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Healthy Food, Drinks and Choking Guidance in New Zealand: Do Early Learning Service Menus Align?

A thesis presented in partial fulfilment of the requirements of the degree of
Master of Science
In
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ABSTRACT

Background: Food intake from birth to six years is especially important as early life is a period for healthy flavour learning, rapid growth, and establishing long-term eating patterns. Early learning services (ELS) provide an influential environment outside of the home where young children consume a considerable amount of their daily nutritional requirements. Understanding the foods and drinks available within ELS is crucial to address health issues young children may face during their formative years, such as an increased risk of choking, overweight and obesity, and subsequent development of non-communicable diseases such as cardiovascular diseases and diabetes mellitus.

Aim: To assess the alignment of food and drinks served to NZ children in ELS with the Ministry of Health (MoH) *Healthy Food and Drink* (HFD) and *Reducing Food Related Choking* (choking) guidance.

Methods: Menus (271) collected remotely from 148 ELS from November 2020-March 2021 were analysed for their nutritional quality (percentage of 'green', 'amber', and 'red' menu items) using a scoring system based on the MoH guidance.

Results: Overall, 2.6% of menus met the MoH HFD guidance, and alignment was greater for menus for over two-year-olds (over-2s) than under two-year-olds (under-2s; $p < 0.01$). One-fifth (18.5%) of menus met the MoH choking guidance. Services with a *Healthy Heart Award* (HHA) provided more green items to over-2s ($p = 0.039$) and under-2s ($p = 0.01$), and fewer red items to over-2s ($p = 0.04$). Providing more green menu items was inversely correlated with providing less high-choking-risk foods ($p < 0.01$, $r = -0.347$ over-2s; $p < 0.01$, $r = -0.504$ under-2s). Menu scores did not vary by service location ($p = 0.317$ over-2s; $p = 0.108$ under-2s), neighbourhood socioeconomic deprivation ($p = 0.118$ over-2s; $p = 0.770$ under-2s), type (services operating independently versus those part of an education group chain; $p = 0.451$ over-2s; $p = 0.520$ under-2s), or menu length (full menu providing a minimum of one meal and two snacks daily, or partial menu providing less; $p = 0.445$ over-2s, $p = 0.796$ under-2s).

Conclusions: Alignment with MoH nutritional guidance is low, particularly in ELS caring for very young children (under-2s). Service characteristics, except for HHA status, are a poor predictor of the nutritional quality of menus at ELS. There is a widespread need to further support ELS with the implementation of nutrition guidelines.

Key words: *Nutrition, food environment, children, early-childhood-education, health*

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CONTRIBUTIONS

This study used the menus and survey results collected during baseline data collection for the *Healthy Active Learning* project by the Massey University project team (Ajmol Ali, Owen Mugridge, Sophie Turner and Tayla Knightsbridge-Eager). I did not participate in the design or implementation of these surveys. I conducted follow-up communication with specific early learning services and contacted early learning service providers to gain the information necessary for this project. Together with Marsha Piddington (MSc Candidate, Massey University), Shannon Green (MSc Candidate, Massey University) and Danika Pillay (PhD Candidate, Massey University) I created the method for analysis of the menus against the *Ministry of Health Healthy Food and Drink Guidance for Schools and Early Learning Services* as outlined in the methods section.

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I analysed each of the menus to give them an overall score. The statistical analyses of the results were performed by me; however, I sought statistical advice and interpreted the results with the help of Statistician Hajar Mazahery (Post Doctorate Fellow) and Ajmol Ali (Professor of Sport and Exercise).

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LIST OF ABBREVIATIONS

ANOVA	Analysis of variance
ARFID	Avoidant Restrictive Food Intake Disorder
Aus	Australia
BMI	Body mass index
BMIz	Body mass index z score
DQI	Dietary Quality Index
ECE	Early childhood education
e.g.	For example
ELS	Early learning service(s)
ERO	Education Review Office
GUiNZ	Growing Up in New Zealand (longitudinal study)
HFD	Healthy Food and Drink Guidance for Early Learning Services
HHA	Healthy Heart Award(s)
HSR	Health Star Rating
IBM	International Business Machines
MoE	Ministry of Education
MoH	Ministry of Health
MPI	Ministry for Primary Industries
Over-2s	Over two-year-olds
OECD	Organisation for Economic Co-operation and Development
n	Sample size
NSW	New South Wales
NZ	New Zealand
P-value	The probability of rejecting the null hypothesis when it is true
r	Pearson's product-moment correlation coefficient
SD	Standard deviation
SPSS	Statistical Package for the Social Sciences
SSB	Sugar-sweetened beverage(s)
Under-2s	Under two-year-olds
US	United States
USE	Under 5 Energize
WHO	World Health Organisation

GLOSSARY

Chain early learning service	Part of a group of services that operate under the same name and/or Education group, as defined by the Education Review Office report on Education Counts.
Food availability	The food available within an early learning service, including all food and drinks provided by and served by the service and free or charitable food provided. Within the scope of this project, does not include food and drinks children and staff bring to an early learning service for themselves or food for special occasions or celebrations.
Food environment	What food is available, and the policies and practices surrounding food provision and mealtimes.
Full menu	Menu that provides a minimum of one meal and two snacks over a period of one week (five days).
Healthy Active Learning	Joint initiative between Sport New Zealand, the Ministry of Education, and the Ministry of Health to improve food and physical activity environments at education centres for children in New Zealand (early learning services, primary, intermediate, and secondary schools).
Healthy Food and Drink Guidance: Early Learning Services	Guidance from the Ministry of Health intended to help licensed early learning services provide healthy food and drinks to children. Classifies food and drinks with colour codes of green, amber and red.
Healthy Heart Award	Voluntary, government-funded early learning service nutrition promotion initiative run by the Heart Foundation. Provides support to early learning services to develop and maintain healthy menus, physical activity policies and food policies. One of three award levels (rito/bronze, whānau/silver, and pā-harakeke/gold) can be obtained.
Health Star Rating	An Australian and New Zealand Government voluntary front-of-pack labelling system that assigns health ratings to packaged foods and beverages, using a scale of 0.5 to 5 stars. When comparing similar foods, foods with more stars are healthier than foods with fewer stars.

High-choking-risk foods to exclude	<p>Foods that present a choking hazard, have low nutritional value and/or are not practical to alter to increase safety. This includes</p> <ul style="list-style-type: none"> • Whole nuts or pieces of nuts • Large seeds, like pumpkin or sunflower seeds • Hard or chewy sweets or lollies • Crisps or chippies and corn chips • Hard crackers (including rice crackers) • Dried fruit (except as part of baked items that are classed as amber) • Sausages, saveloys and cheerios • Popcorn • Marshmallows
Independent Early Learning Service	Service that does not operate as part of an education group/collective group of services, according to the governmental directory 'Education Counts'.
Major city	Auckland or Wellington.
NZ Deprivation	An area-based measure of socioeconomic deprivation in New Zealand, where decile 1 represents the least deprived and decile 10 represents the most deprived areas. Derived from 2018 census data related to income, employment, home ownership, housing quality, family structure and access to technology/communications.
Partial menu	The menu that provides less than one meal and two snacks per day over a period of one week (five days).
Provincial area	Bay of Plenty, Canterbury, Gisborne, Northland, or Southland.
Reducing Food-related choking for Babies and Young Children at Early Learning Services	Guidance from the Ministry of Health intended to help licensed early learning services to managing the high risk of food-related choking in babies and young children.
Urban Accessibility	The measure of geographical proximity to main urban areas in New Zealand, measured by drive time to the nearest medium, large or major area.

CHAPTER 1: INTRODUCTION, AIM AND OBJECTIVES

1.1 Background

Early childhood, from birth to six years, is a crucial developmental period during which children are curious and biologically vulnerable (Rodrigues et al., 2020). This makes it an ideal time to develop food preferences and behaviours that support long-term health outcomes (De Bock et al., 2021; Hu et al., 2009, Mikkilä et al., 2005). Eating patterns established in early childhood track into later childhood, and subsequently into adolescence and adulthood (Lipsky et al., 2015; Luque et al., 2018; Mikkilä et al., 2005). Recommended behaviours such as breakfast consumption and eating without distractions have been found to protect against overweight and obesity (Dubois et al., 2008; Van Lippevelde et al., 2013), amongst other non-communicable diseases. Children are now considered the priority population for interventions to prevent obesity, which is a growing concern at all stages of the life course (De Silva-Sanigorski et al., 2010).

The two places where children spend most of their time are at home and pre-school. Parents and caregivers have a large amount of control over a young child's food environment in both settings (Gerritsen et al., 2018). Recognised best practices in early learning services (ELS) across New Zealand (NZ; Ministry of Education, 2021) Australia (Australian Children's Education and Care Quality Authority, 2020), the United States (US; Harvard College, 2021) and the United Kingdom (UK; Action for Children, 2017) include providing nutritious food and drinks, promoting water and milk consumption, and modelling healthy eating. The development of healthy eating habits in early life provides the rationale to ensure that healthy food is served to children in education settings. The early childhood setting provides an opportunity to correct less-than-optimal behaviours learned at home and/or extend positive health behaviours to the home setting, especially if nutrition activities involve parent-caregiver collaboration (Natale et al., 2017; Tysoe & Wilson, 2010). Effective early-childhood-based interventions for improving children's diets tend to involve parents and include modifications to ELS nutrition policies and menus to meet dietary guidelines (Stacey et al., 2017).

The early childhood education (ECE) sector in NZ is diverse, including teacher-led kindergartens, parent-led playgroups, and Māori mediums such as te kōhanga reo (Ministry of Education, 2020). Early learning service (ELS) attendance rates in NZ are among the highest in the Organisation for Economic Co-operation and Development (OECD) countries (Organisation for Economic Co-operation and Development, 2021). With 97.1% of three and four-year-olds attending an ELS at

some point before starting school, and time spent in childcare increasing with age (Education Counts, 2020), these settings have the potential for widespread impact on health promoting behaviours in young children. Nutritious ELS menus can increase children's preferences for healthy foods, help them to maintain a healthy weight and engage with learning (Jackson et al., 2015). Menu evaluation against recommendations from the Ministry of Health allows for improvement by nutrition promotion in ELS which can help to improve child health through the prevention of childhood obesity, other non-communicable diseases as well as food-related choking.

The current Western food environment is 'obesogenic' (Huang et al., 2020). Cheap, energy dense foods can be obtained with minimal exertion, promoting positive energy balance and weight gain (Swinburn, 2008). The World Health Organisation (WHO) Commission on Ending Childhood Obesity acknowledges the role of the environment in mediating health outcomes and as a major contributor to childhood obesity (World Health Organisation, 2016). Nearly one-third (30.8%) of children aged two to 14 are either overweight or obese, according to the 2020/21 NZ Health Survey (Ministry of Health, 2021), and Māori and Pacific children experience disproportionately higher levels of obesity than children from other ethnic groups (Shackleton et al., 2018). In NZ and overseas, type two diabetes is emerging at a younger age along with increasing trends in cardiovascular diseases (Ministry of Health, 2005; Owen et al., 2009), emphasising the need for early preventative measures. If children are highly exposed to obesogenic food environments in early life, their innate preference for sweet and salty flavour can persist, which contributes to unbalanced nutritional intakes, weight gain and decreased quality of life (Birch & Anzman, 2010).

Another concern for pre-school aged children is the increased risk of choking, which like obesity, is mediated through environmental influences. Choking injuries are a major cause of death and disability among pre-school aged children, and many of these injuries are related to food (Alexander, 2019; Lorenzoni et al., 2022). In NZ choking on food was responsible for eight deaths among zero to 14-year-olds between 2006-2010, and 134 hospitalisations between 2008-2012 (Safekids Aotearoa, 2015). More recently it has been estimated that up to 46 one to two-year-olds, and 42 three to four-year-olds per year will have a choking incident that either requires hospitalisation or is fatal (Starship, 2019a; Starship, 2019b). Guidelines from national governments and professional membership organisations in the US (American Academy of Pediatrics, 2010), the UK (Scientific Advisory Committee on Nutrition, 2018), Canada (Cyr et al., 2012), Australia (New South Wales Ministry of Health, 2014) and NZ (Ministry of Health, 2020b) agree that altering what food is available and how it is served to children contributes to food-related choking prevention. Some

dangerous food items such as meat can be prepared in a way that makes them safer, whilst complete exclusion is recommended for others such as nuts up until the child is developmentally mature enough to 'handle them' (Lorenzoni et al., 2022). Determining how often high-choking-risk foods are served in NZ ELS, and whether this differs based on service location and other factors such as having a *Healthy Heart Award* (HHA) from the NZ Heart Foundation, contributes to an understanding of whether there are appropriate choking prevention measures in place.

Menu evaluation protocols are essential to assess whether ELS are providing nutritious and safe food, in line with national Ministry of Health (MoH) guidance for *Healthy Food and Drink* (HFD) (2020a) and *Reducing Food-Related Choking* (Ministry of Health, 2020b). Menu evaluations can be used to plan public health interventions, develop policy proposals, and identify areas for further staff training (Sampaio et al., 2017). There is no consensus on the best way to evaluate menus in education centres (Cupertino et al., 2021). Checklists against key indicators, interviews with educators, and developing 'diet quality index' incorporating national nutrition guidelines are methods used across the globe (Gregorič et al., 2015; Reilly et al., 2016; Rodrigues et al., 2020).

Dietary guidelines for ELS have been found to be poorly implemented both in NZ and overseas. A 2014 investigation into the quantity, quality, and variety of 257 ELS menus found that only 5% of centres met the MoH *Food and Nutrition Guidelines for Healthy Children and Young People Aged 2-18 years* and the *Fuelled4Life Nutrition Guide for Early Childhood Education Services* (Gerritsen et al., 2017). This low guidance adherence is consistent with several investigations that have taken place in Canada (Ward et al., 2017) Australia (Yoong et al., 2014), New York (NY; Dixon et al., 2016) and Mexico (Benjamin-Neelon et al., 2013). A large-scale evaluation of menu quality of NZ ELS has not been undertaken since 2014, and to the best of the authors' knowledge; the choking safety of ELS menus has never been investigated. Lack of certainty around whether MoH guidelines are being implemented in ELS leaves young children vulnerable to the risks of excessive, inadequate, or unbalanced nutritional intakes and food-related choking. To determine what support ELS require to improve the nutritional quality and choking safety of their menus, distinctions need to be made between the characteristics of ELS who are already implementing the guidance and those who are not.

The food environment in ELS is influenced by sociodemographic and geographical factors, such as service type and location. Research suggests that in neighbourhoods with food security issues, energy dense, processed foods are more likely to be consumed (Munday & Wilson, 2017). For under

two-year-olds, where both the impact of poor nutrition and risk of choking is greater (Denny et al., 2015), nutritional guidance is stricter, which can make adherence more difficult. Gerritsen et al., (2016) found that service type also has an impact on food practices, with kindergartens being more likely than other service types to engage in positive practices such as teaching food and nutrition concepts weekly, involving children in gardening and talking to children about what they are eating. Factors which have previously been associated with more nutritious menus in NZ ELS include participation in the Heart Foundation's HHA scheme and being in either a low or high (but not medium) socioeconomic area (Gerritsen et al., 2017; Heart Foundation, 2022).

1.1.1 Scope

The present study will examine food provision in the ELS setting, using a convenience sample of ELS menus and food availability surveys. This data was collected as part of baseline data collection for *Healthy Active Learning*, a five-year (2021-2026) nationwide health promotion initiative delivered by Sport New Zealand, the Ministry of Education (MoE) and the MoH (<https://sportnz.org.nz/resources/the-joint-initiative/>). The study will determine how closely menus align with the MoH guidelines for healthy food and drink and the prevention of food-related choking in children, and how specific sociodemographic and geographical factors predict this alignment.

The results of this study will increase our knowledge of the food and beverages being served to pre-school children at ELS and help inform public health interventions which may be necessary to improve the nutritional quality and safety of food environments. Findings will also be a useful benchmark for ELS food environments prior to the implementation of *Healthy Active Learning*. This government led initiative aims to improve health outcomes for tamariki (children) and rangatahi (young people) by building capacity for ELS and schools to promote healthy eating and active play through the provision of education and resources.

1.2 Aim and Objectives

1.2.1 Aim

To assess the alignment of early learning service (ELS) menus with the Ministry of Health (MoH) *Healthy Food and Drink Guidance-Early Learning Services* and guidance for *Reducing Food-Related Choking for Babies and Young Children at Early Learning Services* and determine whether this differs for menus for over two-year-olds (over-2s) and under two-year-olds (under-2s).

1.2.2 Objectives

1. To use the MoH *Healthy Food and Drink Guidance-Early Learning Services* to determine the proportion of 'green', 'amber' and 'red' foods and beverages available in a convenience sample of ELS menus.
2. To investigate the prevalence of 'high-choking-risk foods to exclude' on ELS menus as classified by the MoH (2020b).
3. To investigate the association between the nutritional quality of menus and ELS characteristics including:
 - Whether the service is independent or part of an education group chain
 - Service location (major city or provincial area)
 - Socioeconomic status of neighbourhood (using NZ Deprivation score)
 - Menu length (full or partial)
 - Participation in the Heart Foundation's *Healthy Heart Award* (HHA) scheme

1.2.3 Thesis Structure

This thesis contains four chapters with additional references and appendices.

Chapter 1 outlines the background, scope, and justification of this research regarding nutrition environments in ELS. Included in this chapter are the study aim, objectives, and researcher contributions. Chapter 2 consists of a review of the body of literature on the nutrition environments in ELS with a focus on the rationale for evaluating food environments, prevention of childhood obesity and food-related choking. Chapter 3 is the manuscript of the empirical data collected as part of this thesis, made up of an abstract, introduction, methods, results, discussion, and conclusions. Chapter 4 provides the conclusion to the thesis, outlining the strengths and limitations of this study, and presents recommendations for both future research and how the findings of this thesis may inform future menu evaluations. Following this are a series of appendices containing supplementary methods, the questionnaire used to collect data for this research and a sample menu analysis.

1.2.4 Researcher Contribution

Table 1.1 Researcher’s contributions to thesis

Contributor	Research contribution
Olivia Hall	Principle researcher – thesis author Research study proposal, literature review, data collection, cleaning and analysis, results formulation and discussion, thesis manuscript preparation
Professor Carol Wham	Primary academic supervisor Provided supervision for the design and conduct of the research, thesis chapter writing and manuscript preparation
Professor Ajmol Ali	Academic supervisor Provided supervision for the design and conduct of the research, thesis chapter writing and manuscript preparation

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

An enduring theme shaping early childhood policy is that the early years are formative of a child's long-term wellbeing (Woodhead, 2006) This idea, rooted in a developmental perspective, can be traced back as far as Plato (428-348BC):

'And the first step... is always what matters most, particularly when we are dealing with the young and tender. This is the time when they are taking shape and when any impression we choose to make leaves a permanent mark' (cited in Clarke and Clarke, 2000, p 11).

The importance of early intervention is recognised globally with healthcare strategies and plans that aim to set the foundation for good health before children start school, such as the *Healthy Child Programme* in the UK and the *Well Child Tamariki Ora Programme* in Aotearoa (NZ).

Comprehensive early childhood programmes are a tool for ensuring that children are provided with adequate nutrition, care and support in their formative years, a protective factor against later health risks. With near universal enrolment of three and four-year-olds in early childhood education in many high-income countries such as NZ, an unprecedented number of children are acquiring skills, ways of relating, communicating, and learning within ELS (Education Counts, 2020). By providing access to large numbers of young children for regular periods of time, ELS are increasingly recognised as a key setting for delivering public health initiatives that alter eating and activity behaviours (Gerritsen et al., 2021) which once established, track into adulthood and can be difficult to change (Mikkilä et al., 2005).

Although the risk of developing metabolic diseases increases most rapidly in later life, this is neither the easiest nor most effective time to modify risk factors. Early-life factors such as nutrition shape the course of development, such as development of the brain (Cusick & Georgieff, 2016) and establishment of the gut microbiome (Robertson et al, 2019), influencing the pathogenesis of obesity (Pietrobelli et al., 2017; Woo Baidal et al., 2016) and other non-communicable diseases such as cardiovascular disease (Berenson & Srivivasan, 2005). Obesity is now well recognised as a public health crisis affecting the young, old, rich, and poor. Worldwide, rates of obesity have nearly tripled since 1975 and 39 million children under the age of 5 were classified as either overweight or obese in 2020 (WHO, 2021). At a highly dependent life period, none of the upstream causes of obesity and metabolic disease are in the control of the child, which is why it is the duty of care of parents, families, caregivers, and educators to encourage healthy behaviours. It is also the role of

governments to create policies and provide public health guidance to build surrounding environments that are conducive to health.

The WHO identifies that evidence-based feeding practices are essential for attaining proper childhood nutrition, along with sustainable socioeconomic development, and poverty reduction (WHO, 2003). Aligning menus and food policies in formal childcare settings with the most up to date, national nutrition guidance is critical tool for implementing evidence-based feeding practices that support health; targeting childhood obesity, inequities, and other non-communicable diseases linked with unhealthy lifestyles (WHO, 2016).

2.2 The early childhood setting

Nearly all (97% of) NZ children attend an ELS in the six months prior to starting school, with weekly average attendance increasing from 15 hours in 2002 to 21.6 hours in 2019 (Education Counts, 2020). This increase can be attributed to what UNICEF terms ‘the childcare transition’ - rapid growth in the ECE sector in OECD countries as women are more involved in the workforce (OECD, 2017; UNICEF, 2008). In NZ, government subsidies such as 20 hours per week free ECE for three to five-year-olds, and equity funding to increase ECE participation in deprived communities (Dalli & Te One, 2002; Education Counts, 2021) have also contributed to increased ECE attendance.

Bronfenbrenner’s (1977) Ecological Systems theory places ELS at the ‘microsystem’ level of childhood development due to their immediate, bi-directional developmental influence (Darling, 2007). The feedback of peers and educators within ELS allow children to learn appropriate behaviours to enhance their learning, health, and social outcomes throughout life, however, can also promote inappropriate behaviours if these are modelled and not corrected. This potential for either benefit or harm is apparent in the literature. In NZ, ELS attendance at 24 months old was associated with positive behavioural outcomes at 54 months old in the *Growing Up in New Zealand (GUiNZ)* study (Gerritsen et al., 2021), and the longitudinal *Competent Learners* study has shown a positive relationship between ECE attendance and academic achievement in secondary school years (Wylie & Hodgen, 2011). On the contrary, greater exposure to ECE was related to greater levels of externalising behaviour such as hyperactivity and social disruption in the US *National Institute of Child Health and Human Development (NICHD)* study of early childcare - one of the most comprehensive studies of ECE to date (Belsky, 2006). Children and their families also influence the socio-cultural environment (attitudes, beliefs, perceptions, values, and norms) of the ELS they attend, which may shape other environmental factors such as food availability, subsequently influencing children’s nutritional intake and ability to maintain a healthy weight.

According to the 2018 Census, New Zealand's multi-cultural population of nearly five million is made up of 70.2% NZ European, 16.5% Māori (indigenous population), 15.1% Asian and 8.1% Pacific Peoples (Statistics New Zealand, 2019). Therefore, it is not surprising that there is a wide range of ELS types in NZ to represent varying cultural, educational values and philosophies within the population. Licensed ELS in NZ include centre-based and home-based care (Bird et al., 2016) which can be 'teacher-led' (kindergartens, home-based care, and Te Kura/correspondence school), 'whānau-led' (te kōhanga reo, focused on strengthening Māori culture and wellbeing) or 'family-led' (playcentres, playgroups and ngā puna kōhungahunga run cooperatively by parents and member families; Ministry of Education, 2020). These services operate under the national ECE curriculum *Te Whāriki* (translates in Māori language to 'woven mat') which takes a culturally inclusive, holistic, and child-centred approach to learning. All ELS receiving NZ government funding are independently evaluated by the Education Review Office (ERO), a public service that reviews the quality of childhood education settings in NZ (Education Review Office, 2021). Unfortunately, due to the broad scope of *Te Ara Poutama indicators of quality* included in these reviews, menu evaluation is not included (Education Review Office, 2021).

2.3 Childhood nutrition concerns

2.3.1 Early development of dietary risk factors

Developing healthy eating patterns in childhood is a key chronic disease prevention strategy as it can eliminate dietary risk factors for diseases such as cardiovascular disease (Waxman, 2003). The *Global Burden of Disease* study, which tracked the dietary trends of adults in 195 countries between 1990 and 2020, estimated that one in five (11 million) deaths per year can be attributed to poor diet (Global Burden of Disease 2017 Diet Collaborators, 2019). The leading dietary risk factors identified were high sodium (salt) intake and low intake of healthy foods (wholegrains, fruit, vegetables, nuts, and seeds).

With the shifting 'obesogenic environment' of the 21st century food market, poor dietary patterns are emerging early in life, with *GUINZ* finding that by nine months of age, 51% of infants had tried unhealthy food (sweets, chocolate, hot chips, or potato chips) and 37% had tried unhealthy drinks (fruit juice, soft drinks, coffee, tea, or herbal drinks; Gerritsen et al., 2021). This is concerning since in utero and early childhood are sensitive period periods of flavour learning, where taste preferences for these energy dense, nutrient poor foods and drinks are most likely to be conditioned (Skinner et al., 2002a; Trabulsi & Mennella, 2012).

Longitudinal studies show that two of the strongest predictors of individual food choices in adolescence and adulthood are taste preferences and whether a food has been eaten from an early age (Skinner et al., 2002a; Skinner et al., 2002b). Therefore, shifting eating patterns and taste preferences early in life can ingrain behaviours that protect against chronic diseases. This was shown during an evaluation of the NY based *Healthy Start* programme, where pre-schoolers that received a food service intervention to decrease saturated fat intake at pre-school (n=195) and those that also received nutrition education (n=242) had a combined 30% reduced risk of elevated cholesterol, a predisposing factor to cardiovascular diseases (Williams et al., 2013). The researchers noted that this effect was greater than that of similar US based interventions in elementary school aged children (5-12 years old), perhaps because young children consume a greater percentage of their daily nutritional intake at ECE than older children do at school (Pillay et al., 2022). Children attending a part-time childcare service (e.g., morning or afternoon only) are recommended to be provided with at least one-third of their daily nutritional requirements, which is in line with the maximum amount of nutrition consumed by children attending a full day of school in an NZ study (Benjamin-Neelon, 2018; Regan et al., 2008). Unlike school-aged children, pre-schoolers are unlikely to obtain their own snacks outside of ECE (Rockell et al., 2011), emphasising the importance of the food environment within ELS.

Alongside preventing chronic diseases, establishing healthy eating patterns in early life helps children to meet their nutritional requirements for growth and prevent deficiencies of micronutrients such as calcium and iron (termed ‘hidden hunger’; Kim et al., 2019). Iron is of particular concern in young children, due to its widespread deficiency and the potential long lasting neurological effects of low stores (East et al., 2018; Lozoff et al., 2000; Sundararajan & Rabe, 2021).

2.3.2 Dietary patterns of New Zealand children

The consumption of sugar-sweetened beverages (SSBs) and low vegetable consumption have historically been concerning nutritional issues in the NZ childhood population (Ministry of Health, 2002; Ministry of Health, 2021). Furthermore, there are socioeconomic and ethnic differences in the prevalence of these behaviours, which widen existing gaps in health outcomes.

The *2002 National Children’s Nutrition Survey* captured in-depth data about dietary intakes of NZ children, however, this data is now two decades old and did not capture children under five years-of-age (Ministry of Health, 2003). Annual NZ Health Surveys have since examined a limited number of dietary behaviours of 2–14-year-olds, such as their intake of healthy (fruit and vegetables) and

unhealthy (fast-food and SSBs) foods and drinks. Vegetable intake is showing a downward trend, with only 41.9% of children consuming two-to-three servings of vegetables per day in the 2020/21 survey compared with 58.2% in 2011/12 (Ministry of Health, 2021). Sugar sweetened beverages are consumed at least once per week by 32.3% of children (Ministry of Health, 2021). Children in areas of high neighbourhood deprivation and of Māori or Pacific ethnicity are more likely to consume SSBs and fast-food frequently (three or more times per week; Ministry of Health, 2021). Fast-food and SSBs can be broadly categorised into the category of 'HFSS' foods and drinks – which encompasses those that are high in fat, sugar, and/or salt. This data indicates that existing policies in place to promote vegetable consumption and plain water and milk as the best drinks for children have not been effective in shifting dietary patterns to improve health outcomes, including the prevention of obesity, especially in Māori and Pasifika populations. Limiting the availability of HFSS foods and beverages seems to be an obvious starting point for initiating this shift.

2.4 Childhood obesity

2.4.1 Childhood obesity in the New Zealand context

The most recent annual NZ Health Survey found 18.1% of children aged two to four years were overweight, 12.7% obese, and 4.4% underweight (Ministry of Health, 2021). A study examining variations in childhood obesity prevalence across NZ communities between 2010/11 to 2015/16 using data from the nationwide *Before School Check* (B4SC) of four-year-olds found that over one-third of the variation in obesity prevalence between communities could be explained by the socioeconomic and urban composition of the community, with a further 10% explained by the ethnic composition (Gibb et al., 2019). Obesity is disproportionately experienced by those of Māori and Pasifika ethnicity, and those living in areas of high socioeconomic deprivation (Ministry of Health, 2021). Obesity prevention strategies are needed that target these population groups, especially when considering the population of under five-year-olds has a greater proportion of Māori and Pasifika than the general population, and that these populations are growing at a faster rate (Statistics New Zealand, 2021).

2.4.2 Early childhood obesity prevention

The WHO identifies the early childhood sector as one of the six key areas for ending childhood obesity (WHO, 2016). At pre-school children can become equipped with skills that protect against overweight and obesity by being active, learning about nutrition and practicing gardening and

cooking. Obesity prevention strategies delivered by outside organisations within ELS typically include one or more of the following components: dietary intervention, (2) nutrition/health education, (3) physical activity programmes, (4) behaviour modification and support (Caballero, 2004). For example, the NZ *Under-5-Energize* (USE) programme translated these components into six primary messages that were emphasized to ELS communities; more active play, milk and water as the best choice, less sweet drinks, daily fruit and vegetables, less energy dense snacks and less screen time (Rush et al., 2017).

Table 2.1 summarises prevention studies for childhood obesity that have taken place around the world over the past 12 years. All studies include an outcome measure of body size such as body mass index (BMI), and outcomes vary widely from what may be classed as ‘highly successful’ (positive changes in body size, composition and/or eating behaviours; De Silva Sanigorski et al., 2010; Zhou et al., 2014), to ‘moderately successful’ (changes in body size but no improvement in physical activity behaviour; Natale et al., 2014), to ‘limited success’ (no change in obesity prevalence; Rush et al., 2017; Woo Baidal et al., 2017).

In two studies of obesity interventions delivered at ECE in the US and Australia (*Head Start*, Lumeng et al., 2015; and *Healthy Beginnings*, Wen et al., 2015) positive shifts in body size were not sustained outside of the intervention (Lumeng et al., 2015; Wen et al., 2015). When obesity interventions are delivered at ECE they are heavily influenced by the ECE environment (physical resources, food service components, attitude and experience of educators and parents), therefore addressing these factors in the design to build capacity for continued healthy eating and activity outside of the intervention is crucial. Parental collaboration and support are also vital, since parents have a large degree of control over children’s choices in early life.

It should be noted that even when obesity rates did not improve because of these interventions, other health markers did, such as behaviour (e.g., decreases in SSB consumption) and dental caries (Rush et al., 2017; Woo-Baidal et al., 2017) which were not investigated by Lumeng and colleagues (2015). Non-BMI markers should be considered as an outcome measure for obesity prevention since growth patterns change frequently in early life, such as in the transition from infancy to early childhood (around one year of age) and gains in height and weight are not always matched (Wells, 2003). Arguably, changes in behaviour/eating patterns are more reliable predictors of future health status, especially when study durations are short (less than one year) and unable to capture growth trends.

Table 2.1: Evaluations of early childhood obesity prevention interventions

Authors (year)	Country	Design	Number of analysed participants	Intervention Length	Objective	Outcome measure(s)	Relevant findings
Woo Baidal et al. (2017)	US	Pre post quasi-experimental with control	N=1,461	2 years	Examine the impact of changes in a nutritional programme for women, infants, and children on BMI and obesity-related behaviours among children aged 2-4 years.	BMIz change and prevalence of obesity related behaviours. Measured using children's anthropometry and parent questionnaire data obtained at 6 monthly visits and interviews conducted pre and post intervention.	No difference in BMIz score among children at intervention sites. Improvement in sugar sweetened beverage consumption and sleep duration.
Rush et al. (2017)	NZ	Repeated cross-sectional (multiple cohorts)	N=18,774	4 years	Evaluate the effectiveness of a tailored healthy eating and activity programme (Under 5 Energize) in the Waikato region over 4 years of implementation.	Prevalence of obesity and dental decay. Measured using health data from the 'Before School Check' (B4SC), pre intervention and over three years of implementation.	No significant change in obesity prevalence among children. Significant decrease in dental decay at year three.
Lumeng et al. (2015)	US	Quasi - experimental with control	N=43,748	2 years	Compare BMI change of children in 12 Head Start pre-schools with those in non-Head Start pre-schools.	BMIz change between five points (pre, year 1, summer, year 2, post). Measured using Head Start anthropometric data for intervention group and electronic health record data for comparison group.	Head Start children who were overweight or obese showed a greater decline in BMIz in the first year and lower mean BMIz at the end of the observation period compared with non-Head Start children, however had a greater adiposity rebound over summer.
Wen et al. (2015)	Aus	Longitudinal follow up of randomised	N=369	2 years	Assess the sustainability of a home-based intervention (the Healthy Beginnings trial) on	Primary: BMI and BMIz. Secondary: dietary behaviours, QoL, physical activity and TV viewing time of	The reduction in BMI and BMIz and improvements in secondary outcomes at

		controlled trial			low-socioeconomic status children's BMI and BMI z score 3 years post intervention (5 years old).	children and mothers. Measured using anthropometry and semi-structured interviews undertaken by trained staff with mothers in the home setting.	the end of the trial was not apparent at age 2 years for intervention or control group.
Natale et al. (2014)	US	Randomised controlled trial	N=307	6 months	Examine the effectiveness of an obesity prevention programme (Healthy Inside-Healthy Outside) for 2–5-year-olds that involved caregivers and parents within the childcare setting.	Primary: BMI and BMIz at four time points during and after the programme. Secondary: dietary patterns, physical activity, time spent watching TV, playing video games and using a computer. Measured via anthropometry, semi-structured interviews and questionnaires with parents and teachers.	Mean BMI z-score increased in intervention and control groups but substantially less so in intervention group. Reductions in BMI were significantly associated with parent satisfaction with the programme. Significant increase in fruit and vegetable and milk consumption in the intervention group.
Zhou et al. (2014)	China	Pre-post quasi-experimental with control	N=357	1 year	Test the effectiveness of a multifaceted intervention integrating childcare centres, families, and communities to promote healthy growth and physical fitness in pre-school Chinese children (mean age 3.5 years).	Body composition, BMI, BMIz, physical fitness and healthy food preparation. Measured using anthropometry, eight physical activity tests and food preparation records.	Significantly lower body fat percentage, fat mass and body weight, and higher muscle mass in intervention compared to control centre. Improvement in all levels of physical fitness.
De Silva-Sanigorski et al. (2010)	Aus	Repeated cross sectional	N=12,000	4 years	Determine the effectiveness of a community wide, multi-setting intervention in reducing obesity and promoting healthy behaviours amongst 2-year-old and 3.5-	BMI, BMIz, prevalence of obesity related behaviours, environmental factors (policy, sociocultural and physical). Measured via routine national health checks and parent	Significant increase in the proportion of children in a healthy weight range, especially in 3.5-year-old group. Increased daily intake of vegetables and

					year-olds in early learning services.	completed Eating and Physical Activity Questionnaires.	fruit, decreased daily intake of fruit juice.
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BMI = Body mass index, BMIZ = BMI z-score, Aus = Australia, US = United States

2.5 Choking

2.5.1 Risk and prevalence

Although 'accidents happen', many of the risks associated with unintentional injury are predictable and can be prevented through education, environmental modifications, and legislation (Watson & Errington, 2016). A prime example in the early childhood population is choking, which occurs when a mechanical obstruction of the airway impairs respiratory function (Mayorathan & Pranavan, 2022).

In the first years of life, children become more mobile and keener to explore their immediate environment, through putting foreign objects (both food and non-food) into their mouth, nose, or ears (Lorenzoni et al., 2019). Pre-schoolers are also highly active and distractible throughout daily activities, including mealtimes. Together with their underdeveloped chewing and swallowing ability, immature dentition, and narrower airways, these factors result in a high choking-risk, particularly during feeding and play (Denny et al., 2015). The force of air generated by a cough in a young child is also less than an adult, therefore less likely to effectively dislodge an airway obstruction.

Choking is a leading cause of unintentional death in young children (Chang et al., 2021; Salih et al., 2016) and studies have estimated that up to 60-80% of choking deaths in children are related to food (Committee on Injury Violence and Poison Prevention, 2010; Lorezoni et al., 2019). Over the past 50 years, the development of choking prevention strategies such as regulating the size of parts used in children's toys, choking hazard warning labels and public awareness campaigns have reduced the prevalence of non-food related choking injuries in children (Cramer et al., 2019), however the same cannot be said for the injuries that are related to food.

The prevalence of non-fatal food-related choking events is largely unknown as many of these events are transient and do not require medical treatment, therefore are not recorded (Committee on Injury, Violence and Poison Prevention, 2010). Reporting to Susy Safe, an online registry of foreign body accidents established in 2005, has helped to fill gaps in food-related choking data for European and surrounding countries, however, does not yet include Australasia (Susy Safe, n.d.). Safekids Aotearoa monitor unintentional injuries among NZ children (0-14 years) using hospital and death records. The latest published data on injuries from unintentional suffocation, strangulation or choking found that 134 (45%) hospitalisations between 2008 and 2012 and eight deaths (4.9%) between 2006 and 2010 were related to choking on food (Safekids Aotearoa, 2015).

2.5.2 Risky foods and consequences

Globally, guidelines for reducing food-related choking agree that dangerous foods share shape, texture, and dimension characteristics (Lorenzoni et al., 2022). Round (e.g., grapes) and cylindrical (e.g., hot dogs) shaped foods that are similar in diameter to the airway post the greatest risk to upper airway obstruction (Denny et al., 2015). Compressible (e.g., hot dog, soft candy, and popcorn) and small foods (e.g., nuts) can slip into the airway before the child has had a chance to chew them (Sidell et al., 2013; Kaushal et al., 2011). Hard (e.g., bone) and fibrous (e.g., pineapple) textures are difficult for children to chew due to their lack of molars, and sticky (e.g., peanut butter) textures are difficult to remove if they get stuck.

Complications of choking include but are not limited to; pulmonic or bronchial infections, asthma (Van-As et al., 2012), asphyxiation (Mayorathan & Pranavan, 2022), hypoxic-ischemic brain injury (Wu et al., 2018) and death (Chang et al., 2021). Of the 2,744 food foreign body injuries recorded in the SUSY Safe database between 2005-2011, nuts were most often associated with complications (Van-As et al., 2012) whilst hot dogs have been associated with the most deaths (Denny et al., 2015). To the best of the authors knowledge, such data on food types associated with choking is not available in NZ.

Whether or not the physiological effects of choking are severe or long lasting, the traumatic experience may cause a child to develop fear around eating. This is one of the three eating behaviours/patterns that contributes to Avoidant Restrictive Food Intake Disorder (ARFID), a recognised paediatric feeding disturbance (American Psychiatric Association, 2013; Zickgraf & Ellis, 2018). The avoidance of food may be substantial enough to cause weight loss, failure to gain appropriate weight, nutritional deficiencies, and psychosocial impairment (Brigham et al., 2018). Since ARFID is a relatively new medical diagnosis, there are few population-wide studies relating ARFID to previous choking events (Brigham et al., 2018), but case reports show an association between these two factors (Tanidir & Hergüner, 2015; Thomas et al., 2017). The potential long-term influences on children's health and quality of life due to choking incidents are one of the drivers for enforcing regulations that decrease the risk of food-related choking.

2.5.3 Food-related choking prevention at early childhood centres in New Zealand

Regulation around the food that can and cannot be served in childcare centres is considered a first line of defence against food-related choking. From January 2021 it became mandatory for all licensed ELS in NZ to only prepare and serve food in accordance with national guidance *Reducing Food Related Choking in Babies and Young Children at Early Learning Services* (Ministry of Health,

2020b) and for at least one first aid qualified adult to be present per 25 children, an increase from the previous 1:50 ratio (Ministry of Health, 2021). These changes were triggered by a review of legislation after a child suffered permanent neurological damage from choking on an apple at a day-care in 2016 (Alexander; 2019). However, despite the change in legislation, ELS are not required to check and exclude high-risk foods which parents provide to children in their lunchbox. Arguably, every early learning educator should be first aid trained so that they know how to respond if a child is choking. Furthermore, children can choke on any food and even fluid, so excluding high risk foods cannot completely remove food-related choking risk.

2.6 Early learning service food and physical activity environments

2.6.1 Food and activity environments

The ELS food environment includes what food and beverages are readily available and the practices surrounding food provision, such as sitting with children whilst they eat and talking to them about their food. The physical activity environment includes structured and unstructured active play, and the utilization of ECE programmes such as *He Oranga Poutama* and *Playball* which teach sporting skills (Playball, 2013; Sport New Zealand, n.d.). It is recommended that families, educators, and governments all contribute to the development of feeding and activity policies in education centres to meet the unique needs of their children (Cupertino et al., 2021). Feeding policies should span to all aspects of food provision including fundraisers/special occasions and practices role modelled by staff, to provide consistent health messages to children. Health professional input into menu development and staff training on responsive feeding help to ensure nutritional quality of the food environment at ECE.

In Australia and NZ, around 40-50% of childcare centres provide meals or snacks daily (Gerritsen et al., 2017; Thorpe et al., 2020). Community based centres and areas of social disadvantage (rural and low-income urban areas) are more likely to require children to bring food from home (Gerritsen et al., 2017; Thorpe et al., 2020), a practice which is associated with an over-representation of discretionary (HFSS) foods and beverages when parent education levels are low (Pearson et al., 2021). Where an ELS provides meals and snacks for a full day of care, the American Dietetic Association (ADA) recommends that this should meet one-half to two-thirds of a child's daily nutritional needs (Benjamin-Neelon, 2018). It is common for ELS to employ a cook for meal planning and preparation, although far less common for cooks to have nutrition training, which is not a requirement for employment (Gerritsen et al., 2017).

Licensing criteria for NZ ELS state that where food is provided, it should be of “sufficient variety, quantity, and quality to meet the nutritional and developmental needs of each child” (Ministry of Education, 2021). Where food is provided by parents, the service should “encourage and promote healthy eating guidelines”. As these guidelines are somewhat vague, monitoring their implementation is challenging. Health and safety practices criterion 22 for licensed ELS covers the prevention of food-related choking in infants and young children, such as serving developmentally appropriate food and ensuring children are seated and supervised during eating (Ministry of Education, 2021). These recommendations are in line with the WHO’s global strategy for feeding young children (WHO, 2003).

2.7 Assessing food environments in early childhood settings

2.7.1 Methods of assessing foods environments in early learning services

Since food environments are crucial in mediating health outcomes, assessing their suitability for children in ELS is equally crucial. Menu evaluations can provide a range of information such as the balance of macronutrients (carbohydrates, protein, and fats) and adequacy of micronutrients (vitamins and minerals) across the menu. The food served in ELS in NZ is currently not regulated or evaluated outside of one-off, funded research projects. Internal evaluations are also not apparent, likely due to a lack of know-how by services and the voluntary expectation of meeting current criteria.

Research studies assessing ELS food environments can be broadly categorised into those using ‘quick’ audit methods (menu plan collection and comparison to guidelines), ‘comprehensive’ audit methods (observation of food provision and nutrition analysis using a nutrient database), or a combination of both (Reilly et al., 2016). The collection of a menu plan requires sourcing this directly from an ELS or school, which may be done remotely, whilst observation involves being onsite to view and record the amount of food served to children, as well as collecting menu and recipe data, and leftovers after mealtime (Dean et al., 2016). Undertaking a ‘quick’ menu audit requires researchers to score menus against the nutritional guidelines used for comparison. In Europe, the ‘Dietary Quality Index (DQI)’ for preschool children has been established for this purpose (Huybrechts et al., 2010; Pinket et al., 2016), and adapted in Canada known as the Canadian DQI (Jarman et al., 2019). When comparing ‘quick’ and ‘comprehensive’ menu audits, Reilly et al. (2016) found that quick menu audits to provide better agreement with observed food provision practices than comprehensive audits, suggesting that quick audits can be a valid and low-cost menu assessment method.

2.7.2 Results of food environment assessments at early learning services

Poor nutritional quality is a shared finding across various national and international menu analyses undertaken in the ELS setting over the past decade (See Table 2.2), with very few services meeting the criteria of a nutritious menu. Provision of core food groups such as vegetables, wholegrains and meat/meat products tend to fall short of healthy target ranges, whilst HFSS foods and beverages exceed them.

Two NZ studies where quick audits were undertaken on one-week menus found contrasting results; with only 3/57 menus meeting nutrition guidelines in the *Kai Time in ECE* study (Gerritsen et al., 2017) and four out of ten ELS meeting nutrition guidelines in a small study undertaken in the Hawkes Bay (McKelvie-Sebileau, 2022). Comprehensive menu audits provide quantitative data on the provision and/or consumption of core food groups against dietary recommendations. In Australia, one day of food and beverages served across 20 ELS were found to provide half the recommended vegetables and dairy products, and less than half (22%) of meat and meat alternatives (Bell et al., 2015). In a larger study in the US consumption of core food groups met less than half of children's daily requirements for wholegrains, protein foods and vegetables across 108 menus (Dixon et al., 2016). Among studies with mixed menu analysis methodologies (a blend of quick and comprehensive), similar patterns with a deficit in food groups are apparent, such as limited wholegrains (Benjamin-Neelon et al., 2013) and fruit and vegetables (Ward et al., 2017).

Table 2.2: Early learning service food environment assessments

Author (year)	Country	Design	Menu number (menu length)	Objective	Analysis type	Outcome measure(s)	Relevant findings
McKelvie-Sebileau et al. (2022)	NZ	Cross-sectional	n=18 (one week)	Analyse the alignment of early learning service menus with national nutrition guidance and describe common barriers to providing a healthy food environment.	Menu plan and comparison to guidelines.	Percentage of 'green', 'amber' and 'red' menu items.	Four out of ten centres met nutrition guidelines and provided no red items. The proportion of red items provided by other centres varied from 3-35%.
Ward et al. (2017)	Canada	Cross-sectional	n= 61 (two days)	Compare the food and beverages provided at lunchtime with nutrition recommendations for early learning services in two Canadian provinces using Esha Food Processor software.	Menu plan and nutrient analysis software.	Mean daily servings of food groups and amounts of nutrients provided.	Average fruit and vegetable servings per day equated to less than one serving. Provision of fat was within the recommended range, whilst energy and fibre were below recommendations.
Gerritsen et al. (2017)	NZ	Cross-sectional	n=57 (one week)	Determine menu alignment with national dietary guidelines for 3–4-year-olds in licensed early learning services.	Menu plan and comparison to guidelines.	Menu score out of ten based on quantity, variety, and quality criteria.	Low scores for alignment with nutrition guidelines. Three (5%) menus scored 10/10 and the mean menu score was 6.8/10.
Dixon et al. (2016)	US	Cross-sectional	n=108 (two days)	Compare foods and beverages provided to and consumed by 3–4-year-old children at child-care centres in New York with national nutrition recommendations.	Observation and nutrient analysis software.	Percentage of recommended daily intake provided and consumed.	Foods and beverages with added sugars exceeded recommended limits by 68%. Less than half of the recommended amounts consumed for whole grains, protein foods and vegetables.
Bell et al. (2015)	Aus	Pre-post cohort study	n=20 (one day)	Determine impact of the <i>Start Right Eat Right</i> programme on children's nutritional intakes in	Observation and nutrient	Daily energy, servings of key food groups and nutrients on menu, provided	At baseline, 22% of centres met targets for meat and meat alternatives, 50% for dairy and 50% for vegetables. Over 90%

				day-care 2-6 months after the beginning of the intervention.	analysis software.	and consumed by children.	of centres met the targets for all food groups post <i>Start Right Eat Right</i> .
Bell et al. (2014)	Aus	Quasi-experimental, pre-post cohort with control	n=96 baseline, 102 follow up (two weeks).	Determine the impact of a 20-month intervention to introduce health eating policies and practices on nutritional quality of early learning service menus compared to a control group.	Menu plan and comparison to guidelines.	Daily provision of high fat, salt or sugar foods, sweetened drinks, water, 'child sized' servings of fruit and vegetables appropriate to hours open.	At baseline, no services met guidelines for vegetables, approximately half provided sweetened drinks and nearly all offered high fat, salt or sugar foods. There was a significant increase in the proportion excluding sweetened drinks and providing appropriate fruit and vegetables servings post intervention, but no significant increase in compliance with high fat, salt or sugar food guidelines.
Yoong et al. (2014)	Aus	Cross-sectional	n=46 (two weeks)	Describe food provision in childcare centres (3–5-year-olds) against national recommendation for core food groups.	Menu plan and comparison to guidelines.	Daily food group servings of vegetables, fruit, grains, meat and dairy and correlation with socioeconomic status and locality.	The proportion of centres meeting guidelines for food groups was 96% for fruit, 87% for grains, 59% for meat, 89% for dairy and 0% for vegetables. No significant association was observed between service compliance with nutrition guidelines and socioeconomic status or locality.
Benjamin-Neelon et al. (2013)	Mexico	Cross-sectional	n=96 (one day)	Compare menus for children from 4-6 to 48-72 months old with MyPlate national recommendations.	Observation and comparison to guidelines.	Mean daily servings of key food groups and amounts of nutrients provided.	Excessive amounts of high-energy beverages (full-fat milk, fruit juice, sugar sweetened beverages) and limited wholegrains on menus for both age groups.

2.8 Summary

Early childhood is a time of high plasticity where public health initiatives stand to have the most reward by engraining lifetime behaviours and reducing cumulative disease risk. Children rely on feedback from the external environment to grow and develop. For nearly all NZ children, like many children in high income countries across the globe, this feedback comes from out-of-home care prior to starting school (Education Counts, 2020).

Without a requirement for food environments to be regularly evaluated in ELS in NZ, little is known about how well these influential settings are meeting the nutritional needs of children and preventing harm from non-communicable diseases and choking. In the past five years, there has been only one large, funded research project examining alignment of food and drinks served to children in ELS with national guidelines and the results were poor (Gerritsen et al., 2017).

Although menu evaluations are a considerable undertaking, it is crucial that we gain a greater understanding about the nutritional environments in ELS so that we can tailor health promotion initiatives such as *Healthy Active Learning* in a way that engrains health into these settings. This includes increasing 'know-how' within services, which is an identified barrier to implementing health eating practices in ELS in NZ, Australia, Canada, and America (Chow & Humbert, 2011; Gerritsen et al., 2016; Grady et al., 2018; Lyn et al., 2014). Gaining this understanding is key to address many of the nutrition-related issues facing young children such as food hardship, overweight and obesity and poorer health outcomes for Māori and Pasifika children.

CHAPTER 3: RESEARCH STUDY MANUSCRIPT

The following chapter is present as a manuscript prepared for the Health Promotion Journal of Australia. Abstracts for this journal should not exceed 250 words, and the entire article should be no longer than 6,000 words including title and abstract. There should be more than six tables and/or graphics, and 50 references.

3.1 Abstract

Objective: To assess alignment of food and drinks served to New Zealand (NZ) children in early learning services (ELS) with the Ministry of Health (MoH) *Healthy Food and Drink* (HFD) and *Reducing Food Related Choking* (choking) guidance.

Methods: Menus (271) collected remotely from 148 ELS from November 2020-March 2021 were analysed for their nutritional quality (percentage of 'green', 'amber', and 'red' menu items) using a scoring system based on the MoH guidance.

Results: Overall, 2.6% of menus met the MoH HFD guidance, and alignment was greater for menus for over two-year-olds (over-2s) than under two-year-olds (under-2s; $p < 0.01$). One-fifth (18.5%) of menus met the MoH *choking* guidance. Services with a *Healthy Heart Award* (HHA) from the Heart Foundation provided more green items to over-2s ($p = 0.039$) and under-2s ($p = 0.01$), and less red items to over-2s ($p = 0.04$). Providing more green menu items was inversely correlated with providing less high choking risk foods ($p < 0.01$). Menu scores did not vary by service location, neighbourhood socioeconomic deprivation or type (services operating independently versus those part of an education group chain).

Conclusions: Alignment with MoH nutritional guidance is low, particularly in ELS caring for very young children (under-2s). Service characteristics, except for HHA status, are a poor predictor of nutritional quality of menus at ELS.

So what: Greater uptake of the HHA scheme could assist ELS to provide healthier food and drinks. Early learning services need further support from the public health sector to implement national nutritional guidelines.

Key words: *Nutritional quality, food environment, children, choking, healthy eating habits, health outcomes*

3.2 Introduction

Food intake from birth to six years is especially important as early life is a period for healthy flavour learning (Trabulsi & Mennella, 2012), rapid growth (Robertson et al., 2019) and establishing long-term eating patterns (Mikkilä et al., 2005). Early learning services (ELS) provide an influential environment outside of the home where young children consume 50-75% of their daily nutritional requirements (Benjamin-Neelon, 2018).

Understanding the foods and drinks available within ELS is crucial to address health issues young children may face during their formative years, such as an increased risk of choking (American Academy of Pediatrics, 2010), overweight and obesity (Caballero, 2004), and subsequent development of cardiovascular diseases (Waxman, 2003) and diabetes (Hagman et al., 2019). Rates of obesity have nearly tripled since 1975 and 39 million children under the age of five were classified as either overweight or obese in 2020 (WHO, 2021). In NZ, infants and children of Māori and Pasifika ethnicity have a higher prevalence of early life risk factors for obesity (Howe et al., 2015).

Subsequently, whilst national trends in obesity prevalence among NZ four-year-olds between 2011/12 and 2015/16 indicated a slight downward trend (-0.24% each year), for Māori and Pasifika children they trended upward by 0.83% and 2.13% per year respectively (Gibb et al., 2019).

Previous NZ studies have examined ELS food environments from the perspective of food policies and practices (Gerritsen et al., 2016), food groups (Gerritsen et al., 2017) and nutrition-related behaviours (Gerritsen et al., 2018). Findings indicate that kindergartens are more likely than other service types (e.g., education and care services) to employ nutrition practices such as teaching children nutrition concepts (Gerritsen et al., 2016) and services involved with the Heart Foundation's *Healthy Heart Award* (HHA) scheme are more likely to serve healthy food and drinks (Gerritsen et al., 2017). Food availability in ELS has not yet been examined using both the MoH *Healthy Food and Drink* (HFD; Ministry of Health, 2020a), which recommends altering food and beverage provision for under-2s compared with over-2s, and choking guidance (Ministry of Health, 2020b).

Therefore, the aim of this study was to assess the alignment of early learning service (ELS) menus with the Ministry of Health (MoH) *Healthy Food and Drink Guidance-Early Learning Services* and guidance for *Reducing Food-Related Choking for Babies and Young Children at Early Learning Services* and determine whether this differs for menus over-2s and under-2s.

A convenience sample of ELS menus was investigated, as part of a baseline analysis for a nationwide health promotion initiative (*Healthy Active Learning*; Sport New Zealand, 2021) where all ELS in the country were invited to participate. This provides an important snapshot of the food environment in

NZ ELS prior to the initiation of curriculum and environmental changes through *Healthy Active Learning*.

3.3 Materials and methods

3.3.1 Data collection

The data for this study (ELS menus and supplementary food availability survey) was collected cross sectionally between November 2020 and March 2021 by the *Healthy Active Learning* project team at Massey University (Massey University Human Ethics Committee NOR 20/07). Both the menus and responses to food availability queries informed the menu analysis.

The names of licensed ELS in NZ were obtained via the website Education Counts, a governmental directory of education services (Education Counts, 2022a). All ELS with a valid email address on their webpage, or a 'contact us' page were invited to participate. A total of 152 services provided a menu(s) and 161 provided a food availability response which represents 3.2% and 3.4% of all licensed services in the country, respectively (n=4687; as of 2020 according to Education Counts).

The food availability survey was developed using the *School-FERST (Food Environment Review and Support Tool) National Survey* (D'Souza, Vandevijvere & Swinburn., 2019) and refined during consultation with representatives from health promotion agencies (the Ministry of Health and the Heart Foundation), Massey University and the University of Auckland, including Māori and Pasifika cultural advisors. The surveys were pilot tested at an ELS in July 2020, and final versions were uploaded into the secure online survey software tool Massey Qualtrics.

Food availability responses, collected via email, concerned the type of bread used, use of salt in cooking, whether deep-fried foods, sausages/dried meat products, popcorn and vegetables were served to children and whether plain milk and water were the only available drinks. Services were asked to attach a copy of their ELS menu(s), if available. Among 19 services who did not provide a menu, follow up emails were sent between May and June 2022 with a maximum of two emails over three weeks and eight additional menus were collected. Early learning services (n=12) who only provided food occasionally (once a week or less), or to supplement the intake of children without food from home were excluded from the analysis sample. Six ELS falsely reported having a HHA (four had signed up but not started the programme and two had expired awards) which was corrected using Heart Foundation records.

3.3.2 Measures

Service type (e.g., education and care service, kindergarten or playcentre), age-range (over and under-2s) and 'chain' versus 'independent' status were derived from Education Counts (Education Counts, 2022a). Neighbourhood socioeconomic deprivation was determined using the 2018 NZ Deprivation scores (Environmental Health Intelligence New Zealand, 2018), where deprivation scores are derived from 2018 census data relating to income, home ownership, employment, qualifications, family structure, housing, access to transport and communications. Each ELS was allocated a decile score from 1-10 based on their address, and subsequently scores were collapsed into levels of low (deciles 1-3), medium (deciles 4-7) and high deprivation (deciles 8-10; Dean, 2016). Urban accessibility was determined using 2022 Urban Accessibility criteria (Statistics New Zealand, 2022). Menu length ('full' or 'partial') was determined by the researcher after examining the number of meals and/or snacks provided on menus.

3.3.3 Data analysis

A menu analysis toolkit ('Early Learning Service Toolkit') was developed to allow for comparison of each menu with the MoH guidance, which is based on a 'traffic light' classification of 'green' (most nutritious), 'amber' (moderately nutritious) and 'red' (least nutritious) items. Information on toolkit development and components can be found in Appendix 1. The toolkit is available on request.

Menus were entered and analysed in Microsoft Excel (2019) between May and July 2022. When a menu cycle of more than one week was provided, the first week in the cycle was analysed. Each menu was broken down into individual meal items (e.g., apple) and mixed meals (e.g., lasagne) and categorised as either 'red' (%red), 'amber' (%amber), 'green' (%green) or 'uncategorisable'. Items were analysed every time they appeared on the weekly menu, to represent their percentage contribution to food availability. Separate analyses were completed for services that served food and drinks to under-2s and over-2s (this information was derived from Education Counts), as menu item classifications differ for these age groups in the guidance. Menu items that fit the definition of 'high-choking-risk foods to exclude' (%high-choking-risk) were also categorised (Ministry of Health, 2020).

Green items included most fruits and vegetables, lean meat, eggs, legumes, vegetable oil and lunch meals made up of at least 75% green ingredients with no red or high-choking-risk ingredients. Amber items were usually packaged items for which a rating was based, among other criteria, on *Health Star Rating* (HSR) - an Australian and New Zealand voluntary front-of-pack labelling system that assigns health ratings to packaged foods and beverages, using a scale of 0.5 to 5 stars (Ministry for

Primary Industries, n.d.). Amber items included standard spreads (e.g., jam) and processed meat products with a HSR of 3.0 or lower. Baked items also met this category if they contained some wholegrains, wholemeal flour, fruit, or vegetables, and were of a suitable portion size. Red items included any sweetened drinks and baked items with poor nutritional value (i.e., those that did not meet the amber criteria) or a high-choking-risk (e.g., whole nuts), as well as lunch meals containing a red item or no green items.

Uncategorisable items were those where the menu provided insufficient information for a decision between categories (Haynes et al., 2021). For example, in a 'roast' lunch meal that did not specify the cut of meat it was unclear whether this was 'green' (no visible fat) or 'red' (visible fat). Due to changes in the *Healthy Active Learning* initiative following covid-19 pandemic disruptions, it was not possible to contact ELS for this information. Therefore, uncategorisable items were discussed among the primary dietetic research team and MoH staff were consulted when necessary. In most cases, it was conservatively estimated that the item fit the rating of higher nutritional quality (e.g., green for roast meat; McKelvie-Sebileau et al., 2022).

An eight-point menu-scoring criteria was applied (Table 3.1) based on the Canadian Diet Quality Index (DQI-C; Jarman et al., 2019). Part A provided a quality score of 0-3 based on increasing %green, and Part B on decreasing %red. A score of three ('high' quality) represented alignment with the MoH guidance. The scores were aggregated to give a total menu score of between 0-6.

Table 3.1 Early learning service menu-scoring criteria

Part A: Availability of healthy food and beverages ('green' items)			
Quality level	Over-2s	Under-2s	Score
High (alignment with guidance)	75-100%	100%	3
Medium	50-74%	75-99%	2
Poor	25-49%	50-74%	1
Very poor	Less than 25%	Less than 50%	0
Part B: Exclusion of unhealthy food and beverages ('red' items)			
Quality level	Over-2s	Under-2s	Score
High (alignment with guidance)	0	0	3
Medium	Less than 12.5%	Less than 12.5%	2
Poor	12.5-25%	12.5-25%	1
Very poor	Over 25%	Over 25%	0
Overall Menu Score (Part A + Part B)			0-6

Score of 0-6 awarded to each menu based on combined score from Part A and Part B. Part A score awarded based on percentage of green menu items and Part B awarded based on percentage of red menu items.

3.3.4 Statistical analysis

Data was downloaded from Microsoft Excel and analysed in IBM SPSS statistical package version 25 (IBM corporation, New York, USA). Variables were tested for normality using the Kolmogorov-Smirnov and Shapiro Wilk test and homogeneity using the Levene's test. Normally distributed data was expressed as mean \pm SD (standard deviation) and data not normally distributed was expressed as median [25th–75th percentiles]. Analyses were conducted using t-test when comparing means of two groups and ANOVA when comparing three or more groups (normally distributed variables), Mann-Whitney when comparing medians of two groups and Kruskal-Wallis when comparing three or more groups (non-normally distributed variables). Spearman's correlation examined the relationship between two variables. $P > 0.05$ was considered statistically significant, $r = 0.1$ was considered a weak correlation, $r = 0.3$ a moderate correlation and $r = 0.5$ a strong correlation (Field, 2009).

3.4 Results

3.4.1 Service characteristics

Most of the 148 ELS that provided their menu(s) for analysis were education and care services ($n = 140$; 94.6%), seven were kindergartens (4.7%) and one was a playcentre (0.7%). Only 6/148 services (3.8%) were located outside of urban areas, thus both 'ELS type' and 'urban accessibility'

were disregarded as variables of interest. There was a relatively even split between independent services (n=88; 59.5%) and those part of a chain, i.e., operating under the same name and/or education group as other services (n=60; 40.5%). Auckland and Wellington based services (n=115; 78%) made up most of respondents with n=33 (22%) in provincial areas (Bay of Plenty, Canterbury, Gisborne, Northland, or Southland). Neighbourhood socioeconomic deprivation indices were mixed, with n=34 low (23%), n=62 medium (42%) and n=52 high (35%). Services typically provided care to children of all-ages (n=121/81.8%) with just under one fifth (n=27;18.2%) providing care to over-2s only. Services typically provided a 'full' menu(s) to children (at least one meal and two snacks daily - n=109;73.6%), with 39 services (26.4%) providing only partial menus. Only 25 ELS (16.9%) had been awarded a HHA at the time of menu collection.

Table 3.2 Characteristics of the sample of early learning services

		All respondents n (%)
Characteristic	Total	148
Service Type	Education and Care Service	140 (94.6)
	Kindergarten	7 (4.7)
	Playcentre	1 (0.7)
Chain or Independent	Chain*	60 (40.5)
	Independent	88 (59.5)
Urban accessibility	Major urban area	114 (77.0)
	Large urban area	16 (10.8)
	Medium urban area	7 (4.7)
	Small urban area	5 (3.4)
	Low urban accessibility	2 (1.4)
	Rural	4 (2.7)
Location	Major city (Auckland or Wellington)	115 (78)
	Provincial area†	33 (22)
Deprivation‡	Low (deciles 1-3)	34 (23)
	Medium (deciles 4-7)	62 (42)
	High (deciles 8-10)	52 (35)
Age range	All ages	121 (81.8)
	Over-2s	27 (18.2)
Menu length	Full§	109 (73.6)
	Partial	39 (26.4)
Healthy Heart Award	Awarded	25 (16.9)
	Not awarded	123 (83.1)

* Part of a group of services operating under the same name and/or Education group

† Bay of Plenty, Canterbury, Gisborne, Northland, or Southland

‡ Derived from 2018 NZDeprivation decile scores of 1-10 and collapsed into low (1-3), medium (4-7) and high (8-10) deprivation

§ Minimum of one meal and two snacks provided daily

3.4.2 Types of food and drinks provided

A total of 148 menus were analysed for over-2s and 123 for under-2s. Of the 121 services who provided care to children of all ages, 95 (64%) used the same menu for both age groups, which was analysed twice, once for each age group.

The average menu composition for each age group compared with the MoH HFD guidance is shown in Figure 3.1; 55.5% green, 29.2% amber and 15.3% red for over-2s and 61.7% green, 23.1% amber and 15.2% red for under-2s.

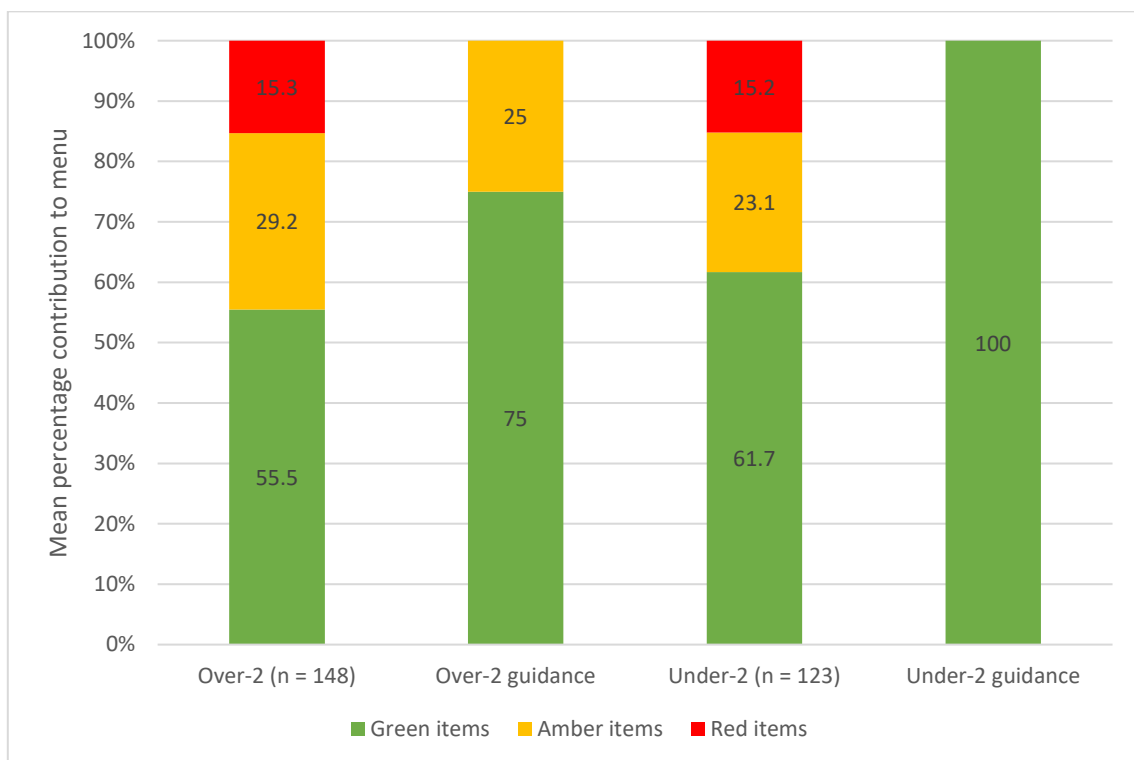


Figure 3.1 Mean composition (green, amber, and red items) of menus for over-2s and under-2s compared with the Ministry of Health Healthy Food and Drink Guidance

The distribution of overall menu scores for the respective age groups is shown in Figure 3.2. Only seven (2.6%) of menus (n=7), from seven ELS (4.1%) met the current MoH HFD guidance for ELS (i.e., had a menu score of 6/6). One menu was a 'full menu' providing lunch and two snacks daily across the week, and the rest were partial menus providing only some meals and/or snacks.

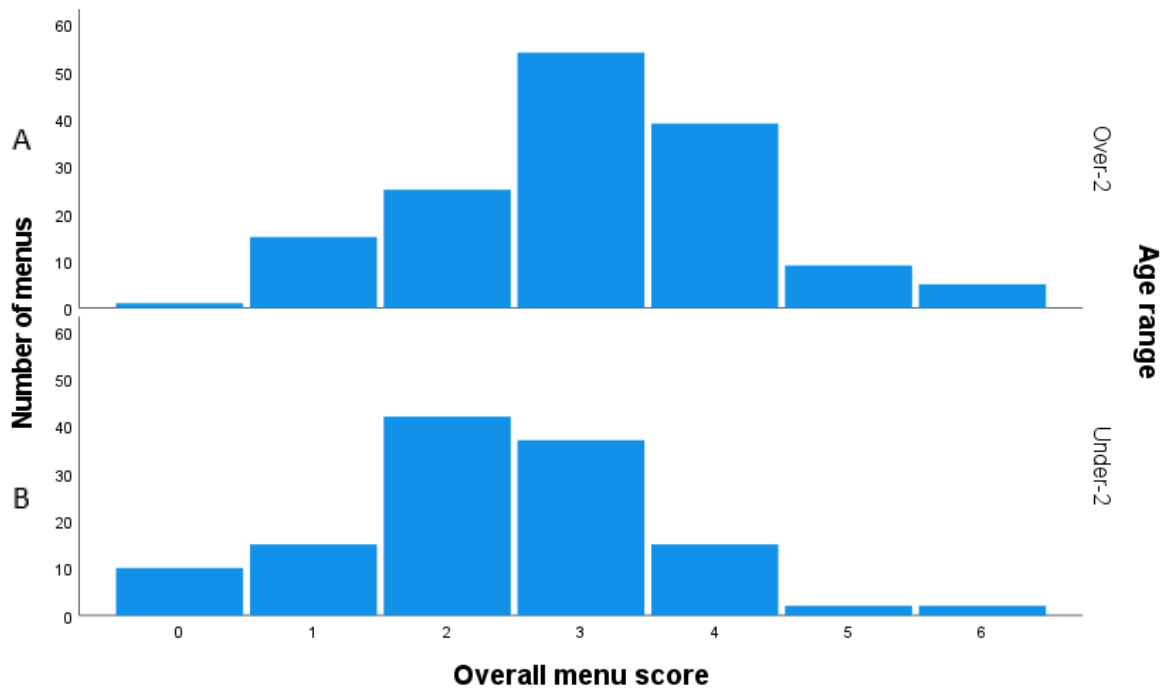


Figure 3.2 Distribution of overall menu scores for over-2s (A) and under-2s (B)

Where a score of 6 reflects full alignment with the Ministry of Health Healthy Food and Drink guidance, and alignment reduces with a decrease in overall menu score

3.4.3 Comparison of menu characteristics by service characteristics and age groups

As shown in Table 3.3, the mean overall menu score for over-2s (3.09/6) was found to be significantly higher ($p < 0.01$) than that of the under-2s (2.37/6) and was not associated with service characteristics for either age group (all $p > 0.05$). The under-2s menu had a statistically higher %green compared with the over-2s ($p < 0.01$), but not %red ($p = 0.928$). There was no significant difference between the median %high-choking-risk foods on menu ($p = 0.214$) between over-2s (5.10%) and under-2s (4.90%). One-fifth (18.5%) of menus ($n = 50$), did not contain any high-choking-risk foods. Achieving a HHA showed a weak correlation with providing more green menu items to over-2s ($p = 0.04$, $r = 0.170$) and under-2s ($p = 0.01$, $r = 0.166$) and providing fewer red items to over-2s ($p = 0.04$, $r = 0.130$). There was no significant association between achieving a HHA and %red for under-2s ($p = 0.081$, $r = 0.158$). No other service characteristic showed an association with %green, %red or %high-choking-risk.

Table 3.3 Comparison of menu characteristics by service characteristics and age group

Menu characteristic	Group	Subgroup	Over-2s			Under-2s		
			Count	Mean (SD)	p-value	Count	Mean (SD)	p-value
Overall menu score	Full sample*	-	148	3.09 (1.20)	<0.01†	123	2.37 (1.23)	<0.01†
	Chain or Independent	Chain‡	57	3.00 (1.17)	0.451	49	2.29 (1.17)	0.520
		Independent	91	3.15 (1.23)		74	2.43 (1.27)	
	Location	Major city§	115	3.15 (1.23)	0.317	96	2.47 (1.29)	0.108
		Provincial	33	2.91 (1.10)		27	2.04 (0.94)	
	Deprivation¶	Low	34	3.41 (1.02)	0.118	30	2.23 (1.07)	0.770
		Medium	62	2.89 (1.27)		54	2.41 (1.38)	
		High	52	3.13 (1.21)		39	2.44 (1.14)	
	Menu length	Full#	109	3.04 (0.98)	0.445	101	2.36 (1.12)	0.796
		Partial	39	3.26 (1.68)		22	2.45 (1.68)	
Healthy Heart Award	Awarded	25	3.40 (0.87)	0.165	20	2.75 (2.75)	0.136	
	Not awarded	123	3.03 (1.25)		103	2.30 (1.27)		
% green items	Full sample*	-	148	55.5 (16.0)	<0.01†	123	61.7 (13.8)	<0.01†
	Healthy Heart Award	Awarded	25	61.5 (11.4)	0.04†	20	66.9 (8.12)	0.01†
		Not awarded	123	54.3 (16.5)		103	60.7 (14.5)	
% red items	Full sample*	-	148	15.3 (9.89)	0.928	123	15.2 (9.42)	0.928
	Healthy Heart Award	Awarded	25	12.5 (6.60)	0.04†	20	11.9 (6.73)	0.081
		Not awarded	123	15.9 (10.4)		123	15.9 (9.76)	
% high-choking-risk items	Full sample*	-	148	5.10 [2.30, 10.9]**	0.214	123	4.90 [1.80, 10.0]**	0.214

* Singular p-value from the independent t test displayed twice

† p<0.05

‡ Part of a group of services operating under the same name and/or Education group

§ Auckland or Wellington

|| Bay of Plenty, Canterbury, Gisborne, Northland, or Southland

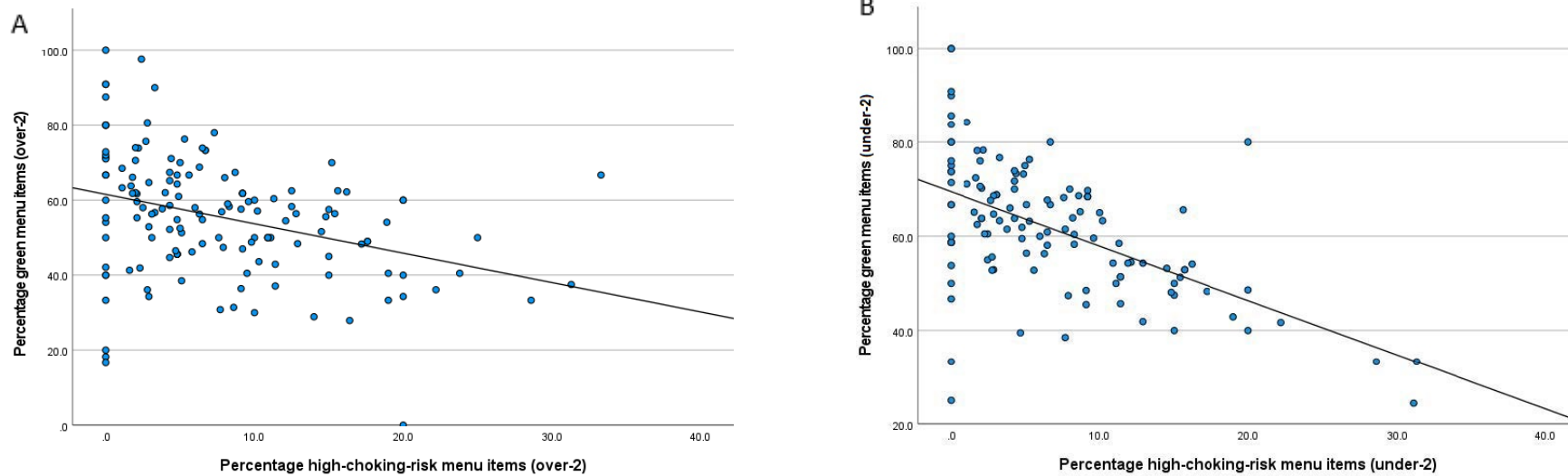
¶ Derived from NZDep decile scores and collapsed into low (1-3), medium (4-7) and high (8-10) deprivation

Minimum of one meal and two snacks provided daily

** Median [IQR]

3.4.4 Relationship between providing nutritious and high-choking-risk menu items

For both the over-2s and under-2s menus, there was a significant inverse correlation ($p < 0.01$) between %green and %high-choking-risk. In the over-2s sample, there was a moderate negative linear relationship between these two variables ($p < 0.01$, $r = -0.347$), and in the under-2s sample the relationship was strong ($p < 0.01$, $r = -0.504$).



Figures 3.3 A and B Correlation between green items and high-choking-risk items on over-2s (A) and under-2s (B) menus

3.5 Discussion

Findings from this study showed seven out of 271 ELS menus (2.6%) achieved MoH HFD guidance alignment while one-fifth (n=50;18.5%) met the choking guidance. The guidance alignment score of menus for over-2s was, on average, 12% higher than the score for under-2s ($p<0.01$). Early learning services with a HHA from the NZ Heart Foundation provided more green items to over-2s ($p=0.04$) and under-2s ($p=0.01$), and less red items to over-2s ($p=0.04$). Providing more green menu items was inversely correlated with providing less high-choking-risk foods ($p<0.01$). Menu scores did not vary by service location, neighbourhood socioeconomic deprivation, type ('chain' versus 'independent' services) or menu length ('full' versus 'partial' menus).

3.5.1 Service characteristics

The findings from the current study are only broadly generalisable to 'teacher-led' (education and care services and kindergartens) services, which made up 99.3% of respondents. No services were whānau-led (e.g., te kōhanga reo), and only one was parent-led (playcentre), where food environments are likely to differ due to different teaching philosophies and cultural practices. This respondent skew may be because more teacher-led services provide food and drinks to children and/or follow a set menu, therefore felt that the research related to them. All-ages services (n=121; 81.8%) were overrepresented, and no services provided care to under-2s only. There was however a reasonable representation of 'chain' (n=60; 40.5%) and 'independent' (n=88; 59.5%) ELS. The proportion of 'full' menus in this sample of ELS (n=109; 73.6%) is comparable to a previous a NZ study (Dean, 2016; 66.3%). Few services (n=25; 16.9%) had a HHA, despite this being government-funded initiative (Heart Foundation, 2022).

Auckland or Wellington based services made up 41.6% of the ECE sector in 2020 (Education Counts, 2022a), but over 75% of the sample population, with less than 5% of services in rural or low urban accessibility areas. The rest of NZ is more rural, where access to food outlets such as grocery stores may be restricted. The impact this has on ELS food provision in rural versus urban areas has therefore not been explored in the present study. There was a fair representation of New Zealand's overall population in terms of neighbourhood socioeconomic status.

3.5.2 Types of food and drinks provided

The low %green and high %amber and %red in this sample of ELS menus compared with the MoH guidance suggests that children's healthy eating exposures at ELS are lacking, whilst exposure to energy dense, nutrient poor foods and drinks (high in fat, salt and/or sugar - HFSS) exceeds

recommendations. The negative relationship between %green and %high-choking-risk in this sample of ELS menus indicates that ELS who provide more healthy foods and beverages also provide less high-choking-risk foods and may be more health conscious and/or aware of nutritional guidelines.

Under-2s menus were further from meeting the MoH guidance of providing only green menu items in our cohort, despite containing (on average) more green items than over-2s menus. Plain breads/crackers and full fat milk, rated green for under-2s but amber for over-2s, were widespread on menus, which may explain some of the variation. The assumption that unspecified 'breads/crackers' were plain, and 'milk' was full fat may have also contributed to this difference.

Some positive trends from the present study can be reported. For example, SSB provision was relatively low (16.6% of menus) compared with nearly half of childcare services serving these beverages in a New South Wales (NSW, Australia) study (Bell et al., 2014). In a North Carolina study, over 75% of meat consumed was high fat or deep fried (Ball et al., 2008), but here no ELS served deep fried meat and only 8.5% served high fat cuts. On the contrary, it appears to hold true that vegetables (Bell et al., 2014; Yoong et al., 2014) and meat/meat alternatives (Bell et al., 2015; Gerritsen et al., 2017) are not provided in sufficient quantities at ELS, both overseas and in NZ. These foods are rich in nutrients important for cognition and growth (Benton & ILSI Europe, 2008).

Evidence suggests that exposure to a food, even one that was initially disliked, is an effective strategy to increase a young child's preference for it (Anzman-Frasca et al., 2012). Humans have a weak ability to down regulate their food intake in response to consuming energy-dense foods and drinks (Prentice et al., 2003). Providing children with foods and drinks that are rich in nutrients relative to their energy content (e.g., vegetables) helps them to develop healthy eating habits and an ability to self-regulate energy intake, helping to protect against overweight and obesity (Benton, 2004). On the contrary, being exposed to unhealthy, energy-dense foods and drinks too often may contribute to ingraining eating habits that promote excess weight and lead to poorer health outcomes in later life (Skinner et al., 2002a; Skinner et al., 2002b).

3.5.3 Comparison of menu characteristics by service characteristics and age groups

3.5.3.1 Overall menu score

Of the seven ELS menus (4.7%) that achieved alignment with the MoH HFD guidance based on their overall menu score, six were 'partial' menus which only captured a small portion of food availability at ELS. This highlights the lack of complete guidance alignment, with only one full menu achieving this alignment (0.7%). This is lower than the 5% of services that met nutritional guidelines based on

menu-scoring in the 2014 *Kai Time in ECE* survey (Gerritsen et al., 2017), and less than the 4/10 services in a recent NZ study which utilized the MoH HFD guidance (McKelvie-Sebileau et al., 2022).

A possible reason for this low guidance adherence is lack of awareness of the national nutritional guidelines. Early childhood centres in Columbia (n=1343) were less prepared for guidance implementation when awareness of guidance was low or non-existent (Chriqui et al., 2020). It may also reflect the lack of nutrition teaching and professional development opportunities for ECE educators in NZ (Gerritsen, 2016), where educators lack the baseline knowledge to implement the guidance even if they are aware of it. A nutrition knowledge survey of 386 ECE teachers in NZ found that nutrition knowledge was lacking and limited by lack of staff training, confidence, and resources (Rapson, 2020). Of the 80 ELS cooks surveyed by Gerritsen et al. (2017), only two (12.5%) had nutrition training and 12 (15%) had attended a menu development course run by the Heart Foundation.

Barriers to promoting healthy food to children may also be responsible for ELS low alignment with nutrition guidelines in the current study. Lack of support from whānau (families) is the most common barrier experienced by 20.6% (Gerritsen et al., 2016) to 30% (McKelvie-Sebileau et al., 2022) of ELS in NZ-based studies. Other barriers reported across Australia, Canada and the US are the perceived cost of healthier options and lack of resources and understanding of how to apply dietary guidelines (Chow & Humbert, 2011; Grady et al., 2018; Lyn et al., 2014). Therefore, consideration of how to empower staff to operationalise nutritional guidance whilst communicating and collaborating with whānau appears crucial.

In NZ, despite having two sets of ELS nutritional guidance for over-2s under-2s, there are no practical tips to assist all-ages services with two sets of meal provision. Subsequently, nearly two-thirds (64%) of all-ages services in the present study served the same menu to all children. Furthermore, there is no mandate for the guidelines to stipulate minimum standards for food provision in ELS in NZ. This contrasts with most states in the US (Chriqui et al., 2020) and Canada (Childcare Resource and Research Unit, 2022) where minimum requirements are regulated.

3.5.3.2 Service characteristics

There was no significant association between any service characteristics ('chain' versus 'independent', location, deprivation, menu length or HHA status) and the overall menu score, or %high-choking-risk across the weekly menus in this study. This indicates that sociodemographic and geospatial factors may be poor predictors of food availability at ELS.

The *Kai Time in ECE* study found that low and high (but not medium) deprivation services had better menu scores (Gerritsen et al., 2017). Lack of observation of this finding in the present study may reflect a greater reach of local food and nutrition assistance programmes (which have historically targeted high deprivation areas), to medium deprivation areas. It may also reflect the wide variation in menus across socioeconomic areas. In NSW Australia, where ECE nutrition environments are similarly unregulated, there was no association observed between dietary guidance alignment and socioeconomic status or locality (Yoong et al., 2014).

3.5.3.3 High-choking-risk foods

Approximately 5% of the menu items in this sample posed a 'high-choking-risk'. This is a useful benchmark for NZ where, to the best of the authors' knowledge, no previous data has been reported. However, 'high-risk-foods to alter' (e.g., apple) as classified in the MoH guidance for *Reducing Food-Related Choking for Babies and Young Children at Early Learning Services* were not included, so the actual number of 'choking risk foods' may be higher.

Worldwide, the foods that cause children to choke vary according to the dietary patterns of the population; for example, fish bones in Finland where fish consumption is widespread (Gregori et al., 2007). In the current study, hard crackers (69.7%) and dried fruit (31.7%) were the most common high-choking-risk foods served. Recent findings from the NZ Hawkes Bay region found that nearly one-third (28.3%) of services were concerned about food-related choking and perceived this as a barrier to providing healthy food (McKelvie-Sebileau et al., 2022). This indicates that some ELS may not feel confident or able to alter 'healthy' high-choking-risk foods (e.g., apple) or find healthy alternatives to inappropriate foods (e.g., wholegrain crackers), reinforcing the need for further education and support with the implementation of choking guidance.

The practice of removing high-choking-risk foods also does not equate to improved ELS choking safety without evidence of other practices such as education and first aid training of parents and caregivers, suggested to be the most important preventative strategy for preventing food-related choking (Mayorathan & Pranavan, 2022).

3.5.3.4 Healthy Heart Award

The HHA scheme is the most comprehensive and widespread voluntary, government-funded nutrition promotion initiative operating in the NZ ELS setting (Malatest International, 2014) and has previously been associated with healthier ELS menus (Gerritsen et al., 2017). As part of obtaining a

HHA, a nutrition advisor from the Heart Foundation provides healthy eating support, such as assisting services to create and operationalise healthy eating policies. The initiative also includes a menu checklist component, which sets serving requirements for food groups based on the MoH HFD guidance. Although we found that having a HHA was not associated with an increased overall menu score (potentially related to sensitivity of the small sample size), it was associated with the provision of more green (healthy) menu items for both age groups, and less red (unhealthy) menu items for under-2s. This is consistent with the HHA menu checklist, which puts greater focus on healthy food inclusion than unhealthy food exclusion. Achieving a HHA does not require the ELS to exclude all high-choking risk foods, or have choking policy in place, and subsequently we observed no association between a HHA and %high-choking-risk. Collaboration between the MoH and the Heart Foundation to incorporate a 'choking prevention' component would be a useful future direction to ensure consistent healthy messaging to ELS educators.

3.4.4 Relationship between providing nutritious and high-choking-risk menu items

The moderate (over-2s) to strong (under-2s) correlation between providing more green menu items and providing less high-choking-risk menu items in this study indicates that as ELS include more highly nutritious items on their menus, the availability of less nutritious high-choking-risk foods declines. This may reflect greater health literacy of services with nutritious menus - that they are also aware of and strive to minimise choking hazards. This would indicate that the MoH guidelines are being utilised to some degree in menu planning, even if they are not being properly implemented. This finding is promising, as it points to the guidelines being somewhat useful for ELS, but implementation seems to be the limiting factor to improving menu quality and safety.

3.6 So what?

The present study has shown that most ELS menus do not meet NZ MoH guidelines for providing healthy menus and reducing food-related choking in children. Children tend to be exposed to unhealthy food items too frequently, which is concerning for ensuring proper growth, development, and obesity prevention. Extending the reach of Heart Foundation's HHA could assist more services to provide nutrient-rich foods at ELS, through practical implementation of national nutritional guidance. Establishing what barriers ELS face in creating healthy food environments an important direction for future research, which can be used to inform further public health interventions.

Interventions in the ELS setting should be prioritised, as ELS provide access to large numbers of children at a highly dependent life period.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

4.1 Summary of findings

The aim of the study was to assess the alignment of early learning service (ELS) menus with the Ministry of Health (MoH) *Healthy Food and Drink Guidance-Early Learning Services* and guidance for *Reducing Food-Related Choking for Babies and Young Children at Early Learning Services* and to determine whether this differs for menus for over two-year-olds (over-2s) and under two-year-olds (under-2s).

Using a menu-scoring criteria designed to reflect the MoH food and drink classifications, we found that seven out of 271 ELS menus (4.7%) achieved guidance alignment, but only one of these was a 'full' menu providing all meals and snacks to children (0.7%). This alignment is lower than the 5% of menus meeting nutrition guidelines in the *Kai Time in ECE* study (Gerritsen et al., 2017), which utilized a similar methodology of allocating a menu score based on governmental healthy eating guidance.

In the current study, the mean menu score for over-2s (3.06/6) was significantly higher ($p < 0.01$) than that of the under-2s (2.37/6), which can be partly attributed to the greater allowance for serving moderately nutritious ('amber') foods and drinks to children over two years of age in the MoH guidance. Nearly two-thirds of all-ages services served the same menu to all children in this sample of ELS, which indicates limited uptake of recommendations to alter food availability based on children's age.

A study objective was to examine the 'choking risk' of food items on ELS menus based on the MoH choking guidance - a novel topic for ELS research both in NZ and overseas. The average contribution of high-choking-risk foods to menus was 5% (5.10% for over-2s and 4.90% for under-2s), with hard crackers (69.7%) and dried fruit (31.7%) served more often than other choking-hazards such as popcorn (9.6%). This indicates that awareness of certain food-related choking hazards in NZ may be higher than others, and further education around suitable alternatives to common high-choking-risk foods is needed to increase the choking safety of ELS menus.

In the present study, neighbourhood socioeconomic deprivation (variable 'deprivation') and whether ELS were in a city or province (variable 'location') did not influence overall menu quality. This finding was somewhat surprising - indicating that limited availability and accessibility of healthy food in lower socioeconomic and less densely populated areas does not necessarily influence food selections. There may be other influences that off-set these constraints which the present study did

not explore, such as food donations and subsidies received by ELS in lower socioeconomic areas which help them to provide healthy food. The absence of a significant finding may also be related to the sensitivity of the small 'provincial' sample size (n=33).

Furthermore, whether ELS were independently owned, or part of an education group chain (variable 'chain' or 'independent') did not influence overall menu quality in the present study. One may expect education groups to invest more resources into menu development and therefore have more standardised, healthier menus across their services. The fact that no relationship was found between 'chain' or 'independent' ELS and overall menu score suggests that there are underlying differences in values, teaching philosophies and health literacy levels of ELS and their teaching staff regardless of ownership status. Service type (e.g., kindergarten or te kōhanga reo), a variable which was not tested in this study due to the skewness of the convenience sample, may have reflected these underlying values and philosophies more closely.

It could be hypothesized that it is easier to achieve nutrition guidance alignment with a shorter menu than a longer menu, however in this study menu quality did not differ between 'full' menus and 'partial' menus. Services providing partial menus may be less likely to employ a cook or have onsite cooking facilities, therefore rely more on packaged foods which generally have a lower rating, mitigating the potential 'head start' of achieving guidance alignment with a shorter menu.

The only service characteristic that influenced the 'green' and 'red' portion of menus was having a HHA from the Heart Foundation, and even so the effect of having a HHA on improving menu quality was weak. Services who had been awarded a HHA provided more green items to over-2s ($p=0.04$, $r=0.170$) and under-2s ($p=0.01$, $r=0.166$), and less red items to over-2s ($p=0.04$, $r=0.130$). It should be noted that the sample size of ELS with a HHA was small at $n=25$. The menu checklist component of this initiative appears to assist ELS with practical implementation of nutrition guidelines from the MoH, and Heart Foundation nutrition advisors are available to support ELS with how to improve menus and implement healthy food environments.

This study utilised a convenience sample of ELS menus, where all ELS in the country were invited to participate as part of a baseline analysis for a nationwide health promotion initiative *Healthy Active Learning*, achieving a total sample that represented 3.2% of the total ELS population. This sampling method is less likely to produce a representative and generalisable sample than probability sampling strategies such as simple random sampling, which would be gold-standard for future research in this area (Jager et al., 2017).

4.2 Strengths

To the best of our knowledge, this is the first NZ study to translate the current (2020) MoH *Healthy Food and Drink Guidance-Early Learning Services* and *Reducing Food Related-Choking* into a workable criterion for scoring ELS menus. Therefore, this research paints a unique overall picture of nutritional quality and safety in NZ ELS. Examining the prevalence of high-choking-risk foods in a childcare food environment also appears to be unique, as evidence is lacking in the international literature; however, this is an important research area given the well-established role of food in choking incidents (Lorenzoni et al., 2022).

Participant burden in this study was low compared to similar menu evaluation studies (Ball et al., 2008; Gerritsen et al., 2017; Yoong et al., 2014) as providing a menu and response to the six-question food availability questionnaire could be completed remotely in under 15 minutes. There was no requirement for services to verify their menu (e.g., through food records) or for the researchers to come on site for mealtime observation, which may have deterred participation. One week (five days) of food and drink provision was analysed, which represents a longer duration of food provision than the one-two days which appears typical of cross-sectional ELS menu analyses (Bell et al., 2015; Benjamin-Neelon et al., 2013; Dixon et al., 2016; Ward et al., 2017; Yoong et al., 2014). A strength of this sample was also that it comprised a reasonable range of services from different socioeconomic deprivation areas in NZ.

Collecting and analysing raw data (menus as set out by the ELS) as opposed to participants completing a questionnaire about their menu minimised potential reporting errors. Consultation with relevant agencies who created the menu quality criteria used for classifications (the MoH for HFD and choking guidance and the Heart Foundation for the HHA menu checklist) also helped to verify the validity and accuracy of assumptions made to categorise menu items.

4.3 Limitations

The most substantial limitations in this study arose from conducting a 'quick' menu audit in which recipes were usually not available, and onsite observation of meal preparation and provision did not occur. There was insufficient detail provided on many menus (e.g., regarding portion sizes and the fat content of milk) to make comparisons with the relevant nutrition recommendations. The food-related choking risk analysis undertaken in this study was limited to whether 'high-risk foods to exclude' were present on the menu, and guidance on preparing risky but nutritious foods for safer consumption ('high-risk foods to alter' such as apple, carrot, and tough meat), was not utilised. Assumptions were also used widely throughout analysis, such as 'milk is full fat and unsweetened

unless otherwise stated,' and inaccuracies arising from such assumptions may have impacted on the findings in the present study.

This research utilized a convenience sample of ELS menus, collected as a part of baseline food environment data collection for a nationwide health promotion initiative, *Healthy Active Learning*. This sample may be subject to bias in favour of services interested in nutrition and/or proud of their menu. There was also a participation bias towards urban, Auckland-based services which may have been influenced by the population density of Auckland - home to one-third of New Zealand's population in 2018 (Statistics New Zealand, 2019). In terms of the ECE sector, there was limited diversity in service types, for example te kōhanga reo (Māori immersion services) who represented 9.4% of the ECE sector in 2020 were not included (Education Counts, 2022a). Nevertheless, half of Māori tamariki (children) attend an English-medium ELS with over 54% attending education and care services (Education Counts, 2022b), the main service type engaged in this study.

The responses to food availability questionnaires were all self-reported by service managers, head teachers or chefs, except for HHA status which was verified by the Heart Foundation. The use of self-reported data without an associated verification procedure (such as observing congruence between the written menu and actual food and drinks provided onsite) is a limitation due to the human errors associated with self-reporting food-related data (Cade et al., 2007). Studies in US childcare centres have found that agreement between menus and actual food and beverages served ranges from 52-100%, and grains and vegetables are served less often than indicated on menus (Benjamin-Neelon et al., 2010; Dave & Cullen, 2018). Therefore, the results of this study need to be interpreted with caution, as overall nutritional quality may be lower than the findings suggest.

Foods and beverages children bring to ELS from home were not examined as part of this study, however just over a quarter (n=39) of ELS in this sample required children to bring some food from home. Previous studies in Australia and the US have indicated that the nutritional quality of food brought from home is low (Kelly et al., 2010; Sweitzer et al., 2009), however can be improved with caregiver targeted nutrition education that provides resources and support to construct a healthy lunchbox, such as the *Lunch Is In The Bag* programme in the US (Sweitzer et al., 2010). This highlights how both caregivers and childcare providers play an important role in improving a young child's food environment and providing consistent, positive health messages to children.

4.4 Use of findings

The absence of validated menu evaluation tools for the ELS setting in NZ is perhaps one of the reasons for the gap in the literature on ELS nutrition environments. It is a considerable undertaking to carry out a menu audit, regardless of whether it includes a 'comparison to nutrition guidelines' component, and these evaluations are not part of regular government funded ERO reviews in NZ. The 'Early Learning Service Menu Analysis Toolkit' and menu-scoring criteria developed as part of this study can be used for future 'quick' menu audits in NZ (audits using only menus) which provides a greater research incentive for monitoring adherence to national ELS nutrition guidance.

The lack of detail on menus in this study and overall low nutritional quality of the menus themselves presents a potential area for improvement in planning and writing ELS menus in NZ. Increasing access to credible and carefully designed advice on menu development and design (e.g., through a registered nutritionist or dietitian), alongside advice on appropriate foods and drinks, would help ELS to provide healthier menus (Frampton et al., 2014). Furthermore, it would allow for menus to be more easily reviewed by health professionals and/or researchers in the future.

The findings of this study also help to inform structural interventions and policy level changes that could better support ELS to create healthy food environments. The near universal dis-alignment of ELS menus in this sample with MoH nutritional guidance, and most all-ages services not adapting their menus for over-2s and under-2s as recommended, indicate that the guidelines have not yet been effective in helping ELS to adopt healthy food practices. There is a need for nutrition-focused professional learning and development for ELS staff members, delivery of further resources and support for practical implementation of nutrition guidelines, and more stringent monitoring and/or regulation of the food environments in these settings.

In this study, participation in the HHA seems to have had a small (3-4% of explained variance) but positive impact on increasing healthy food availability and limiting treat food availability at ELS. Therefore, maximising the reach of this existing initiative would be a useful starting point. As suggested by Gerritsen et al. (2018), this could include incorporating aspects of the HHA into teacher training and practice to promote further knowledge transfer to ELS staff, who have been shown to lack nutrition knowledge (Rapson et al., 2020). This would have benefits beyond menu planning, since the HHA includes training on responsive feeding practices such as sitting with children whilst they eat and talking to them about food (Gerritsen et al., 2018). Interventions which focus on building capacity for sustained changes through staff training, resources, and follow-up support have previously been demonstrated to have a positive impact on improving ELS menu compliance scores (Bell et al., 2014; De Silva-Sanigorski et al., 2010; Seward et al., 2017). An analysis of food provision

in 70 ELS in NSW found that the only consistent facilitator of healthier menus was cook training (Grady et al., 2018). Appropriate alteration of high-choking-risk foods is a component of the MoH choking guidance that relies heavily on cook training.

Since poor food intake in early life can have serious short and long-term outcomes such as obesity and obesity-related complications (Di Cesare et al., 2019), it is important to identify any groups that may be at risk of experiencing disproportionately adverse outcomes. The present study found that children attending services across different locations (major cities versus provincial areas) and socioeconomic deprivation levels (low, medium, and high) are just as vulnerable to poor food availability. This finding indicates that public health interventions to improve the availability of health foods in ELS should focus on reaching all sub-groups of the NZ population.

4.5 Future directions

More in-depth research is necessary to determine the choking safety of ELS food environments. As previously mentioned, removing high-choking-risk foods from menus is only one aspect of food-related choking prevention at ELS (Mayorathan & Pranavan, 2022), alongside providing a safe physical environment and first aid training of educators (Ministry of Health, 2020b). Gathering choking-related policies and incident records, surveying educators to gauge their food-related choking knowledge and observing preventative practices (e.g., appropriate preparation of food and ensuring children are seated whilst eating) are all areas future research should explore. It would also be interesting to identify if the fear expressed about food-related choking among educators in the Hawkes Bay region is shared in other areas of NZ (McKelvie-Sebileau et al., 2022).

Interestingly, despite 'variety' being one of the three nutrition aspects referred to in NZ ECE regulations (Ministry of Education, 2021) it is not a component of the MoH HFD guidance, and therefore has not been examined in this study. In this evaluation, ELS were not penalised for having repetitive or restricted menus (e.g., serving an apple for morning tea every day). Including a 'variety' component would provide greater insight about the suitability of menus for meeting children's nutrient requirements, enhancing a variety of food choices and potentially promoting biodiversity of the gut microbiome, which when compromised is pathologically linked to obesity (Turnbaugh et al., 2009) and type two diabetes (Larsen et al., 2010). This should be considered in future ELS food availability studies. Feeding practices of parents and teachers and how these differ across services are also an important consideration, since non-responsive feeding approaches (pressuring children to eat and uninvolved feeding) are associated with weight gain (Benjamin-Neelon et al., 2018).

This study provided information about what is on the menu in NZ ELS, but children's acceptability of the offered food and beverages may paint a different picture. Benjamin-Neelon et al., (2013) recommend that "future studies should move beyond menus and assess what children actually consume in childcare" (p. 2014). Plate wastage analyses conducted in ELS in Australia (Bell et al., 2015) and the US (Hasnin et al., 2020) indicate that children's intake of key food groups such as fruit and vegetables at ELS remain low even when offered in amounts that meet nutritional guidelines. This should be investigated in the NZ context, as similar findings would indicate an increased urgency to assist ELS with menu development and creating supportive eating environments.

There are numerous components of the ELS food environment that the present study has not explored, such as the existence of healthy eating policies, food available on special occasions and fundraising events, how food is sourced and prepared (e.g., inhouse chefs, external caterers and/or food donations) and involvement with health and nutrition promotion initiatives other than the HHA, such as *Enviroschools* (Enviroschools, n.d.). Considering these factors and seeking views and collaborations from the ECE sector are important next steps in determining how to operationalise a harmonised approach to improve nutrition guidance alignment (Spence et al., 2020). This includes what ELS providers perceive to be the main barriers and enablers to providing healthy food, and where they feel improvement efforts should be focused.

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Appendix 1: Toolkit development

The method of determining assumptions differed depending on the food group/information required for analysis, for example for a baked item where portion size was required for categorisation the Australia and New Zealand Food Database Foodworks (version 10.0) was used to determine an average portion size. Kai Hong Tan, a registered foodservice nutritionist for the Heart Foundation, was consulted for guidance on common food service practices in NZ Schools and ELS.

A combination of methods was used by the researchers to make categorisations (green, amber, or red) for items in the Food database; ingredients list, nutrition information panel and/or Health Star Ratings. This information was obtained by searching Countdown and Bidfood websites for product profiles, New Zealand websites for recipes and food provider websites for ingredients lists between February and May 2022. If the ingredients list of food provider meals was not available online, providers were contacted via email with a request to provide this information. Where the HSR was not available for a product, it was calculated using the MPI excel calculator (Ministry for Primary Industries, n.d.).

Separate categories in the food database were created for items such as hummus that are a mix of different food groups in the guidance. The criteria for categorisation in these cases was based off of the categorisation for the dominant food group (e.g., legumes for hummus), taking into account other food groups/nutrients present (e.g., rating reduced from green to amber for hummus with less than 75% fruit/vegetable/nut/legume content and/or HSR under 3.5).

Appendix 2: Toolkit components and uses

Toolkit section	Description	Use
<p>Analysis Templates</p> <ul style="list-style-type: none"> • Individual item classification: Under two-year-olds • Individual item classification: Over two-year-olds • Mixed meal template • Full menu classification 	<p>The individual item templates are interactive documents that automatically classify menu items (e.g., breads and cereals) based on their characteristics (e.g., plain or wholemeal) according to their categorisation within the Ministry of Health <i>Healthy Food and Drink Guidance: Early Learning Services</i>.</p> <p>The mixed meal template is used to list items within a recipe, along with their individual categorisation of 'green' 'amber' and 'red' to give a rating to the overall meal.</p>	<p>Classify menu items (individual items or mixed meals).</p>
Assumptions	A list of statements that are assumed to be true for all items within a food group where the menu lacks detail, for example regarding brands, portion sizes or cooking methods.	Standardise menu item categorisations and minimise inter-researcher variability.
Definitions and rules	A list of descriptions for nutrition related terms and instructions to following during menu analysis.	Standardise menu item categorisations and minimise inter-researcher variability.
Food Database	A master list of common food items and their classification, including ratings for individual branded products (e.g., Fantastic original rice crackers) and the overall average rating for a product type (e.g, rice crackers). Includes foods that do not fit directly into one of the food group headings in the guidance, such as hummus.	<p>Inform assumptions about products based on average characteristics, for example the average HSR of rice crackers.</p> <p>Classify individual food items on menus.</p>
Healthy Heart award criteria	A table showing the required number of servings for different foods across a certain period (day, week, or fortnight) to obtain a Healthy Heart Award at any of the three levels (rito/bronze, whānau/silver, and pā-harakeke/gold)	Provide more detail around types of products used on the menu (e.g., plain or wholegrain products) for centres that indicated they had a

		Healthy Heart Award.
Reference Recipes	A list of classifications for common mixed meals, developed using New Zealand (NZ) online recipe databases (for example, Countdown online, Pak n Save online, New Zealand Herald and Kidspot) and nutritional judgement.	Classify mixed meals where recipes are not available.
Reference Recipes (Early Learning Service Providers)	A list of classifications for mixed meals in which the recipe or meal itself is provided by an Early Learning Service food provider.	Classify mixed meals where recipes are not available.

Appendix 3: Food availability questionnaire

1. What type of bread do you use? (e.g. white bread, wholemeal, wheatmeal, multigrain or wholegrain). If available, please give the brand.
2. Do you add salt to cooking?
3. Do you give children any deep-fried foods?
4. Do you give children sausages, dried meat products (e.g. jerky, biltong) and/or sausage rolls?
5. Do you give children popcorn?
6. Do you include vegetables at lunch and/or snacks?
7. Do you only provide plain milk and/or water to children?
8. If you have a menu (or sample menu/template), are we able to have a copy?

Appendix 4: Example menu analysis

Key

A Amber
 G Green
 N No
 R Red
 Y Yes

Part A: Meals

Meal	Ingredients and classification	Contains fruit or vegetable	%green	%amber	%red	Overall rating
<i>Cottage pie</i>	Mince (g), vegetable oil (g), potato (g), milk (a over-2, g under-2), vegetables (g,g,g), lentils (g)	Y				
Over-2s			88	12	0	G
Under-2s			100	0	0	G
<i>Butter chicken</i>	Minced chicken (g), vegetable oil (g), chickpeas (g), pumpkin (g), butter chicken sauce (a), peas (g), corn (g), carrots (g), vegetable oil (g)	Y				
Over-2s			88	12	0	G
Under-2s			88	12	0	G
<i>Vegetarian risotto</i>	Rice (a over-2, g under-2), vegetables (g,g,g), garlic (g), ginger (g), soya sauce (a), vegetable oil (g), mixed beans (g,g,g), corn (g)	Y				
Over-2s			83	17	0	G
Under-2s			92	8	0	G
<i>Beef nachos</i>	Mince (g), vegetables (g,g,g), red kidney beans (g), pasta sauce (a), wholemeal baked wrap chips (g over-2, a under-2), cheese (a)	Y				
Over-2s			75	25	0	G

Under-2s			63	37	0	A
<i>Tuna pasta bake</i>	Spring tuna (g), carrots (g), capsicum (g), broccoli (g), zucchini (g), garlic (g), cheese (a), pasta (a over-2, g under-2), vegetable oil (g), celery (g), carrot (g), cucumber (g), beetroot (g), tomato (g)	Y				
Over-2			86	14	0	G
Under-2			93	7	0	G

Assumptions applied

- Tomato based butter chicken sauce
- No cream in pasta sauce

Part B: Menu scoring card

Menu category	Menu Item	Category over-2s	Category under-2s	High choking risk	Assumptions made
<i>Morning tea</i>	Seasonal fruit	G	G	N	
	Seasonal fruit	G	G	N	
	Seasonal fruit	G	G	N	
	Seasonal fruit	G	G	N	
	Fruit salad	G	G	N	No juice added
	Fruit salad	G	G	N	No juice added
	Fruit salad	G	G	N	No juice added
	Yoghurt	G	A	N	Low fat
	Wholemeal cheerio cereal	G	G	N	
	Mousetraps (wholemeal bread and cheese and/or spaghetti)	A	A	N	Cheese and spaghetti served
	Wholemeal scones	A	A	N	½ regular scone size
	Scrambled eggs	G	G	N	

	Wholemeal toast	G	A	N	
<i>Lunch</i>	Cottage pie	G	G	N	
	Butter chicken	G	G	N	
	Vegetarian risotto	G	G	N	
	Beef nachos	G	A	N	
	Tuna pasta bake	G	G	N	
<i>Afternoon tea</i>	Seasonal fruit	G	G	N	
	Rice crackers	R	R	Y	Hard to chew
	Apple, fruit, zucchini, bran muffin	A	A	N	Mini size
	Cheese sticks	A	A	N	Fresh cheese cut into sticks
	Seasonal fruit	G	G	N	
	Rice crackers	R	R	Y	Hard to chew
	Wholemeal crackers	R	R	Y	Hard to chew
	Carrots	G	G	N	
	Celery	G	G	N	
	Cucumber	G	G	N	
	Cheese sticks	A	A	N	Fresh cheese cut into sticks
	Hummus	A	A	N	
	Rice crackers	R	R	Y	Hard to chew
	Seasonal fruit	G	G	N	
	Pretzel sticks	R	R	Y	
	Sandwich (wholemeal bread with vegemite)	A	A	N	
	Muesli baked slice	R	R	Y	Contains dried fruit and/or whole nuts or seeds and/or is hard to chew
	Rice crackers	R	R	Y	
	Fresh seasonal fruit	G	G	N	

Part C: Menu score calculation

	Over-2 (#)	Over-2 (%)	Under-2 (#)	Over-2 (%)
Menu items	37	100	37	100
Red	7	19	7	19
Amber	7	19	10	27
Green	23	62	20	54
High-choking-risk	7	19	7	19