Investigation of the Association between the Relative Reinforcing Value of Food in 3 Year-Old Children With Body Weight and Composition: The Choice and Motivation in Preschooler Snacking (CHAMPS) Study

By
Samantha Wong

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ABSTRACT

INVESTIGATION OF THE ASSOCIATION BETWEEN THE RELATIVE REINFORCING VALUE OF FOOD IN 3 YEAR-OLD CHILDREN WITH BODY WEIGHT AND COMPOSITION: THE CHOICE AND MOTIVATION IN PRESCHOOLER SNACKING (CHAMPS) STUDY

Samantha Wong  Advisor: Dr. Jess Haines
University of Guelph, 2018

The relative reinforcing value of food (RRVF; how hard a child is willing to work for a food versus non-food reinforcer) and weight are strongly associated across many life stages, but few studies exist among preschool age children. Linear regression was used to investigate the association between the RRVF (measured as the food reinforcing ratio (FRR)) and body mass index (BMI) z-score and percent fat mass (%FM) among thirty-three 3 year old children. Food parenting practices were investigated as potential moderators. The food (cookie) versus non-food (audiobook) reinforcer design was delivered using a sequential progressive fixed ratio reward schedule. FRR was positively associated with BMI z-scores. No significant associations were found between FRR and %FM. Restriction for Health moderated the association between FRR and BMI z-scores. There was no evidence for moderation by the other food parenting practices explored.

Keywords: Preschool Age Children, Childhood Obesity, Reinforcer, Operant, Food Reinforcing Ratio, Bioelectrical Impedance Analysis
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List of Abbreviations

RRVF – Reinforcing value of food

RRVF – Relative reinforcing value of food

FRR – Food reinforcement ratio

PFR – Progressive fixed ratio

WHO – World Health Organization

BMI – Body mass index

BIA – Bioelectrical impedance analysis

FM – Fat mass

%FM – Percent fat mass

FFM – Fat-free mass

BF – Body fat

TBW – Total body water
1.0 Introduction

The RRVF is reflective of how hard a child is willing to work for a food reinforcer compared to a non-food reinforcer. There is growing evidence across many stages of the lifespan that the RRVF is positively associated with body weight (Epstein, Leddy et al., 2007). Specifically, those who are more motivated to work for a food reinforcer over a non-food reinforcer present with a higher weight, compared to those who are more reinforced by non-food reinforcers. These findings highlight the potential of RRVF as a key variable in the childhood obesity crisis. It should be noted that the term “reinforcer” is used when operant responses are required to earn a stimulant, as opposed to “reward” which is a stimulant that encourages behaviour without an operant response. Recent data from the World Health Organization (WHO) show that 41 million children under the age of five were overweight or obese in 2016; furthermore, this number could increase to 70 million by the year 2025 (WHO, 2017). While a number of studies have examined the how the RRVF may influence obesity risk among adults and school aged children, few studies have examined this association among preschool age children. It is important to understand how the RRVF presents in all life stages in order to gain a stronger understanding of how this factor contributes to the development of overweight and obesity. Additionally, existing research has not examined how this association may differ by food parenting practices. Further, existing RRVF research has been conducted exclusively in the United States. Given that food parenting practices and food systems in Canada may differ from those in the United States, it is essential to investigate the RRVF in the Canadian context. This study will address these critical gaps in research by using developmentally appropriate protocols to assess the RRVF, and investigate how RRVF is associated with weight, and %FM among
preschool age children in Canada. This study will also examine how these associations are moderated by food parenting practices.

2.0 Review of the Literature

2.1 Childhood Obesity

Data from the Canadian Community Health Survey and Canadian Health Measures Survey, indicate that the prevalence of overweight and obesity in Canadian children has decreased between 2004-2013 (Rodd & Sharma, 2016); however, children’s weight and BMI z-scores in 2012-2013 were still above the World Health Organization (WHO) cut off values (Rodd & Sharma, 2016). Addressing obesity in childhood is critical given that obesity that develops in childhood persists throughout the life stages. Obesity can promote the development of numerous comorbidities, such as diabetes, depression, heart complications, and places considerable stress on the health care system (Canadian Obesity Network, n.d.). The Canadian Obesity Network (n.d.) claims that the direct costs of overweight and obesity in Canada accounted for $6 million (4.1%) of Canada’s health care budget. While the causes of obesity are many, there is emerging evidence to suggest that the RRVF and the availability of enriching non-food alternatives in the environment are key drivers in the development of overweight and obesity in children (Kong, Feda, Eiden, & Epstein, 2015; McCullough, Guilkey & Stark, 2017; Rollins, Loken, Savage, & Birch, 2014; Temple, Legierski, Giacomelli, Salvy, & Epstein, 2008).

2.2 Food as a Reinforcing Factor

Food is a primary reinforcer, which means that we do not require learning to understand its value and its ability to reinforce behaviour is innate (Best et al., 2012; Epstein, Leddy, Temple, Faith, 2007; Psychestudy, 2017). This can be contrasted by a secondary reinforcer, which requires learning through indirect or direct associations with primary reinforcers to
understand or perceive its value (Astur et al., 2015). A commonly cited secondary reinforcer is money, given that we learn its value through its association with a primary reinforcer (i.e., being able to purchase food) (Astur et al, 2015). Given the biological need for food as sustenance, food is inherently a powerful reinforcer (Best et al., 2012; Epstein, Leddy et al., 2007). Some research claims that food is as strong of a reinforcer as drugs (e.g., cocaine) (Hursh & Bauman, 1987). The strength of food as a reinforcer for behaviour varies between individuals due to a myriad of factors including, temperament, food availability, instrumental conditioning, parenting practices, and choice, all of which have been minimally and investigated discretely among preschool age children (Best et al., 2012; Epstein, Leddy et al., 2007).

**2.3 Reinforcing Value of Food**

To measure the RRVF, participants are typically asked to complete tasks (e.g., clicking a computer mouse) to earn the food reinforcer. With each reinforcer earned, the amount of work required to earn the next reinforcer is increased. The amount of work in which an individual is willing to engage to earn the reinforcer is described as the reinforcing value of that reinforcer (Best et al., 2012; Epstein, Leddy et al., 2007).

The relative reinforcing value of food (RRVF) refers to the reinforcing value of a food reinforcer relative to an alternative reinforcer. Behavioural Theories of Choice describes the considerations we make in the presence of 2 or more choices (Best et al., 2012; Epstein, Leddy et al., 2007; Lappalainen & Epstein, 1990). For example, if a participant is presented with two reinforcers at the same time, with the same amount of work required to earn each reinforcer, the results will be reflective of the *relative* reinforcing value of each reinforcer (Epstein, Leddy, et al., 2007). The ability of an individual to choose between concurrent alternatives allows researchers to determine which is the preferred reinforcer; the preference depends on the
reinforcing value of the alternatives and the amount of work needed to earn each reinforcer (Epstein, Leddy, et al., 2007). The theory suggests that when the effort for two reinforcers is equal, an individual will work for their preferred reinforcer: as the demand or cost of the preferred reinforcer increases, there is a shift in preference and the other less-preferred reinforcer becomes more appealing (Epstein, Leddy, et al., 2007; Lappalainen & Epstein, 1990). We are presented with choices on a daily basis (e.g., coffee or tea, cookie or fruit, buy lunch or pack leftovers), and our health is largely impacted by these choices. An understanding of how children behave when given the choice between food and a food alternative is critical to our understanding of the complexity of the origins and influencing factors of obesity.

By presenting two reinforcers at the same time (concurrent schedule), researchers are able to assess the relative rate of responding for one reinforcer in the presence of an alternative (Domjan, 2010). With concurrent schedules we are able to directly compare the number of schedules completed ($P_{\text{max}}$= maximum schedule achieved) between the alternatives to determine the reinforcing value of the reinforcers (Domjan, 2010; Rollins et al., 2014). When it is not possible to use concurrent schedules, such as the case with younger children, sequential schedules can be used, which have the participant working for only one reinforcer at a time; preschool age children have been shown to have difficulty understanding concurrent schedules, and sequential schedules have been used to improve comprehension of the task (McCullough et al., 2017). For sequential scheduled tasks the RRVF is described as the ratio of responding for the food reinforcer, termed the food reinforcing ratio (FRR) (Kong, Eiden, et al. 2016). This is calculated by dividing the total number of schedules completed for the food reinforcer by the sum of the schedules completed for both food and non-food reinforcer. By doing this we are able
to quantify the difference in motivation to work between the two reinforcers, when these reinforcers are presented at different times.

2.4 Factors Influencing the Reinforcing Value of Food

Despite the fact that food is a primary reinforcer, instrumental conditioning (i.e., through parenting practices or conditioning history) can influence the reinforcing value of certain food items by adding a conditioned reinforcing value (Capaldi, 1996; Domjan, 2010; Lu, Xiong, Arora, & Dubé, 2015). Instrumental conditioning develops through the association of a behaviour/response and the resultant consequence. The following examples provide practical food-related situations for the 4 types of instrumental conditioning: positive reinforcement occurs when a child is given ice cream after performing well in school or eating all of their vegetables; negative reinforcement can occur when a child stops eating before feeling full to avoid the uncomfortable sensation that comes with overeating; positive punishment can transpire when a child feels nauseous after eating too much sugary or fatty foods; and negative punishment/omission training could occur when a child is placed in a time out if they do not eat their vegetables. Each of the aforementioned facets of instrumental conditioning has the ability to change the strength food as a reinforcer, and therefore the rate of responding or frequency of consumption (BCOTB, 2013; Domjan, 2010; Psychestudy, 2017). Furthermore, these associations can result in a conditioned preference for the food used as a reinforcer and alter our food preferences, wherein the preference and liking of the high-energy-dense food used as a reinforcer is amplified and those of the low-energy-dense foods is depleted (Capaldi, 1996). Due to the fact that preschoolers are almost entirely dependent on their parents for food, parental feeding practices are a key instrumental conditioning factor to the allocation of value placed on
food and resulting eating behaviours of children (Lu, Xiong, Arora & Dubé, 2015; Ventura & Birch, 2008).

2.4.1 Food Parenting Practices and Child Eating Behaviour

To extend the idea of instrumental conditioning as a factor in the RRVF, one must consider the food parenting practices that are implemented during the early years of life. There is growing research that supports the role of food parenting practices on the development of taste preferences, eating habits, and weight among children (Musher-Eizenman & Holub, 2007). Using food as a means of behaviour modification is a common practice among parents and acts as “parent-induced instrumental conditioning” and amplifies the strength of food as a reinforcer (Lu et al., 2015). Some examples of food parenting practices that function as instrumental conditioning methods include: using food to regulate child emotions, encouragement of balance and variety, using food as a reward, modeling healthy eating behaviours, monitoring unhealthy foods, pressure to eat, restriction for health, and restriction for weight control (Ventura & Birch, 2008; Stifter & Moding, 2018). When a particular food is provided as a reinforcer or removed as punishment, the reinforcing value of the food and child’s preference for that food increases (Birch, 1981; Birch, Zimmerman, & Hind, 1980; Lu et al., 2015). Similarly to food being used as a reinforcer, control measures and restrictions placed on food also have an amplifying effect on the RRVF (Lu et al., 2015). A comprehensive literature review by Faith, Scanlon, Birch, Francis and Sherry (2004) analyzed 22 articles that examined the associations of food parenting practices on child outcomes; studies showed that parental controls and restriction were significantly associated with caloric intake and eating in the absence of hunger, which resulted in a 5 fold increase in likelihood that the child would be overweight in later years (Faith et al., 2004). These findings are supported by Ventura and Birch (2008), and Lu and colleagues (2015), who found
that children exposed to parental controls have higher incidences of eating in the absence of hunger, consume more restricted foods when free and available, and presented with a higher weight. It should be noted that the effects of food parenting practices on the strength of food as a reinforcer vary depending on the child’s personality traits such as temperament and how sensitive they are to reinforcers (Lu et al., 2015).

2.5 Relative Reinforcing Value of Food

2.5.1 Relative Reinforcing Value of Food as a Risk Factor for Obesity

The strength of the RRVF exhibited by an individual has been shown to predict calorie intake as well as an increase in adiposity over time (Epstein, Temple, et al., 2007; Epstein et al., 2015; Rollins et al., 2014; Hill, Saxton, Webber, Blundell, & Wardle, 2009). It has been well established that adults and adolescents with a higher RRVF are more likely to be overweight or obese as compared to those with lower RRVF (Epstein, Temple, et al., 2007; Kong et al., 2015; McCullough, et al. 2017; Rollins, et al., 2014; Temple et al., 2008). More specifically, those with higher weight are more strongly reinforced by, complete more schedules (Kong et al, 2015; Kong, Eiden et al., 2016), and respond more frequently to food reinforcers (McCullough et al., 2017), when compared to children who are not overweight. Few studies have explored this association among infants and young children, however the limited existing data suggest a positive association between RRVF and weight among infants and preschool ge children (Kong, Eiden, et al., 2016; Kong, Feda et al., 2016; Rollins et al., 2014; McCullough et al., 2017). Of these studies, only two have investigated the role of the RRVF in preschool age children; both of which were conducted among samples of highly educated Caucasian populations in the United States (Rollins et al., 2014; McCullough et al., 2017). Given the role of the RRVF on obesity risk, and the development of eating behaviours in preschool years, it is imperative that this gap in
research is addressed among more demographically diverse samples (Birch, Johnson, & Fisher, 1995).

### 2.5.2 Food vs. Food Reinforcement Tasks

There is limited research on the RRVF in preschool age children. Rollins and colleagues (2014) validated the RRVF task among preschool age children aged 3-5 years old using a concurrent schedule in which two reinforcers were offered at the same time, allowing the participant to choose which they want to work for. Researchers used a food versus food design, offering two graham crackers that only differed in shape. The authors acknowledged that the use of two similar food alternatives was unconventional since typically the aim of this task is to determine how hard a participant will work for two different types of reinforcers, such as food and non-food reinforcer or healthful and less healthful food reinforcer. However, they used similar food reinforcers with the goal of validating the RRVF task in the preschool age population. The predictive validity of the RRVF task in preschool age children was established by comparing results to an ad libitum snack test with study foods using Pearson correlations and significance testing ($\alpha = .05$). Total responses and response rates for the graham crackers were found to have positive and significant correlations with calorie intake during the ad libitum snack test (total intake: $r = .61$, $p < .001$ and $r = .40$, $p < .01$; response rate: $r = .44$, $p < .05$ and $r = .46$, $p < .05$). From this, the authors concluded that the RRVF task predicted calorie intake observed during the ad libitum snack test. The RRVF of each graham cracker was positively associated BMI z-scores (response rate $r = .41$, $p < .05$; $r = .42$, $p < .05$). Several limitations are present in this study: firstly, the sample was comprised of middle-high income, highly educated, Caucasian participants and findings may differ in more diverse samples; BMI was used as a proxy marker of obesity, rather than measuring body composition (i.e. measuring fat mass, muscle mass, etc.) using surrogate
methods such as bioelectrical impedance analysis (BIA) (Talma et al., 2013); and the age range of 3-5 years of age would have introduced multiple developmental stages and may have resulted in differential comprehension of the protocol among participants. For example, the use of concurrent schedules is more cognitively demanding than a sequential design and may not have been well understood by 2 and 3 year olds, which could have negatively impacted the results of the study. Given their cognitive capacity, younger children likely require sequential schedules to eliminate the complexity of choice. Despite the lack of choice in sequential schedules, studies using this design have yielded similar associations of food reinforcement to those that use concurrent schedules (Kong et al., 2015; Kong, Eiden, et al., 2016; McCullough et al., 2017). This validation study by Rollins and colleagues (2014) provides a strong framework for future research with preschool age children.

Building upon the study by Rollins and colleagues (2014), McCullough and colleagues (2017) were the first to investigate the effects of RRVF in the context of food type among preschool age children 3-5 years of age. McCullough and colleagues used two different foods in the RRVF task: high-energy-dense foods (cookies), and low-energy-dense foods (fruit). During pilot testing it was found that preschoolers did not understand the concurrent PFR schedule, and a sequential PFR schedule was used for the full study. This provides further support for the use of sequential schedules in preschool age populations. Rather than providing the food reinforcer immediately after the children had earned it, pictures of the reinforcers were earned during the task and the foods were provided as a lump sum at the end. Researchers found that the RRV of cookies was significantly higher for overweight and obese children (OW/OB) (Mean=0.57) than for those of healthy weight (HW) (Mean =0.41), t(58)=−2.7, p=.007. A 3-day food record showed no significant differences between OW/OB and HW children in total calories or the number of
fruit and vegetable servings consumed in a day. McCullough and colleagues posit that perhaps a higher RRVF for healthier foods, such as fruit, is protective against obesity. Limitations in the study by McCullough and colleagues (2017) echo those of Rollins and colleagues (2014); the sample was comprised of highly educated, middle-upper class Caucasians, and the utilization of BMI without additional markers of body composition. Additionally, providing pictures of reinforcers as opposed to immediate delivery introduces delayed gratification as a confounding variable and could have added to the children’s confusion in completing the RRVF task (Lattal, 2010). According to Lattal (2010), a delay of reinforcer in operant tasks can increase, decrease, or have no impact on performance. Young children are not likely to understand the delay without previously establishing the operant response of clicking the computer mouse (Lattal, 2010), and this would have limited the satisfaction children experienced during the task. As discussed with the study by Rollins and colleagues (2014), it is possible that the age range of participants (3-5 years) was too wide, and the developmental stages would be too varied to provide appropriate adaptations to the RRVF task.

Previous RRVF studies have found that there is little difference in level of effort for food reinforcers by weight, and that the substantive differences in effort for reinforcer by weight is found with the non-food alternative, where the healthy weight individuals will work as hard for these reinforcers as for the food reinforcer, whereas overweight and obese individuals will not (Hill et al., 2009; Kong et al., 2015; Kong, Anzman-Frasca, et al., 2016; Kong, Eiden et al., 2016; Temple et al., 2008). This indicates that the utility of food versus food designs may not be as appropriate as food versus non-food reinforcement tasks in providing critical insight into the obesity crisis. Future research is needed that focuses on the differences in motivation to work for a food versus non-food reinforcer among a sample of demographically diverse preschool age
children. Existing research could also be improved by measuring children’s body fat, versus using proxy measures of adiposity (e.g., BMI).

2.5.3 Food versus Non-food Reinforcement Tasks

As discussed above, research using a food versus non-food approach may be more ecologically valid than the food versus food design. Research using this protocol has been conducted among school aged children and infants. However, no research has used this approach with preschool age children. Among school aged children different approaches to assess RRVF have been used. Hill and colleagues (2009) administered the RRVF task via questionnaire to 316 children 7-10 years of age to investigate whether the RRVF was able to predict weight gain and adiposity shifts 1 year after baseline testing. Weight and adiposity were measured using a foot-to-foot bioelectrical impedance analysis (BIA) device. The questionnaire assesses how hard the child would work to gain access to the reinforcers. Researchers defined RRVF as the total number of food choices made compared to the non-food choices; the reinforcers offered were a miniature cookie (food reinforcer) and a small sticker (non-food reinforcer). There was a significant decrease in the number of food choices as the amount of work to obtain a food reinforcer increased (p<.001). The number of food choices made at baseline significantly predicted an increase in BMI ($\beta=.06$, p<.001) and fat mass index (fat mass (kg) divided by height (m$^{1.28}$)) (p=.001) over the 1-year study period; this association was found among those who were overweight/obese as well as those at a healthy weight at baseline. Hill and colleagues (2009) have demonstrated that the RRVF predicts weight gain in school-age children.

Temple and colleagues (2008) conducted a study in the United States, which required children 8-12 years of age to complete operant responses for the RRVF computerized task; the reinforcers included pizza (food) or 5 minutes with a self-selected non-food alternative (video
game, magazine or colouring). A variable ratio of concurrent schedule was used: meaning the amount of work required to earn the alternative reinforcer doubled with each reinforcer earned, and the schedule for the food reinforcer remained the same throughout the task. The RRVF was described as responses for food and number of schedules completed for food. There was a significant interaction (p<.001) between BMI z-score and reinforcement schedule, meaning that children with higher BMI z-scores worked harder for the food reinforcer compared to non-overweight children who were more reinforced by the non-food alternative.

The RRVF using food and non-food reinforcers has also been explored in infant populations. Kong and colleagues (2015) conducted two separate studies with a total of 57 infants in the United States (Epstein, Leddy, et al., 2007; Killeen et al., 2009). Parents were asked to bring the infant’s favourite food as the food reinforcer, and for the non-food reinforcer, 2 different reinforcers were tested: 1) 10 seconds of watching a DVD (alternative for study 1), or 2) blowing bubbles (alternative for study 2). The reinforcing value of alternatives was defined as the maximum schedule reached; the FRR was calculated as the maximum schedule reached for food divided by the total number of schedules for food and alternative combined. A greater weight-for-length z-score was found to be significantly associated with the FRR in both the DVD and Bubble studies (r=.06, p<.001 and r=.49, p=.006, respectively). Conversely, a lower weight-for-length z-score was found to be associated with the maximum number of schedules completed for the DVD and Bubbles (r=-.71, p<.001 and r=-.53, p=.003, respectively). Energy density was determined using Nutritionist Pro, and was considered to be low to medium energy density if <4 kcal/g and high energy density if >4 kcal/g. Energy density was not associated with the maximum number of schedules completed for food in either study (DVD: p=.36, Bubbles: p=.49). Consistent with other studies, a higher RRVF compared to the reinforcing value of a
non-food alternative was found to be associated with a higher weight. Limitations noted by the authors include the homogenous sample of highly educated Caucasian participants, and that the DVD and Bubble reinforcers may have had different reward value.

Another study in the United States, by Kong, Eiden, and colleagues (2016) demonstrated that it is possible to alter the FRR using an enriched music experience intervention among 27 infants aged 9-16 months. This pre and post-test intervention program involved two study visits before and after the intervention. The intervention group engaged in a 6-week music program in which the infants made music with their parents, whereas the control group engaged in weekly 45 minute play dates held at the same time as the 6-week music intervention. The two studies before and after the intervention and control period were administered using the PFR sequential reward schedule, with reinforcers (infant’s favourite food versus 10 seconds of music) counterbalanced between participants. The music offered as a reinforcer was not the same as the intervention music to avoid familiarity bias. These tasks were separated over 2 days to avoid fatigue and disinterest in the tasks. The RRVF and reinforcing value of music were defined as the maximum schedule completed for each reinforcer (Food $P_{\text{max}}$ and Music $P_{\text{max}}$, respectively), and the FRR was calculated as described previously. On average, food reinforcement ($P_{\text{max}}$) decreased among infants in the intervention group and increased marginally in the control group ($F[1,24]=6.57, p=.02$) over the intervention period. From baseline to post-intervention; it was found that 71.4% of intervention infants decreased their food reinforcement, compared to 25% of infants in the control group ($p=.018$). This resulted in 78.6% of intervention infants showing a decrease in their FRR, compared to 41.7% in the control group ($p=.05$). In conjunction with a decrease in the Food $P_{\text{max}}$ and FRR, there was a minor increase, albeit not significant, in the Music $P_{\text{max}}$ of the intervention group and decrease in Music $P_{\text{max}}$ in the control group.
Although the anthropometric findings were not significant, there was a decrease in the weight-for-length z-score among infants in the intervention group and an increase in the same measurement in the control group \( F[1,24]=2.43, p=.13 \). These findings indicate that it may be possible to make a positive shift in the reinforcing value of non-food alternatives from an early age. These desirable food alternatives can act as a protective factor against overeating and resultant weight gain.

Findings from these American studies describe a strong relationship between the relative reinforcing values of food with weight, and there is evidence to suggest that a desirable non-food alternative is protective against obesity. Despite this evidence among infants and adolescents, there are no studies to examine this relationship in preschool age children, nor are there any that have examined this relationship in the Canadian context. It is possible that the food parenting practices and food systems in Canada may differ from those in the United States. Disparities in these factors may influence the frequency and quality of foods provided to children, both of which have an impact on food preference and therefore influence the RRVF. Thus, it is unclear whether the results from the American-based studies are generalizable to the Canadian context.

### 3.0 Significance

Current overweight and obesity trends from the WHO predict that the number of children under the age of five will increase from 41 million, as seen in 2016, to 70 million by the year 2025 (WHO, 2017). Obesity that develops in childhood without intervention will continue into adulthood with the increased likelihood of developing comorbidities (WHO, 2017) that put financial strain on the healthcare system. In 2006, obesity contributed to $3.9 billion in direct healthcare costs, and $3.2 billion in indirect costs (Janssen, 2013). There is growing evidence to suggest that the RRVF may be an important risk factor contributing to obesity. However, few
studies have examined how RRVF is associated with obesity risk among preschool age children. This study will address this knowledge gap by examining associations between RRVF and obesity among 3 year olds in Canada. Results of this study will improve the ecological validity of our current knowledge by including body composition measurements in a sample of Canadian children. An understanding of how the RRVF is associated with excess weight gain during this life stage is critical to inform early life obesity prevention intervention programs (Birch et al., 1995). Results from this study will allow us to develop a better understanding of how unhealthy eating behaviours develop in early years. This information can be used to develop more individualized guidance regarding appropriate feeding practices and obesity prevention strategies among preschool age children, with the hopes of changing the trajectory of this epidemic.

The investigation of the RRVF is absent within the Canadian context. It is possible that the food parenting practices and food systems in Canada may differ from those in the United States. Disparities in these factors may influence the frequency and quality of foods provided to children, both of which have an impact on food preference and therefore influence the RRVF. Thus, it is unclear whether the results from the U.S.-based studies are generalizable to the Canadian context. The proposed study attempted to address these key knowledge gaps by examining how the reinforcing value of high-energy-dense foods versus a non-food alternative is associated with weight outcomes among a sample of Canadian preschoolers. By understanding how the type of reinforcer offered is related to its reinforcing value and how it impacts weight and body composition, our results will help inform more tailored recommendations within obesity prevention interventions.
Research Objectives: (1) To examine the associations between the RRVF with weight status and %FM among preschool age children in Canada. (2) To examine whether food parenting practices have a moderating effect on the associations examined in Objective 1.

Hypotheses: We hypothesized that children who find food more reinforcing compared to a non-food alternative will have higher weight status and %FM compared to those who are more strongly reinforced by a non-food alternative. Further, we hypothesized that the associations between RRVF and each outcome variable (weight status and %FM) will be moderated by key food parenting practices shown to be associated with the RRVF in children (Ventura & Birch, 2008; Stifter & Moding, 2018). Specifically, the associations examined will be stronger among children whose parents score higher on Food as Reward, Food to Regulate Emotion, Restriction for Health and Restriction for Weight.

4.0 Methods

4.1 Participants

The inclusion criteria for this study was that the child participating was aged 3 years old (36-47 months), the family lives in the Guelph, Ontario, Canada area and was able to travel to the university food laboratory for the study. Exclusion criteria included the following: food allergies to ingredients in study foods (e.g., peanuts, milk, wheat, soy; to minimize risk with study food); diagnosed developmental disability (could possibly influence understanding of task); diagnosed with a condition that could impact food intake (e.g., Celiac Disease); taking medication that could impact appetite, taste or olfactory senses (e.g., corticosteroids, antibiotics). There were no inclusion or exclusion criteria based on weight. Children were recruited through the Guelph Family Health Study (GFHS) pilot 1 and pilot 2 phases, and the Guelph community. Families in the GFHS were contacted via email, which included information about the study and
an invitation to participate. Posters were distributed to neighbourhood groups, community centres, libraries, and through social media (i.e., as an advertisement on Facebook parent groups) (Appendix A). All modes of recruitment included researcher contact information.

4.2 Procedures

Parents who responded to recruitment material were screened with an online Qualtrics survey to determine eligibility (Appendix B). Those who met inclusion criteria were invited, via email, to participate in two 1-hour study visits. At the first study visit, parents were given the opportunity to ask questions about the study and sign the consent form (Appendix C). Children were asked to taste and rate the study foods and select their most preferred food, which was used for the task during the second study visit. Children were also able to familiarize themselves with the food/non-food reinforcement task (referred to hereafter as the FRR task) at this visit. The order of the practice task was randomized for each participant. While children engaged in the practice task, parents were free to complete the survey, which included questions related to demographics, socioeconomic status, and food parenting practices.

At the second study visit, children were asked to complete the FRR tasks, the order of which was counterbalanced from the initial visit. Counterbalanced means that the order of the reinforcers presented is alternated between visits (i.e., the child was presented with the food reinforcer first, and the non-food reinforcer was presented first at the second visit); the initial order was determined randomly. It was preferred that this second visit took place the following day, however it was acceptable for the visit to be no more than 1 week after the initial visit. When the child was finished with the food and non-food tasks, trained research staff assessed children’s weight, height, and body composition (BIA). The intra- and inter-rater reliability CV
for each of height was 0.12% and 0.14%, respectively, weight was 0.01% and 0.24% respectively, and for BIA Resistance was 0.15% and 1.5%, respectively (Appendix G).

For both study visits, parents were asked to feed their child as usual on the day of the visit, with a snack 2 hours before the visit, but to refrain from providing their child with food or fluids other than water within 1 hour before their visit. This was to minimize the influence of hunger on the child’s motivation to earn the reinforcers. Prior to the FRR task parents were asked to provide a diet recall from when the child woke up to the time of testing to ensure their child had not eaten anything within 1 hour of the study visit (Appendix F). Parents were not allowed in the room during the RRVF and non-food tasks to avoid bias. The reasons for this included: children may engage in tasks to please parents – thereby making parental praise the reinforcer rather than the food or non-food reinforcer provided; parents may inadvertently behave in a coercive manner to get children to engage in the tasks, which interferes with voluntary action (Canadian Pediatric Society, 2008); and lastly, not having parents in the room would likely not introduce undue stress given that it has been shown that by 3 years of age, there is a dramatic decrease in separation anxiety from parents (Howard, Martin, Berlin, & Brooks-Gun, 2011).

Families were provided a $50 prorated grocery store gift card as a thank you for participating, at the end of the second visit; if families were unable to complete the second study visit a $25 gift card was mailed to them. Following the conclusion of the second visit, parents were invited to ask any questions about the process. Families were provided with the opportunity to receive aggregate results following the conclusion of this study.

The study outlined above was piloted and video recorded to ensure accuracy of protocol implementation prior to the full study. Video recordings of all pilot visits were shared with Dr. K. L. Kong at the State University of New York at Buffalo to confirm fidelity to the protocol.
4.3 Measures

Predictor variables

FRR task:

Children were presented with one reinforcer at a time in a sequential progressive ratio schedule (i.e., 1, 4, 8, 12, etc.), with the reinforcers counterbalanced between participant’s visits. The food reinforcer offered was a 1.8 g (±0.3g) portion of their preferred snack, and the non-food reinforcer was 10 seconds of an audiobook chosen by the child (The Paper Bag Princess (PBP) or Mortimer by Robert Munsch). Children were presented 5 study foods, one at a time (Great Value Honey Teddy Grahams™, Oreos™, Chips Ahoy Soft Chocolate Chunk Cookies™, Great Value Chocolate Striped Shortbread Cookies™, and Great Value Animal Cookies™) and asked to rate each food as “yummy”, “just okay”, or “yucky” using a picture with three faces to represent each category. Children were then asked to select their favourite food, which would be used in the FRR task. Children were also presented with the cover of two books (Paper Bag Princess (Munsch, 1980) and Mortimer (Munsch, 1983)) and asked which book they would like to listen to. If children had difficulty choosing a book, a brief description of the content of each book was provided (i.e., the PBP has a princess and a dragon, and Mortimer has a boy singing).

The child and one of the researchers were seated opposite from each other at a children’s table. A wireless computer mouse was set in front of children for use during the task. In order to minimize the amount of distractions during the task, the test materials (i.e., computer, speakers, research assistant) were kept to the side of the test room. The computer tracked the number of PR schedules completed; a research assistant was seated at this computer to control the program. This set up was consistent with the design used in Kong, Eiden and colleagues’ (2016) study.
Before and after each food task (liking assessment and food reinforcer tasks) a hunger assessment was administered to determine the child’s level of fullness.

Appropriate encouragement phrases during the task included “that’s right, you press the button for more cookies/to hear more of the story”, “good job”. When the child was finished with the task, the researcher asked if they are finished and confirmed with different phrasing, such as “you do not want any more cookies/to hear more of the story?”

The food and audiobook tasks were limited to a maximum of 25 schedules for each reinforcer. The RRVF was defined as the FRR, as described by Kong and colleagues (2015), which is the maximum schedule achieved (Food$_{P_{max}}$) in proportion to the maximum schedules reached for both food and audiobook (Book$_{P_{max}}$) (FRR = Food$_{P_{max}}$/ (Food$_{P_{max}}$ + Book$_{P_{max}}$)).

**Outcome Variables**

**Weight:**

Weight in kilograms (kg) was taken with a calibrated digital scale, and height was measured in metres (m) and centimetres (cm) using a stadiometer. BMI z-scores were calculated using the WHO Anthro program for preschool age children. This measure takes the resultant BMI (kg/m$^2$) and compares it to the appropriate age and sex international growth standards (Must & Anderson, 2006). The classifications can be seen in Table 1 below. This reference tool was developed using a diverse sample of children who were raised in optimal conditions (WHO, 2008), and is therefore more representative of the population in the city of Guelph and more generalizable to other geographical locations. BMI z-scores were presented as a continuous variable in data analysis.
Table 1. BMI z-score classifications (WHO, 2008).

<table>
<thead>
<tr>
<th>Z-score</th>
<th>BMI-for-age</th>
<th>Weight-for-age</th>
<th>Weight-for-length/height</th>
<th>Growth indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 3</td>
<td>See note 1</td>
<td>Obese</td>
<td>Obese</td>
<td>See note 2</td>
</tr>
<tr>
<td>Above 2</td>
<td></td>
<td>Overweight</td>
<td>Overweight</td>
<td></td>
</tr>
<tr>
<td>Above 1</td>
<td></td>
<td>Possible risk of overweight (See note 3)</td>
<td>Possible risk of overweight (See note 3)</td>
<td></td>
</tr>
<tr>
<td>0 (median)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below -1</td>
<td></td>
<td>Wasted</td>
<td>Wasted</td>
<td></td>
</tr>
<tr>
<td>Below -2</td>
<td>Stunted (See note 4)</td>
<td>Underweight</td>
<td>Severely underweight (See note 5)</td>
<td>Severely wasted</td>
</tr>
<tr>
<td>Below -3</td>
<td>Severely stunted (See note 4)</td>
<td>Severely underweight (See note 5)</td>
<td>Severely wasted</td>
<td>Severely wasted</td>
</tr>
</tbody>
</table>

Notes:

1. A child in this range is very tall. Tallness is rarely a problem, unless it is so excessive that it may indicate an endocrine disorder such as a growth-hormone-producing tumor. Refer a child in this range for assessment if you suspect an endocrine disorder (e.g. if parents of normal height have a child who is excessively tall for his or her age).

2. A child whose weight-for-age falls in this range may have a growth problem, but this is better assessed from weight-for-length/height or BMI-for-age.

3. A plotted point above 1 shows possible risk. A trend towards the 2 z-score line shows definite risk.

4. It is possible for a stunted or severely stunted child to become overweight.

5. This is referred to as very low weight in IMCI training modules. (Integrated Management of Childhood Illness, In-service training. WHO, Geneva, 1997).

Percent Fat Mass:

The major limitation of using BMI z-scores to assess obesity risk is that they do not provide information about the type of tissue (i.e., lean muscle mass versus fat mass) that contributes to the resultant weight classification (Must & Anderson, 2006). Thus, BMI z-scores alone are an incomplete method of determining obesity risk. In order to determine %FM, a tetrapolar supine single frequency (50kHz) BIA device was used. BIA is a validated and practical method of indirectly measuring body composition among children (Talma et al., 2013;
The National Institutes of Health, 1994; Wells & Fewtrell, 2006). While other methods could provide more accurate measures of body composition, they were not feasible in our research setting. Firstly, dual energy x-ray absorptiometry and computerized tomography scans would expose children to radiation (Wells & Fewtrell, 2006); further, these methods in addition to magnetic resonance imaging are very expensive, and require trained technicians to operate (Wells & Fewtrell, 2006). BIA is a method of predicting body composition with minimal risk to the participant, is low cost, and is easily operated (Wells & Fewtrell, 2006). Resistance (ohms, Ω) from this measurement was used to calculate total body water (TBW), fat mass (FM), fat free mass (FFM) and respective percentages of body weight. The Kushner equation (Kushner, Schoeller, Fjeld & Danford, 1992) and Fomon total body water (TBW) constants (Fomon, Haschke, Ziegler & Nelson, 1982) were used to calculate the proportion of fat (%FM). TBW was divided by the TBW constant to obtain FFM, which is then calculated as a proportion of total weight to obtain %FM. The %FM was used as a continuous variable in data analysis.

\[ \text{TBW} = \frac{0.593H^2}{R} + 0.065W + 0.04 \]

**Table 2. Hydration Constants for boys and girls aged 3-4 years.**

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th></th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>TBW (%)</td>
<td>Age</td>
<td>TBW (%)</td>
</tr>
<tr>
<td>3 yr (36mo)</td>
<td>77.5</td>
<td>3 yr (36mo)</td>
<td>77.9</td>
</tr>
<tr>
<td>4 yr (48mo)</td>
<td>77.0</td>
<td>4 yr (48mo)</td>
<td>77.7</td>
</tr>
</tbody>
</table>


Stipulations for using BIA include: no jewellery or metal in clothing (e.g., buttons); no physical activity, eating or drinking for 30 minutes prior to measurement; encourage participants to void before measurement; no movement during measurement; abduction of legs and arms by
30 degrees, or place a rolled up towel between thighs in the case of overweight/obese participants. Children were asked to adhere to these parameters, however if they were unable to do so, violations to these standards of practice were noted (e.g., child fussy during measurement). Anthropometric measurements were taken following the conclusion of the FRR task at visit 2. This order violates the restriction of food 30 minutes prior to measurement, however this was done to reduce the likelihood of distress impacting performance in the FRR task. The research team also discussed this violation and concluded that the amount of food consumed by children before measurement would be negligible.

**Moderator Variables**

**Food Parenting Practices:**

*Comprehensive Feeding Practices Questionnaire:*  

Food parenting practices such as using food as a reinforcer and enforcing control measures parentally-induce instrumental conditioning and increase the strength of food as a reinforcer. The Comprehensive Feeding Practices Questionnaire (CFPQ) (Musher-Eizenman & Holub, 2007) is a validated self-reported tool used to assess parental feeding practices for children from 18 months to 8 years of age (see Appendix C for Study Survey). The questionnaire has a total of 12 subscales, however this study only investigated 4 of these categories of food parenting practices; these items include: using Food to Regulate Child Emotions (3 items), using Food as a Reward (3 items), Restriction for Health (4 items), and Restriction for Weight Control (8 items) (Stifter & Moding, 2018; Ventura & Birch, 2008). These questions were investigated for a moderating effect for the associations between FRR and BMI z-scores and FRR and %FM. All items were presented on a 4-point Likert scale (Cronbach’s alpha for the CFPQ using this scale was 0.82 for the CHAMPS Study): responses were coded as a numerical value from 1 to 4.
(1= strongly disagree, 4= strongly agree), totaled and averaged to generate a score for each of the
two food parenting practices of interest. A higher score reflects higher level of engaging in the
specific parenting practice. To simplify data analysis, scores were categorized as low if the
average score was at or below the midpoint of the scale range (2.5 or lower), and high if the
score was above the midpoint (Loth, MacLehose, Larson, Berge, & Neumark-Sztainer, 2016).

**Covariates**

**Hunger assessment:**

The level of hunger a child feels was intended to be assessed using the “Peter Peter
Pumpkin Eater” protocol, to remain consistent with other studies (Rollins et al., 2014;
McCullough et al., 2017). The protocol involves reading the child a story featuring Peter Peter
Pumpkin Eater describing his hunger using a series of pictures to show the level of fullness he
feels after eating a varying amount of food: empty, half full/empty stomach, full stomach. During
the pilot study, children did not seem to be interested in the story or did not want to hear the
story. In the full study, children were asked to rate their hunger in the same way they were asked
to rate their liking of study foods; the researcher pointed at each picture and said what level of
hunger was represented. This activity was delivered before the liking assessment and pre-post
FRR task, but was not required for the audiobook task. At each hunger assessment, children were
asked to rate their hunger and what the other two pictures represented to check understanding of
the task. The purpose of measuring hunger was to investigate whether it acted as a covariate the
observed FRR.

**Demographics:**

As mentioned previously, demographic information was captured in an adapted version
of the GFHS survey. Demographic information included: child sex, ethnicity and household
income. Sex of the child, and family’s household income investigated were covariates in data
analysis.

4.4 Data Analysis

Descriptive statistics were performed to describe the sample, with sex, household income,
and hunger rating used as covariates in analysis. All statistics were analyzed using the Statistical
Analysis Software (SAS), University Edition. Participant data was excluded if families were
unable to complete any one of the study components: FRR task or anthropometric measurements.

The RRVF was calculated as the FRR described by Kong and colleagues (2015), FRR =
\[ \text{Food}_{\text{Pmax}} / (\text{Food}_{\text{Pmax}} + \text{Audiobook}_{\text{Pmax}}) \]. Linear regression was used to examine the association
between FRR and the continuous outcomes, BMI z-score and %FM. Hunger, time since last
meal, household income, sex, and age were investigated as covariates. Sex and age were not used
in the BMI z-score or %FM model as these variables already accounts for these factors.
Household income was not predictive of any associations and was therefore not included in the
adjusted model. Hunger was found to lack face validity in that children rated their hunger
inconsistently with how they performed in the FRR Task; thus it was also excluded from the
final adjusted model. Time Since Last Meal was investigated as an alternative to hunger, but this
was also found to be non-significant in the model.

To examine whether there was a moderating effect of food parenting practice (Food as
Reward, Food as Emotion Regulation, Restriction for Health, and Restriction for Weight) on the
association between FRR and the outcome variables, interaction terms (FRR x potential
moderating factor) were investigated. If evidence for moderation was found (i.e., a significant
interaction term), these data would be dichotomized into low and high scores using the median of
the survey scale range as the midpoint (Loth et al., 2016); participants who had scores on the midpoint were categorized as ‘low’.

There are no data available to calculate an ideal sample size. Alternatively, the sample sizes of N=45 and N=60, from Rollins and colleagues (2014) and McCullough and colleagues (2017), respectively, were used to guide the projected sample size. The average number of participants from these two studies is N=53. Given the timeline of this project in addition to the available resources and staff, this study was designed for feasibility and not for significance. Therefore, a sample size of N=30 was determined to be ideal for this study.
5.0 Manuscript – The Relative Reinforcing Value of Food in 3 Year-Olds: Associations with BMI z-score and Percent Fat Mass

5.1 Abstract

There is growing evidence of an association between the relative reinforcing value of food (RRVF; how hard a child is willing to work for a food versus a non-food reinforcer) and weight across many life stages, but few studies have examined this association among preschool age children. The primary objective of this study was to investigate the association between the RRVF (measured as the food reinforcing ratio (FRR)) and body mass index (BMI) z-score and percent fat mass (%FM), in 3 year-old children. The secondary objective of this study was to investigate whether food parenting practices moderated the associations explored in objective 1. The sample was comprised of 33 children who were 3 years of age (36-47 months). Children selected their favourite food reinforcer (cookie) and non-food (audiobook) reinforcer to be used in the FRR task. The task was delivered using a sequential progressive fixed ratio reward schedule. Demographic data and food parenting practices were measured from parents via online survey. Child height, weight and percent body fat using bioelectrical impedance analysis were assessed by trained research staff. Linear regression analyses were performed to investigate associations between the FRR and BMI z-scores and %FM. FRR was positively associated with BMI z-scores ($\hat{\beta} = 1.48, CI = 0.29, 2.66, p = 0.04$). No significant associations were found between FRR and %FM. Parent restriction was found to moderate the association between FRR and BMI z-scores; among children whose parents reported high restriction, FRR was positively associated with BMI z-score ($\hat{\beta} = 1.90, CI = 0.43, 3.37, p = 0.01$), whereas no significant association was found among children whose parents reported low restriction ($\hat{\beta} = 0.77, CI = -1.54, 3.08, p = 0.48$). There was no evidence for moderation by the other food parenting practices.
explored: Food as Reward, Food to Regulate Emotion, and Restriction for Weight. Findings from this study support the RRVF as a potential risk factor in the development of childhood obesity. Additionally, this study elucidates the role of food parenting practices on this relationship.

Keywords: Preschool Age Children, Childhood Obesity, Reinforcer, Operant, Food Reinforcing Ratio, Bioelectrical Impedance Analysis

5.2 Introduction

The relative reinforcing value of food (RRVF) is reflective of how hard a child is willing to work for a food reinforcer compared to a non-food reinforcer. There is growing evidence across many stages of the lifespan that the RRVF is positively associated with weight (Epstein et al., 2015; Kong, Eiden, et al., 2016; Rollins et al., 2014). Specifically, those who are more motivated to work for a food reinforcer (typically energy-dense food) over a non-food reinforcer present with a higher weight, compared to those who are more reinforced by non-food reinforcers. These findings highlight the RRVF as a potential risk factor for excess weight gain in children.

Despite the growing evidence supporting the association between RRVF and weight among American children, there are very few studies among young children (McCullough et al., 2017; Rollins et al., 2014), and none within the Canadian context. It is also possible that the food parenting practices and food systems in Canada may differ from those in the United States, which could influence child food preference and the RRVF. Thus, it is unclear whether the results from U.S.-based studies are generalizable to Canadian populations. The two studies that have explored this association among American preschool age children have some key methodological limitations that may limit the validity of their findings. First, both McCullough
and colleagues (2017) and Rollins and colleagues (2014) included children across the preschool age years (2 – 5 years), which is a life stage when there are considerable variations in development that could have influenced comprehension of the study protocols. Second, the protocol used by McCullough and colleagues (2017) delayed gratification, a potential confounder (Lattal, 2010), by providing reinforcers as a lump sum at the end of the task, as opposed to providing reinforcers immediately after they were earned. Our study aimed to address these limitations by using a progressive fixed ratio schedule protocol, wherein reinforcement is provided immediately, among a sample of 3 year-old children in Canada.

The objectives for this study were twofold: first, to examine the associations between the RRVF with weight status and %FM among 3 year-old children in South-Western Ontario, Canada; and second, to examine whether food parenting practices shown to be associated with increased obesity risk in children, i.e., Food as Reward, Food to Regulate Emotion, Restriction for Health, and Restriction for Weight (Ventura & Birch, 2008; Stifter & Moding, 2018), moderate the associations examined in Objective 1. We hypothesized that children who find food more reinforcing compared to a non-food alternative will have higher BMI z-score and %FM as compared to those who are more strongly reinforced by a non-food alternative. Further, we hypothesized that the associations between RRVF and each outcome variable (BMI z-score and %FM) will be stronger for children whose parents scored higher for Food as Reward, Food to Regulate Emotion, Restriction for Health, and Restriction for Weight.

5.3 Materials and Methods

5.3.1 Participants

Families with children aged 3 years old (36-47 months) were invited to participate in this study through Facebook advertisements, posted flyers, and emails. All families were recruited
from Guelph, Ontario. Exclusion criteria included food allergies to ingredients in study foods, diagnosed developmental disability, diagnosed with a condition that could impact food intake (e.g., Celiac Disease), and taking medication that could impact appetite, taste or olfactory senses (e.g., corticosteroids, antibiotics). There were no inclusion or exclusion criteria based on weight.

A total of 57 families expressed interest in this study: 5 children were not eligible due to allergies; 4 were outside of the age range; 6 families did not answer follow-up emails; 8 families were too busy to accommodate study visits; and 1 family completed the first study visit, but was not able to continue to the second. Therefore, the analytic sample included 33 children.

5.3.2 Procedure

This study consisted of two, 1-hour sessions, no more than 7 days apart. For both study visits, parents were asked to feed their child as usual with a snack 2 hours before the visit, but to refrain from providing their child with food or fluids other than water 1 hour before their visit. Parents provided a diet recall before children began the study tasks to ensure children had followed these instructions. Parents were not allowed in the room during the study tasks to avoid parental influence on children’s behaviour.

At the first study visit (visit 1), children completed a liking assessment of study foods and completed a practice round of the FRR task, which was delivered in a sequential fixed ratio reward schedule (i.e., each reinforcer, food or audiobook, was offered in a separate task). The order of the reinforcers at visit 1 was randomized. At the second study visit (visit 2), children were asked to complete the FRR task again, with the order of the reinforcer counterbalanced from the initial visit. At the end of visit 2 trained research staff measured children’s weight, height, and body composition using bioelectrical impedance assessment (BIA).
Families were provided a $50 grocery store gift card as a thank you for participating. The University of Guelph Research Ethics Board approved the procedures for this study (REB#17-07-005).

**Liking Assessment:**

Children were presented 5 study foods, one at a time (Great Value Honey Teddy Grahams™, Oreos™, Chips Ahoy Soft Chocolate Chunk Cookies™, Great Value Chocolate Striped Shortbread Cookies™, and Great Value Animal Cookies™) and asked to rate each food as “yummy”, “just okay”, or “yucky” using a picture with three faces to represent each category. Children were then asked to select their favourite food, which would be used in the FRR task. Children were also presented with the cover of two books (Paper Bag Princess (Munsch, 1980) and Mortimer (Munsch, 1983)) and asked which book they would like to listen to.

**5.3.3 Measures**

**FRR task:**

Children were presented with one reinforcer at a time in a sequential progressive ratio reward schedule (i.e., 1, 4, 8, 12, etc.). Food reinforcers were 1.8 g (±0.3g) portions, and the non-food reinforcer was 10 seconds of an audiobook. Children were provided with the reinforcer immediately after completing a schedule. Study room set-up followed the protocol by Kong, Eiden, and colleagues (2016). Appropriate encouragement phrases during the task included “that’s right, you press the button for more cookies/to hear more of the story”, “good job”. When the child was finished with the task, they were asked if they were finished and confirmed with questions such as “are you all done?” or “you do not want to keep reading the story/eating snacks?”
The food and audiobook tasks were limited to a maximum of 25 schedules for each reinforcer. The RRVF was defined as the FRR, as described by Kong and colleagues (2015), which is the maximum schedule achieved (Food\textsubscript{Pmax}) in proportion to the maximum schedules reached for both food and audiobook (Book\textsubscript{Pmax}) (FRR = \frac{\text{Food}_{\text{Pmax}}}{\text{Food}_{\text{Pmax}} + \text{Book}_{\text{Pmax}}}).

**BMI z-score:**

Weight in kilograms (kg) was measured using a calibrated digital scale, height was measured in metres (m) and centimetres (cm) using a stadiometer, and BMI z-scores were calculated using the WHO Anthro program for preschool age children. Children’s height was measured as the average of two measurements with a portable stadiometer, and weight was measured once with a calibrated digital scale. Children were asked to remove their shoes before both of these measurements. BMI z-scores were classified as per WHO guidelines, (WHO, 2008). The intra- and inter-rater reliability coefficients of variation (CV) for each of height was 0.12% and 0.14%, respectively, and weight was 0.01% and 0.24%, respectively.

**Percent Fat Mass:**

Percent FM was measured using a tetrapolar supine single frequency (50kHz) BIA device. All children were provided the opportunity to use the restroom before measurement. Measurement was then taken with children lying down on a bed with legs and arms abducted 30 degrees from midline, with any metal jewellery or clothing removed. Resistance (ohms, Ω) from this measurement was used to calculate total body water (TBW), fat mass (FM), fat free mass (FFM), in kg and as a percent of body weight. The Kushner equation (Kushner, Schoeller, Fjeld & Danford, 1992) was used to calculate TBW using weight (in kg), height (in cm) and resistance (in ohms). The Fomon total body water (TBW) constants (Fomon, Haschke, Ziegler & Nelson, 1982) were used to calculate FFM. TBW was divided by the TBW constant to obtain FFM,
which is then calculated as a proportion of total weight to obtain %FM. The %FM was investigated as a continuous outcome variable in data analysis. The intra- and inter-rater reliability CV for BIA Resistance was 0.15% and 1.5%, respectively.

**Food Parenting Practices:**

Food parenting practices were measured using the Comprehensive Feeding Practices Questionnaire (CFPQ) (Musher-Eizenman & Holub, 2007), a validated self-reported tool used to assess parental feeding practices for children from 18 months to 8 years of age. The subscales Food to Regulate Child Emotions (3 items), using Food as Reward (3 items), Restriction for Health (4 items), and Restriction for Weight control (8 items), were investigated as potential moderators. All items were presented on a 4-point Likert scale (Cronbach’s alpha for the CFPQ using this scale was 0.82 for our Study): responses were coded as a numerical value from 1 to 4 (1 = strongly disagree, 4 = strongly agree), totaled and averaged to generate a score for each of the food parenting practices of interest. A higher score reflects a higher level of engaging in the specific parenting practice. Scores were categorized as low if the average score was at or below the midpoint of the scale range (e.g., Low Restriction for Health = 2.5 or lower), and high if the score was above the midpoint (Loth, MacLehose, Larson, Berge, & Neumark-Sztainer, 2016).

**5.3.4 Data Analysis**

Linear regression was used to examine the association between FRR and the continuous outcomes, BMI z-score and %FM. Household income was investigated as a covariate; however, effect estimates did not change substantively when included in the model and therefore it was not included in the final adjusted model. Sex and age were not included in the model as covariates given that the BMI z-score and %FM calculations already account for these variables.
To examine whether food parenting practices (Food as Reward, Food as Emotion Regulation, Restriction for Health, and Restriction for Weight) moderated the association between FRR and the outcome variables, interaction terms (FRR x potential moderating factor) were included in the models. If evidence of moderation was found (i.e., interaction term was significant), analyses were stratified by low and high scores on the food parenting practice subscale. Statistical Analysis Software (SAS), University Edition was used for all analyses. P value ≤ 0.05 was considered significant.

5.4 Results

5.4.1 Descriptive Data

The sample included 19 (57.6%) boys and 14 (42.4%) girls (Table 3). The sample of children and parents was predominantly white (90.9%) with a small proportion being mixed (9.1%). The participating parents were all mothers, with the majority being highly educated (60.6% having a university education or higher) and reporting high household incomes (60.6% were $100 000 or higher).

Children were more motivated to earn the food reinforcer compared to the audiobook reinforcer, with an overall average FRR = 0.61, average FoodPmax = 9.91, and average BookPmax = 6.82. The average BMI z-score for children in this study was 0.41, and the average %FM was 33.41%. The mean BMI z-score and %FM were higher for children whose FRR was above 0.5 as compared to those with an FRR below 0.5, with p = 0.01 and p = 0.09, respectively (see Table 4.).

5.4.2 Linear Regression Analysis for FRR and Outcome Variables (BMI z-score and %FM)

FRR was positively associated with BMI z-score ($\beta = 1.48$, CI = 0.29, 2.66, p = 0.04). No significant association was found between FoodPmax and BMI z-score ($\beta = 0.02$, CI = -0.04,
0.07, \( p = 0.57 \)). Book_{Pmax} was negatively associated with BMI z-score \( (\beta = -0.05, CI = -0.11, -0.00, p = 0.05) \). No significant association was found between FRR and %FM \( (\beta = 1.76, CI = -3.80, 7.32, p = 0.52) \). Neither Food_{Pmax} \( (\beta = -0.05, CI = -0.30, 0.20, p = 0.68) \) nor Book_{Pmax} \( (\beta = -0.09, CI = -0.34, 0.15, p = 0.43) \) were associated with %FM. See Table 5 for linear regression results.

### 5.4.3 Potential Moderators of FRR on BMI z-scores and %FM by Food Parenting Practices

Results from the interaction models suggested that the food parenting practice Restriction for Health may moderate the association between FRR and BMI z-score \( (p \leq 0.05) \). Thus, we stratified analyses by high and low Restriction for Health. Among children whose parents reported high Restriction for Health, FRR was positively associated with BMI z-score \( (\beta = 1.90, CI = 0.43, 3.37, p = 0.01) \), whereas no significant association was found between FRR and BMI z-score among children whose parents reported low Restriction for Health \( (\beta = 0.77, CI = -1.54, 3.08, p = 0.48) \).

None of the other food parenting practices explored, Food as Reward \( (p = 0.63) \), Food to Regulate Child’s Emotions \( (p = 0.35) \), and Restriction for Weight \( (p = 0.61) \) moderated the association between FRR and BMI z-scores. Similarly, there was no evidence for moderation for any food parenting practice in the FRR and %FM model.

### 5.5 Discussion

The purpose of this study was to investigate the association between the RRVF and BMI z-score and %FM, and to determine whether these associations were moderated by food parenting practices. Among this sample of 3 year-old children, FRR was positively associated with BMI z-score, but not %FM. The food parenting practice of Restriction for Health moderated the association between FRR and BMI z-score; among children whose parents reported high
Restriction for Health FRR was positively associated with BMI z-score, whereas no association was found among children whose parents reported low Restriction for Health.

Our study builds on previous FRR research with preschoolers by strengthening the methods implemented by McCullough and colleagues (2017) and Rollins and colleagues (2014). Specifically, our study examined this association using a narrow age range, which eliminated the concern of variations in development across the preschool years of 2-5 years. We also used a sequential PFR ratio reward schedule to refrain from introducing delayed gratification. Lastly, we also examined variables that have been otherwise absent in the literature, i.e., %FM as an outcome variable and food parenting practices as potential moderators. Findings from this study provide further support for the role of RRVF in the obesity puzzle and highlight the importance of including food parenting practices as a moderator of preschool age children’s food behaviours.

Our finding that FRR was positively associated with BMI z-scores is consistent with previous research with preschoolers (McCullough et al., 2017; Rollins et al., 2014) and throughout multiple age groups (Kong, Eiden et al., 2016; Epstein et al., 2015; Temple et al., 2008). Similar to Kong, Eiden and colleagues (2016) who examined this association in infants, our non-food reinforcer, and not the food reinforcer was associated with higher BMI z-scores. These findings indicate that children in our study had varying degrees of motivation to work for the non-food reinforcer, and that the difference in the RRVF lies in children’s motivation to work for the non-food reinforcer compared to the food reinforcer (Hill et al., 2009; Kong et al., 2015; Kong, Anzman-Frasca, et al., 2016; Kong, Eiden et al., 2016; Temple et al., 2008).

While children with an FRR above 0.5 presented with a slightly higher %FM compared to those with an FRR below 0.5, this difference was not significant and the relationship between FRR and %FM was non-significant. Although %FM has not been reported in other studies...
exploring FRR, Hill and colleagues (2009) determined that the RRVF was a predictor of long-term adipose deposition using a fat mass index (fat mass, measured via foot-to-foot BIA, divided by height in metres squared) among school-age children. It is possible that our non-significant findings for %FM may have arisen for several reasons: our small sample size could have resulted in type 2 error; the effect estimate for the association between RRVF and children’s %FM was larger than that for BMI z-scores, however the confidence interval was wider suggesting that the small sample size may explain the lack of significant associations found for %FM. In addition, our sample was comprised of 3 year-olds, which is the age when adiposity rebound (the rise in BMI after infancy) occurs among many children between 3 and 7 years of age; our cross-sectional design does not allow us to account for adiposity rebound and therefore occurrence of adiposity rebound may have confounded our results (Cole, 2004). Nevertheless, it is important to include body composition estimates in conjunction with BMI z-scores, even among this age group, to ascertain a more accurate assessment of %FM and a more detailed picture of disease risk (Freedman et al., 2005; Must & Anderson, 2006). More research is needed with larger and more diverse samples to determine whether RRVF is a significant predictor of %FM among young children.

Our finding that Restriction for Health moderated the association between FRR and BMI z-scores is consistent with previous research that suggests that restrictive food parenting practices may increase a child’s preference for that food (Birch, 1981; Birch et al., 1980; Lu et al., 2015; Ventura & Birch, 2008). The Restriction for Health subscale asks parents whether they restrict “junk foods” and “sweets”; thus, our results suggests that the food parenting practices Restriction for Health may increase the RRVF of the food items that are restricted. Future
research should continue to investigate Restriction for Health as a moderator in this relationship given our promising preliminary findings.

There was no evidence for moderation by the remaining three food parenting practices explored. Interestingly, we found that while Restriction for Health did moderate the association between FFR and BMI z-score, Restriction for Weight did not. Restriction for Weight was endorsed less frequently by parents, which may explain the lack of moderating effect by Restriction for Weight. Food as Reward is a food parenting practice that has been strongly linked to high reinforcing values of food (Birch & Fisher, 1998), however our study did not observe any significant moderation from this variable, which may have been due to our small sample size.

The large number of studies that have found an association between food parenting practices and children’s eating behaviours (Faith et al., 2004; Lu et al., 2015; Ventura & Birch, 2008), underscore the need for additional research with larger and more diverse populations to elucidate the role of food parenting practices on the RRVF.

5.5.1 Limitations

Several limitations should be considered when interpreting the results of this study. It is likely that the small sample size could have contributed to the lack of significant findings by limiting the power to detect significant results (Kjøl Ersbøll & Kjøl Ersbøll, 2003). This sample was also composed of mainly white, highly educated, high-income families, which limits the generalizability of findings. The absence of preload before the FRR task may have limited the standardization of feeding across participants. While preloads have not been used in studies among infants and preschoolers (McCullough et al., 2017; Kong, Eiden et al., 2016; Rollins et al., 2014) due to concern of acceptance by the children, they have been for studies involving older children (Temple et al., 2008). Instead of preloads, parents in this study were instructed to
provide their child with something to eat 2 hours before their study visit, and to withhold food or
drink other than water for 1 hour before their visit; same-day recalls were administered before
visits began to ensure that parents adhered to this request. We investigated Time Since Last Meal
as a possible covariate, but it did not substantively influence our findings. However, future
RRVF studies should explore whether preloads are acceptable for use among preschool age
children as a method to standardize dietary intake of participants. Lastly, this was a cross
sectional study, therefore we are unable to determine the direction of the observed associations.

5.5.2 Summary and Conclusions
To our knowledge, the methods utilized for this study represent the most age appropriate
in the literature to date for preschool age children. Results from this study support the growing
evidence for the positive association between the RRVF and body weight. The novel
examination of how this association is moderated by food parenting practices revealed that
Restriction for Health is an important moderator to consider when exploring this RRVF-weight
relationship. Future research should investigate more discrete age groups among young children
to account for variations in developmental stages. Despite the lack of significant findings for
%FM and the food parenting practices of Food as Reward, Food to Regulate Emotion, and
Restriction for Weight, future research should continue to investigate these variables given their
known associations with disease risk and eating behaviours, respectively. Larger sample sizes
and more sensitive body composition methods (e.g. BOD POD™) would also strengthen the
research in these fields. Our study will help to inform future obesity prevention interventions as
well clinical care to promote healthful weight gain in children. Specifically, our results suggest
that non-food reinforcers should be used to promote desired behaviour from children, as opposed
to rewarding behaviour with unhealthy foods.
5.8 References


**INTRODUCTION**


5.9 Tables

Table 3. Summary of Participant Demographics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>19 (57.57)</td>
</tr>
<tr>
<td>Female</td>
<td>14 (42.42)</td>
</tr>
<tr>
<td>Age, months, mean (SD)</td>
<td>41 (3.52)</td>
</tr>
<tr>
<td>Parent Education</td>
<td></td>
</tr>
<tr>
<td>High school graduate, Some college or technical school, Some university</td>
<td>5 (15.15)</td>
</tr>
<tr>
<td>College graduate</td>
<td>8 (24.24)</td>
</tr>
<tr>
<td>University graduate</td>
<td>9 (27.27)</td>
</tr>
<tr>
<td>Postgraduate training or degree</td>
<td>11 (33.33)</td>
</tr>
<tr>
<td>Household Total Income</td>
<td></td>
</tr>
<tr>
<td>Less than $100, 000</td>
<td>8 (24.24)</td>
</tr>
<tr>
<td>$100,000 to $149,999</td>
<td>16 (48.48)</td>
</tr>
<tr>
<td>$150,000 or more</td>
<td>4 (12.12)</td>
</tr>
<tr>
<td>No response</td>
<td>5 (15.15)</td>
</tr>
</tbody>
</table>

Table 4. Summary of Participant Characteristics by FRR* †

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>FRR ≥ 0.5 (N=24, 72.7%)</th>
<th>FRR &lt; 0.5 (N=9, 27.3%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td>Mean (SD)</td>
</tr>
</tbody>
</table>

42
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>BMI z-score</th>
<th>%FM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food as Reward</td>
<td>2.33 (0.84)</td>
<td>2.11 (0.82)</td>
</tr>
<tr>
<td>Food to Regulate Emotion</td>
<td>1.69 (0.55)</td>
<td>1.44 (0.47)</td>
</tr>
<tr>
<td>Restriction for Health</td>
<td>2.94 (0.88)</td>
<td>2.86 (0.95)</td>
</tr>
<tr>
<td>Restriction for Weight</td>
<td>1.69 (0.51)</td>
<td>1.61 (0.42)</td>
</tr>
</tbody>
</table>

*Significant differences are shown in bold

† If the FRR > 0.5, this means that more work was performed to receive the food reinforcer

Table 5. Linear Regression Results of FRR Task *

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>BMI z-score</th>
<th>%FM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Pmax</td>
<td>0.02 (-0.04, 0.07)</td>
<td>-0.05 (-0.30, 0.20)</td>
</tr>
<tr>
<td>Book Pmax</td>
<td>-0.05 (-0.11, -0.00)</td>
<td>-0.09 (-0.34, 0.15)</td>
</tr>
<tr>
<td>FRR</td>
<td><strong>1.49 (0.24, 2.75)</strong></td>
<td>1.76, (-3.80, 7.32)</td>
</tr>
</tbody>
</table>

* Significant associations are shown in bold
**6.0 Summary and Conclusions**

The trajectory of the childhood obesity epidemic is cause for concern. The estimated 41 million overweight and obese children under 5 years of age in 2016 is projected to rise to 70 million by 2025 (WHO, 2017). The RRVF has been shown to be associated with higher weight status among individuals across the life span (Kong, Eiden, et al., 2016; McCullough et al., 2017; Epstein et al., 2015). Despite the growing evidence supporting the association between RRVF and weight among American children, there are very few studies among young children (McCullough et al., 2017; Rollins et al., 2014), and none within the Canadian context.

Previous research by McCullough and colleagues (2017) and Rollins and colleagues (2014) examined the association between RRVF and BMI among preschool age children, which provided a foundation on which to build our study. These two studies that have explored this association among American preschool age children have some key methodological limitations that may limit the validity of their findings. First, both McCullough and colleagues (2017) and Rollins and colleagues (2014) included children across the preschool age years (2 – 5 years), which is a life stage during which there are considerable variations in development that could have influenced comprehension of the study protocols. Second, the protocol used by McCullough and colleagues (2017) introduced delayed gratification, a potential confounder (Lattal, 2010), by providing reinforcers as a lump sum at the end of the task, as opposed to providing reinforcers immediately after they were earned. Our study aimed to address these limitations by using a progressive fixed ratio schedule protocol, wherein reinforcement is provided immediately, among a sample of 3 year-old children.

Young children are dependent on their parents for food, suggesting that parents’ food parenting practices may influence the association between RRVF and child weight. Thus, our
study also examined whether the association between RRVF and child weight outcomes were moderated by food parenting practices.

Results from this study support the growing evidence for the relationship between the RRVF and weight. As hypothesized, the RRVF was positively and significantly associated with BMI z-scores. These results suggest that interventions should focus on reducing the RRVF; one potential approach to do this would be to promote non-food reinforcers. For example, Kong, Eiden and colleagues (2016) delivered an enriched music intervention to 9-18 month old infants to investigate its effect on the RRVF. The intervention consisted of a weekly 45 minute music program for 6 weeks, wherein parents attended with infants to play with and enjoy musical instruments or CDs together; this is contrasted to the control group, which also met weekly for 6 weeks and engaged in active play with no musical toys. Researchers found that children in the 6-week music intervention had a significant decrease in their RRVF when compared to control group (p=0.002). It would be interesting to observe whether a similar intervention among 3 year-old children could reduce RRVF among preschoolers and whether such an intervention could also reduce children’s obesity risk.

Contrary to our hypothesis, the RRVF and %FM was not significantly associated. However, the importance of including body composition measures in this type of research should not be discounted. It is possible that the %FM of our particular sample was not varied enough to detect an association. An observational study by Hill and colleagues (2009) found that the RRVF significantly predicted changes in adipose tissue after 1 year from baseline measurements in a sample of 7-10 year olds (B=0.09, p = 0.001). This supports the importance of continuing to investigate FM as a part of future RRVF studies. In future research it may be pertinent to use a blocked recruitment to ensure the enrollment of children from a variety of weight classifications.
Our results show that the food parenting practice of Restriction for Health moderated the association between RRVF and BMI z-scores. Specifically, children whose parents scored high for this practice had a significantly higher FRR compared to children whose parents scored low on Restriction for Health. Questions on the Restriction for Health subscale specifically asked about the restriction of “junk food” and “sweets”; given that our study foods fall in these categories the higher FRR is likely reflected, in part, by a restriction of these foods at home. When certain foods are restricted, it increases the reinforcing value of that food; when given the opportunity, these foods can be consumed in excess (Ventura & Birch, 2008; Lu et al., 2015). This is the first study to examine the moderating effects of food parenting practices, and more research is needed to determine the direction of this relationship and how the food parenting practice of Restriction for Health impacts eating behaviours in later years.

Although the other food parenting practices of Food as Reward, Food to Regulate Emotion and Restriction for Weight were not found to moderate the association between RRVF and BMI z-score, it would be important to investigate further the influence of these parenting practices with a larger and potentially more diverse sample. Our results suggest that children whose parents scored higher for each of these practices had a higher FRR as compared to children whose parents scored low on these practices. This suggests that there may be a moderating effect that we may not have been able to detect due to our relatively small sample size.

It would also be interesting for future research to investigate the moderating role of child temperament on the relationship between the RRVF and weight and body composition. Kong, Anzman-Frasca and colleagues (2016) were the first to investigate the role of temperament on
the FRR among 105 infants and found that rate of recovery from distress or excitement and cuddliness (being comforted by being held) were significantly negatively correlated with FRR ($\rho=-.211, p=.031$ and $\rho=-.272, p=.0005$, respectively) (Kong, Anzman-Frasca, et al., 2016). In addition to this, child temperament has been found to be associated with maternal feeding practices (McMeekin et al., 2013); therefore, it is possible that parents are more likely to use food to soothe their child in times of emotional distress and that this influences the FRR (Kong, Anzman-Frasca, et al., 2016). One study found that children who had frequent temper tantrums over food and were not able to regulate were 3 times more likely to become overweight by 9.5 years of age (Agras, Hammer, McNicholas, & Kraemer, 2004). Thus, it is possible that food parenting practices are influenced by child temperament, which in turn has the potential to influence the RRVF.

Our study used Time Since Last Meal/Snack to help standardize children’s level of satiety/hunger. This was done because the conventional hunger assessment (i.e., Peter Peter Pumpkin Eater) used in previous research (McCullough et al., 2017; Rollins et al., 2014) did not seem to yield rational data in our sample. For this measurement, children would be read a story about Peter Peter Pumpkin Eater and asked to follow along and identify pictures of an empty, half-full, and full stomach; after this exercise, children would be asked what their level of hunger was by having them point to the pictures used in the story. We pilot tested this protocol among six children and this method was not well received by our sample; children either did not want to hear the story or did not demonstrate an understanding of the story or hunger ratings, e.g., children rated themselves higher on the hunger scale after the completion of the RRF task. Thus, in our study we decided to present the pictures in the same way children were asked to rate their liking of the study foods; where children were asked to rate their level of hunger before and after
the RRF task. This method also resulted in the same scattered ratings as we saw in using the story. The limitation of using time since last meal as a method of hunger assessment is that the size and satiety of the child at the time of last meal is not standardized. We considered using a preload, e.g., a standard serving of yogurt, as a solution to this, however, we again would not be able to standardize a child’s intake of this item as some children may refuse to eat the preload. Future research would benefit from determining a more reliable method of measuring hunger and standardizing intake in young children.

Future research could benefit from investigating alternate non-food reinforcers to capture the reinforcing value of a variety of non-food reinforcers. We found that some children in our study who were not motivated to work for the book were often highly interested in playing with the toys that were in the observation room. It is possible that this interest in playing with toys was due to the fact that children did not have to work for the toys, and knew that work was required for the book (Epstein, Leddy, et al., 2007). Alternatively, this could be a function of the type of non-food reinforcer offered; it is possible that a different non-food reinforcer, such as playing music, could have been more appealing to children. It would be interesting to investigate this relationship with different non-food reinforcer options. That being said, tangible non-food reinforcers, such as toys, would likely cause distress once removed and would not be ideal in a research setting.

Our study was comprised of predominantly white (90.9%), high-income families (60.6% earned over $100 000 per year), and future research would benefit from recruiting from a more diverse sample of individuals to better represent the Canadian demographic. It would also be interesting to explore whether the association between RRVF and child weight outcomes may differ by socio-economic status or parents’ education level.
Future research on the RRVF would benefit from studying other individual age groups among the preschool years, i.e., 2 years, in addition to including other more sensitive body composition measurements, i.e., BOD POD™, among larger and more diverse samples. It would also be interesting to investigate how an intervention similar to Kong, Eiden and colleagues (2016), as described previously, would impact the RRVF among preschool age children.

In summation, our study methods represent the most age appropriate in the literature to date. Our results support the growing evidence for the positive association between the RRVF and body weight. The novel examination of how this association is moderated by food parenting practices revealed that Restriction for Health is an important moderator to consider when exploring this RRVF-weight relationship. Future research can build on these findings to further elucidate the potential role of RRVF on obesity risk among young children.
7.0 References


Bioelectrical Impedance Analysis in Body Composition Measurement. NIH Technol Assess Statement 1994 Dec 12–14; 1–35.


8.0 Appendices

Appendix A – CHAMPS Study Recruitment Poster

Be a Champ!

Children between 36-42 months (3 years old) are invited to participate in the C.H.A.M.P.S. Study.

We need your help!
Our study is looking at how kids make choices with food and how this impacts their eating behaviours and health.

You will receive a $50 gift card for participating!

How can you help?
You and your child will join us for two study visits. The study visits will be at the University of Guelph and will take 1 hour each. There will be a handful of tasks to see how your child makes food choices when offered different foods.

Total time commitment: 2 hours

Want to participate?
Contact me through email for more information:

Samantha Wong, RO
MSc Candidate
swong10@uoguelph.ca
University of Guelph

THE C.H.A.M.P.S. STUDY
Choice and Motivation in Preschool Snacking

UNIVERSITY OF GUELPH
Appendix B- CHAMPS Study Screening Survey

Thank you for your interest in the CHAMPS Study! The purpose of filling out this survey is so that the research team can make sure that your child can participate in this study safely.

Do you have at least one child that is 3 years of age (36-47 months)?
☑ Yes (1)
☑ No (2)

We would like parents to be present for all parts of the study- are you able to participate in the study with your child?
☑ Yes (1)
☑ No (2)

Is your child able to follow instructions in English?
☑ Yes (1)
☑ No (2)
☑ Prefer not to answer (3)

Are you able to travel to the University of Guelph?
☑ Yes (1)
☑ No (2)
☑ Prefer not to answer (3)

Does your child have any diagnoses that impact their eating, appetite, or hunger? (e.g. Celiac Disease, Inflammatory Bowel Disease, Diabetes, Heart Condition)
☑ Yes (1)
☑ No (2)
☑ Prefer not to answer (3)

If your child currently taking any medications that impact their eating, appetite, or hunger? (e.g. antibiotics, corticosteroids, Ritalin, Adderall)
☑ Yes (1)
☑ No (2)
☑ Prefer not to answer (3)

Does your child have any food allergies or intolerances to dairy, soy, nuts, wheat (oreos, animal crackers, chocolate chip cookies, honey teddy grahams, fudge striped cookies)?
☑ Yes (1)
☑ No (2)
☑ Prefer not to answer (3)
Does your child have a condition that prevents them from understanding and following instructions independently?
☑ Yes (1)
☑ No (2)
Prefer not to answer (3)
Appendix C- CHAMPS Study Consent Form

Consent Form: CHoice And Motivation in Preschooler Snacking (CHAMPS) study

Project Director: Dr. Jess Haines, PhD, RD. Department of Family Relations and Applied Nutrition, University of Guelph, 519-824-4120 ext. 53780

Research Assistant: Samantha Wong, RD (MSc Candidate) Department of Family Relations and Applied Nutrition, University of Guelph, swong10@uoguelph.ca

Researchers at the University of Guelph are interested in how young children select their food. Please read this form carefully as it tells you important information about the study and your rights and your child’s rights as a subject if you choose to participate. A member of the research team will also talk to you about the study and answer any questions you may have. You should not sign this form unless you understand what is written and have all of your questions answered.

What is the purpose of this study?

Our research team is interested in learning how young children select their food. We hope that by observing your child during a variety of tasks at the University of Guelph we can learn more about how to encourage healthy eating behaviours in young children.

Why am I being asked to participate?

You are also being asked to participate in this study because your child is 3 years of age.

How long will I take part in this research study?

In total, this study will take approximately 2 hours to complete. There are a total of 2 study visits, 1 hour each. You will be asked to visit the University of Guelph campus for both study visits.

What will happen in this study?

Day 1 (1 hour)

You and your child will be asked to come to the University of Guelph. We will ask you to not feed your child anything other than water for 2 hours before coming to this visit.

Your child will be asked to complete two tasks. For the first task, the research assistant will provide your child with a selection of 5 different foods – your child will try each of them and then choose their favourite food to use for the other task. If your child does not like any of the study foods, s/he will be unable to continue with this study.
For the second task, your child will be asked to click a computer mouse to gain access to either a small portion of the selected snack they choose in the first task or 10 seconds of an audio book by Robert Munsch. Your child will be asked to do this task until s/he demonstrates that s/he understands that when s/he click the mouse s/he receive either the food or the audio book and/or does not wish to continue with this task. If your child does not engage in the task, s/he will not be able to continue with the study.

In a separate room, you will be given a survey to complete online while your child completes these tasks. The survey will ask you questions about your child’s eating behaviours, your parenting related to your child’s eating, and demographic (income, ethnicity) information.

**Day 2 (1 hour)**

You and your child will be asked to come to the University of Guelph. We will ask you to not feed your child anything other than water for 2 hours before coming to this visit. A research assistant will take physical measurements for your child to determine their weight, height, and their level of muscle and fat. You will be asked to remain in the room for this part of the study.

Next, your child will complete the same task as they did on day 1 – they will click the computer mouse to earn snacks and then again to earn sections of the audiobook. You will be asked to wait outside of the room while your child completes this task. Your child will do this task until s/he no longer wants to do the task.

**What are the possible risks and discomforts of taking part in this study?**

You will be asked to complete a survey that asks about what your child eats, your parenting related to your child’s eating and your demographic information. Some of the questions asked on the survey may make you uncomfortable. You can choose not to answer any questions that make you feel uncomfortable.

A research assistant will also be taking your child’s physical measurements (weight, height, muscle, and body fat). To measure muscle and body fat, an untraceable electric current will be used. This is not painful, and only poses a risk to individuals with pacemakers. These tests may make you or your child feel uncomfortable. You or your child may choose not to have these physical measurements taken.

We are unable to guarantee an allergy free environment or allergy free study foods. Please note the brand names and ingredient list for study foods listed below. All study foods will be cut into 5g portions to reduce the risk of choking.

Honey Graham Bear Cookies (Great Value): Enriched wheat flour, graham flour, palm and canola oil and modified palm oil, sugar, brown sugar, honey, glucose, dextrose, salt, natural and artificial flavours, sodium bicarbonate, ammonium bicarbonate, soy lecithin. Contains: what, soy. May contain: eggs, milk.
Fudge Striped Shortbread Cookie (Great Value): Enriched wheat flour, sugar/glucose-fructose, modified palm oil, palm kernel and palm oil water, cocoa, corn starch, salt, baking soda, soy lecithin, artificial flavour, ammonium bicarbonate, salt type compound (salt, glycerine). Contains: soy, wheat. May contain: peanuts, tree nuts, milk, eggs.

The Original Oreo (Christie): Wheat flour, sugar, modified palm oil, vegetable oil, cocoa, glucose-fructose, soy lecithin, corn starch, salt, baking soda, ammonium bicarbonate, artificial flavour. Contains: Wheat, soy.

Chips Ahoy Soft Chunky Original (Christie): Chocolate chunks (sugar, unsweetened Chocolate, dextrose, cocoa butter, milk ingredients, soy lecithin, artificial flavour), wheat flour, shortening (vegetable, modified palm), golden sugar and/or sugar, whole grain wheat flour, coconut (with sulphites), fancy molasses, glucose-fructose, baking soda, modified milk ingredients, salt, ammonium bicarbonate, ammonium phosphate, soy lecithin, artificial flavour, caramel colour. Contains: milk, soy, wheat, sulphites.

Animal Cookies (Great Value): enriched wheat flour, sugar, palm and canola oil and modified palm oil, glucose-fructose, salt, sodium bicarbonate, ammonium bicarbonate, monocalcium phosphate.

There is a small risk that someone other than research staff will see your information. Federal law requires us to protect the privacy of health information that identifies you. To protect your privacy, your completed surveys and your child’s observation notes will only have code numbers on them instead of your names. The survey data will be kept on an encrypted password protected laptop that is housed in a locked research lab at the University. Only members of the research team will have access to the data. Please note that confidentiality cannot be guaranteed while data are in transit over the Internet. A master list with participant names and codes will be kept separate from recorded data in a locked cabinet in a research office. All paper and electronic data will be stored for 7 years.

You do not waive any legal rights by agreeing to participate in this study.

Federal or Provincial law may require the study team to give information to government agencies, for example, to prevent harm to you or others, or for public health reasons. If you tell us or we learn something from the observations that makes us believe that your child or others have been or may be physically harmed, we may be required to report that information to the appropriate agencies.

What are the benefits of participating in this study?

There are no direct benefits to participating in this study. Information we learn from this study may help us to identify how to help children develop healthful eating behaviours.

Upon completion of project, you will have the ability to receive a summary of the findings of the study. If you wish to receive a copy of the results please provide your email address:
What happens if I decide not to take part in this research study?

Your participation in this study is completely voluntary. If you decide not to participate in this study, it will not affect any current or future relations you or your child may have with the University of Guelph.

Do I have the right to withdraw from the study?

If you agree to participate in this study, you are free to withdraw at any time. The decision to withdraw will not affect any current or future relations you or your child may have with the University of Guelph. You may also choose to remove your data from the study so we cannot use any of your data in our analyses. You can withdraw your data from this study up to 2 months after participating. You may do this by writing to the Principal Investigator, Jess Haines, at The Department of Family Relations and Applied Nutrition, Room 226, Macdonald Stewart Hall, University of Guelph, 50 Stone Road East, Guelph, ON N1G 2W1 or by calling her directly at 519-824-4120 ext. 53780.

Will I be paid to be in this research study?

If you decide to participate in this study, you will receive a prorated $50 dollar grocery store gift card at the end of your second study visit. If you are unable to complete the second study visit, a $25 gift card will be mailed to you.

Will it cost me anything to participate in this study?

There will be no cost to you or your family to participate in this study.

If I have questions or problems, whom should I contact?

The project director for this study is Jess Haines, PhD, RD, in the Department of Family Relations and Applied Nutrition at the University of Guelph. If you have any questions, please feel free to contact her now, or at any time during the study. Her phone number is (519) 824-4210 ext. 53780. You can also contact the project coordinator, Samantha Wong at (226)-820-6888 or at swong10@uoguelph.ca

This project has been approved by the Research Ethics Board for compliance with federal guidelines for research involving human participants. If you have questions regarding your rights and welfare as a research participant in this study (REB#17-07-005), please contact: Director, Research Ethics; University of Guelph; reb@uoguelph.ca; (519) 824-4120 (ext. 56606)

You can talk to her about:
• Your rights as a research participant
• Concerns about the research
• A complaint about the research
Any pressure you feel to take part or continue in the research study
I agree that I have read and understand what is required of my family if we participate, and understand the benefits and risks. I have had the opportunity to ask questions about the study and have received adequate answers. I am making an informed decision for myself and on behalf of my children to participate in this study, as listed below. Please provide us with the names of your children participating in this study:

If you understand the information we have given you, and would like to take part in this research study, then please sign below:

PLEASE SIGN HERE FOR YOUR PARTICIPATION IN THE STUDY:

Consent for ADULT Participation:

I wish to participate in this project.

Print name: _______________________________________

____________________________
Signature

____________________________
Date signed

Consent for Child Participation:

I wish to participate in this project.

Print name: ________________________________

____________________________
Parent Signature

____________________________
Date signed

REMOVE SHEET 6 FROM THE BACK OF CONSENT FORM & FILE IN PARTICIPANT FOLDER
Appendix D- CHAMPS Study Survey

Thank you for your interest in the CHAMPS Study! This study requires you to answer questions that will help us gain a better understanding of your child's health behaviours and your parenting practices. This questionnaire will take approximately 30 minutes.

How would you describe your ethnicity/race? Please select all that apply.
- White (1)
- Aboriginal/First Nations peoples (2)
- Chinese (3)
- Black (4)
- Korean or Japanese (5)
- Latin American (6)
- South Asian (for example: East Indian, Pakistani, Sri Lankan, etc.) (7)
- Southeast Asian (for example: Vietnamese, Cambodian, Filipino, Malaysian, Laotian, etc.) (8)
- West Asian (for example: Arab, Iranian, Afghan, etc.) (9)
- Other, please specify (10) ____________________
- I am not comfortable answering this question (11)

Please indicate your gender:
- Male (1)
- Female (2)
- I am not comfortable answering this question (3)

Please confirm how many children you have in total:
- 1 (2)
- 2 (3)
- 3 (4)
- 4 (5)
- 5 (6)
- I am not comfortable answering this question (7)

Please confirm how many children you have that are 3 years of age (36-42 months):
- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- I am not comfortable answering this question (6)
Which of the following best describes your current marital status?
- Married (1)
- Not married, but living with partner (2)
- Single, never been married (3)
- Divorced (4)
- Separated (5)
- Widowed (6)
- I am not comfortable answering this question (7)

What is the highest grade or degree you completed in school?
- 8th grade or less (1)
- Some high school (2)
- High School graduate (3)
- Some college or technical school (4)
- College graduate (5)
- Some university (6)
- University graduate (7)
- Postgraduate training or degree (8)
- I am not comfortable answering this question (10)

What is the total annual income of your household before taxes? Your household includes income from you and anyone who lives with you who depends on the same income. Be sure to include income from all sources, such as salary and wages, child support, interest, public assistance and pensions.
- Less than $10,000 (1)
- $10,000 to $19,999 (2)
- $20,000 to $29,999 (3)
- $30,000 to $39,999 (4)
- $40,000 to $49,999 (5)
- $50,000 to $59,999 (6)
- $60,000 to $69,999 (7)
- $70,000 to $79,999 (8)
- $80,000 to $89,999 (9)
- $90,000 to $99,999 (10)
- $100,000 to $149,999 (11)
- $150,000 or more (12)
- I don’t know (13)
- I am not comfortable answering this question (14)
In what country were you born?
- Canada (1)
- Other, please specify (2) ____________________
- I am not comfortable answering this question (3)

How long have you lived in Canada? Please state number of years:
- Less than 1 year (1)
- 1 to 5 years (2)
- 6 to 10 years (3)
- 11 to 15 years (4)
- 16 to 20 years (5)
- Greater than 20 years (6)
- I am not comfortable answering this question (7)

The term natural health product is used in Canada to describe dietary supplements such as vitamins and minerals, herbal medicines, homeopathic preparations, probiotics, and many alternative and traditional medicines. Do you or any of your family members currently use any natural health products?
- Yes (1)
- No (2)
- I am not comfortable answering this question (3)
If the term natural health product is used in Canada to describe dietary supplements such as vitamin... Yes is selected

Please provide the following information about the natural health products your family uses. Include only parents and children enrolled in the study. Example: John Doe, 1 capsule of 1000 IU Vitamin D daily, doctor's recommendation

<table>
<thead>
<tr>
<th>Family member (1)</th>
<th>Natural health product (1)</th>
<th>Reason for using this product (ex. general health or a specific health concern) (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product 1 (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 2 (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 3 (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 4 (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 5 (7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 6 (8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 7 (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 8 (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 9 (11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product 10 (12)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If how many children between the ages of 18 months and 5 years old do you have? 1 is selected

Or how many children between the ages of 18 months and 5 years old do you have? 2 is selected

Or how many children between the ages of 18 months and 5 years old do you have? 3 is selected

What is the first name of your child between the ages of 18 months and 5 years old?

First Name Only (2)
Please select the appropriate age for $q://QID897/ChoiceTextEntryValue/2$:
- 30months - 36months (1)
- 37months-42months (2)

How would you describe $q://QID897/ChoiceTextEntryValue/2$’s ethnicity/race? Please select all that apply.
- White (1)
- Aboriginal/First Nations peoples (2)
- Chinese (3)
- Black (4)
- Korean or Japanese (5)
- Latin American (6)
- South Asian (for example: East Indian, Pakistani, Sri Lankan, etc.) (7)
- Southeast Asian (for example: Vietnamese, Cambodian, Filipino, Malaysian, Laotian, etc.) (8)
- West Asian (for example: Arab, Iranian, Afghan, etc.) (9)
- Other, please specify (10) ___________________
- I am not comfortable answering this question (11)

How are you related to $q://QID897/ChoiceTextEntryValue/2$?
- Mother (1)
- Stepmother (2)
- Foster Mother (3)
- Father (4)
- Stepfather (5)
- Fosterfather (6)
- Grandmother (7)
- Grandfather (8)
- Other, please specify (9) ___________________
- I am not comfortable answering this question (10)
Next are questions about feeding $\{q://QID897/ChoiceTextEntryValue/2\}$. Please let us know how much you agree or disagree with the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Agree (4)</th>
<th>Strongly Agree (5)</th>
<th>I am not comfortable answering this question (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am firm about what ${q://QID897/ChoiceTextEntryValue/2}$ should eat.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am firm about when ${q://QID897/ChoiceTextEntryValue/2}$ should eat.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am firm about where ${q://QID897/ChoiceTextEntryValue/2}$ should eat.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am firm about how much ${q://QID897/ChoiceTextEntryValue/2}$ should eat.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I avoid going to cafes or restaurants which sell unhealthy food with ${q://QID897/ChoiceTextEntryValue/2}$.</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>I avoid buying sweets and snack foods, like cookies and chips, and bringing them into the house.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I do not buy foods that I would like because I don't want ${q://QID897/ChoiceTextEntryValue/2}$ to have them.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I try not to eat unhealthy food when ${q://QID897/ChoiceTextEntryValue/2}$ is around.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The following are questions about $\{q://QID897/ChoiceTextEntryValue/2\}$’s eating habits and behaviours. Please indicate how much you agree or disagree with each of these statements using the following options:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Neveř (1)</th>
<th>Rarely (2)</th>
<th>Sometimes (3)</th>
<th>Often (4)</th>
<th>Always (5)</th>
<th>I am not comfortable answering this question (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ loves food.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ eats when worried</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ has a big appetite.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ finishes his/her meal quickly.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ is interested in food.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ is always asking for a drink.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ refuses new foods at first.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ eats slowly.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ eats less when angry.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ enjoys tasting new foods.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ eats less when he or she is tired.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ is always asking for food.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ eats more when annoyed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If allowed to, ${q://QID897/ChoiceTextEntryValue/2}$ would eat too much.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If allowed to, ${q://QID897/ChoiceTextEntryValue/2}$ would eat too much.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>${q://QID897/ChoiceTextEntryValue/2}$ eats more when anxious.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statement</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ enjoys a wide variety of foods. (17)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ leaves food on his or her plate at the end of the meal. (19)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ takes more than 30 minutes to finish a meal. (20)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Given the choice, $(q://QID897/ChoiceTextEntryValue/2)$ would eat most of the time. (21)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ looks forward to mealtimes. (22)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ gets full before his or her meal is finished. (23)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ enjoys eating. (24)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ eats more when he or she is happy. (25)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ is difficult to please with meals. (26)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ eats less when upset. (27)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ gets full easily. (28)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ eats more when he or she has nothing else to do. (29)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Even if $(q://QID897/ChoiceTextEntryValue/2)$ is full, he or she finds room to eat favourite foods. (30)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>If given the chance, $(q://QID897/ChoiceTextEntryValue/2)$ would drink continuously throughout the day. (31)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ cannot eat a meal if he or she has had a snack just before. (32)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>If given the chance, $(q://QID897/ChoiceTextEntryValue/2)$ would always be having a drink. (33)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>is interested in tasting food he or she hasn’t tasted before. (34)</td>
<td></td>
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<td>---------------------------------------------------------------</td>
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<td></td>
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</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ decides that he or she doesn’t like a food, even without tasting it. (35)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>If given the chance, $(q://QID897/ChoiceTextEntryValue/2)$ would always have food in his/her mouth. (36)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ eats more and more slowly during the course of a meal. (37)</td>
<td></td>
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</tr>
</tbody>
</table>

<p>| | | | | | |</p>
<table>
<thead>
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<tbody>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Is $q://QID897/ChoiceTextEntryValue/2$ currently in childcare, day care or preschool?

- Yes (1)
- No (2)
- I am not comfortable answering this question (3)

If Yes Is Not Selected, Then Skip To As you read each description of the c...

What type of care does $q://QID897/ChoiceTextEntryValue/2$ receive?

- In a day care center or preschool (1)
- In out-of-home family daycare (2)
- In in-home care, for example with a babysitter, nanny or relative (3)
- I am not comfortable answering this question (4)

How many hours in an average week is $q://QID897/ChoiceTextEntryValue/2$ at childcare, day care or preschool.

- I am not comfortable answering this question (1)

Who provides food for $q://QID897/ChoiceTextEntryValue/2$ while your child is at childcare, day care, or preschool?

- I/we pack food for my child (1)
- The childcare, day care or preschool provides food for my child (2)
- I am not comfortable answering this question (3)
Please indicate how much you agree or disagree with each of these statements using the following options: **Strongly disagree** Disagree **Agree** **Strongly agree** I am not comfortable answering this question

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>I am not comfortable answering this question</th>
</tr>
</thead>
<tbody>
<tr>
<td>I keep track of the sweets (for example: candy, ice cream, cake, pies, pastries) that they eat. (1)</td>
<td>○</td>
<td>○</td>
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<tr>
<td>I keep track of the snack food (for example: potato chips, Doritos, cheese puffs) that they eat. (2)</td>
<td>○</td>
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<tr>
<td>I keep track of the high-fat foods that they eat. (3)</td>
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<tr>
<td>I keep track of the sugary drinks (for example: soda or pop, kool-aid) that they drink. (4)</td>
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<tr>
<td>I let them eat whatever they want. (5)</td>
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<td>At dinner, I let them choose the foods they want from what is served. (6)</td>
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<td>When they get fussy, giving them something to eat or drink is the first thing I do. (7)</td>
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<tr>
<td>I give them something to eat or drink if he or she is bored, even if I think they are not hungry. (8)</td>
<td>○</td>
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<tr>
<td>I give them something to eat or drink if he or she is upset, even if I think they are not hungry. (9)</td>
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<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ does not like what is being served, I make something else. (10)</td>
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<tr>
<td>I allow $(q://QID897/ChoiceTextEntryValue/2)$ to eat snacks whenever he or she wants (11)</td>
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<tr>
<td>I allow $(q://QID897/ChoiceTextEntryValue/2)$ to leave the table when he or she is full, even if my family is done eating. (12)</td>
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<tr>
<td>I encourage $(q://QID897/ChoiceTextEntryValue/2)$ to eat healthy foods before unhealthy ones. (13)</td>
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<tr>
<td>Most of the food I keep in the house is healthy. (14)</td>
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<tr>
<td>I involve $(q://QID897/ChoiceTextEntryValue/2)$ in planning family meals. (15)</td>
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<tr>
<td>I keep a lot of snack food (for example: potato chips, Doritos, cheese puffs) in my house. (16)</td>
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<tr>
<td>$(q://QID897/ChoiceTextEntryValue/2)$ should always eat all the food on his or her plate. (17)</td>
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<tr>
<td>I have to be sure that $(q://QID897/ChoiceTextEntryValue/2)$ does not eat too many high-fat foods. (18)</td>
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<tr>
<td>I offer $(q://QID897/ChoiceTextEntryValue/2)$ his or her favourite foods in exchange for good behaviour. (19)</td>
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<tr>
<td>I allow $(q://QID897/ChoiceTextEntryValue/2)$ to help prepare family meals. (20)</td>
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<tr>
<td>If I did not guide $(q://QID897/ChoiceTextEntryValue/2)$’s eating he or she would eat too much of his/her favourite foods. (21)</td>
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<tr>
<td>A variety of healthy foods are available to $(q://QID897/ChoiceTextEntryValue/2)$ at each meal served at home. (22)</td>
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<tr>
<td>I offer sweets (for example: candy, ice cream, cakes, pastries) to</td>
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<tr>
<td>Task</td>
<td>Outcome 1</td>
<td>Outcome 2</td>
<td>Outcome 3</td>
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<td>Outcome 5</td>
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</tr>
<tr>
<td>1. As a reward for good behaviour. (23)</td>
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<tr>
<td>2. I encourage to try new foods. (24)</td>
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<tr>
<td>3. I discuss why it's important to eat healthy foods. (25)</td>
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<tr>
<td>4. I tell that healthy food tastes good. (26)</td>
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<td>5. I encourage to eat less so he or she won't get fat. (27)</td>
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<tr>
<td>6. If I did not guide or regulate's eating, he or she would eat too many junk foods. (28)</td>
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<tr>
<td>7. I give small helpings at meals to control his or her weight. (29)</td>
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<tr>
<td>8. If says &quot;I'm not hungry&quot;, I try to get him/her to eat anyway. (30)</td>
<td>☒</td>
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<tr>
<td>9. I discuss the nutritional value of foods. (31)</td>
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<tr>
<td>10. I encourage to participate in grocery shopping. (32)</td>
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<tr>
<td>11. If eats more than usual at one meal, I try to restrict his or her eating at the next meal. (33)</td>
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<tr>
<td>12. I restrict the food that make his or her fat. (34)</td>
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<tr>
<td>13. There are certain foods shouldn't eat because they will make him or her fat. (35)</td>
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<td>☒</td>
</tr>
</tbody>
</table>
I withhold sweets or desserts from ${q://QID897/ChoiceTextEntryValue/2} in response to bad behaviour. (36)

I keep a lot of sweets (for example: candy, ice cream, cake, pies, pastries) in my house. (37)

I encourage ${q://QID897/ChoiceTextEntryValue/2} to eat a variety of foods. (38)

If ${q://QID897/ChoiceTextEntryValue/2} eats only a small helping, I try and get him or her to eat more. (39)

I have to be sure that ${q://QID897/ChoiceTextEntryValue/2} does not eat too much of his/her favourite foods. (40)

I don’t allow ${q://QID897/ChoiceTextEntryValue/2} to eat between meals because I don’t want him or her to get fat. (41)

I tell ${q://QID897/ChoiceTextEntryValue/2} what to eat and what to eat without explanation. (42)

I have to be sure that ${q://QID897/ChoiceTextEntryValue/2} does not eat too many sweets (for example: candy, ice cream, cake, or pastries). (43)

I model healthy eating for ${q://QID897/ChoiceTextEntryValue/2} by eating healthy foods myself. (44)

I often put ${q://QID897/ChoiceTextEntryValue/2} on a diet to control his/her weight (45)

I try to eat healthy foods in front of my child, even if they are not my favourite. (46)

I show enthusiasm about eating healthy foods. (47)

I show ${q://QID897/ChoiceTextEntryValue/2} how much I enjoy eating healthy foods. (48)
When ${q://QID897/ChoiceTextEntryValue/2}$ says he or she is finished, I try to get him or her to eat one or two more bites of food. (49)

I let ${q://QID897/ChoiceTextEntryValue/2}$ decide how much to eat:

- Always (1)
- Most of the time (2)
- Sometimes (3)
- Rarely (4)
- Never (5)
- I am not comfortable answering this question (6)

${q://QID897/ChoiceTextEntryValue/2}$ usually takes supplements: Examples are multivitamins, iron drops, cod liver oil.

- Always (1)
- Most of the time (2)
- Sometimes (3)
- Rarely (4)
- Never (5)
- I am not comfortable answering this question (6)

I am comfortable with how ${q://QID897/ChoiceTextEntryValue/2}$ is growing:

- Yes (1)
- No (2)
- I am not comfortable answering this question (3)

${q://QID897/ChoiceTextEntryValue/2}$:

- Should weigh more (1)
- Is about the right weight (2)
- Should weigh less (3)
- I am not comfortable answering this question (4)

${q://QID897/ChoiceTextEntryValue/2}$ is hungry at mealtimes.

- Always (36)
- Most of the time (31)
- Sometimes (32)
- Rarely (33)
- Never (34)
- I am not comfortable answering this question (3)
I let ${q://QID897/ChoiceTextEntryValue/2} decide how much to eat:
- Always (36)
- Most of the time (31)
- Sometimes (32)
- Rarely (33)
- Never (34)
- I am not comfortable answering this question (3)

I am comfortable with how ${q://QID897/ChoiceTextEntryValue/2} is growing:
- Yes (42)
- No (43)
- I am not comfortable answering this question (3)

${q://QID897/ChoiceTextEntryValue/2}:
- Should weigh more (45)
- Is about the right weight (46)
- Should weigh less (47)
- Not sure (48)
- I am not comfortable answering this question (3)

Are you worried that ${q://QID897/ChoiceTextEntryValue/2} will become overweight as he or she is growing up?
- Yes (1)
- No (2)
- I am not comfortable answering this question (3)

Are you worried that ${q://QID897/ChoiceTextEntryValue/2} will become underweight as he or she is growing up?
- Yes (1)
- No (2)
- I am not comfortable answering this question (3)

How would you classify ${q://QID897/ChoiceTextEntryValue/2}’s current weight.
- Very underweight (1)
- Underweight (2)
- Average (3)
- Overweight (4)
- Very overweight (5)
- I am not comfortable answering this question (6)
Next, you will see a set of statements that describe children's reactions to a number of situations. We would like you to tell us what $\{\text{q://QID1537/ChoiceTextEntryValue/2}\}$'s reaction is likely to be in those situations. There are of course no "correct" ways of reacting; children differ widely in their reactions, and it is these differences we are trying to learn about. Please read each statement and decide whether it is a "true" or "untrue" description of your $\{\text{q://QID1537/ChoiceTextEntryValue/2}\}$'s reaction within the past six months. Use the following scale to indicate how well a statement describes $\{\text{q://QID1537/ChoiceTextEntryValue/2}\}$: 

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Extremely untrue of your child</td>
</tr>
<tr>
<td>2</td>
<td>Quite untrue of your child</td>
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<tr>
<td>3</td>
<td>Slightly untrue of your child</td>
</tr>
<tr>
<td>4</td>
<td>Neither true nor false of your child</td>
</tr>
<tr>
<td>5</td>
<td>Slightly true of your child</td>
</tr>
<tr>
<td>6</td>
<td>Quite true of your child</td>
</tr>
<tr>
<td>7</td>
<td>Extremely true of your child</td>
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<tr>
<td>8</td>
<td>I am not comfortable answering this question</td>
</tr>
</tbody>
</table>

If you cannot answer one of the items because you have never seen $\{\text{q://QID1537/ChoiceTextEntryValue/2}\}$ in that situation, for example, if the statement is about the child's reaction to your singing and you have never sung to your $\{\text{q://QID1537/ChoiceTextEntryValue/2}\}$, then select NA (not applicable). Please be sure to select a number or NA for every item $\{\text{q://QID1537/ChoiceTextEntryValue/2}\}$:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Scale 1</th>
<th>Scale 2</th>
<th>Scale 3</th>
<th>Scale 4</th>
<th>Scale 5</th>
<th>Scale 6</th>
<th>Scale 7</th>
<th>Scale 8</th>
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</thead>
<tbody>
<tr>
<td>Seems always in a big hurry to get from one place to another. (1)</td>
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<tr>
<td>Gets quite frustrated when prevented from doing something s/he wants to do. (2)</td>
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<td>When drawing or colouring in a book, shows strong concentration. (3)</td>
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<tr>
<td>Likes going down high slides or</td>
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<td>Other adventurous activities. (4)</td>
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<td>Is quite upset by a little cut or bruise. (5)</td>
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<tr>
<td>Prepares for trips and outings by planning things s/he will need. (6)</td>
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<td>Often rushes into new situations. (8)</td>
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<tr>
<td>Tends to become sad if the family's plans don't work out. (7)</td>
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<td>Likes being sung to. (9)</td>
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<td>Seems to be at ease with almost any person. (10)</td>
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<tr>
<td>Is afraid of burglars or the &quot;boogie man.&quot; (11)</td>
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<td>Notices it when parents are wearing new clothing. (12)</td>
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<td>Prefers quiet activities to active games. (14)</td>
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<td>When angry about something, s/he tends to stay upset for ten minutes or longer.</td>
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<tr>
<td>(13) When building or putting something together, becomes very involved in what s/he is doing, and works for long periods. (15) Likes to go high and fast when pushed on a swing. (16) Seems to feel depressed when unable to accomplish some task. (18) Is good at following instructions. (17) Takes a long time in approaching new situations. (19) Hardly ever complains when ill with a cold. (20) Likes the sound of words, such as nursery rhymes. (21) Is sometimes shy even around people s/he</td>
<td>☒ ☐ ☐ ☐ ☐ ☐ ☐</td>
<td>☐ ☐ ☐ ☐ ☐ ☐ ☐</td>
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<td>has known a long time. (22)</td>
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<tr>
<td>Is very difficult to soothe when s/he has become upset. (23)</td>
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<td>Is quickly aware of some new item in the living room. (25)</td>
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<tr>
<td>Is full of energy, even in the evening. (24)</td>
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<tr>
<td>Is not afraid of the dark. (26)</td>
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<td>Sometimes becomes absorbed in a picture book and looks at it for a long time. (27)</td>
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<td>Likes rough and rowdy games. (28)</td>
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<tr>
<td>Is not very upset at minor cuts or bruises. (29)</td>
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<tr>
<td>Approaches places s/he has been told are dangerous slowly and cautiously. (30)</td>
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<td>o</td>
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<tr>
<td>Is slow and unhurried in deciding what</td>
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<tr>
<td>to do next. (31)</td>
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<tr>
<td>Gets angry when s/he can't find something s/he wants to play with. (33)</td>
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</tr>
<tr>
<td>Enjoys gentle rhythmic activities such as rocking or swaying. (32)</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Sometimes turns away shyly from new acquaintances. (34)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Becomes upset when loved relatives or friends are getting ready to leave following a visit. (35)</td>
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<tr>
<td>Comments when a parent has changed his/her appearance. (36)</td>
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</tr>
</tbody>
</table>

How often do you or another family member read to your child?

- Never (1)
- Rarely (2)
- Sometimes (3)
- Often (11)
- Prefer not to answer (12)
How often does your child listen to audio recordings of books (audiobooks)?
- Never (1)
- Rarely (2)
- Sometimes (3)
- Often (4)
- Prefer not to answer (5)

Does your child enjoy reading or being read to?
- A great deal (11)
- A lot (12)
- A moderate amount (13)
- A little (14)
- None at all (15)
- Prefer not to answer (16)

Has your child ever read or listened to The Paper Bag Princess by Robert Munsch?
- Yes (1)
- No (2)
- Prefer not to answer (3)

What is your weight? Please include units (i.e., lbs or kg)
________________________________________________________________

What is your height? Please include units (i.e., ft, in, cm)
________________________________________________________________
What is your spouse's weight? Please include units (i.e., lbs or kg)

________________________________________________________________

What is your spouse's height? Please include units (i.e., ft, in, cm)

________________________________________________________________
Appendix E - CHAMPS Study Child Assent Form

Child Assent Script for Research Assistant

Once the parent (proxy reporter) has finished completing the consent forms, the weight and height of the child participant will be taken. Prior to taking these measurements this script will be read to the child.

For food/non-food reinforcement task (Study Visit 1):
I work at the University of Guelph and today we would like to have you complete two activities for us. These activities are for a research project I am doing. For the first activity, we are going to read you a story and then you are going to tell us how hungry you feel. In the second activity you are going to click a computer mouse and eat some snacks/and listen to a story. You can stop whenever you want and do not have to finish the activities if you do not want to. Is this okay? May we begin?
☐ Child assent obtained, Research Team signature: __________

For weight and height measurements (Study Visit 2):
I work at the University of Guelph and we would like to measure how tall you are and how much you weigh. These measurements are for a research project I am doing. All you need to do is stand on this weighing machine and up against this height machine and we will measure you. Is this okay? You do not have to do this if you do not want to. Is it okay if I take your height now? Is it okay if I take your weight now?
☐ Child assent obtained, Research Team signature: __________

For Bioelectrical Impedance Analysis (Study Visit 2):
I work at the University of Guelph and we would like to measure how much muscle you have. This measurement is for a research project I am doing. All you need to do is lie down on this table and I will place these sticky pads on your hand and foot. A bit of electricity will go all the way from your hand to your foot and that will tell me how much muscle you have! You will not feel this at all and it is very safe. I need you to lie very still while the machine is on. You can stop this at any time and do not have to finish this test. Is this okay? May I put the sticky pads on you now? May I turn the machine on now?
☐ Child assent obtained, Research Team signature: __________
Appendix F- CHAMPS Study Materials

Visit Checklist

<table>
<thead>
<tr>
<th>Visit 1</th>
<th>Food First</th>
<th>Book First</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔ Overview of study</td>
<td>✔ Overview of study</td>
<td>✔ Overview of study</td>
</tr>
<tr>
<td>✔ Sign Consent Form (GAMER)</td>
<td>✔ Sign Consent Form (GAMER)</td>
<td>✔ Sign Consent Form (GAMER)</td>
</tr>
<tr>
<td>✔ Same-Day Recall (GAMER)</td>
<td>✔ Same-Day Recall (GAMER)</td>
<td>✔ Same-Day Recall (GAMER)</td>
</tr>
<tr>
<td>✔ Child Affect (GAMER)</td>
<td>✔ Child Affect (GAMER)</td>
<td>✔ Child Affect (GAMER)</td>
</tr>
<tr>
<td>✔ Remind parent about survey (GAMER)</td>
<td>✔ Remind parent about survey (GAMER)</td>
<td>✔ Remind parent about survey (GAMER)</td>
</tr>
<tr>
<td>✔ Hunger Assessment</td>
<td>✔ Hunger Assessment</td>
<td>✔ Hunger Assessment</td>
</tr>
<tr>
<td>✔ Food Tasting &amp; Rating</td>
<td>✔ Food Tasting &amp; Rating</td>
<td>✔ Food Tasting &amp; Rating</td>
</tr>
<tr>
<td>✔ Hunger Assessment</td>
<td>✔ Hunger Assessment</td>
<td>✔ Hunger Assessment</td>
</tr>
<tr>
<td>✔ FRR Practice 1 (food)</td>
<td>✔ FRR Practice 2 (book)</td>
<td>✔ FRR Practice 1 (book)</td>
</tr>
<tr>
<td>✔ Hunger Assessment</td>
<td>✔ FRR Practice 1 (food)</td>
<td>✔ FRR Practice 2 (book)</td>
</tr>
<tr>
<td>✔ FRR Practice 2 (book)</td>
<td>✔ Hunger Assessment</td>
<td>✔ Hunger Assessment</td>
</tr>
</tbody>
</table>

** Confirm Visit 2 – remind parents about survey if not yet completed

<table>
<thead>
<tr>
<th>Visit 2</th>
<th>Food First</th>
<th>Book First</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔ Daily Health Condition</td>
<td>✔ Daily Health Condition</td>
<td>✔ Daily Health Condition</td>
</tr>
<tr>
<td>✔ Same-Day Recall (GAMER)</td>
<td>✔ Same-Day Recall (GAMER)</td>
<td>✔ Same-Day Recall (GAMER)</td>
</tr>
<tr>
<td>*Remind parents about survey if not yet completed</td>
<td>*Remind parents about survey if not yet completed</td>
<td>*Remind parents about survey if not yet completed</td>
</tr>
<tr>
<td>✔ Hunger Assessment</td>
<td>✔ Hunger Assessment</td>
<td>✔ Hunger Assessment</td>
</tr>
<tr>
<td>✔ FRR 1 (food)</td>
<td>✔ FRR 2 (book)</td>
<td>✔ FRR 1 (book)</td>
</tr>
<tr>
<td>✔ Hunger Assessment</td>
<td>✔ FRR 2 (book)</td>
<td>✔ Hunger Assessment</td>
</tr>
<tr>
<td>✔ FRR 2 (book)</td>
<td>✔ Hunger Assessment</td>
<td>✔ Hunger Assessment</td>
</tr>
</tbody>
</table>

**Check for completion of survey

**Provide gift card & parking compensation – have parents sign off on receiving these

Comments/Notes:

______________________________________________________________________________

______________________________________________________________________________
**Diet Recall**

<table>
<thead>
<tr>
<th>Participant ID:</th>
<th>Interviewer’s Initials:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>Visit number: 1 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Food/Drink Item</th>
<th>Time Consumed</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Does this day represent the child’s usual eating habits? Yes No

Notes: ______________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
<table>
<thead>
<tr>
<th>Study Food</th>
<th>Yummy</th>
<th>Just Okay</th>
<th>Yucky</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate Chip Cookie</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fudge Stripped Cookie</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oreo Cookie</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal Cookie</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teddy Graham Cookie</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Favourite Food: ____________________
Data Collection Sheet

<table>
<thead>
<tr>
<th>Practice (1)</th>
<th>Data Collection (2)</th>
<th>Redo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food used:</td>
<td>Feeder:</td>
<td>Gamer:</td>
</tr>
<tr>
<td>Apt. Time:</td>
<td>Sex:</td>
<td>DOB:</td>
</tr>
<tr>
<td>Baseline State of Child:</td>
<td>How is your child feeling today?</td>
<td></td>
</tr>
<tr>
<td>o 1 = drowsy</td>
<td>o 2 = alert/calm</td>
<td></td>
</tr>
<tr>
<td>o 3 = alert/active</td>
<td>o 4 = fussy</td>
<td></td>
</tr>
<tr>
<td>o 5 = crying</td>
<td>o 6 = shy/quiet</td>
<td></td>
</tr>
<tr>
<td>o 4 = fussy</td>
<td>o 5 = crying</td>
<td></td>
</tr>
<tr>
<td>o 6 = shy/quiet</td>
<td>o 7 = alert/active</td>
<td></td>
</tr>
</tbody>
</table>

**HUNGER ASSESSMENT**
(1 = hungry, 2 = kind of hungry, 3 = full)

Before Liking Ax: 1 2 3 Before food task: 1 2 3
After food task: 1 2 3

**COMMENTS:**

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

Food Pmax:
Book Pmax:

**Anthropometrics**

Height (cm): 1. _________________ 2. _________________
Average: __________________________

Weight: __________________________
BIA: Resistance 1 _______________ Resistance 2 _______________
Hunger Assessment

Peter-Peter Pumpkin Eater

Food Reinforcers
Audiobook Reinforcers

Study Room Set up
Appendix G- Inter and Intra-Rater Reliability CV

Table 6. Inter and intra-rater reliability coefficients of variation (CV) for height, weight, and BIA*

<table>
<thead>
<tr>
<th></th>
<th>Intra-Rater CV (%)</th>
<th>Inter-Rater CV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>0.12</td>
<td>0.14</td>
</tr>
<tr>
<td>Weight</td>
<td>0.01</td>
<td>0.24</td>
</tr>
<tr>
<td>BIA</td>
<td>0.15</td>
<td>1.5</td>
</tr>
</tbody>
</table>

* These data were taken between three members of the research team from five participants.