffeinated products, opportunities provided by the surrounding environment also had a part to play in their consumption. This included accessibility of items in terms of price and convenience, advertising, habit, but also associations with foods and time of day.

4.1.4.1 Accessibility

Participants identified accessibility of caffeinated products to be of a key influence on consumption. Firstly, physical locations where caffeinated products were highly available and often free drove consumption. For example, where coffee and tea were provided in a work environment by the employer, focus group participants stated that they would often consume the product more frequently than if they were at home, as it was more readily available and in their proximal vicinity. On occasion it was also of a higher quality than what they would be able to afford to consume in the home environment, as one of the workers in the second provincial focus group explained:

- “That’s why I come to work, to get Moccona; we won’t pay for that at home.”

Accessibility during work hours (apart from coffee provided by employers) was also linked to the often close proximity of coffee retailers to offices and places of work; enabling individuals to consume coffee without giving it too much thought, and ‘easy to grab’ as one of the community members described it. Another example was provided by a student participant:

- “I used to work in the mall every day, and ten steps down there was a coffee kiosk, and I would have coffee every day, just because it was right there in front of me and I could see it every day. And I just had to show up and they’d be like ok, we’ll just bring your coffee down.”

Price was an influencing factor in the consumption of tea, kola and RTDs; it was suggested that the low price of RTDs and kola drinks was a large contributing factor to high rates of consumption in young adults, with cheaper drinks being consumed more. The low price of tea (compared to coffee) was also explained as being the main reason why Pacific Islanders would have tea rather than coffee in their homes. While high accessibility made it easier to consume caffeinated products, the mere fact that it was in the vicinity also influenced people to consume it; they had coffee as a 'time filler' or 'an excuse to take a break', at home they consumed kola drinks whenever they were in the fridge and energy drinks when they were given out free at universities.

Kola drinks were frequently consumed as a beverage of choice overseas, the reason given, being that it was a familiar drink when compared to foreign alternatives with an easy name to pronounce; the brand name 'Coca-Cola' sounds the same in most languages. It was also trusted as being safer to drink than the local water when travelling.

4.1.4.2 Advertising

Advertising of chocolate, coffee, energy drinks, kola drinks and RTDs were identified as a strong influencing factor when participants discussed reasons for consumption of these products. It was recognized that for some of these products, advertising is targeted at different population groups. Energy drinks and caffeinated RTDs were seen as targeting younger generation or teenagers, with reference to them as being displayed as a drink for the 'cool kids' (as described by one of the students) and their having a lot of 'hype' for this age group. For coffee and chocolate, advertising influences on consumption came from the variety of products and tastes available, with new flavours given as being the reason to try; participants stated that if there were new flavours, they would buy them just to see what they were like. This was also true for new varieties of energy drinks. For sports supplements however, it was not the

hedonic properties or specific population groups that were seen as being targeted by advertising, but rather having the best and latest product to aid training. In focus group 1, one female whose sons competed in adventure racing made the following comment:

- “Reps come round and push it on you, or they tell you... ‘It’s the best’ [sports supplements] you know... or the latest.”

Both energy and kola drinks were seen as advertised as beverages to consume with friends at parties, with high emphasis on fun and associated with summertime; marketing strategies identified included company-funded beach parties and giveaways. Participants quite easily quoted kola and energy drink company taglines, such as Coca-Cola’s ‘open happiness’. Advertising energy drinks specifically for their high amount of caffeine (one female student recounted one company actively advertising to students that the product contained the maximum legal level of caffeine allowed in an energy drink), also induced participants to buy and consume the intended product. Caffeinated alcoholic RTDs were seen by participants as marketed strongly towards young adults; females in particular were being targeted with RTDs and marketed as being the ‘trendy’ drink.

4.1.4.3 *Food and smoking associations*

Caffeine intake for many participants occurred as a result of associative patterns of consumption with either food or smoking. The majority of caffeinated products are taken in the form of beverages and as one of the workers in focus group 2 stated:

- “If you go to eat something you generally want to drink.”

Tea and coffee were often consumed with breakfast and lunch, when biscuits or cake were offered during the day and coffee especially when cafe food was eaten. For some people, consumption of kola drinks only occurred if food was being eaten at the same time; especially in conjunction with fast food such as burgers, pizza and hot chips. Kola, chocolate and popcorn were also consumed together when watching movies. One

participant in the urban community focus group suggested that energy drinks were consumed with junk foods in situations where nutritional knowledge may be lacking, e.g. when young males first move out of their parents' house. Chocolate is a food in its own right, and was given as a sweet treat regularly consumed following a meal. The incorporation of chocolate into many different sweet foods was also credited as being a cause of incidental consumption.

Various participants queried whether cigarettes contained caffeine, but while there is commonly none in New Zealand cigarettes, caffeine was often consumed while smoking – mainly via the co-consumption of coffee and energy drinks 'every time' as one blue collar worker stated.

4.1.4.4 *Habit and personal rituals*

For some people consumption of caffeinated products was sometimes a habit or personal ritual rather than being consumed for any other particular reason. However, there were still strong links with regular consumption also being related to participants feeling that the habit was borne from some sort of dependence or addiction to the caffeine. Habit was mentioned as the reason behind having defined times of day for consumption of tea, chocolate and coffee. The habit of using products such as energy drinks and coffee when a stimulus was needed was also mentioned in relation to studying and physical activity. When unable to describe why they consumed a particular product, or consumed it in a particular pattern (e.g. coffee in the morning and tea at night), and even after probing, some participants would cite habit as the main factor:

- “Sometimes I don't even think about it, I mean you get in, you make yourself a hot drink, it's like a routine throughout the day”

This was what one of the Pasifica participants stated, and when the same group was asked what breaking their routine would be like, another responded as follows:

- “Just feel odd – like something is missing. But more the routine than the actual caffeine itself.”

4.1.4.5 *Time of day*

The social acceptability of consumption of caffeinated products not only transferred to which of these products participants consumed, but at what time of day they were consumed as well. While participants talked about the stimulatory aspects of caffeine (discussed in Section 4.1.5) often being sought in the morning, they also stated that social conventions dictated the use of coffee and tea at this time and were more accepted (at this time) than other caffeinated products such as kola and energy drinks. This feeling was so strong that one young female participant likened the acceptability of drinking Coca-Cola in the morning to drinking alcohol at the same time:

- “If you’re like walking to work with a can of Coke compared to having a coffee people would be like why are you having a can of Coke in the morning ...”
- “It’s kind of like drinking alcohol in the morning ...”
- “Like you probably could, but it’s just not right to, you know what I mean?”
- “It seems weird”

However, despite the low social acceptability of drinking kola and energy drinks around breakfast time, participants stated that young workers and teenagers are often seen drinking energy drinks at this hour of the early morning.

4.1.5 Theme Three - Functional Expectations

Both social and environmental settings play an influencing role in caffeine consumption. However, participants perceived various products as having the ability to regulate mood and energy levels, so often consumption resulted from a desire for these effects.

4.1.5.1 *Waking up and staying up*

For many participants, initial and important associations with caffeinated beverages were 'waking up' and 'staying up'. When examining products used in the morning to 'wake-up', coffee and tea were consumed, whereas later in the day energy drinks, kola drinks and coffee were used as a 'pick-me-up'. Some participants stated that they were not able to function properly in the morning without their coffee or tea and relied on products to keep them awake and functioning, as described by a Pasifica participant:

- “[When] I go without it [coffee] I sort of feel like the day isn’t going to be the same, like I need it to function.”

The use of energy drinks, coffee, kola drinks and caffeine tablets in this context were most frequently cited as not only being used to delay sleep but also when the participant was already displaying signs of fatigue. The reasons for needing to stay awake included studying, driving long distances (e.g. truck drivers for work), shift work or working long hours. Perceptions of the high caffeine content in products as well as high availability of coffee, kola drinks, energy drinks and caffeine tablets in petrol stations and work environments were also viewed as reasons for consumption whilst driving. Using caffeine as a 'safety mechanism' to stay awake while driving was also discussed by university students:

- “It’s dangerous driving while sleepy ... some places in the world do it, where they are forced to drive and drive and drive, so they kind of have to [use caffeine pills].”

In situations involving alcohol, a desire to stay awake accounted for some use of caffeinated RTDs.

4.1.5.2 *Mental stimulation*

Caffeinated products were specifically sought when individuals wanted mental stimulation and enhanced concentration. This was within both non-frequent users wanting to improve mental performance but also regular consumers feeling that mental performance was inhibited by non-consumption as illustrated by one student:

- “Last year I used to have like three cups a day... and [afterwards] not drinking as much coffee... I couldn’t focus.”

When mental performance and caffeine were not linked to regular consumption patterns, energy drinks, coffee and caffeine tablets were consumed to improve mental performance in the context of studying and aiding in academic performance during exams. The effects of caffeine were seen as dually advantageous as it aided individuals to stay awake longer for study, while at the same time maximising mental performance during the additional time gained from being awake.

4.1.5.3 *Physical Stimulation*

The need for stimulation (not only mental but also physical) drove caffeinated-product consumption for focus group participants. While this physical stimulation included the energy for waking up and staying awake as previously described, a large portion of discussions around use of caffeine as a physical stimulant related to situations of physical exercise such as participating in team sports, endurance events or going to the gym. Users of these products believed that performance and endurance was improved; this belief came from personal experiences, anecdotal evidence from peers as well as advertising.

Products used for this purpose included caffeinated sports supplements (pre-workout supplements and sports gels), coffee, caffeine tablets and energy drinks. Consumption of these products was often associated with differing types of physical activity. For endurance activities such as competing in triathlons or long-distance bike racing, sports gels were taken during the race and caffeine tablets beforehand. Ease of use of these products (transportation, size) influenced their use over other products. Both caffeinated pre workout supplements and caffeinated sports gels were given as used by sports teams, situations where consumption was also talked about as being influenced by peers and availability. In one example, a participant described sports supplements as being added to the team drink bottles; so they drank it because it was the only drink available. When pre-workout supplements were used in conjunction with going to a gym to work out (resistance training), focus group participants felt that peer influence and social acceptance were major determinants of consumption as well as advertising; these influences are discussed in Section 4.1.3.5. Though various products were identified as being consumed for increased energy, sports supplements and caffeine tablets were seen as more suitable for the elite athlete, or those with specific fitness goals who were looking for the purely functional performance-enhancement aspect of these products. While these products were also consumed by individuals taking part in recreational sporting activities, there was a lesser use as both coffee and energy drinks were often seen as sufficient vectors for caffeine intake to increase physical performance. One such example is a dietetic student who made her own pre-workout smoothie incorporating coffee for stimulation before going to the gym.

- “I do it in a smoothie though too, before I go to the gym. Like coffee, banana, chocolate protein powder and I mix it all up with some oats. And it’s an extra energy boost without having to have that extra coffee on the side.”

4.1.5.4 *Emotional well being*

While the mention of some caffeinated products brought associations of stimulation and energy, the consumption of others was linked to their ability to improve mood by calming and relaxing. This pattern of seeking out particular products for comfort or to de-stress correlated with those items that participants often did not view as containing caffeine. Products met with surprise by participants at containing caffeine included chocolate (both eating and drinking), tea and RTDs. However, while coffee was widely recognised by participants as containing caffeine and having stimulating properties, it was still included with chocolate, tea and RTDs as a product consumed in order to relax.

Chocolate consumption in response to the need for comfort was discussed as being more commonplace in females, and even more so for those undergoing menstruation. Seeking emotional comfort from chocolate was also discussed as occurring following relationship issues such as breakups and when grumpy and/or in a bad mood. The consumption of tea (standard, green and herbal mixes) to improve mood by comforting and calming was very similar to that described for chocolate. In addition, tea was described as a 'quiet-time drink' and, in addition to being consumed in response to the need to relax, it was given to people who were in shock or needed comforting, as highlighted by an urban community member:

- “As soon as you said that [tea], it’s like I’ve been crying and you’ve been comforting me, that’s what comes to mind.”

When tea was consumed in this manner, there were no overt associations with time of day, however it was mentioned frequently as being taken before bed to relax and 'cosy up' before going to sleep. It was also drunk for comfort during times of sickness. For some participants, these times of sickness were the only times they would drink tea; moreover, tea would replace their normal daily coffee intake until they recovered. Coffee, and its use as a beverage to calm and relax, was strongly linked to its hedonic properties as perceived by some people; mainly the physical smell, taste and heat of the beverage in hand.

Winding down after a day's work was cited as a reason for RTDs being consumed to relax, and while RTDs were mentioned as being consumed in relaxed environments such as social occasions with friends, this was the only mention of them being used in this way.

4.1.5.6 Hedonic properties

While stimulant properties and social influences combined with habit and personal ritual influenced caffeinated-product consumption, at other times it was the physical properties of the product itself; the taste, temperature, smell, mouth feel (bubbles of kola drinks) and overall sensual experience that dictated consumption. When pleasing to the consumer, these properties in themselves turned into reasons behind product consumption, while for others these characteristics put them off consuming them entirely. Enjoyment or dislike of taste was a dominant topic when discussing most caffeinated products, with the only products where taste did not factor into consumption being sports supplements and caffeine tablets. The influence of taste went from individuals consuming a square of chocolate a day for the taste, to participants naming family members who would only drink kola drinks because they did not like the taste of water. Taste and aroma also dictated whether or not energy drinks and caffeinated RTDs were bought, with some not consuming these due to their being too sweet and 'sickly', and for others taste only factoring into which variety of these products was consumed. For coffee, expectations of taste and aroma were factors in its use, but also the process of preparing the coffee in the right manner (espresso versus plunger versus instant) to get the right taste was integral to whether or not the coffee would be drunk as explained by one community member:

- “I have a plunger at home, and I will drink plunger before flat whites, and if I'm over at someone's house and they offer me instant, I'll have tea. Because ... if you're going to have coffee, and I only have two to three a day, why muck around.”

Temperature of the product was also given as a driving factor for product consumption. In the morning and during colder months of the year hot chocolate, tea and coffee were sought after as a way of warming up; whereas in hot weather kola and energy drinks replaced tea, coffee and chocolate. Green tea, while consumed hot, was also said to be taken for its refreshing qualities.

Another aspect of taste that drove consumption of premixed caffeinated RTDs was that participants stated they enjoyed the taste but were unable to recreate it themselves with kola and spirits, and so brought the premixed RTDs. For RTDs as well as kola drinks, sweetness and enjoyment of the taste made them easy to drink and so participants credited this with high consumption levels.

4.1.5.7 *Product substitution*

Substituting caffeinated beverages for food or meals was identified by female participants as another cause for consumption. There were two main reasons behind this; coffee replaced meals of friends of participants when they were looking at controlling caloric intake and losing weight, and when a lack of money, food availability or time made coffee or tea the realistic option instead of food. Product substitution also occurred when tea was taken instead of coffee if participants felt that they had had enough coffee for the day or in times of sickness (for example chocolate replaced coffee while pregnant), and energy drinks or kola drinks replaced alcoholic beverages as previously discussed. Substitution between different caffeinated products also took place with temperature changes; habitual coffee consumers reported drinking kola drinks instead of coffee during warmer months of the year.

4.1.5.8 *Placebo Effect*

While use of caffeinated products for mental and physical stimulation functional properties was a major driver of consumption, several participants expressed

scepticism about the caffeine working to produce these intended effects. The idea of a placebo or psychological effect (either by itself or in conjunction with caffeine) being responsible for any effects experienced was raised several times. One of the university students involved in focus group 5 commented as follows:

- “I think it depends on your own motive, like if you think that it’s going to wake you up then I guess it will help wake you up. Like, I mean if I wanted a coffee and I thought like I needed it to keep me awake, it probably will help me just because I think it will. But I don’t know. Whether it does or not, I don’t know.”

4.1.6 Theme Four - Individual Experiences

In Sections 4.1.3, 4.1.4 and 4.1.5 social, environmental and psychological reasons attributed to consumption of caffeinated products were described. However, caffeine intake was also influenced by individual physical reactions. This section details individual experiences as well as participant perceptions around product sources of caffeine and caffeine as a substance itself.

4.1.6.1 Tolerance

All participants were able to identify without prompting that there were differences in levels of caffeine tolerance between individuals, as well as within the individual themselves with patterns of non-use versus chronic caffeine intake. An example of tolerance is described by a university student:

- “If I haven’t had coffee for a while and I just have coffee, then I tend to get really shaky hands, and I can feel my heart beat as well.”

A difference in tolerance between individuals was discussed by the example of some participants being unable to drink coffee as it would keep them awake whereas others were able to drink it and go to sleep. Participants reacted differently to products that contained differing amounts of caffeine, either not feeling or not linking any stimulatory effects felt with its consumption. Children were also seen by participants as having a lower tolerance to the stimulatory effects of caffeinated products than adults; in particular Pasifika participants talking about how children became ‘hyper’ after drinking kola drinks.

4.1.6.2 *Addiction and Dependence*

Participants often brought up the idea of caffeine addiction and dependence, attributing this both to the caffeine but also sugar content of the products mentioned. The word addiction and 'fix' was used when individuals needed to consume the product in order to wake up, function properly, or when non-use caused withdrawals such as headaches and tremors. Two young workers described the idea of addiction to caffeinated products as follows:

- “Because it’s addictive. But how much is addictive...when do you know you’re addicted to it?”
- “When you feel you have to have it. Like you have to have a coffee to wake up, then yeah, even if I didn’t really feel like it, [I] still have to have it [coffee]”

Participants described family members making them go out at night to specifically buy coffee when their supplies had run out, their need was so high. It was also mentioned that even though some people viewed caffeinated products negatively, this did not stop them from consuming them, the reason being that it was addictive, as one university student observed with her friend:

- “One of the girls in my class last year did that even though she was studying nutrition. She was like ‘I know this [energy drinks] is really bad, but I’m not going to stop’”

The main products discussed as being addictive due to the caffeine content were coffee, kola and energy drinks, with the latter two also being discussed as addictive due to high sugar content. The addictive qualities of coffee was cited by some participants as the particular reason as to why they did not wish to start consuming it; they did not wish to become dependent on it.

4.1.6.3 *Withdrawal*

When abstaining from regular caffeine consumption, participants reported symptoms of migraines, inability to concentrate, shaking, fidgeting, mood changes (getting grumpy and irritable) and feeling 'exhausted'. They identified these as 'withdrawals' that would go away once caffeine consumption recommenced. Coffee, energy drinks and kola drinks were the main products implicated in this, and symptoms could last for multiple days as one community member discussed:

- "The headache lasted four days, non-stop. Almost as bad as a migraine."

When individuals had headaches, one participant stated that she would often offer the person coffee instead of a Panadol and it would help just as much; in a separate focus group another participant said the same of her father.

4.1.6.4 *Intoxication*

While participants relied on caffeinated products for both mental and physical stimulus, consumption of high levels was reported as giving unwanted side effects. At the lower level of the spectrum this was as associated with children becoming hyperactive after consuming kola drinks (however, participants also attributed this to the sugar content), with the other end being participants reporting heart palpitations and uncontrollable shaking. A variety of participants described these contraindications, with the following examples coming from a young male apprentice and older blue collar worker:

- "Do you guys remember that ammo [energy drink] drink? It was that R18 stuff. I had that, and I had the shits for two days, and I was like, shaking for a good two hours... I thought I was going to die."

- “I used to drink heaps of coffee ... but my heart started doing flutters. I only drink two cups a day but I drink shitloads of tea, so the difference, I don’t get the same effect, I don’t know why that is.”

The mention of these symptoms was not isolated, and participants expressed having high levels of concern during episode of heart palpitations and tremors; it often stopped them from future consumption. Another description of the feelings of caffeine overdose from a worker involved in focus group 2 was as follows;

- “It spins me out ... when you get up too fast off the ground and you *get all* that sparkly lights, like when you get a migraine. And then you think ahh is that a migraine or am I just spinning out, then you have to wait for about a minute to see if it is a migraine or you just got up too fast.”

4.1.6.5 *Additional Negative Effects*

Both caffeine consumption and non-consumption were identified as being able to cause negative effects, however additional negative effects were discussed that often came about via the co-ingestion of other substances present in caffeinated products; the major one being sugar. Participants stated that it was the sugar levels in kola drinks, energy drinks and chocolate that made them feel physically ‘bad’ after consuming large amounts, and they associated chocolate, energy drinks and kola drinks with ‘rotting teeth’. Excess sugar consumption was viewed in a negative light, and therefore coffee was seen as a ‘healthier’ vector of caffeine consumption as sugar levels were able to be controlled by the consumer. One of the dietetics students described the sugar content of some products in relation to the caffeine as follows:

- “I don’t really see caffeine as a bad thing, most of the time it’s in stuff that has heaps of sugar in it, and that’s what you find the bad thing is, like you don’t want to have heaps of sugar”

Energy drinks’ ‘come-down’ effect, identified as the loss of energy after the initial boost from sugar and caffeine, was another negative aspect of consumption of this

particular product. Sugar levels in caffeinated alcoholic RTDs were also attributed as leading to worse hangovers than spirits, and making your teeth feel 'gritty' (also after consumption of kola drinks). In addition to caffeinated products contributing unwanted substances such as sugar to the body, another participant also expressed concerns about tea "stripping iron from the blood", and espresso coffee being bad for you compared to instant coffee, though no particular reason could be given. While only sometimes being seen as a negative, a laxative effect of caffeine was mentioned.

Within different tolerances and caffeine consumption levels, caffeine was said to cause mental anxiety or enhance any pre-existing emotions, highlighted by female university students:

- "I think if you're more stressed, the level of stress is accentuated by the caffeine. Like if you're unhappy, like a mood enhancer. If you're really happy it makes you super happy, if you're depressed it makes you..."
- "I think it stresses you out more..."
- "And anxiety too. I think anxiety and nervousness is something that, if you're in that zone, it makes it worse."

Throughout the seven focus groups, while negative effects of caffeine consumption (such as headaches, insomnia and tremors) were brought up, there was no mention of and first aid applied, hospital admissions, or fatalities as a result.

4.1.6.6 *Caffeine Perceptions*

Throughout the course of the focus groups, participants voiced their perceptions of both caffeinated products and caffeine itself. When first confronted with the word 'caffeine', the initial main association was with coffee, with ideas of addiction and dependence (including withdrawals and signs of caffeine intoxication), habit and the social aspects of consumption also featuring frequently. Other quick associations of

caffeine were mood, emotions, foods and smoking as well as specific sites of consumption (e.g. at work), although these varied between groups.

Following the brainstorm of ideas on caffeine, participants were asked what products they considered as containing caffeine. All groups were able to identify coffee, kola and energy drinks as products containing caffeine. Some, but not all groups, correctly identified tea, caffeine tablets, chocolate, and sports supplements as products containing caffeine. 'Alcohol' was also given by participants as containing caffeine, however the type of alcohol was not specified (RTD vs. spirits/beer etc.) apart from one example where a university student correctly attributed caffeine in alcoholic beverages to coming from the non-alcoholic mixer, not the spirit:

- “Some might. If you drink with Red Bull.”

Several other non-caffeinated products were suggested as containing caffeine, with those being 'some foods', cake, Berocca, apples and cigarettes. Medicines were also mentioned but no specific details were given.

When participants were given the resource (Appendix I) outlining caffeine-containing products, many expressed surprise at the inclusion of chocolate, tea and caffeinated RTDs. As one group of workers stated:

- “I didn't realise that tea had caffeine in it”
- “I didn't know chocolate had caffeine in it”
- “The RTDs... that surprised me”

On viewing the caffeinated product resource (Appendix I), participants also began to make links between various products and initial caffeine perceptions (e.g. energy) that had previously been verbalised within their group, such as discussed by one young apprentice;

- “Once I drank a really lot of V, and I got the shakes; is that from the caffeine?”

These conversations allowed for the observation of other beliefs around caffeine and caffeinated products. This included the belief that drinking tea would “strip the iron

from your blood”, caffeine “thins your blood”, and that most caffeinated products were “bad for you” as expressed by one community member:

- “I think it’s also interesting that you haven’t put any like, healthy stuff on here, like green tea is really high in caffeine. I suppose tea is healthy. But I associate everything except for tea I guess as not a good thing? Not to say I don’t consume most of them... but there’s no like, nothing on here that I would really put in the healthy category. But then there is healthy stuff which has got caffeine in it.”

This particular individual, when queried further on what healthy products she meant, was unable to identify any apart from the aforementioned green tea.

4.1.6.7 *Caffeine content perceptions*

Views held by various participants on caffeine levels in different products included the following:

- That coffee shop coffees have more caffeine than instant coffee
- That tea and coffee had the same amount of caffeine.
- Tea had less caffeine than coffee.
- That green tea had little or no caffeine in it.
- That Coca-Cola has the same amount of caffeine as coffee.
- That caffeine in caffeine tablets ‘hits you quicker’ than the caffeine in coffee.

It is difficult to separate overall perceptions of caffeine as a substance from perceptions of individual caffeinated products. However, an attempt to explore this was made during the course of the focus groups and, where participants were able to separate out caffeinated products and think about caffeine as a whole, differing opinions emerged. Opinions on caffeine as a substance varied widely - from good, to good in moderation, to neutral, and to caffeine having negative connotations with aspects of substance dependency; some varying examples of which (given by community group participants) are below:

- “I think it’s like the elixir of life, its right up there with wine.”
- “There’s actually a very small percentage of humans that need additional energy.”

The general consensus across the focus groups was that the stimulation provided by caffeine is beneficial, but not many of the participants were comfortable with being dependent on caffeine. A large number of participants identified caffeine as good in moderation, such as workers in focus group 2:

- “It’s just like anything, it’s just balance. You can have a bit, you can have too much, and it may have adverse effects. But it’s just like balance of everything. You can have a coffee a day or a couple a day [points to energy drinks] one of these once a week or you know, some that’s probably fine, but if you have heaps, you’ll have effects; it’s probably all to do with the balance that you put into your body.”
- “It’s just moderation”

Various participants also felt that caffeine consumption was unavoidable, as it is present in so many commonly consumed beverages and foods.

4.1.7 Summary of focus group findings

From the thematic analysis, four key themes were generated from the 36 parent nodes. These were:

- Social drivers
- Environmental opportunity
- Functional expectations
- Individual experience

Social drivers showed how social situations combined with peer pressure; sociocultural background and social norms drove the consumption of products and their variants. Environmental opportunity also influenced consumption; accessibility (be it due to low price/free or being in the vicinity of the product) and advertising influencing individuals to eat and drink caffeinated products. The theme 'environmental opportunity' also encompassed how personal rituals and associations with time of day, food or smoking could drive consumption due to ingrained habits.

Anticipation of particular effects occurring as a result of caffeinated product consumption was classed under the theme 'functional expectations'. These focused around the energising effects (waking up and staying awake, as well as physical and mental stimulation), emotional effects and physical properties of the products themselves.

Finally, the theme 'individual experiences' recounted participants' experiences with the drug-like effects of caffeine; addiction, tolerance, intoxication and withdrawals symptoms being described across many groups. This section also incorporated participant perceptions of caffeine as a substance and ideas on caffeine content of the products discussed.

A summary of the parent nodes and corresponding caffeinated products that focus group participants associated with the parent nodes is given in Table 4.4 from which questionnaire items were based.

Table 4.4: Parent nodes and associations by product (cont. over page)

Parent Nodes	a. Tea	b. Coffee	c. Chocolate	d. Kola Drinks	e. Energy Drinks	f. RTDs	g. Sports Supplements	h. Caffeine Tablets
1: Addiction and dependence	Yes	Yes	Yes	Yes	Yes	-	-	-
2: Advertising	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
3: Age differences generational	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
4: Alcohol content	-	-	-	Yes	Yes	Yes	-	-
5: Convenience	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6: Emotional comfort	Yes	Yes	Yes	-	Yes	Yes	-	-
7: Ethnic and/or cultural practices	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
8: Food associations	Yes	Yes	Yes	Yes	Yes	-	-	-
9: Friends	Yes	Yes	Yes	Yes	-	Yes	Yes	-
10: Gender differences	-	-	-	-	Yes	Yes	Yes	-
11: Energy to stay awake or get through the day	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
12: Habit, routine, personal ritual	Yes	Yes	Yes	Yes	Yes	Yes	-	-
13: Hedonic properties	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes
14: Home life and family	Yes	Yes	Yes	Yes	-	Yes	-	-

Table 4.4: Parent nodes and associations by product (cont. from over page, and cont. over page)

Parent Nodes	a. Tea	b. Coffee	c. Chocolate	d. Kola Drinks	e. Energy Drinks	f. RTDs	g. Sports Supplements	h. Caffeine Tablets
15: Initial caffeine perceptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16: Intoxication	Yes	Yes	Yes	Yes	Yes	-	Yes	-
17: Mental stimulation	Yes	Yes	-	-	Yes	-	Yes	Yes
18: Negative effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
19: Out and about (not at home)	Yes	Yes	Yes	Yes	-	Yes	-	-
20: Overall caffeine perceptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
21: Partying and drinking culture	-	-	-	Yes	Yes	Yes	Yes	Yes
22: Peer pressure	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes
23: Perceptions of caffeine levels in products	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
24: Physical activities (sports and gym)	-	Yes	-	-	Yes	-	Yes	Yes
25: Physical stimulation	-	Yes	-	-	Yes	Yes	Yes	Yes
26: Product substitution	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes
27: Safer than spirits	-	-	-	Yes	-	Yes	-	-
28: Smoking associations	-	Yes	-	-	Yes	-	-	-

Table 4.4: Parent nodes and associations by product (cont. from over page)

Parent Nodes	a. Tea	b. Coffee	c. Chocolate	d. Kola Drinks	e. Energy Drinks	f. RTDs	g. Sports Supplements	h. Caffeine Tablets
29: Social acceptance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
30: Socialising	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
31: Studying or students	Yes	Yes	-	-	Yes	Yes	-	Yes
32: Time of day	Yes	Yes	Yes	Yes	Yes	Yes	-	-
33: To wake up	Yes	Yes	-	Yes	Yes	Yes	-	-
34: Tolerance Levels	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
35: Withdrawals	Yes	Yes	-	Yes	Yes	-	-	-
36: Work environment occupation	-	Yes	-	-	Yes	-	-	Yes

4.2 Part B: Questionnaire pilot testing

4.2.1 Participants

Pilot testing of the CaffCo yielded higher participation rates than anticipated. While 50 respondents had been deemed as being sufficient for the pilot test, having the questionnaire pilot test open on the internet for the minimum 24 hours gave a total of 227 respondents. These pilot test respondents consisted of focus group participants, Massey University academic staff and members of the community recruited through Facebook community pages. Of these, 4% (n 8) were aged between 15 and 18 years old, 28% (n 64) 19-30 years old, 58% (n 132) 31-50 years old, 9% (n 20) 51-70 years old, and 1% (n 2) 71 years old or over. Female participation was highest, with respondents identifying as 'female' making up 89% of respondents (n 201), 11% (n 25) of respondents identifying as 'male', and 1 respondent identifying as 'other'. Ethnic spread of respondents was as follows (participants were able to choose multiple ethnicities); 75% (n 170) New Zealand European, 18% (n 41) European, 7% (n 16) Maori, 3% (n 7) Chinese, 3% (n 6) Latin American, 2% (n 5) Indian, 1% (n 2) Korean, 1% (n 2) Southeast Asian, 1% (n 2) Cook Islands Maori, 1% (n 2) African, and 1% (n 2) Samoan.

4.2.2 Questionnaire modification

Feedback on ease of use of the CaffCo was gathered from each questionnaire section by feedback mini-section. Changes were then made where relevant to improve ease of use and to incorporate influences on consumption that had not previously been identified in focus groups. This included rephrasing or simplifying some questions and answer choices, and including an additional 'socialising environment' choice for consumption. Additional influences on consumption were identified by pilot test participants and included in the questionnaire as follows; tea, coffee, chocolate, kola

drinks, energy drinks and caffeinated RTDs were consumed as a result of stress and while travelling.

Smartphone and tablet compatibility was also raised as an issue due to some questions having a high number of columns (e.g. withdrawal and intoxication questions with grid formatting), and not being able to see all options at one time. However, while the columns of these questions stretch wider than the typical Smartphone screen, Qualtrics allows the user to scroll across question options in order to easily view and select all options.

Length of the CaffCo was also identified by various participants as a factor that may limit response accuracy; they had expected the questionnaire to be shorter than it was. While approximate timing of the CaffCo (Qualtrics gave the mean completion time as 20 minutes) was included in the information sheet at the beginning, it may be that not all participants read it thoroughly, so mean completion time was added to the questionnaire introductory statement. Two percent (n=5) of pilot test questionnaire respondents requested that a 'neither agree or disagree' option be included in the Likert scale questions dealing with influences on consumption; however as the Likert scale is dealing with actions not opinions, it was kept as a 4-point scale.

Upon consultation with researchers who would be using the CaffCo in the future, a participant identification number was added into the screening questions so that participant responses would be able to be aligned with any additional tests that may take place (e.g. genetic testing).

Chapter Five

5. Discussion

The aim of this study was to develop a quantitative questionnaire able to identify patterns and influences of consumption as well as negative effects of consumption of caffeinated products in New Zealanders aged 15 and over. Rather than quantifying or identifying trends within the New Zealand population, focus groups were undertaken whereby participants identified a diverse range of responses for consumption of caffeinated products. Although focus group results should never be used to generalise for the broader population (Krueger & Casey, 2015; Pew Research Center, 2015), the results from this study do however provide a preliminary glimpse into caffeine consumption patterns and influences of adults 15 years and over in New Zealand. This chapter gives a brief overview and discussion of the key findings from the thematic analysis of the focus group transcriptions and development of the caffeine consumption habits questionnaire (CaffCo).

5.1 Characteristics of focus group and pilot test participants

Statistics New Zealand report the ethnic spread of the New Zealand population (following the 2013 census) as follows; 74% European, 15% Maori, 12% Asian, 7% Pasifica and 1% combined Middle Eastern, Latin American and African. Statistics New Zealand (2014b) also estimates that 51% of the population in New Zealand are female and 49% male. Focus group participants comprised a representation of both genders and diverse ethnic groups as in the 2013 New Zealand census. However pilot group participants were under representative for Pasifica and Asian people, younger adults aged 15-18 years old and older people over 71 years.

5.2 Overview of themes influencing caffeine consumption

The findings from this study revealed four main themes influencing caffeinated product consumption, being social drivers, environmental opportunity, functional expectations and individual experiences, each with an array of sub-themes. Influences on food and beverage consumption patterns are multi-factorial, with complex social, environmental, genetic, emotional, physiological and psychological factor interactions; product choice is almost never influenced solely by one domain (French, Blair, & Booth, 1994; Baranowski *et al.*, 1999; Luciano *et al.*, 2005). The present study reflected these multi-factorial influences – while four main themes were identified there was a high incidence of overlap between them.

5.2.1 Social drivers

‘Social drivers’ as a key theme included influences such as socio-cultural background, home hospitality, peer pressure, social expectations and acceptability of consumption patterns as well as associations with alcohol.

Perceptions of age differences in beverage consumption patterns for coffee and tea were identified; older generations were suggested to drink more tea whereas younger generations were more likely to consume coffee. This is reflective of research conducted by Luciano, Kirk, Heath, and Martin (2005), who found significant positive correlations between age and tea consumption, as well as negative correlations between age and coffee preference. Coffee and tea consumption levels were also negatively correlated; coffee consumption decreased with increasing tea consumption and vice versa (Luciano *et al.*, 2005). Coffee was also seen by focus group participants as a beverage where consumption began when individuals reached a certain age and stage of life. While participants did not specify an exact age, it has been reported that coffee and tea intake in females increases steadily after 12.5 years of age to 18-19 years of age (Striegel-Moore *et al.*, 2006). Perceptions of other caffeinated product

consumption patterns with age varied between focus groups (possibly due to varying demographic spread of focus groups).

In the present study focus group participants specifically associated tea consumption with British, Asian, Turkish and Pasifica backgrounds, as well as with differing consumption habits; indeed, culture was suggested by Mullie *et al.* (2009) as having a particularly strong influence on tea consumption. Generational differences combined with cultural preferences may be a reflection of both the rich tea and coffee-drinking heritage of these cultures (Grigg, 2002; Fredholm, 2011) as well as New Zealand's status as a country of immigrants (Bedford, Ho, & Lidgard, 2002). It shows maintenance of traditional patterns of consumption by older generations, and assimilation by younger generations into the culturally diverse New Zealand society and the adoption of new consumption patterns. Coffee and tea were seen by focus group participants as consumed where social convention dictated that it should be offered to visitors in a home environment; personal culture and social expectations are strong influences on beverage and product consumption (French *et al.*, 1994). Personal cultures of participants in the present study also manifested in patterns of kola-drink consumption; patterns of consumption mirrored those with which they had been brought up with in childhood. This reflects maternal dietary patterns being imitated in later life by their children; higher maternal nutritional knowledge correlates with more nutrient rich diets of their children (Yabanci, Kisac, & Karakus, 2014).

The association of coffee drinking and socialising was strong, with focus group participants using the phrase 'going out for coffee' to describe meeting up with friends or family even when coffee consumption was not specifically involved. Coffee has been associated with socialising for centuries; coffee houses having originally been popular places for academics and those from a higher class to meet (Schivelbusch, 1993; Pelchovitz & Goldberger, 2011). The use of this phrase 'going out for coffee' only further highlights the integration of coffee into today's culture.

Caffeine ingestion as a result of co-ingestion with alcohol (via caffeinated alcoholic RTDs or mixing energy drinks / kola drinks / caffeine tablets / caffeinated sports supplements with alcohol) was frequently reported by focus group participants. These

alcohol consumption patterns were driven by social norms, peer validation, low price, taste preference, convenience, energy provision and beverage alcohol content. Peer pressure and social acceptance have long been recognised as driving factors for alcohol consumption especially in young adults (Huckle *et al.*, 2008), even more so than price (Parsons & Stephenson, 2013). Some participants reported consuming caffeinated beverages to stay awake while consuming alcohol; a pattern associated with higher rates of risk taking and prolonged drinking sessions (MacKenzie *et al.*, 2007; Weldy, 2010). New Zealand has a high prevalence of binge drinking (Huckle *et al.*, 2008); consumption of caffeine in conjunction with alcohol is likely to contribute to this due to an increased time awake increasing the volume of alcohol able to be ingested in one drinking session.

A need for social acceptance often documented in the literature as driving food and beverage consumption (French *et al.*, 1994; Hattersley *et al.*, 2009) was suggested by participants as an influencing factor in consumption of kola drinks, energy drinks, caffeinated RTDs, caffeinated sports supplements and caffeine tablets. This is especially true in adolescents (Croll, Neumark-Sztainer, & Story, 2001); it was noted by adolescents in the present study that social image was most highly mentioned with alcoholic RTD consumption for all caffeinated products. Coffee and energy drinks were also identified by adolescent participants to be consumed as a result of a wanting peer acceptance, similar to findings by Stead *et al.* (2011). Sports supplements were acknowledged during focus groups as being identified with young males who frequently engaged in resistance exercise wanting to fit in with peers; similar to a 'jock mentality' seen associated with increased energy drink consumption in males (Miller, 2008). There is a need for further research in the area of social influences on caffeine consumption; future use of the CaffCo developed as a result of this study will add to this literature.

Consumption of energy drinks has been identified as a manifestation of risk-taking activities commonly seen in adolescents (Wesensten, 2014) and wanting to develop independence from their home environment (Brown, McIlveen, & Strugnell, 2000). While focus group discussions gave the popular viewpoint that energy drink consumption was high in adolescents, it was caffeine tablets and caffeinated alcoholic

beverages rather than energy drinks that were seen as being consumed to rebel against societal norms, possibly related to New Zealand's 'binge drinking' culture (Huckle *et al.*, 2008). Energy drink consumption has also been recorded as being higher with lower socioeconomic status (Griffiths & Woodson, 1988; Reyner & Horne, 1997; Lovallo *et al.*, 2006), younger generational groups and males (Lovallo *et al.*, 2006; Puckeridge *et al.*, 2011). Participants in the present study believed low nutrition knowledge in young males contributed towards energy drink consumption, and the literature supports this - nutritional knowledge deficits have a higher prevalence in males, and contribute increased towards energy drink and sweetened beverage consumption (Brown *et al.*, 2000; Pirouznia, 2003; Wardle *et al.*, 2004; Milosavljevic, Mandic, & Banjari, 2015). Koc, Gul, Akpinar, and Yilmaz (2014).

5.2.2 Environmental Opportunity

A further influence on caffeinated product consumption identified was the environment in which an individual inhabited. Students, blue collar workers and Pacifica focus group participants all stated that there was a higher chance of them consuming a product if the price was considered to be low; the product was free (common with tea and coffee at places of work) or it was in their vicinity. This may be a reflection of students often having a lower expendable income than full time workers due to the time commitments of study, and data from the 2013 census which placed Pacific people as having the lowest median personal income of all major ethnic groups in New Zealand (Statistics New Zealand, 2014a). Environment has been found to influence food and beverage consumption by intake increasing with dimmed lighting (Lavin & Lawless, 1998), cooler temperatures (Brobeck, 1948), and soft or preferred ambient music playing (Caldwell & Hibbert, 2002). Perceived effort to acquire foods and beverages is also a strong influencing factor on consumption (Levitsky, 2002; Wansink, 2004). A review on the psychology of eating revealed that foods requiring minimal effort to obtain were more likely to be eaten (e.g. within arm's reach versus 2

metres away) (Wansink, 2004); this was reflected with focus group participants reporting consuming various caffeinated products because 'it's just there'.

Advertising of kola/energy drinks, chocolate and RTDs, had a noticeable influence on focus group participants e.g. easily quoting Coca-Cola's catch phrase 'open happiness', and participants buying products due to having seen new varieties advertised. Advertising of RTDs, energy drinks and Coca-Cola specifically target adolescents and young adults (Simon & Mosher, 2007; McEwan *et al.*, 2010; Bunting *et al.*, 2013) and have an association with increased levels of consumption in these groups, (Smith & Foxcroft, 2009). Participants reported habits and correlations with time of day, food consumption, studying and smoking as often driving caffeinated product consumption over and above any other influence. This reflects findings in the literature that purport caffeine consumption e.g. tea and coffee as being highly linked with meal patterns, daily rituals, time of day (Hattersley *et al.*, 2009), and smoking (Grigg, 2002; de Castro & Taylor, 2008; Wesensten, 2014). Participants also correctly identified 7th Day Adventists as not consuming caffeine due to religious beliefs, the same as Jehovah's Witnesses, Hindus and Mormons (Ribeiro & Sebastião, 2010).

5.2.3 Functional Expectations

Caffeinated products were used by participants as both stimulatory and relaxing agents, as well as for their intrinsic hedonic properties.

Coffee, tea, kola drinks, energy drinks, caffeinated RTDs, sports supplements and caffeine tablets were all used by participants to provide energy; both physical and mental as well as waking up and staying awake. This was in agreeance with a wide range of literature that supports the use of caffeinated products for their energising effects (Griffiths *et al.*, 1990; Reyner & Horne, 1997). However, tea, coffee, chocolate and caffeinated RTDs were also reported in the present study as being used to de-stress and relax; food and beverage consumption has been documented as having high emotional associations (French *et al.*, 1994). Coffee intakes in men have been observed

to increase in situations of stress, whereas high levels of tea consumption can be found in females in situations of relaxing (Steptoe & Wardle, 1999). Some participants were surprised to find out that these 'relaxing' products contained caffeine, perhaps due to the strong association – from the participants' perspectives – of the word caffeine with energy and stimulation.

Taste was cited as a major influencing factor when choosing to consume caffeinated products – this was often the only reason a product would be consumed. There are many studies which support taste as being a major driver in product selection and consumption; energy drinks and kola drinks will often be chosen for their sweet flavour (Hattersley *et al.*, 2009; Bunting *et al.*, 2013; Koc *et al.*, 2014), and taste is one of the integral factors determining if a new product will be successful in the marketplace (Mittal & Kamakura, 2001).

Female participants stated consuming caffeinated beverages such as tea, coffee, energy drinks and kola drinks in place of food in order to lose weight. This is a reflection on food choice in females often being based on perceived effects of consumption on their own physical appearance (Chambers, Lobb, Butler, & Traill, 2008). As well as filling the stomach up with liquid, the caffeine content is also able to temporarily decrease feelings of hunger (Carter & Drewnowski, 2012). Caffeinated products such as tea and coffee were also used by participants to replace food where there was either no food available, or they needed to save money. Replacing food with coffee or tea due to financial constraints is a worrying trend that nutritional status of the individual is compromised, and may be reflective of the harsh financial realities that some people in New Zealand face; use of the CaffCo developed as part of this research may aid in determining some of these patterns.

5.2.4 Individual Experiences

Individual experiences of caffeinated product consumption (tolerance, dependence, withdrawal and intoxication) were further key themes, with participants reporting

variable responses. Some individuals were unable to consume caffeinated beverages without experiencing 'feelings of dread'; others reported uncontrollable shaking on consumption or being able to have coffee before bed without an effect on their sleeping patterns. Genetics, habitual consumption patterns, caffeine dosage and other constituents of caffeinated products all play a role in the different ways in which individuals respond to consuming a caffeinated product (Curhan *et al.*, 1996; Gray, 1998).

Participants' experience of adverse effects from consumption of caffeinated products such as heart palpitations and uncontrollable shaking were consistent with symptoms of caffeine intoxication as defined in the American Psychiatric Association's DSM-5 - Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2013). While participants in the present study reported ceasing product consumption when these effects occurred, intoxication symptoms or an awareness of the negative effects of caffeine consumption may not always mean an individual will reduce or stop consumption. In a survey of 162 randomly selected caffeine users, 14% reported consumption despite knowledge of possible harm (Hughes *et al.*, 1998). Participants in the present study did not identify themselves or others they knew of as having been hospitalised due to caffeine intoxication or any caffeine-related fatalities. However an increasing rate of hospital admissions related to caffeine intake has been reported (Pennington *et al.*, 2010; Ribeiro & Sebastião, 2010). In New Zealand a study showing 21% of hospital admissions to a emergency department involving alcohol also involving RTDs as well (Das *et al.*, 2014), reflecting the contribution of caffeinated alcohol to overall alcohol intake in New Zealand. Deaths where caffeine was found to be a contributing factor were around 0.02% in a study conducted by Swedish researchers (Thelander *et al.*, 2010). Data from future nationwide studies using the CaffCo may provide more insight into New Zealand specific data on experiences with hospitalisation following caffeine intake.

Caffeine has been suggested to induce similar physiological and psycho-stimulant effects to cocaine and amphetamine (Ferre, 2008). Interestingly, when describing caffeinated product use (especially when describing coffee and energy drinks), participants used terminology commonly associated with illicit drug use such as 'fix',

'addicted', 'dependent' and stating that they needed to consume coffee or energy drinks in order to feel that they were functioning normally. This is indicative of the dependency and withdrawal states developed with chronic caffeine intake (Kendler *et al.*, 2006; Ferre, 2008; Ribeiro & Sebastião, 2010), reflective of work carried out by Hughes *et al.* (1998) where a survey of 162 caffeine users demonstrated 24% of these respondents met DSM-5 criteria for caffeine withdrawal.

While caffeine ingestion has been suggested to cause headaches with cessation of regular use (American Psychiatric Association, 2013), coffee was used by one focus group participant to relieve headaches among their friends and family, whether the afflicted individual was a regular caffeine consumer or not. While this particular participant could not give reason as to why coffee worked to ameliorate headaches, randomised, double blind crossover studies have demonstrated that caffeine (relative to placebo) has a significant analgesic effect on tension headaches (Migliardi, Armellino, Friedman, Gillings, & Beaver, 1994). For regular caffeine consumers this may be through reducing headaches caused by caffeine withdrawals, and in non-frequent caffeine consumers caffeine may prevent headaches through its vasodilator effects and also increasing efficacy of pain medications (Gray, 1998; Shapiro, 2007).

5.3 Caffeine questionnaire (CaffCo)

The aim of this study was to develop a questionnaire to evaluate caffeine intake patterns, influences on consumption, and both positive and negative experiences across a range of caffeinated products in New Zealand adults aged 15 years and over.

Numerous questionnaires deal with caffeine intake (Zuckerman *et al.*, 1964; Hughes, 1993; Shohet & Landrum, 2001; Fred Hutchinson Cancer Research Centre, 2004; McIlvain, 2008; Heinz *et al.*, 2009; Hendrick *et al.*, 2010; University of Otago and Ministry of Health, 2011; Huntley & Juliano, 2012; Nova *et al.*, 2012; Wong *et al.*, 2012; Schliep *et al.*, 2013; Sundborn *et al.*, 2014); however those that examine patterns of intake as well as reasons behind consumption and negative experiences across a range

of products are limited to particular population groups (McIlvain, 2008) or only focus on a singular aspect of caffeine consumption such as outcome expectancies (Heinz *et al.*, 2009), or caffeine dependency (Huntley & Juliano, 2012). Those questionnaires dealing with the New Zealand population and caffeine intake are even more limited; with none specifically formulated for evaluating caffeine intake. Rather in these questionnaires caffeine intake was secondary to the enquiry of inclusion of caffeinated products (Hughes, 1993; University of Otago and Ministry of Health, 2011; Wong *et al.*, 2012; Sundborn *et al.*, 2014). As a result, for the present questionnaire, the majority of items were formulated as original questions (applying questionnaire best practices as outlined in Section 3.4.1), excluding the FFQ component for each product (influenced by FFQ frequency ratings in the Fred Hutchinson Cancer Research Centre questionnaire 'Supplemental Beverage Questions' (2004)).

For ease of use, the caffeine questionnaire developed in this study was arranged by sections relating to each caffeinated product, with additional sections for items about caffeine withdrawal / intoxication and demographic information. The focus groups and subsequent thematic analysis was able to identify influences on consumption; however while this research aimed to identify as many of these influences as possible, the list of themes and theme descriptors was not exhaustive. Pilot testing of the questionnaire identified a small number of additional influences on consumption (including consumption during stressful situations and while travelling) which were then added to the questionnaire; however there may still be options that are not included. For the purpose of identifying any additional influencing factors on consumption, the 'other' option with text entry remained on the final draft of the CaffCo.

Within each product section of the CaffCo (tea, coffee, chocolate, kola drinks, energy drinks, caffeinated alcoholic RTDs, caffeinated sports supplements and caffeine tablets) there was an FFQ component for the product and its variants. Due to the large amount of product variants on the market (i.e. differing brands.), only those identified by focus group participants and pilot test respondents as being the most frequently consumed were included. Questions following the FFQ component dealt with motivations for consumption; however this was for the overall product and it must be

kept in mind that influences on consumption may differ between product variants. A questionnaire dealing with consumption influences for each different product variant would have a very high level of participant burden, and so the CaffCo only dealt with influences on each product as a collective of its variants. Based on pilot data, the median time taken to complete the online CaffCo (20 minutes) is higher than that recommended by Krosnick and Presser (2010), who suggest 10 minutes as the optimal time allowance to complete an online questionnaire. Various pilot test respondents gave feedback that the CaffCo was too long, however they also stated that this was in relation to not knowing how long it would take before beginning the questionnaire. Timing of the CaffCo had been laid out in the information sheet, however following this feedback it was also included in the introductory paragraph of the questionnaire, and a progress bar was added for participants to be able to track their own progress.

The CaffCo was developed to be used as an online tool (as well as a paper version), due to the numerous advantages that of conducting questionnaire research online. For the researcher, these advantages are a reduction in time, money and resources spent administering the questionnaire and collating results, along with being able to reach a large audience over a relatively short period of time (Evans & Mathur, 2005; Wright, 2005). Having the questionnaire as an online tool can also be advantageous for the participant in that it decreases bias produced by having an interviewer present, and it is flexible with the participant able to complete it at the most convenient time, at their own rate, and may come back to it if interrupted – it does not need to be completed in one sitting (Evans & Mathur, 2005; Wright, 2005). Having the questionnaire as an online tool, while advantageous, also introduces limitations. These include excluding those population groups who do not have access computer, internet, or with low computer literacy skills (Wright, 2005), and in the case of the present study, those individuals 15 years of age where parental consent for participation cannot be given online. The questionnaire is also limited to those with English literacy, however the inclusion of visual aids (pictures of caffeinated products) and simplification of language used in the questionnaire would aid in comprehension.

The FFQ component of the CaffCo will be used to identify patterns of product consumption rather than quantify individual caffeine intake. While it may provide

some indication of caffeine intake levels, the large range and brand diversity of caffeinated products makes it difficult to provide an accurate caffeine intake level, as caffeine content varies across brands and serving sizes. More accurate caffeine intake measures may be gathered from adapting overseas caffeine specific FFQs (e.g. the supplementary beverage FFQ developed by the Fred Hutchinson Cancer Research Centre (2004)) to caffeinated products found on the New Zealand market, and using it in conjunction with the CaffCo developed in this research. However the aim of the CaffCo was not to quantify caffeine intake levels but rather to determine patterns of consumption.

5.4 Questionnaire validation and reliability

Questionnaires need to possess validity and reliability to ensure a higher quality of data collected. Validity is the degree to which a tool measures what it is designed to measure, and includes content validity (whether the tool encompasses most of the relevant aspects), criterion-related validity (how well the tool results are reflected when other validated tools are applied to the same population) and construct validity (whether the tool reflects the theory of the concept being measures) (Prous, Salvanes, & Ortells, 2009; Kazi & Khalid, 2012). Criterion-related validity was unable to be measured as the CaffCo was not administered to pilot test participants in conjunction with any other validated caffeine habits measurement tool. Reliability measures the degree to which a tool is able to measure true variance between subjects (free from error introduced by bias or random error) (Prous *et al.*, 2009). One reliability measure that was unable to be measured in this study due to time constraints was test-retest or intra-observer reliability; when similar or identical responses are obtained after the same questionnaire is given to the same population at differing points in time. While test-retest reliability was unable to be tested, efforts were made to reduce bias through question wording, order, and randomisation of question response options.

Pilot testing of the CaffCo was carried out on focus group participants, academics and community members (n=227). Although this was a much higher number than the

recommended 30 pilot test participants by Prous *et al.* (2009) and 50 pilot test participants by Ruel *et al.* (2015) this was not a concern. Such a high response rate demonstrates the strengths of using social media for research; a large number of individuals are able to be reached within a short period of time. Having the online pilot test open for 24 hours allowed for participants with differing work schedules to participate, and so aided to increase the demographic spread of respondents. Content validity and inter-rater reliability were gained in that focus group participants were able to confirm that the CaffCo was an accurate representation of focus group discussions, and that it included all opinions expressed. Content validity was also given by pilot testing the tool among academics who had a special interest in caffeine, and community members. Feedback from both of these groups gave rise to topics not included in the focus group discussions, which were then able to be incorporated into the CaffCo. These additional topics may have arisen as while focus groups were conducted to the point of data saturation, qualitative research will always have some degree of additional ideas or opinions belonging to those uninvolved in the research. Construct validity was shown by the CaffCo being compared to content of other pre-existing caffeine questionnaires as well as scientific literature that pertained to the themes addressed in the questionnaire.

Chapter Six

6 Conclusion

6.1 Research problem and aims of the research study

Currently there is no existing tool suitable to investigate New Zealand-specific caffeine intake patterns in conjunction with influences on consumption and associated negative effects across a range of caffeinated products. Therefore, the aim of this research was to develop such a tool; where intake, influences and negative effects were able to be accurately captured and quantified in New Zealand adults 15 years and over. This research also pilot tested and refined the CaffCo to ensure ease of use and to provide content validity, construct validity and inter-rater reliability.

6.2 Summary of results/ main findings

The aims of this research project were met, resulting in the development of a quantitative, New Zealand specific caffeine habits questionnaire for adults aged 15 years and above. The final CaffCo questionnaire was developed following a series of focus groups and questionnaire pilot testing. The CaffCo was developed as an online tool with the option of a paper version for those 15-17 years old (where parental consent may be required) or for those without access to a computer. The CaffCo was personalised to each respondent based on the caffeinated products that they consumed, and ranged from 12 to 65 questions, which took an average of 20 minutes to complete.

Questionnaire development was achieved through meeting a series of objectives; first conducting a series of focus groups on caffeinated product use, developing a

questionnaire from thematic analysis of focus group data, and pilot testing and refining the CaffCo questionnaire.

From the focus groups, thematic data was collected on the influences on caffeinated product consumption, negative experiences of consumption and common caffeine sources. This thematic data was then used to shape the CaffCo. Pilot testing of the developed CaffCo on focus group participants, academics and members of the community was then able to provide content validity, construct validity and inter-rater reliability. Feedback from this pilot test also aided in refining the CaffCo by addressing some previous unexplored themes and increasing ease of use.

6.3 Strengths

Currently, the CaffCo developed through this research is the only tool that specifically evaluates caffeinated product consumption patterns in New Zealand adults aged 15 years and over. The CaffCo is not only able to evaluate patterns of intake over a wide variety of caffeinated products but also analyse influences on consumption of different products and various negative experiences associated with consumption.

Additional strengths of this study include the demographic spread of the focus group participants and thematic analysis of focus group transcriptions. Focus group participants came from a wide variety of backgrounds (age, gender, occupation, education, region of New Zealand etc), contributing to an extensive array of caffeinated product consumption patterns and experiences, which would not have occurred with more homogenous groups. The addition of two extra focus groups to the five that were originally planned also ensured that data saturation was obtained. Data gathered from thematic analysis of the focus group transcriptions offers a preliminary glimpse into patterns and influences of consumption of different caffeinated products in New Zealand adults aged 15 years and over; information which was previously limited to secondary data on caffeinated product intake from studies of overall dietary habits.

In addition, developing the CaffCo as an online tool enables it to be distributed quickly and to a broad audience through the wide reach of social media, with a reduction in time and resources that would normally be spent administering a questionnaire offline. Results from Qualtrics are able to be easily collated and exported to data analysis software such as Microsoft Excel or SPSS (Statistical Package for the Social Sciences). The option of a paper version of the CaffCo further extends its potential reach within the New Zealand population; making it available to those who may not have access to a computer, internet access, or prefer paper questionnaires and for individuals 15 years of age who will need offline parental consent for participation. The inclusion of visual aids (pictures of caffeinated products) also helps in cognitive processing, decreasing participant fatigue and aiding participants to identify context for questionnaire items (e.g. for those with lower English literacy or unfamiliar with caffeinated product name). The CaffCo also allows for refinement/modification for use in other countries, and can be tailored to specific caffeinated products by removal of question sections.

6.4 Limitations

The nature of qualitative research and analysis lends itself to limitations – firstly in that the data collected is likely not to be fully exhaustive. Additional opinions and experiences of caffeinated product consumption will be present for some individuals of the population; pilot testing of the CaffCo aided in identifying some of these. The inclusion of an ‘other’ category for many of the questionnaire items gives respondents the opportunity to express opinions that are not included in the CaffCo.

The CaffCo developed by this research is also limited in its ability to quantify the caffeine intake levels of individuals. While the FFQ component of each section of the CaffCo is able to identify caffeinated product consumption patterns, it only contains the most commonly consumed variants of each product group (e.g. main types of coffee or tea etc.) in order to reduce time taken to complete the CaffCo and participant burden. To fully quantify caffeine intake in individuals, a separate caffeine

FFQ would need to be developed that included all caffeinated products available on the New Zealand market.

In the CaffCo, questionnaire items to address influences of consumption and negative effects were asked by overall product (tea, coffee, chocolate, kola drinks, energy drinks, caffeinated alcoholic RTDs, caffeinated sports supplements, caffeine tablets) rather than for individual product variants; this introduces limitations in that differences in influences of consumption between product variants (with a product grouping) are unable to be explored.

While distributing the CaffCo both online and on paper increases the ease of data collection, it may also introduce limitations. English literacy is needed to complete the CaffCo; for those individuals with low English literacy skills or where English is not their first language the CaffCo may not be filled out correctly and accuracy of results may be compromised; introducing the possibility of the questionnaire results not being able to truly reflect influences on caffeine consumption and experiences in New Zealand adults. This is a standard problem found with questionnaires. While best practices for questionnaire structure can be applied to aid in decreasing the effect of differing individual literacy levels, translating the CaffCo to relevant languages or having it used in an interviewer / interviewee situation.

While feedback from pilot testing of the CaffCo was able to provide content validity, construct validity and inter-rater reliability, test-retest reliability was unable to be tested, as it was outside the scope of this study. This limits the CaffCo in that it cannot be said to be so reliable that the same results will be able to be gained from the same population under identical circumstances in a short period of time.

6.5 Use of the findings

There is a gap in the literature with regards to caffeine intake patterns and influences on caffeine consumption in New Zealanders. This is despite caffeine's status as a commonly consumed compound found in many popular beverages as well as

chocolate, and linked to a number of adverse outcomes. There is need for a nationwide study on the caffeine intake of New Zealanders, including consumption patterns of common caffeine sources, influences on consumption and effects experienced as a result of consumption. The CaffCo developed as a result of this research is the first questionnaire specifically designed to investigate the caffeine intake patterns of the New Zealand adult population (15 years and over) and should be used as such. There is potential for the CaffCo to be modified to fit different population groups, such as different ethnicities, age groups or specific sections emphasised if consumption patterns of a particular product are being investigated.

6.6 Recommendations

- While the CaffCo has demonstrated content validity, construct validity and inter-rater reliability, further investigations need to be done to ensure test-retest reliability before its widespread use.
- A nationwide study of caffeine use patterns should be carried out using the CaffCo to gauge caffeinated product intake patterns in New Zealand adults 15 year and over.
- Results from the CaffCo may be limited due to English literacy levels of respondents; efforts should be made to translate the CaffCo to relevant languages before distribution.
- Future studies may examine the association between inter-individual genetic variation of CYP1A2, ADORA2A and AHR with caffeine consumption habits using the CaffCo developed through the present study.
- A New Zealand-specific caffeine FFQ should be developed to more accurately assess caffeine intake levels, and used in conjunction with the CaffCo developed through the present research project.

References

- Alsene, K., Deckert, J., Sand, P., & de Wit, H. (2003). Association Between A2a Receptor Gene Polymorphisms and Caffeine-Induced Anxiety. *Neuropsychopharmacology*, 28(9), 1694-1702.
- American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.). Washington, DC.
- Attwood, A., Rogers, P., Ataya, A., Adams, S., & Munafò, M. (2012). Effects of caffeine on alcohol-related changes in behavioural control and perceived intoxication in light caffeine consumers. *Psychopharmacology*, 221(4), 551-560.
- Australian Beverages Council. (2013). Caffeine - The Facts. Retrieved 13/11/15, from <http://australianbeverages.org/for-consumers/caffeine-facts/>
- Baranowski, T., Cullen, K., & Baranowski, J. (1999). Psychosocial correlates of dietary intake: advancing dietary intervention. *Annual review of nutrition*, 19(1), 17-40.
- Barone, J., & Roberts, H. (1996). Caffeine consumption. *Food and Chemical Toxicology*, 34(1), 119-129.
- Bedford, R., Ho, E., & Lidgard, J. (2002). Immigration Policy and New Zealand's Development into the 21st Century: Review and Speculation. *Asian and Pacific Migration Journal*, 10(3-4), 585-616.
- Beer Wine and Spirits Producers. (2015). Alcohol Beverages Containing Stimulants *Current Practices by Signatories to the Beer, Wine and Spirits Producers Commitments to Reduce Harmful Drinking*.
- Bennett, J., Rodrigues, I., & Klein, L. (2013). Effects of Caffeine and Stress on Biomarkers of Cardiovascular Disease in Healthy Men and Women with a Family History of Hypertension. *Stress & Health: Journal of the International Society for the Investigation of Stress*, 29(5), 401-409.
- Blair, J., Czaja, R., & Blair, E. (2014). *Designing surveys: a guide to decisions and procedures*. United States of America: SAGE Publications.
- Branum, A. M., Rossen, L. M., & Schoendorf, K. C. (2014). Trends in caffeine intake among U.S. children and adolescents. *Pediatrics*, 133(3), 386-393.

- Brobeck, J. (1948). Food intake as a mechanism of temperature regulation. *The Yale Journal of Biology and Medicine*, 20(6), 545.
- Brown, K., McIlveen, H., & Strugnell, C. (2000). Nutritional awareness and food preferences of young consumers. *Nutrition & Food Science*, 30(5), 230-235.
- Bunting, H., Baggett, A., & Grigor, J. (2013). Adolescent and young adult perceptions of caffeinated energy drinks. A qualitative approach. *Appetite*, 65, 132-138.
- Burke, L., & Deakin, V. (2012). *Clinical Sports Nutrition* (Vol. 4th). Australia: McGraw-Hill.
- Burnett, J. (2001). *Liquid Pleasures. A Social History of Drinks in Modern Britain*. London: Taylor and Francis.
- Caldwell, C., & Hibbert, S. (2002). The influence of music tempo and musical preference on restaurant patrons' behavior. *Psychology & Marketing*, 19(11), 895-917.
- Carter, B., & Drewnowski, A. (2012). Beverages containing soluble fiber, caffeine, and green tea catechins suppress hunger and lead to less energy consumption at the next meal. *Appetite*, 59(3), 755-761.
- Chambers, S., Lobb, A., Butler, L., & Traill, W. (2008). The influence of age and gender on food choice: a focus group exploration. *International Journal of Consumer Studies*, 32(4), 356-365.
- Chen, J., Xu, K., Petzer, J., Staal, R., Xu, Y., Beilstein, M., . . . Schwarzschild, M. (2001). Neuroprotection by Caffeine and A2A Adenosine Receptor Inactivation in a Model of Parkinson's Disease. *The Journal of Neuroscience*, 21(10).
- Cheng, M., Hu, Z., Lu, X., Huang, J., & Gu, D. (2014). Caffeine Intake and Atrial Fibrillation Incidence: Dose Response Meta-analysis of Prospective Cohort Studies. *Canadian Journal of Cardiology*, 30(4), 448-454.
- Childs, E., Hohoff, C., Deckert, J., Xu, K., Badner, J., & de Wit, H. (2008). Association between ADORA2A and DRD2 Polymorphisms and Caffeine-Induced Anxiety. *Neuropsychopharmacology*, 33(12), 2791-2800.
- Cleary, K., Levine, D., & Hoffman, R. (2012). Adolescents and young adults presenting to the emergency department intoxicated from a caffeinated alcoholic beverage: a case series. *Annals of Emergency Medicine*, 59(1), 67-69.

- Cornelis, M., El-Soheemy, A., & Campos, H. (2007). Genetic polymorphism of the adenosine A(2A) receptor is associated with habitual caffeine consumption. *American Journal of Clinical Nutrition*, *86*(1), 240-244.
- Cornelis, M., El-Soheemy, A., Kabagambe, E., & Campos, H. (2006). Coffee, CYP1A2 genotype, and risk of myocardial infarction. *Jama*, *295*(10), 1135-1141.
- Costill, D., Dalsky, G., & Fink, W. (1978). Effects of caffeine ingestion on metabolism and exercise performance. *Medicine and Science in Sports and Exercise*, *10*(3), 155-158.
- Croll, J., Neumark-Sztainer, D., & Story, M. (2001). Healthy eating: what does it mean to adolescents? *Journal of Nutrition Education*, *33*(4), 193-198.
- Curhan, G., Willett, W., Rimm, E., Spiegelman, D., & Stampfer, M. (1996). Prospective Study of Beverage Use and the Risk of Kidney Stones. *American Journal of Epidemiology*, *143*(3), 240-247.
- Curhan, G., Willett, W., Speizer, F., & Stampfer, M. (1998). Beverage Use and Risk for Kidney Stones in Women. *Annals of Internal Medicine*, *128*(7), 534-540.
- Das, M., Stewart, R., Ardagh, M., Deely, J., Dodd, S., Bartholomew, N., . . . Than, M. (2014). Patterns and sources of alcohol consumption preceding alcohol-affected attendances to a New Zealand hospital emergency department *The New Zealand Medical Journal*, *127*(1401).
- de Castro, J., & Taylor, T. (2008). Smoking status relationships with the food and fluid intakes of free-living humans. *Nutrition*, *24*(2), 109-119.
- Desbrow, B., Henry, M., & Scheelings, P. (2012). Examination of consumer exposure to caffeine from commercial coffee and coffee-flavoured milk. *Journal of Food Composition and Analysis*, *28*, 114-118.
- Distilled Spirits Association of New Zealand. (2013). Voluntary Industry Code for RTDs: Spirits New Zealand.
- Elmenhorst, D., Meyer, P., Winz, O., Matusch, A., Ermert, J., Coenen, H., . . . Bauer, A. (2007). Sleep Deprivation Increases A1 Adenosine Receptor Binding in the Human Brain: A Positron Emission Tomography Study. *The Journal of Neuroscience*, *27*(9), 2410-2415.
- European Food Safety Authority. (2015). Scientific Opinion on the safety of caffeine. *EFSA Journal*, *13*(5).

- Evans, J., & Mathur, A. (2005). The value of online surveys. *Internet research*, 15(2), 195-219.
- Ferre, S. (2008). An update on the mechanisms of the psychostimulant effects of caffeine. *Journal of Neurochemistry*, 105(4), 1067-1079.
- Fisone, G., Borgkvist, A., & Usiello, A. (2004). Caffeine as a psychomotor stimulant: mechanism of action. *Cellular and Molecular Life Sciences CMLS*, 61(7-8), 857-872.
- Food Standards Australia New Zealand. (2000). Safety aspects of dietary caffeine. Retrieved 29/05/2015, from <http://www.foodstandards.govt.nz/publications/Pages/Safety-aspects-of-dietary-caffeine.aspx>
- Food Standards Australia New Zealand. (2013). Australia New Zealand Food Standards Code.
- Food Standards Australia New Zealand. (2015). Food Standards Code. Retrieved 06/06/2015, from <http://www.foodstandards.govt.nz/code/Pages/default.aspx>
- Frary, C., Johnson, R., & Wang, M. (2005). Food sources and intakes of caffeine in the diets of persons in the United States. *Journal of the American Dietetic Association*, 105(1), 110-113.
- Fred Hutchinson Cancer Research Centre. (2004). Supplemental Beverage Questions. Seattle: Fred Hutchinson Cancer Research Centre.
- Fredholm, B. (2011). Notes on the History of Caffeine Use *Methylxanthines* (Vol. 200, pp. 1-9): Springer Berlin Heidelberg.
- Fredholm, B., Bättig, K., Holmén, J., Nehlig, A., & Zvartau, E. (1999). Actions of Caffeine in the Brain with Special Reference to Factors That Contribute to Its Widespread Use. *Pharmacological Reviews*, 51(1), 83-133.
- Freeman, T. (2006). 'Best practice' in focus group research: making sense of different views. *Journal of Advanced Nursing*, 56(5), 491-497.
- French, J., Blair, A., & Booth, D. (1994). Social situation and emotional state in eating and drinking. *British Food Journal*, 96(1), 23-28.
- Gallimberti, L., Buja, A., Chindamo, S., Vinelli, A., Lazzarin, G., Terraneo, A., . . . Baldo, V. (2013). Energy drink consumption in children and early adolescents. *European Journal of Pediatrics*, 172(10), 1335-1340.

- Graham, T. (2001). Caffeine and Exercise. *Sports Medicine*, 31(11), 785-807.
- Graham, T., Helge, J., MacLean, D., Kiens, B., & Richter, E. (2000). Caffeine ingestion does not alter carbohydrate or fat metabolism in human skeletal muscle during exercise. *Journal of Physiology*, 529(3), 837-847.
- Grandner, M., Knutson, K., Troxel, W., Hale, L., Jean-Louis, G., & Miller, K. (2014). Implications of sleep and energy drink use for health disparities. *Nutrition Reviews*, 72, 14-22.
- Gray, J. (1998). Caffeine, coffee and health. *Nutrition & Food Science*, 98(6), 314-319.
- Greenway, F. (2001). The safety and efficacy of pharmaceutical and herbal caffeine and ephedrine use as a weight loss agent. *Obesity Reviews*, 2(3), 199-211.
- Griffiths, R., Evans, S., Heishman, S., Preston, K., Sannerud, C., Wolf, B., & Woodson, P. (1990). Low-dose caffeine physical dependence in humans. *Journal of Pharmacology and Experimental Therapeutics*, 255(3), 1123-1132.
- Griffiths, R., & Woodson, P. (1988). Caffeine physical dependence - A review of human and laboratory animal studies. *Psychopharmacology*, 94(4), 437-451.
- Grigg, D. (2002). The worlds of tea and coffee: Patterns of consumption. *GeoJournal*, 57, 283-294.
- Guanasekara, I., & Wilson, N. (2010). Very Cheap Drinking in New Zealand: some alcohol is more affordable than bottled water and nearly as cheap as milk. *The New Zealand Medical Journal*, 123(1324).
- Gurley, B., Steelman, S., & Thomas, S. (2015). Multi-ingredient, Caffeine-containing Dietary Supplements: History, Safety, and Efficacy. *Clinical Therapeutics*, 37(2), 275-301.
- Ha, H., Chen, J., Krahenbuhl, S., & Follath, F. (1996). Biotransformation of caffeine by cDNA-expressed human cytochromes P-450. *European Journal of Clinical Pharmacology*, 49, 309-315.
- Hattersley, L., Irwin, M., King, L., & Allman-Farinelli, M. (2009). Determinants and patterns of soft drink consumption in young adults: a qualitative analysis. *Public Health Nutrition*, 12(10), 1816-1822.
- Heinz, A., Kassel, J., & Smith, E. (2009). Caffeine expectancy: Instrument development in the Rasch measurement framework. *Psychology of Addictive Behaviors*, 23(3), 500-511.

- Heishman, S., & Henningfield, J. (1992). Stimulus functions of caffeine in humans: Relation to dependence potential. *Neuroscience & Biobehavioral Reviews*, *16*(3), 273-287.
- Hendrick, V., Comber, D., Eastabrooks, P., Salva, J., & Davy, B. (2010). The Beverage Intake Questionnaire: Initial Validity and Reliability. *Journal of the American Dietetic Association*, *110*(8), 1227-1232.
- Hennink, M. (2013). *Focus Group Discussions*. Oxford: Oxford University Press, USA.
- Higdon, J., & Frei, B. (2006). Coffee and Health: A Review of Recent Human Research. *Critical Reviews in Food Science and Nutrition*, *46*, 101-123.
- Huckle, T., Sweetsur, P., Moyes, S., & Casswell, S. (2008). Ready to drinks are associated with heavier drinking patterns among young females. *Drug and Alcohol Review*, *27*(4), 398-403.
- Hughes, J., Oliveto, A., Liguori, A., Carpenter, J., & Howard, T. (1998). Endorsement of DSM-IV dependence criteria among caffeine users. *Drug & Alcohol Dependence*, *52*(2), 99-107.
- Hughes, R. (1993). Relationships between sensation seeking and use of caffeine, alcohol and cigarettes by New Zealand university students. *Drug and Alcohol Review*, *12*(2).
- Huntley, E., & Juliano, L. (2012). Caffeine Expectancy Questionnaire (CaffEQ): Construction, psychometric properties, and associations with caffeine use, caffeine dependence, and other related variables. *Psychological Assessment*, *24*(3), 592-607.
- Juliano, L., Huntley, E., Harrell, P., & Westerman, A. (2012). Development of the Caffeine Withdrawal Symptom Questionnaire: Caffeine withdrawal symptoms cluster into 7 factors. *Drug and Alcohol Dependence*, *124*(3), 229-234.
- Kassem, N., Lee, J., Modeste, N., & Johnston, P. (2003). Understanding soft drink consumption among female adolescents using the Theory of Planned Behavior. *Health Education Research*, *18*(3), 278-291.
- Kazi, A., & Khalid, W. (2012). Questionnaire designing and validation. *Journal of Pakistan Medical Association*, *62* (5), 514.

- Kendler, K., Myers, J., & Gardner, C. (2006). Caffeine intake, toxicity and dependence and lifetime risk for psychiatric and substance use disorders: an epidemiologic and co-twin control analysis. *Psychological Medicine, 36*(12), 1717-1725.
- Koc, B., Gul, A., Akpınar, M., & Yılmaz, H. (2014). Determining consumers' preferences for energy drinks consumption with conjoint analysis: a cross section study from East Mediterranean, Turkey. *Journal of Nutrition and Food Sciences, 4*(6).
- Krosnick, J., & Presser, S. (2010). Question and Questionnaire Design. In P. W. Marsden, J. (Ed.), *Handbook of Survey Research* (Second ed., pp. 264-313). UK: Emerald Group Publishing.
- Krueger, R., & Casey, M. (2015). *Focus Groups; A practical guide for applied research* (5th ed.). United States of America: SAGE Publications, Inc.
- Krul, C., & Hageman, G. (1998). Analysis of urinary caffeine metabolites to assess biotransformation enzyme activities by reversed-phase high-performance liquid chromatography. *Journal of Chromatography B: Biomedical Sciences and Applications, 709*(1), 27-34.
- Landrum, R. (1992). College students use of caffeine and its relationship to personality. *College Student Journal, 26*, 151-155.
- Lavin, J., & Lawless, H. (1998). Effects of color and odor on judgments of sweetness among children and adults. *Food Quality and Preference, 9*(4), 283-289.
- Levitsky, D. (2002). Putting behavior back into feeding behavior: a tribute to George Collier. *Appetite, 38*(2), 143-148.
- Levy, M., & Zylber-Katz, E. (1983). Caffeine metabolism and coffee-attributed sleep disturbances. *Clinical Pharmacology & Therapeutics, 33*(6), 770-775.
- Linden, A., & Lau-Barraco, C. (2014). A qualitative review of psychosocial risk factors associated with caffeinated alcohol use. *Experimental and Clinical Psychopharmacology, 22*(2), 144-153.
- Lopez, F., Miller, L., Greenblatt, D., Kaplan, G., & Shader, R. (1989). Interaction of caffeine with the GABAA receptor complex: alterations in receptor function but not ligand binding. *European Journal of Pharmacology: Molecular Pharmacology, 172*(6), 453-459.
- Lorist, M., & Tops, M. (2003). Caffeine, fatigue, and cognition. *Brain and Cognition, 53*(1), 82-94.

- Lovallo, W., Farag, N., Vincent, A., Thomas, T., & Wilson, M. (2006). Cortisol responses to mental stress, exercise, and meals following caffeine intake in men and women. *Pharmacology Biochemistry and Behavior*, *83*(3), 441-447.
- Luciano, M., Kirk, K., Heath, A., & Martin, N. (2005). The genetics of tea and coffee drinking and preference for source of caffeine in a large community sample of Australian twins. *Addiction*, *100*(10), 1510-1517.
- MacKenzie, T., Comi, R., Sluss, P., Keisari, R., Manwar, S., Kim, J., . . . Baron, J. (2007). Metabolic and hormonal effects of caffeine: randomized, double-blind, placebo-controlled crossover trial. *Metabolism*, *56*(12), 1694-1698.
- Magkos, F., & Kavouras, S. (2015). Caffeine Use in Sports, Pharmacokinetics in Man, and Cellular Mechanisms of Action. *Critical Reviews in Food Science and Nutrition*, *45*(7-8), 535-562.
- Maughan, R., & Griffin, J. (2003). Caffeine ingestion and fluid balance: a review. *Journal of Human Nutrition and Dietetics*, *16*(6), 411-420.
- McEwan, B., Campbell, M., & Swain, D. (2010). New Zealand Culture of Intoxication: Local and Global Influences. *New Zealand Sociology*, *25*(2).
- McIlvain, G. (2008). *Caffeine Consumption Patterns and Beliefs of College Freshmen*. (Doctor of Education Doctoral Dissertation), University of Kentucky. Retrieved from http://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1641&context=gradschool_diss
- Mesas, A., Leon-Muñoz, L., Rodriguez-Artalejo, F., & Lopez-Garcia, E. (2011). The effect of coffee on blood pressure and cardiovascular disease in hypertensive individuals: a systematic review and meta-analysis. *The American Journal of Clinical Nutrition*, *94*(4), 1113-1126.
- Migliardi, J., Armellino, J., Friedman, M., Gillings, D., & Beaver, W. (1994). CAFFEINE AS AN ANALGESIC ADJUVANT IN TENSION HEADACHE. *Clinical Pharmacology & Therapeutics*, *56*(5), 576-586.
- Miller, K. E. (2008). Wired: energy drinks, jock identity, masculine norms, and risk taking. *Journal of American College Health*, *56*(5), 481-490.
- Milosavljevic, D., Mandic, M. L., & Banjari, I. (2015). Nutritional knowledge and dietary habits survey in high school population. *Collegium Antropologicum*, *39*(1).

- Mittal, V., & Kamakura, W. (2001). Satisfaction, repurchase intent, and repurchase behavior: Investigating the moderating effect of customer characteristics. *Journal of marketing research*, 38(1), 131-142.
- Mullie, P., Guelinckx, I., Clarys, P., Degraeve, E., Hulens, M., & Vansant, G. (2009). Cultural, socioeconomic and nutritional determinants of functional food consumption patterns. *European Journal of Clinical Nutrition*, 63(11), 1290-1296.
- New Zealand Juice and Beverage Association. (2012). Industry Code - Manufacturing and Marketing of Energy Shots.
- New Zealand Ministry for Primary Industries. (2010). Caffeine intake and effects studied: New Zealand Government.
- New Zealand Ministry for Primary Industries. (2012). Caffeine: New Zealand Government.
- New Zealand Ministry for Primary Industries. (2013). New Zealand Food (Supplemented Food) Standard 2013. Wellington: Ministry for Primary Industries.
- New Zealand Ministry of Agriculture and Forestry. (2011). New Zealand Supplemented Food Standard *User Guide - Version 2*.
- New Zealand Ministry of Health. (2003). NZ Food NZ Children: Key results of the 2002 National Children's Nutrition Survey. Wellington: Ministry of Health.
- New Zealand Ministry of Health. (2010). *Dietary Supplements Regulations 1985*. Wellington, NZ.
- New Zealand Ministry of Health. (2013). Hazardous Drinking in 2011/12: Findings from the New Zealand Health Survey. Wellington: Ministry of Health.
- Noordzij, M., Uiterwaal, C., Arends, L., Kok, F., Grobbee, D., & Geleijnse, J. (2005). Blood pressure response to chronic intake of coffee and caffeine: a meta-analysis of randomized controlled trials. *Journal of Hypertension*, 23(5), 921-928.
- Nova, P., Hernandez, B., Ptolemy, A., & Zietzer, J. (2012). Modeling caffeine concentrations with the Stanford Caffeine Questionnaire: Preliminary evidence for the interaction of chronotype with the effects of caffeine on sleep. *Sleep Medicine*, 13, 362-367.

- Olmos, V., Bardoni, N., Ridolfi, A., & Villaamil Lepori, E. (2009). Caffeine levels in beverages from Argentina's market: application to caffeine dietary intake assessment. *Food Additives & Contaminants: Part A*, 26(3), 275-281.
- Palatini, P., Ceolotto, G., Ragazzo, F., Dorigatti, F., Saladini, F., Papparella, I., . . . Santonastaso, M. (2009). CYP1A2 genotype modifies the association between coffee intake and the risk of hypertension. *Journal of Hypertension*, 27(8), 1594-1601.
- Park, S., Jang, J., & Hong, S. (2007). Long-term consumption of caffeine improves glucose homeostasis by enhancing insulinotropic action through islet insulin/insulin-like growth factor 1 signaling in diabetic rats. *Metabolism*, 56(5), 599-607.
- Parsons, A., & Stephenson, N. (2013). Effects of price and alcohol content on purchase behaviour: an analysis of Australian and New Zealand youth drinking. *Young Consumers*, 14(2), 112-121.
- Pelchovitz, D., & Goldberger, J. (2011). Caffeine and Cardiac Arrhythmias: A Review of the Evidence. *The American Journal of Medicine*, 124, 284-289.
- Pennington, N., Johnson, M., Delany, E., & Blankenship, M. (2010). Energy Drinks: A new health hazard for adolescents. *The Journal of School Nursing*, 26.
- Pew Research Center. (2015). Questionnaire design: Pew Research Centre.
- Pirouznia, M. (2003). Adolescent's Nutrition Knowledge. *Preventive Nutrition and Food Science*, 8(3), 260-264.
- Pittler, M. H., & Ernst, E. (2004). Dietary supplements for body-weight reduction: a systematic review. *The American journal of clinical nutrition*, 79(4), 529-536.
- Pray, L., Pankevich, D., & Yaktine, A. (2014). *Caffeine in Food and Dietary Supplements : Examining Safety: Workshop Summary*. Washington D.C.: National Academies Press.
- Prous, M., Salvanes, F., & Ortells, L. (2009). Validation of Questionnaires. *Reumatologia Clinica*, 5(4), 171-177.
- Puckeridge, M., Fulcher, B., Phillips, A., & Robinson, P. (2011). Incorporation of caffeine into a quantitative model of fatigue and sleep. *Journal of Theoretical Biology*, 273(1), 44-54.

- QSR International Pty Ltd. (2012). NVivo qualitative data analysis Software (Version 10).
- Qualtrics. (2015). Qualtrics software (Version 3.673s). Provo, Utah, USA. Retrieved from <http://www.qualtrics.com>
- Renda, G., Zimarino, M., Antonucci, I., Tatasciore, A., Ruggieri, B., Bucciarelli, T., . . . De Caterina, R. (2012). Genetic determinants of blood pressure responses to caffeine drinking. *The American Journal of Clinical Nutrition*, *95*(1), 241-248.
- Rétey, J., Adam, M., Khatami, R., Luhmann, U., Jung, H., Berger, W., & Landolt, H. (2007). A Genetic Variation in the Adenosine A2A Receptor Gene (ADORA2A) Contributes to Individual Sensitivity to Caffeine Effects on Sleep. *Clinical Pharmacology & Therapeutics*, *81*(5), 692-698.
- Reyner, L., & Horne, J. (1997). Suppression of sleepiness in drivers: Combination of caffeine with a short nap. *Psychophysiology*, *34*(6), 721-725.
- Ribeiro, J., & Sebastião, A. (2010). Caffeine and Adenosine. *Journal of Alzheimer's Disease*, *20*, 3-15.
- Ruel, E., Wagner, W., & Gillespie, B. (2015). *The Practice of Survey Research: Theory and Applications*: SAGE Publications.
- Salleh, A. (2008). Athletes' caffeine use reignites scientific debate: ABC Science Online.
- Schivelbusch, W. (1993). *Tastes of Paradise. A social history of spices, stimulants and intoxicants*. New York: Vintage books.
- Schliep, K., Schisterman, E., Mumford, S., Perkins, N., Ye, A., Pollack, A., . . . Wactawski-Wende, J. (2013). Validation of Different Instruments for Caffeine Measurement Among Premenopausal Women in the BioCycle Study. *American Journal of Epidemiology*, *177*(7).
- Shapiro, R. (2007). Caffeine and headaches. *Neurological Sciences*, *28*, S179-S183.
- Shohet, K., & Landrum, R. (2001). Caffeine consumption questionnaire: a standardized measure for caffeine consumption in undergraduate students. *Psychological Reports*, *89*(3), 521-526.
- Simon, M., & Mosher, J. (2007). *Alcohol, energy drinks, and youth: a dangerous mix*: Marin Institute.

- Smith, A., Brockman, P., Flynn, R., Maben, A., & Thomas, M. (1993). Investigation of the Effects of Coffee on Alertness and Performance during the Day and Night. *Neuropsychobiology*, 27(4), 217-223.
- Smith, L., & Foxcroft, D. (2009). The effect of alcohol advertising, marketing and portrayal on drinking behaviour in young people: systematic review of prospective cohort studies. *BMC Public Health*, 9(1), 51.
- Spiller, G. (1998). *Caffeine*. United States of America: RCR Press.
- Statistics New Zealand. (2005). Ethnicity: New Zealand Government.
- Statistics New Zealand. (2013). New Zealand Income Survey: June 2013 quarter. Retrieved 28/11/2015, from http://www.stats.govt.nz/browse_for_stats/income-and-work/Income/NZIncomeSurvey_HOTPJun13qtr/Commentary.aspx
- Statistics New Zealand. (2014a). 2013 Census QuickStats about income. Retrieved 26/11/2015, from <http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-income/personal-income-ethnic.aspx>
- Statistics New Zealand. (2014b). *Interactive population pyramid for New Zealand*. New Zealand Government Retrieved from http://www.stats.govt.nz/tools_and_services/interactive-pop-pyramid.aspx.
- Statistics New Zealand. (2015). *2013 Census - Major ethnic groups in New Zealand*. New Zealand Government Retrieved from <http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/infographic-culture-identity.aspx>.
- Stead, M., McDermott, L., MacKintosh, A., & Adamson, A. (2011). Why healthy eating is bad for young people's health: Identity, belonging and food. *Social Science & Medicine*, 72(7), 1131-1139.
- Stephoe, A., & Wardle, J. (1999). Mood and drinking: a naturalistic diary study of alcohol, coffee and tea. *Psychopharmacology*, 141(3), 315-321.
- Striegel-Moore, R., Thompson, D., Affenito, S., Franko, D., Obarzanek, E., Barton, B., . . . Crawford, P. (2006). Correlates of beverage intake in adolescent girls: The National Heart, Lung, and Blood Institute Growth and Health Study. *The Journal of Pediatrics*, 148(2), 183-187.

- Sulem, P., Gudbjartsson, D., Geller, F., Prokopenko, I., Feenstra, B., Aben, K., . . . Stumvoll, M. (2011). Sequence variants at CYP1A1–CYP1A2 and AHR associate with coffee consumption. *Human Molecular Genetics*, *20*(10), 2071-2077.
- Sundborn, G., Gentles, D., & Metcalf, P. (2014). Carbonated beverage consumption in New Zealand adults. *Pacific Health Dialog*, *20*(1), 87-88.
- The New Zealand Institute for Plant and Food Research Limited, & New Zealand Ministry of Health. (2015). The Concise New Zealand Food Composition Tables 11th Edition.
- Thelander, G., Jonsson, A., Personne, M., Forsberg, G., Lundqvist, K., & Ahlner, J. (2010). Caffeine fatalities - Do sales restrictions prevent intentional intoxications? *Clinical Toxicology*, *48*(4), 354-358.
- Thompson, B., & Schiess, S. (2010). *Risk Profile: Caffeine in Energy Drinks and Energy Shots*. New Zealand Government Retrieved from http://www.foodsafety.govt.nz/elibrary/industry/Risk_Profile_Caffeine-Science_Research.pdf.
- Thomson, B., Campbell, D., Cressey, P., Egan, U., & Horn, B. (2014). Energy drink consumption and impact on caffeine risk. *Food Additives & Contaminants: Part A*, *31*(9), 1476-1488.
- Thomson, B., & Jones, S. (2013). Caffeine in Guarana-Containing Foods. In Institute of Environmental Science & Research Limited (Ed.): Ministry of Primary Industries, New Zealand Government.
- Thomson, B., & Schiess, S. (2010). Risk profile: Caffeine in energy drinks and energy shots. Wellington: New Zealand Food Safety Authority.
- University of Otago and Ministry of Health. (2011). A Focus on Nutrition: Key Findings of the 2008/2009 New Zealand Adult Nutrition Survey. Wellington: Ministry of Health.
- US Food and Drug Administration Consumer Health Information. (2013). FDA to investigate added caffeine. Retrieved 29/05/2015, from <http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm350570.htm>
- Wansink, B. (2004). Environmental factors that increase the food intake and consumption volume of unknowing consumers. *Annual Review of Nutrition*, *24*, 455-479.

- Wardle, J., Haase, A., Steptoe, A., Nillapun, M., Jonwutiwes, K., & Bellisle, F. (2004). Gender Differences in Food Choice: The Contribution of Health Beliefs and Dieting. *Annals of Behavioural Medicine*, 27(2), 107-116.
- Weinberg, A., & Bealer, B. (2001). *The world of caffeine: the science and culture of the world's most popular drug*. London: Routledge.
- Weldy, D. (2010). Risk of Alcoholic Energy Drinks for Youth. *Journal of the American Board of Family Medicine*, 23, 555-558.
- Wells, B., Kelly, B., Pawson, M., LeClair, A., Parsons, J., & Golub, S. (2013). Correlates of Concurrent Energy Drink and Alcohol Use among Socially Active Adults. *American Journal of Drug and Alcohol Abuse*, 39(1), 8-15.
- Wesensten, N. (2014). Legitimacy of concerns about caffeine and energy drink consumption. *Nutrition Reviews*, 72(S1), 78-86.
- Wong, J., Parnell, W., Black, K., & Skidmore, P. (2012). Reliability and relative validity of a food frequency questionnaire to assess food group intakes in New Zealand adolescents. *Nutrition Journal*, 11(65).
- World Health Organisation. (2015). The ICD-10 classification of mental and behavioural disorders *Clinical descriptions and diagnostic guidelines* (2015 ed.). Geneva: World Health Organisation.
- Wright, K. (2005). Researching Internet-Based Populations: Advantages and Disadvantages of Online Survey Research, Online Questionnaire Authoring Software Packages, and Web Survey Services. *Journal of Computer-Mediated Communication*, 10(3), 00-00.
- Yabanci, N., Kisac, I., & Karakus, S. (2014). The effects of mother's nutritional knowledge on attitudes and behaviors of children about nutrition. In J. C. Laborda, F. Ozdamli & Y. Maasoglu (Eds.), *5th World Conference on Educational Sciences* (Vol. 116, pp. 4477-4481). Amsterdam: Elsevier Science Bv.
- Yang, A., Palmer, A., & Wit, H. (2010). Genetics of caffeine consumption and responses to caffeine. *Psychopharmacology*, 211, 245-257.
- Zagnoni, P., & Albano, C. (2002). Psychostimulants and Epilepsy. *Epilepsia*, 43, 28-31.
- Zuckerman, M., Kolin, E., Price, L., & Zoob, I. (1964). Development of a sensation-seeking scale. *Journal of Consulting Psychology*, 28(6), 477-482.

Appendices

Appendix A: MUHEC 15_006 approval confirmation letter



MASSEY UNIVERSITY
ALBANY

20 May 2015

Karli Marie Rowe
100 Albany Highway
Greenhithe
Auckland 0632

Dear Karli

HUMAN ETHICS APPROVAL APPLICATION – MUHECN15/006

Why do we use Caffeine? The development of a questionnaire to examine reasons and patterns of caffeine intake in New Zealand adults

Thank you for your application. It has been fully considered, and approved by the Massey University Human Ethics Committee: Northern.

Approval is for three years. If this project has not been completed within three years from the date of this letter, a re-approval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

A handwritten signature in black ink, appearing to read 'A. Chrystall'.

Dr Andrew Chrystall
Acting Chair
Human Ethics Committee: Northern

cc Dr Kay Rutherford-Marwick, Dr Carol Wham
Institute of Food Science and Technology
Albany Campus

Dr Ajmol Ali
School of Sport and Exercise
Albany Campus

Prof Harjinder Singh
Head of Institute of Food Science and Technology
Palmerston North

Appendix B: Focus group poster advertisement



School of Food and Nutrition
Massey University
Private Bag 102904
North Shore City 0745, Auckland
New Zealand

Why do we use caffeine?

Are you 15 or older and able to hold a conversation in English?

We 'd like to invite you to take part in a study examining the reasons why New Zealanders consume caffeine (found in coffee, tea, energy drinks, chocolate and other foods), and the effects that it has on them.

We invite you to participate in a 1 hour group discussion, where these issues will be explored.

Light refreshments will be provided, and you will be reimbursed with a \$20 MTA petrol voucher for any travel costs.



Interested?

Please contact: Karli Rowe
Email: caffeine@outlook.co.nz
Mobile: 021 2233806

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application 15/006. If you have any concerns about the conduct of this research, please contact Dr Andrew Chrystall, Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 43317, email humanethicsnorth@massey.ac.nz.

Appendix C: Focus group participant information sheet



School of Food and Nutrition
Massey University
Private Bag 102904
North Shore City 0745, Auckland
New Zealand

Why do we use caffeine?

The development of a questionnaire to examine reasons and patterns of caffeine intake in New Zealand adults.

INFORMATION SHEET

We are looking for individuals over 15 years old to take part in a study looking at the reasons why New Zealanders consume caffeine.

Researcher Introduction

Hello, my name is Karli Rowe and I am currently studying towards a Master of Science degree in Nutrition and Dietetics at Massey University (to become a Dietitian). This project is being undertaken as part of my degree. My supervisors are Dr Kay Rutherford-Markwick, Dr Ajmol Ali and Dr Carol Wham. Together, the supervisors have an extensive background of research in the fields of nutrition, physiology and public health.

Project Description

Currently, there is little information about caffeine intake and the reasons behind caffeine consumption in New Zealand. Caffeine is widely used as an energiser; however some people can get unwanted side effects. This study aims to develop a questionnaire that will be used to look at caffeine intakes, effects, and the reasons behind caffeine intake in New Zealand adults aged over 15 years.

You are invited to participate in a 1 hour focus group, where caffeine consumption patterns will be discussed. The focus group discussion will be audio-recorded, and information from these discussions will be used to help make the questionnaire. You will also be invited to complete the resulting questionnaire later in the year. Light refreshments will be provided during the focus groups.

Participant Identification and Recruitment

Participants are being recruited by flyers placed around universities, community settings, places of work and social media. You will be contacted by email and/or phone prior to the focus groups.

You must be:

- 15 years of age or older
- Fluent in spoken and written English
- Available to participate in a 1 hour long focus group located in either Auckland or Whakatane

We will undertake five focus groups with 6-10 participants in each session (30-50 participants in total).

You will be reimbursed with a \$20 MTA voucher to cover any travel expenses.

Project Procedures

During the focus group, you will be asked to contribute to group discussions about patterns of use of different foods and drinks which contain caffeine. This includes food items such as tea, coffee, alcoholic caffeinated beverages, soft drinks, energy drinks, chocolate and others. The focus groups will be conducted by the researcher Karli Rowe, with the help of an assistant and will be voice-recorded. The focus groups will

take place after work hours in community group rooms.
You will also be invited to complete an online questionnaire later in the year.

You are welcome to discuss any concerns regarding the focus group or questionnaire with the researcher. If you do not feel comfortable at any time with the questions asked, you do not need to answer. Everything discussed within the focus group will be kept confidential by the researchers.

If you feel concerned about your caffeine or other food and beverage consumption, please consult with your GP. Otherwise, Samaritans NZ is an organisation available for non-judgemental, confidential support to anyone in distress (04 473 9739). Alcohol Drug Helpline (0800 787 797) is a free, anonymous service available if you have concerns about your alcohol consumption.

Data Management

Audio recordings of the focus groups will be transcribed, so that individuals will not be able to be identified, and only the researchers will have access to any information collected. All information collected will be kept strictly confidential, and in locked storage at the Massey University School of Food and Nutrition. After 5 years, the data will be destroyed by a staff member.

Data collected from this study will be used to help formulate a questionnaire surrounding caffeine intake in New Zealand. Results from this study may be presented at conferences or published, and be made accessible to you.

Participant's Rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study up until the start of the focus groups;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- be given access to a summary of the project findings when it is concluded.

Project Contacts

If you have any questions about this project, please contact the researcher and/or one of the supervisors.

Student researcher:

Karli Rowe
Massey School of Food and Nutrition
Email: caffeine@outlook.co.nz
Phone: 021 2233806

Supervisors:

Dr Kay Rutherford-Markwick
School of Food and Nutrition
Email:
K.J.Rutherford@massey.ac.nz
Phone: +64 (09) 414 0800 ext.
43646

Dr Ajmol Ali
School of Sport and Exercise
Email: A.Ali@massey.ac.nz
Phone: +64 (09) 414 0800 ext.
43414

Dr Carol Wham
School of Food and Nutrition
Email: C.A.Wham@massey.ac.nz
Phone: +64 (09) 414 0800 ext.
43644

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application 15/006. If you have any concerns about the conduct of this research, please contact Dr Andrew Chrystall, Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 43317, email humanethicsnorth@massey.ac.nz.

Appendix D: Focus group participant screening questionnaire



School of Food and Nutrition
Massey University
Private Bag 102904
North Shore City 0745, Auckland
New Zealand

Why do we use caffeine?

The development of a Questionnaire to examine patterns of caffeine intakes in New Zealand adults.

Participant Screening Questionnaire

Thank you for expressing interest in our study. Please complete the following questions to make sure you are able to participate.

Are you fluent in spoken English? Yes / No

Are you fluent in written English? Yes / No

What age group do you fall into?

- Under 15 years old
- 15 - 18 years old
- 19 – 30 years old
- 31 – 50 years old
- 51 years or over

Please provide an email address so that we can contact you:

.....

Full Name – Printed: Date:

Thank you for your interest in participating in this research project.

We will be in touch soon to give you more information. Feel free to contact the researcher at the email address listed below if you have any questions.

Student Researcher:

Karli Rowe

Email: caffeine@outlook.co.nz

Phone: 0212233806

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research. If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Dr Brian Finch, Director, Research Ethics, telephone 06 356 9099 extn 86015, email: humanethics@massey.ac.nz

Appendix E: Focus group parental consent form



School of Food and Nutrition
Massey University
Private Bag 102904
North Shore City 0745, Auckland
New Zealand

Why do we use caffeine?

The development of a questionnaire to examine reasons and patterns of caffeine intake in New Zealand adults.

PARENT/CAREGIVER FOCUS GROUP CONSENT FORM

I give my consent for.....(name of child) to participate in the 'Why do we use caffeine?' study.

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree to the focus group being sound recorded.

Signature:

Date:

Full Name - printed

.....

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application 15/006. If you have any concerns about the conduct of this research, please contact Dr Andrew Chrystall, Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 43317, email humanethicsnorth@massey.ac.nz.

Appendix F: Focus group participant consent form



School of Food and Nutrition
Massey University
Private Bag 102904
North Shore City 0745, Auckland
New Zealand

Why do we use caffeine?

The development of a Questionnaire to examine reasons and patterns of caffeine intakes in New Zealand adults.

FOCUS GROUP PARTICIPANT CONSENT FORM

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree to the focus group session being sound recorded.

I agree not to disclose anything discussed in the focus group.

I agree to participate in this study under the conditions set out in the Information Sheet.

Signature:

Date:

Full Name - printed

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application 15/006. If you have any concerns about the conduct of this research, please contact Dr Andrew Chrystall, Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 43317, email humanethicsnorth@massey.ac.nz.

Appendix G: Focus group moderator guide

Moderator guide

Greet participants when they enter, and introduce them to any participants that may have arrived previously. Let them know that they can help themselves to the refreshments and that where the extra information sheets and consent forms if needed.

Seating:

Participants are to be seated around a table facing each other. The moderator should be included in this but not the central figure. If any participants identify themselves to be particularly loud or boisterous, have them seated next to the moderator (so the moderator may look away / use body language more easily to quieten them if they become too dominating). For individuals that present themselves as quiet or more withdrawn, seat them opposite the moderator so that eye contact can be made and responses drawn out.

Refreshments:

Light refreshments are to be available when the participants arrive, and placed for the participants to access during the focus group. Refreshments should be ones that can be eaten quietly to eat so as not to interfere with the audio recording.

Paperwork:

Have information sheets and consent forms available for the participants when they arrive. For those participants who need parental consent, remind them to bring these signed forms along in the emails leading up to the focus groups. Make sure all consent and assent forms are signed and all questions answered before commencing the focus group.

Audio recording:

Use two audio recording devices. Do not set them up next to each other, rather at different ends of the table. Audio recording should start after the ice breaker activity

but before discussion on focus group topics begins. The moderator is to use their discretion as to when to end audio recording; either after all participants have left following the end of the group discussion or when the group discussion has ended and any subsequent discussions are irrelevant to the topic.

Ground rules:

- One person talking at a time due to audio recording.
- No right or wrong answers – looking for different points of view.
- Respect the opinions of others; even if you don't agree, give them the chance to speak.
- Everything shared is confidential and should not leave the group discussion.
- No using cell phones.

Ice breaker activity:

Any ice breaker activity may be used but an example is 'Two truths and a lie'. For this activity, participants are to go around in a circle introducing themselves and saying two facts about themselves (pets, favourite colour etc.) and one lie. It is then for the other participants to guess which of the three is a lie.

Key questions / themes to be covered:

Introductory questions:

- What comes to mind when you hear the word 'caffeine'?
- What products do you think of as having caffeine in them?

Transition questions:

Participants are to be given a resource with pictures of the main contributors to dietary caffeine intake on it (tea, coffee, chocolate, kola drinks, energy drinks, caffeinated alcoholic RTDs, pre workout sports supplements and sports gels, and caffeine tablets) (Appendix I) and asked the following.

- What do you think of when you see these products?

Key questions:

For each of the products on the resource previously provided, the following key themes were investigated; with participants asked to think both of themselves and friends or family.

- What associations do you have of consuming this product?
 - People
 - Places
 - Situations
 - Emotions
 - Experiences (both negative and positive)
- What do you look to get out of this product?
 - Does consumption meet this expectation?
- What influences you to consume this product?

Ending questions:

Once the moderator had determined that content had been covered in sufficient detail, they let the participants know that the discussion was coming to an end. The moderator then summarised the participant discussions for each product in the above key themes, and asked if anything had been missed out, or if participants could think of any further additions.

Appendix H: Confirmation of MTA voucher form

Confirmation of receipt of 1 x \$20 MTA voucher

By signing, I confirm that I have received 1 x \$20 MTA voucher for my participation in a focus group for the study 'Motives for Caffeine Consumption in New Zealand Adults: Questionnaire Development'.

FOCUS GROUP:

Date	Full Name	Signature

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application 15/006. If you have any concerns about the conduct of this research, please contact Dr Andrew Chrystall, Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 43317, email humanethicsnorth@massey.ac.nz.

Appendix I: Focus group resource

Where is Caffeine?

Tea



Coffee



Chocolate



Energy Drinks



Cola Drinks



Sports supplements



Caffeinated RTDs—
Mixed with cola or added
caffeine / guarana



Caffeine tablets eg—
No-doz



Appendix J: Paper copy of final questionnaire

****please note****

- Questions 6-8 are screening questions. If the participant is 15 years old and has completed the screening questions online then there is no need to include them.
- If the participant has completed the screening questions and is 15 years old, only send out parts of the questionnaire that correspond with the products they have selected as consuming.
- Questions 9-12 are questions included on the online questionnaire for those participants aged 15 years old to choose how they would like to receive the paper copy of the questionnaire, and do not need to be included in the paper version.

CaffCo – Caffeine Consumption Habits Questionnaire

Q1

Caffeine Habits Questionnaire

Thank you for taking the time to complete this questionnaire

This questionnaire examines the reasons for consumption of various caffeine-containing beverages and foods found in New Zealand.

The questionnaire has been designed to be completed by people aged 15 years and over.

Data collected from this questionnaire is confidential.

Further information can be found in the information sheet included; please read this before continuing with the questionnaire.

The questionnaire will take around 15-20 minutes to complete.

Q2 INFORMATION SHEET HERE

Q3 ETHICS STATEMENT HERE

Q4

I have read and understand the information sheet provided and agree to participate in the study under the terms laid out in the information sheet.

- Yes
- No

Q5

Please enter your study identification number

.....

Q6

Which of these items do you drink / eat? Include those that you only consume occasionally.

- Tea (black / green)
- Coffee
- Chocolate
- Kola flavoured drinks (e.g. Coke cola, Pepsi etc)
- Energy drinks / energy shots
- Premixed caffeinated alcoholic RTDs with a kola drink base (e.g. rum and kola) or with added caffeine / guarana
- Caffeinated pre-workout sports supplements and sports gels
- Caffeine Tablets (e.g. No Doz)
- None one of the above

Q7

What age group do you fit into?

- 14 years or under
- 15 years old
- 16-18 years old
- 19-30 years old
- 31-50 years old
- 51-70 years old
- 71 years or over

Q8

What is your gender?

- Male
- Female
- Other

Q9

Thank you for expressing your interest to participate in this survey.

Due to your age, we would like to send you a paper copy of the questionnaire to fill out. A prepaid return envelope will be included to send the survey back.

Alternatively, this can be emailed to you, printed and filled out and then scanned and sent back to us.

Q10

Please select below how you would like to receive the questionnaire.

- By email
- By post

Answer If Please select below how you would like to receive the questionnaire. By email is selected

Q11 Please enter your email address below

.....

Answer If Please select below how you would like to receive the questionnaire. By post is selected



Q12 Please enter your name and postal address below

.....

Tea

Q.13

How often do you drink the following types of tea (on average)?

	Never	Less than once a month	1-3 times a month	Once a week	2-4 times a week	5-6 times a week	Once a day	2-3 times a day	4-5 times a day	6+ times a day
Green tea (1 cup) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Black tea with or without milk (1 cup) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Iced tea (1 glass) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decaffeinated tea (1 cup) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q14 Think about **your own reasons** for drinking tea.

Read the following statements about the different reasons for tea consumption and consider whether you agree, strongly agree, disagree or strongly disagree.

I drink tea...

	Strongly Agree	Agree	Disagree	Strongly Disagree
- because it is cheaper than other hot drinks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because it is what I drink with food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to comfort and relax myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for the warmth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for the taste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- whenever it is offered to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for mental energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of boredom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel I am influenced by peer pressure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of habit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- when I am stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel that I am influenced by advertising	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because it is easily available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to wake up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly Agree	Agree	Disagree	Strongly Disagree
- because others are drinking it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- as my culture influences me to drink it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- when I have had enough coffee for the day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to replace food or meals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- while travelling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I think coffee has too much caffeine in it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q15

What time of day do you drink tea? Choose all options that apply to you.

- Before breakfast
- At breakfast time
- Between breakfast and lunch
- At lunch time
- Between lunchtime and dinner
- At dinner time
- After dinner
- All day
- At no particular time

Q16




In which environments do you drink tea? Select all that apply.




- A home environment (your own or others)
- A socialising environment
- A work environment
- A cafe environment
- A study environment
- Other (please specify) _____

Coffee

Q.17

How often do you drink the following types of coffee (on average)?

	Never	Less than once a month	1-3 times a month	Once a week	2-4 times a week	5-6 times a week	Once a day	2-3 times a day	4-5 times a day	6+ times a day
<p>Instant coffee (made with 1 teaspoon coffee powder)</p> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<p>Plunger / drip coffee (1 medium cup - 250ml)</p> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<p>Small espresso coffee (single shot)</p> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never	Less than once a month	1-3 times a month	Once a week	2-4 times a week	5-6 times a week	Once a day	2-3 times a day	4-5 times a day	6+ times a day
<p>Large espresso coffee (double shot)</p> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<p>Decaffeinated coffee (1 cup)</p> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<p>Iced coffee (1 glass)</p> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q18 Think about **your own reasons** for drinking coffee.

Read the following statements about the different reasons for coffee consumption and consider whether you 'agree', 'strongly agree', 'disagree' or 'strongly disagree'

I drink coffee...

	Strongly Agree	Agree	Disagree	Strongly Disagree
- because it is easily available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of boredom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- as a treat or luxury drink	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because it is what I drink with food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to comfort and relax myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for the warmth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for the taste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- whenever it is offered to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because others are drinking it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- while travelling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- when I am stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- while driving long distances	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for physical energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for mental energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly Agree	Agree	Disagree	Strongly Disagree
- because I feel I am influenced by peer pressure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel that I am influenced by advertising	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of habit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- as my culture influences me to drink it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to stay awake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to wake up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to replace food or meals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- when I am smoking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q19 What time of day do you drink coffee? Choose all options that apply to you.

- Before breakfast
- At breakfast time
- Between breakfast and lunch
- At lunch time
- Between lunchtime and dinner
- At dinner time
- After dinner
- All day
- At no particular time

Q20 In which environments do you drink coffee? Select all that apply.

- A home environment (your own or others)
- A cafe environment
- A work environment
- A study environment
- A socialising environment
- A physical exercise environment
- Other (please specify) _____

Decaf tea and coffee

Q21

Think about **your own reasons** for drinking decaffeinated coffee / tea instead of regular coffee / tea.

Read the following statements about the different reasons for consumption and consider whether you 'agree', 'strongly agree', 'disagree' or 'strongly disagree'.

I drink decaffeinated coffee / tea ...






	Strongly agree	Agree	Disagree	Strongly Disagree
- when I feel that I have had enough regular coffee / tea for the day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I do not want the caffeine in regular coffee / tea	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because it is offered to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I can't tolerate the caffeine in regular coffee / tea	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for medical reasons	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I prefer the taste of decaffeinated coffee / tea compared to regular	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify):

.....

Chocolate

Q22 How often do you eat the following types of chocolate (on average)?
The pictures below include some examples of products, chose the one closest to what you consume.

	Never	Less than once a month	1-3 times a month	Once a week	2-4 times a week	5-6 times a week	Once a day	2-3 times a day	4-5 times a day	6+ times a day
Milk Chocolate small bar (50g) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Milk Chocolate large block (200-250g) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dark Chocolate small bar (50g) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dark Chocolate large block (200-250g) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hot chocolate (1 medium cup) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q23

Think about **your own reasons** for eating chocolate.

Read the following statements about the different reasons for chocolate consumption and consider whether you 'agree', 'strongly agree', 'disagree' or 'strongly disagree'.

I eat chocolate...

	Strongly Agree	Agree	Disagree	Strongly Disagree
- to comfort and relax myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for the taste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- more when I am on my period (females)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- as a treat or luxury food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel that I am influenced by advertising	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because it is already in many of the foods that I eat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for the warmth (drinking chocolate)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel I am influenced by peer pressure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- while travelling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to replace other food or meals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- whenever it is offered to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of boredom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- when I am stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly Agree	Agree	Disagree	Strongly Disagree
- because others are eating it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of habit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because it is easily available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q24

What time of day do you eat chocolate? Choose all options that apply to you.

- Before breakfast
- At breakfast time
- Between breakfast and lunch
- At lunch time
- Between lunchtime and dinner
- At dinner time
- After dinner
- All day
- At no particular time

Q25

Which pattern of eating chocolate describes your own? You may choose more than one option.

- I regularly eat a large amount of chocolate at one time
- I regularly eat small amounts of chocolate
- I occasionally eat small amounts of chocolate
- I occasionally eat a large amount of chocolate all at one time
- Other (please specify) _____

Q26

In which environments do you eat chocolate? Select all that apply.



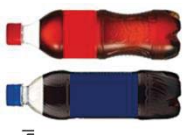
- A home environment (your own or others)
- A cafe environment
- A work environment
- A socialising environment
- A study environment
- Other (please specify) _____



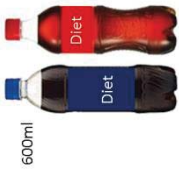
Kola-flavoured drinks

Q27

How often do you drink the following types of kola-flavoured drinks (on average)?

This includes brands such as Coca-Cola, Pepsi and other brands of kola-flavoured drinks. 'Diet', 'Zero', 'Max' varieties are included in their own category below ('diet'), rather than with 'regular' kola drinks.

	Never	Less than once a month	1-3 times a month	Once a week	2-4 times a week	5-6 times a week	Once a day	2-3 times a day	4-5 times a day	6+ times a day
1 glass of regular kola drink (250ml) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 can of regular kola drink (355ml) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 small bottle of regular kola drink (600ml) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never	Less than once a month	1-3 times a month	Once a week	2-4 times a week	5-6 times a week	Once a day	2-3 times a day	4-5 times a day	6+ times a day
<p>1 glass of DIET / ZERO / MAX kola drink (250ml)</p> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<p>1 can of DIET / ZERO / MAX kola drink (355ml)</p> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<p>1 small bottle of DIET / ZERO / MAX kola drink (600ml)</p> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q28

Think about **your own reasons** for drinking kola drinks (including both regular and diet).

Read the following statements about the different reasons for coffee consumption and consider whether you 'agree', 'strongly agree', 'disagree' or 'strongly disagree'

I drink kola drinks (including both regular and diet)...

	Strongly Agree	Agree	Disagree	Strongly Disagree
- because they are cheaper than other drinks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because is the drink I have with meals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because it is cold and refreshing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for the taste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of habit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to replace food or meals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for the bubbles / how it feels in my mouth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- while travelling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- when I am stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- whenever it is offered to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because they are easily available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of boredom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- instead of coffee when the weather is hot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly Agree	Agree	Disagree	Strongly Disagree
- instead of alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because others are drinking it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- as a treat drink	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- as a mixer for alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with takeaway food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel that I am influenced by advertising	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel I am influenced by peer pressure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q29 What time of day do you drink kola drinks (both regular and diet)? Choose all options that apply to you.

- Before breakfast
- At breakfast time
- Between breakfast and lunch
- At lunch time
- Between lunchtime and dinner
- At dinner time
- After dinner
- All day
- At no particular time

Q30 In which environments do you drink kola drinks (both regular and diet)? Select all that apply.

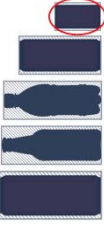
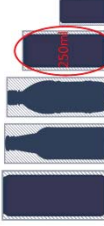


- A home environment (your own or others)
- A cafe environment
- A work environment
- A party environment
- A study environment
- A physical exercise environment
- A bar environment
- Other (please specify) _____

Energy Drinks

Q31 Energy drinks include brands such as Red Bull, V, Mother, Monster Energy and others.

Q32 How often do you drink the following types of energy drinks (on average)?



	Never	Less than once a month	1-3 times a month	Once a week	2-4 times a week	5-6 times a week	Once a day	2-3 times a day	4-5 times a day	6+ times a day
1 energy shot 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 small can of energy drink (250ml) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 small bottle of energy drink (350ml) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 large can / bottle of energy drink (500ml) 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q33

Think about **your own reasons** for drinking energy drinks.

Read the following statements about the different reasons for coffee consumption and consider whether you strongly agree, disagree or strongly disagree.

I drink energy drinks ...

	Strongly Agree	Agree	Disagree	Strongly Disagree
- because they are cold and refreshing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for the taste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel I am influenced by peer pressure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of habit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for physical energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- while driving long distances	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- whenever one is offered to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of boredom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with takeaway food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to improve physical performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for mental energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- instead of alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- as a mixer for alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly Agree	Agree	Disagree	Strongly Disagree
- when I am stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because others are drinking it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel that I am influenced by advertising	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to replace food or meals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- while travelling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- while smoking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with takeaway food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to stay awake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to wake me up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because they are easily available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because it is the drink I have with food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q34

What time of day do you drink energy drinks? Choose all options that apply to you.

- Before breakfast
- At breakfast time
- Between breakfast and lunch
- At lunch time
- Between lunchtime and dinner
- At dinner time
- After dinner
- All day
- At no particular time

Q35

In which environments do you drink energy drinks? (Select all that apply)

- A home environment (your own or others)
- A cafe environment
- A work environment
- A party environment
- A physical exercise environment
- A socialising environment
- A study environment
- A bar environment
- Other (please specify) _____

Caffeinated alcoholic RTDs

Q36 Caffeinated alcoholic RTDs are premixed alcoholic drinks with either a **kola base** (e.g. Jack Daniels, Jim Beam, Woodstock, Coruba and kola etc) or with **added caffeine or guarana** (e.g. some Smirnoff Ice, Purple Goanna).

The pictures below include some examples of products, however there may be products not pictured. **Chose the one closest to what you consume.**

Q37 How often do you drink caffeinated RTDs (on average)?

	Never	Less than once a month	1-3 times a month	Once a week	2-4 times a week	5-6 times a week	Once a day	2-3 times a day	4-5 times a day	6+ times a day
1 RTD can (250-330ml)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1 RTD bottle (330 - 350ml)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Examples of a RTD can:



Examples of a RTD bottle



Q38 Think about **your own reasons** for drinking Caffeinated RTDs.

Read the following statements about the different reasons for coffee consumption and consider whether you 'agree', 'strongly agree', 'disagree' or 'strongly disagree'

I drink caffeinated RTDs...

	Strongly Agree	Agree	Disagree	Strongly Disagree
- because they are cold and refreshing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for the taste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for the alcohol content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel I am influenced by peer pressure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of habit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I know how much alcohol is in them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- whenever one is offered to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of boredom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- when I am stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to replace food or meals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to stay awake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel that I am influenced by advertising	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because others are drinking them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because they are easy to transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly Agree	Agree	Disagree	Strongly Disagree
- while travelling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for physical energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because they are cheaper than other alcoholic drinks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- instead of spirits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to comfort and relax me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q39

What time of day do you drink RTDs? Choose all options that apply to you.

- Before breakfast
- At breakfast time
- Between breakfast and lunch
- At lunch time
- Between lunchtime and dinner
- At dinner time
- After dinner
- All day
- At no particular time

Q40



In which environments do you drink caffeinated RTDs? (Select all that apply)

- A home environment
- A party environment
- A bar environment
- A socialising environment
- Other (please specify) _____

Caffeinated pre-workout supplements and sports gels

Q41

How often do you take caffeinated pre-workout sports supplements or sports gels (on average)?

	Never	Less than once a month	1-3 times a month	Once a week	2-4 times a week	5-6 times a week	Once a day	2-3 times a day	4-5 times a day	6+ times a day
Pre-workout sports supplements 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sports gels 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q42

Think about **your own reasons** for using sports supplements.

Read the following statements about the different reasons for sports supplement consumption and consider whether you 'agree', 'strongly agree', 'disagree' or 'strongly disagree'.

I take sports supplements...

	Strongly Agree	Agree	Disagree	Strongly Disagree
- for physical energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel that I am influenced by advertising	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because of peer pressure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because of pressure from coaches / trainers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to improve physical performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- as they are convenient to take	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- as a substitute for illegal drugs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- while travelling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to replace food or meals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because they are easy to transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because others are using them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- out of habit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q43

The following is a list of different types of physical activities. Select if you take pre workout supplements or sports gels in any of the following environments (select as many or as little as you like).

	Pre workout supplements	Sports gels	I am involved in this type of activity but do not use these	I am not involved in this type of activity
Resistance training (e.g. weight training at the gym, body weight exercises)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Endurance training (e.g. for triathlons, marathons)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competitive team sports (e.g. for competitions, events)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competitive individual sports (e.g. for competitions, events)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Recreational team sports (e.g. social netball, rugby, soccer)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Recreational individual sports (e.g. running, biking, hiking, swimming)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other (please specify):

.....

.....

.....

Q44

In which environments do take caffeinated pre-workout sports supplements or sports gels? (Select all that apply)



- A party environment
- A physical exercise environment
- A socialising environment
- Other (please specify) _____


Caffeine tablets

Q45

Caffeine tablets in include No Doz, Thermo, AllMax, Caffeine Pro, Inner Amour and others.

Q46 How often do you take caffeine tablets (on average)?

	Never	Less than once a month	1-3 times a month	Once a week	2-4 times a week	5-6 times a week	Once a day	2-3 times a day	4-5 times a day	6+ times a day
<p>1 caffeine tablet containing 50mg of caffeine (e.g. Pro Plus)</p> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<p>1 caffeine tablet containing 100mg of caffeine (e.g. No Doz)</p> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never	Less than once a month	1-3 times a month	Once a week	2-4 times a week	5-6 times a week	Once a day	2-3 times a day	4-5 times a day	6+ times a day
<p>1 caffeine tablet containing 200mg caffeine (e.g. Thermo, AllMax, Myprotein Caffeine Pro, Inner Armor etc)</p> 	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify):

.....

.....

.....

Q47

Think about **your own reasons** for using caffeine tablets.

Read the following statements about the different reasons for coffee consumption and consider whether you 'agree', 'strongly agree', 'disagree' or 'strongly disagree'.

I take caffeine tablets...

	Strongly Agree	Agree	Disagree	Strongly Disagree
- for physical energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel I am influenced by peer pressure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because of pressure from coaches / trainers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- as they are convenient to take	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to replace food or meals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to wake up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to improve physical performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- as a substitute for illegal drugs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- while travelling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because others are using them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- for mental energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- while driving long distances	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- because I feel that I am influenced by advertising	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
- to stay awake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly Agree	Agree	Disagree	Strongly Disagree
- with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q48

In which environments do you drink take caffeine tablets?

- A work environment
- A party environment
- A physical exercise environment
- A study environment
- A socialising environment
- Other (please specify) _____

Replacing food or meals - Please fill in this question if you ever use tea, coffee, chocolate, kola drinks, energy drinks, caffeinated RTDs, caffeinated sports supplements or caffeine tablets to replace food or meals. **If you do not do this, you do not need to fill in the questions.**

Q49 When I use these products to replace food or meals, I do it because...

	Tea	Coffee	Drinking chocolate	Eating chocolate	Kola drinks (regular and diet)	Energy drinks	Caffeinated RTDs	Pre-workout supplements / sports gels	Caffeine tablets
I want to lose weight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is cheaper than food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I did not prepare / organise food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is more easily accessible than food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am not hungry or do not feel like eating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I enjoy the product more than food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q50 Are there any other reasons that you use these products to replace food or meals?

Other (please specify):

Feelings of dependency

Q51

Have you ever felt dependent on any of the following products?

For example - you have felt that you needed them to 'feel normal' or to 'get through the day'.

- Tea
- Coffee
- Chocolate
- Kola-flavoured drinks (both regular and diet)
- Energy drinks / energy shots
- Caffeinated pre workout sports supplements / sports gels
- Caffeine tablets
- No, I have never felt dependent on any of these products

Q52

Think about your consumption of the caffeinated products that have been explored.

Have you ever experienced any of the following symptoms **within one day of stopping their normal use**?

Please tick all options that apply to you.

- Headaches
- Mood changes (e.g.. depressed mood, easily annoyed)
- Marked tiredness or drowsiness
- Difficulty concentrating
- 'Flu like' feelings (e.g.. nausea, vomiting, muscle pain, stiffness)
- Other (please specify) _____
- No, I have never experienced any of these

If you selected 'No, I have never experienced any of these' to Q52, please skip ahead to Q55.

Q53

With which products did these symptoms occur (within a day of when you stopped consuming them)?

Select only the options that apply to you.

	Headaches	Mood changes	Marked tiredness / drowsiness	Difficulty concentrating	'Flu-like' feelings
Tea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coffee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chocolate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kola-flavoured drinks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Energy drinks / shots	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Caffeinated sports supplements / sports gels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Caffeine tablets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other symptoms that occurred within a day of not using these products (please specify):

.....
.....

Q54

Did these negative effects impact on your social life, work life or cause you any kind of distress?

- Yes
- No

Q55

Again, think of your experiences with the caffeinated products that have been explored. **Shortly after consuming them**, have you ever felt any of these effects?

Please tick all options that apply to you.

- Restless
- Nervous
- Excited
- Unable to sleep
- A hot or red face
- Needing to pee a lot
- An upset stomach
- Twitches
- Unable to concentrate
- A fast or uneven heartbeat
- Feelings of unlimited energy
- Agitated movements / jittery
- Other (please specify) _____
- No, I have never felt any of these effects shortly after consuming caffeinated products

If you selected 'No, I have never felt any of these effects shortly after consuming caffeinated products' for Q55, please skip ahead to Q61.

Q.56

With which products did these symptoms occur **shortly after consuming these products?**

	Tea	Coffee	Chocolate	Kola-flavoured drinks	Energy drinks / shots	Caffeinated sports supplements / sports gels	Caffeine tablets
- Restless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Nervous	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Excited	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Unable to sleep	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- A hot or red face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Needing to pee a lot	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- An upset stomach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Twitches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Unable to concentrate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- A fast or uneven heartbeat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Tea	Coffee	Chocolate	Kola-flavoured drinks	Energy drinks / shots	Caffeinated sports supplements / sports gels	Caffeine tablets
- Feelings of unlimited energy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Agitated movements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other (please specify):.....

Q57 Did these negative effects (from Q55) impact on your social life, work life or cause you any kind of distress?

- Yes
- No

Q58 Have the effects mentioned above ever led to any of the following? Select the options that are relevant.

	I have never had concern about these effects	Worry or concern	Talking to someone about these effects	Seeking help to stop these effects	First aid being applied	Hospitalisation
- Restless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Nervous	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	I have never had concern about these effects	Worry or concern	Talking to someone about these effects	Seeking help to stop these effects	First aid being applied	Hospitalisation
- Excited	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Unable to sleep	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- A hot or red face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Needing to pee a lot	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- An upset stomach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Unable to concentrate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Twitches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- A fast or uneven heartbeat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Feelings of unlimited energy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Agitated movements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other (please specify):

.....

.....

Please only answer questions Q59 – Q62 if they are relevant to you.

Q59

If you have ever asked for help to try and stop these effects (from Q58), who did you contact?

Select as many options as apply.

- Friends
- Family
- Poisons Hot-line
- Medical professional
- Other (please specify) _____

Q60 Has anyone ever talked to you specifically about your caffeine intake?

- Yes
- No

Q61 For the following products, please select the main reasons why you might not consume them.

This includes products that you never consume but also ones that you may consume but not all of the time. Select the options that apply to you.

	I have never considered taking it	I don't like the flavour	There is too much sugar in it	I don't want to be dependent on it	I react badly to it	It isn't 'good' for me	It has too much caffeine in it	It's too expensive	I don't consume it due to medical reasons
- Tea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Coffee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Chocolate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Kola-flavoured drinks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Energy drinks / energy shots	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Caffeinated alcoholic RTDs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Caffeinated sports supplements / sports gels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Caffeine tablets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q62 Is there any other reason why you don't consume these products? (Please specify product and reason if applicable):

.....

Q63

The following are statements on attitudes and behaviours around caffeinated products.

Read the following statements and consider whether you 'agree', 'strongly agree', are 'unsure', 'disagree' or 'strongly disagree'.

	Strongly agree	Agree	Unsure	Disagree	Strongly disagree
When someone comes to my house, I should offer them a hot drink	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I give chocolate as a gift	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sometimes I 'go out for a coffee' but will drink something else that is not coffee.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is normal to always have kola-flavoured drinks in the fridge at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kola-flavoured drinks are mainly for special occasions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Caffeinated RTDs are more socially acceptable way to drink alcohol than spirits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is socially acceptable to drink kola drinks and energy drinks in the morning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q64

Think about the following items.

Is there an age group that you think of as being the main consumers for each product?

Select as many options as apply.

	14 and under	15-18	19-30	31-50	51-70	70 and over	All age groups	Unsure
- Tea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Coffee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Chocolate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Kola drinks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Energy drinks / energy shots	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Caffeinated RTDs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Caffeinated pre-workout sports supplements / sports gels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Caffeine tablets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q65

Think about the following items.

Is there a gender that you think of as being the main consumers for each product?

	Male	Female	Both	Unsure
- Tea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Coffee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Chocolate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Kola drinks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Energy drinks / energy shots	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Caffeinated RTDs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Caffeinated pre-workout sports supplements / sports gels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Caffeine tablets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q66

What is your ethnicity?

You may choose as many that apply to you.

- European
- NZ European
- Maori
- Samoan
- Cook Islands Maori
- Tongan
- Niuean
- Tokelauan
- Fijian
- Southeast Asian
- Chinese
- Indian
- Korean
- Middle Eastern
- Latin American
- African
- Other (please specify) _____

Q67

Employment status (choose more than one option if applicable):

- Student
- Unemployed
- Part time worker
- Full time worker

Q68

If employed, does your job involve any of the following?

	Yes	No
Manual labour	<input type="radio"/>	<input type="radio"/>
Driving long distances	<input type="radio"/>	<input type="radio"/>
Shift work	<input type="radio"/>	<input type="radio"/>

Q69

What is your highest level of education?

- Primary school education
- Completed year 11 / 5th form
- Completed year 12 / 6th form
- Completed high school
- Diploma / Certificate
- Bachelors Degree
- Postgraduate degree

Q70

What is your living situation?

- Living alone
- Living in a family home with others
- Flatting with others
- Other (please specify) _____

Q71

Do you smoke?

- Yes
- No
- Occasionally
- Prefer not to answer

Q72 (for female participants)

Are you currently on any type of oral contraceptive?

- Yes
- No
- Prefer not to answer

Q73

How much do you weigh (kg)?

- Kg - _____
- Don't know / prefer not to answer

Q74

How tall are you (cm)?

- Cm - _____
- Don't know / prefer not to answer

Q75

Thank you for taking your time to complete this questionnaire. Please feel free to contact our researchers for any further inquiries.

STUDY CONTACT DETAILS HERE

Appendix K: Questionnaire pilot test information sheet



School of Food and Nutrition
Massey University
Private Bag 102904
North Shore City 0745, Auckland
New Zealand

Why do we use caffeine?

The development of a questionnaire to examine patterns of caffeine intake in New Zealand adults.

INFORMATION SHEET

We are looking for individuals over 15 years old to take part in evaluating a questionnaire looking at the reasons why New Zealanders consume caffeine.

Researcher Introduction

Hello, my name is Karli Rowe and I am currently studying towards a Master of Science degree in Nutrition and Dietetics at Massey University (to become a Dietitian). This project is being undertaken as part of my degree. My supervisors are Dr Kay Rutherford-Markwick, Dr Ajmol Ali and Dr Carol Wham. Together, the supervisors have an extensive background of research in the fields of nutrition, physiology and public health.

Project Description

Currently, there is little information about caffeine intake and the reasons behind caffeine consumption in New Zealand. Caffeine is widely used as a stimulant; however unwanted side effects such as an inability to sleep or jitteriness can sometimes result from its use. This study aims to develop a questionnaire that will be used to evaluate caffeine intakes, effects, and the reasons behind caffeine consumption in New Zealand adults aged over 15 years old.

You are invited to complete an online questionnaire – which should take approximately 10-20 minutes – about your caffeine consumption and the reasons for consumption. Information gained from this questionnaire will be used to improve the ease of use of the questionnaire for future studies.

Participant Identification and Recruitment

Participants will either be participants of previous focus groups (invited to complete the questionnaire), or members of the public recruited by flyers placed around universities, community settings, places of work and social media such as Facebook. Once contact has been made, participants will be referred to an online web page where they will be able to complete the questionnaire. If you are 15 years of age, paper copies of the questionnaire, participant information sheet, as well as consent forms (for you and your parents) will be sent out via mail.

Participants must be:

- 15 years of age or older
- Fluent in spoken and written English

Project Procedures

Participants will be asked to complete an online questionnaire about normal patterns of use of different foods and drinks which contain caffeine. This includes food items such as tea, coffee, alcoholic caffeinated beverages, soft drinks, energy drinks, chocolate and others.

Participants will be asked if there are any ways in which the questionnaire could be made easier to use.

Participants are welcome to discuss any concerns regarding the questionnaire with me. If you do not feel comfortable at any time with the questions asked, you do not have to continue with the questionnaire.

If you feel concerned about your caffeine or other food and beverage consumption, please consult with your GP. Otherwise, Samaritans NZ is an organisation available for non-judgemental, confidential support to anyone in distress (04 473 9739). Alcohol Drug Helpline (0800 787 797) is a free, anonymous service available if you have concerns about your alcohol consumption.

Data Management

All information collected will be kept strictly confidential, and in locked storage at the School of Food and Nutrition. After 5 years, the data will be destroyed by a staff member.

Results from this study may be presented at conferences or published, and be made accessible to focus group participants.

Participant's Rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study up until submission of the on-line or written questionnaire;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- be given access to a summary of the project findings when it is concluded.

Project Contacts

If you have any questions regarding this study, please contact the researcher and/or one of the supervisors.

Student researcher:

Karli Rowe
Massey School of Food and Nutrition
Email: caffeine@outlook.co.nz
Phone: 021 2233806

Supervisors:

Dr Kay Rutherford-Markwick
School of Food and Nutrition
Email: K.J.Rutherford@massey.ac.nz
Phone: +64 (09) 414 0800 ext. 43646

Dr Ajmol Ali
School of Sport and Exercise
Email: A.Ali@massey.ac.nz
Phone: +64 (09) 414 0800 ext. 43414

Dr Carol Wham
School of Food and Nutrition
Email: C.A.Wham@massey.ac.nz
Phone: +64 (09) 414 0800 ext. 43644

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research. If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Dr Brian Finch, Director, Research Ethics, telephone 06 356 9099 extn 86015, email: humanethics@massey.ac.nz

Appendix L: Questionnaire pilot test parental consent form



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North Shore City 0745, Auckland
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PARENT/CAREGIVER QUESTIONNAIRE CONSENT FORM

I give my consent for.....(name of child) to participate in the 'Why do we use caffeine?' study.

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree to have data placed into an official archive.

Signature:

Date:

Full Name - printed

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research. If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Dr Brian Finch, Director, Research Ethics, telephone 06 356 9099 extn 86015, email: humanethics@massey.ac.nz

Appendix M: Questionnaire pilot test participant assent form



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Massey University
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Participant Screening Questionnaire

Thank you for expressing interest in our study. Please complete the following questions to make sure you are able to participate.

Are you fluent in spoken English? Yes / No

Are you fluent in written English? Yes / No

What age group do you fall into?

- Under 15 years old
- 15 - 18 years old
- 19 – 30 years old
- 31 – 50 years old
- 51 years or over

Please provide an email address so that we can contact you:

.....

Full Name – Printed: Date:

Thank you for your interest in participating in this research project.

We will be in touch soon to give you more information. Feel free to contact the researcher at the email address listed below if you have any questions.

Student Researcher:

Karli Rowe

Email: caffeine@outlook.co.nz

Phone: 0212233806

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research. If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Dr Brian Finch, Director, Research Ethics, telephone 06 356 9099 extn 86015, email: humanethics@massey.ac.nz