ABSTRACT

Title of Dissertation: FORMATIVE RESEARCH TO ASSESS KEY FACTORS ASSOCIATED WITH THE DIET QUALITY OF HOME-PACKED LUNCHES IN YOUNG SCHOOL CHILDREN

Perrine Nadaud, Doctor of Philosophy, 2018

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In the United States, about 46% of elementary students who are not eligible for school meal (SM) benefits do not participate in the National School Lunch Program (NSLP) and bring home-packed lunches (HPL). With considerable criticism directed at the NSLP, parents may believe that they can pack healthier lunches that respond better to their children's tastes than the SM. Nonetheless, previous studies have found that HPL needed nutritional improvement.

This study's objective was to assess how key parent psychosocial factors related to young school-aged children's diet quality. Using a cross-sectional study design, nine public schools were randomly selected in one school district in Maryland. In-depth interviews with principals and vice-principals were conducted and a web-based survey was sent to kindergarten and first-grade teachers. Parents of children, in those grades, who frequently consume HPL were invited to complete a web-based survey and to report their children's food intake using the Automated Self-Administered 24-hour Recall (ASA24-2016). Children's diet quality was assessed using the HEI-201 and HEI-2015.

19 teachers and 100 parents completed the survey. 71 parents reported at least one day of their child's food intake. Interviews with 15 school administrators revealed that HPL contain too much food and are nutritionally diverse depending on children's country of origin. The survey showed that more than half of the teachers considered HPL more nutritious than SM. Moreover, children's overall diet quality was better when parents scored higher their self-efficacy for enacting healthy diet behaviors in their children and when parents were more closely monitoring their child's food intake. Children of parents with the same higher self-efficacy had better total vegetable scores and were consuming more vegetables in their HPL. They also had better empty calories scores, and more precisely better added sugars scores and were consuming less added sugars in their HPL.

Future interventions aiming to improve HPL's nutritional quality should take into account school lunch policies and the cafeteria environment and incorporate parents' key psychosocial variables.

# FORMATIVE RESEARCH TO ASSESS KEY FACTORS ASSOCIATED WITH THE DIET QUALITY OF HOME-PACKED LUNCHES IN YOUNG SCHOOL CHILDREN

by

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# List of Abbreviations

AI: Adequate Intake

AMDR: Acceptable Macronutrient Distribution Range

BMI: Body Mass Index

CFQ: Child Feeding Questionnaire

CVD: Cardiovascular Disease

DHHS: Department of Health and Human Services

DRI: Dietary Reference Intake

EAR: Estimated Average Requirement

FARMS: Free and Reduced-price Meals System

HEI: Healthy Eating Index

HPL: Home-Packed Lunches

NFSMI: National Food Service Management Institute

NND: New Nordic Diet

NS: Nutrition Standards

NSLP: National School Lunch Program

RDA: Recommended Dietary Allowances

SCT: Social Cognitive Theory

SM: School Meals

SSB: Sugar-Sweetened Beverages

UK: United Kingdom

US: United States

USDA: United States Department of Agriculture

# CHAPTER 1 : INTRODUCTION

## 1.1 Problem statement

Childhood obesity has more than tripled since the 1970s (CDC, 2017). The percentage of children aged 6–11 years in the United States who were obese increased from 7% in 1980 to nearly 18% in 2012 (CDC, 2017). Currently, one in five school-aged children (from 6 to 19 years old) has obesity (CDC, 2017). A healthy diet in early life is key to enabling healthy adulthood and aging ("WHO | Children's diet," 2015). Diet quality of school children is crucial because proper nutrition strengthens their learning potential and well-being and decreases the risk of non-communicable diseases (NCDs), including obesity, cardiovascular diseases, cancer and eating disorders ("WHO | Children's diet," 2015).

In the United States (US), federal and state policies have been implemented to improve the quality of food provided to children through the National School Lunch Program (NSLP) and the School Breakfast Program.. The Healthy, Hunger-Free kids Act published in 2010 requires that, to be part of the NSLP, lunches should meet meal pattern and nutrition standards based on the latest Dietary Guidelines for Americans (United States. Congress. Senate. Committee on Agriculture, 2010). In January 2012, the United States Department of Agriculture (USDA) established new nutrition standards for school meals (SM) that were intended to better align meals with the Dietary Guidelines for Americans (Food and Nutrition Service (FNS), 2012). These nutrition standards require NSLP lunches to include more fruits, vegetables, and whole grains; include only non-fat and low-fat varieties of milk; reduce sodium over time; and control levels of calories and saturated fat (Condon et al., 2015).

The school environment is a pivotal setting impacting children's food choices and eating behaviors (CDC, 2018). In schools in the United States (US), children can eat from a variety of

food sources, such as foods offered by the NSLP, snack bars and vending machines, but they can also bring a home-packed lunch (HPL) (Condon et al., 2015). Moreover, the ambiance in the cafeteria strongly impacts children dietary intake. This ambiance is notably influenced by the cafeteria and lunch room setting, time allocated to eat, and by cafeteria workers behavior (Moore, Murphy, Tapper, & Moore, 2010).

For many children in the United States, lunch is the most consistently social meal of the day (Hendy, 2002). Lunch at school is a meal during which children eat with their peers and possibly trade and share food (Domel Baxter, Thompson, & Davis, 2001). Peer-modeling can positively or negatively impact a child's eating behavior. In a systematic review conducted in 2014, the authors explained that children model the healthy eating habits of their peers, which could lead to an increased vegetable intake and reduced fat intake (Cruwys, Bevelander, & Hermans, 2015). Indeed, peers can increase willingness to try unfamiliar food (Addessi, Galloway, Visalberghi, & Birch, 2005; Laureati, Bergamaschi, & Pagliarini, 2014). However, children are also reluctant to eat novel foods after receiving negative comments from their peers (Greenhalgh et al., 2009).

Unlike SM that follow nutrition standards, the nutritional quality of HPL is the responsibility of parents/caregivers as no dietary guidelines have been established. HPL's food choices are influenced by various factors. The results of focus groups with Australian parents/caregivers showed that the main factors affecting HPL's composition included children's food preferences, school environment, convenience, cost and food safety. These factors, precluding parents from including healthier food, negatively influence the nutritional quality of HPL. School-related barriers, such as the amount of time allocated for eating and the lack of refrigeration facilities, also impact the type and amount of food that can be packed (Bathgate & Begley, 2011).

Previous observational studies conducted in the US have shown that the nutritional content of HPL in school-aged children was less adequate than SM even before the establishment of the nutrition standards. HPL contained fewer fruits, vegetables and dairy products and more snacks high in sugar and/or fat and non-100% fruit juice than SM (Caruso & Cullen, 2015; Farris et al., 2014; Hubbard, Must, Eliasziw, Folta, & Goldberg, 2014; Johnston, Moreno, El-Mubasher, & Woehler, 2012; Rainville, 2001). These results suggest that the nutritional quality of HPL needs to be improved. To date, very few studies have assessed the diet quality of children who frequently consume HPL using an established index, as most of the published studies aimed to identify the types of foods and beverages brought from home by using digital images of the lunch box contents (Hubbard et al., 2014). Moreover, no published studies have assessed which psychosocial factors of parents affect the diet quality scores of young school-aged children who frequently consume HPL.

This study's objective was to conduct formative research to identify key parental psychosocial factors related to lunch-packing behaviors and examine how these factors are associated with their young (5-8 years) school children's diet quality using a validated diet quality index.

The specific aims of the study were as follows:

- Aim 1: Explore school cafeteria environment and relevant school lunch polices perceived by school principals and teachers that might affect nutritional quality and children's consumption of packed lunches.
- Aim 2: Indentify key psychosocial factors and perceptions related to HPL in parents and understand the main reasons why parents pack lunches for their children.

- Aim 3: Examine how parents' psychosocial factors affecting their lunch packing behaviors are associated with their child's diet quality.

**1.2 Summary of dissertation chapters**

Chapter 1 introduces the background that led to this dissertation study as well as its aims.

Chapter 2 describes the importance of healthy eating behaviors during childhood and factors that impact the acquisition of eating habits, such as parental feeding styles and peer-modeling. It also reports the nutritional differences between SM, nutrition standards and HPL studied in the US and in other countries. After explaining the history, requirements and challenges facing the NSLP, this chapter describes personal and environmental factors impacting the consumption of HPL. A conceptual framework based on the Social Cognitive Theory (SCT) illustrating the relationship between personal factors, environmental factors and behavior influencing the diet quality of young school children is also presented.

Chapter 3 explains the designs and methods used to conduct this study.

Chapter 4 presents the first paper which explores elementary school administrators and teachers perspectives of the effect of school lunch policies and cafeteria environment on HPL using in-depth interviews with 15 principals and vice-principals and a web-based survey completed by 19 kindergarten and 1$^{st}$ grade's teachers. Understanding school policies for lunch and recess, school cafeteria environment and operation and teachers' perceived benefits and constraints of those HPL on their students lunch intakes and on their class organization is crucial when assessing those children diet quality. The interview data revealed that the main reasons explaining school lunch and recess schedules related to the lunchroom capacity and children's behavior and that children with HPL have more time to eat than those who eat SM, particularly when the menu is popular. None of the participating schools had any appliances allowed for

students who bring HPL which impact what parents can pack. Lunch aids and other adults such as the principals, vice-principals and parents' volunteers, affect students' food intake by helping them opening their containers, motivating them to eat the food from their HPL and verifying the suitability of those lunches. School administrators perceived that HPL contain too much food, are nutritionally diverse depending on children's country of origin and allow some degree of freedom to the students and parents in what the child is eating. Principals and vice-principals expressed those benefits as possible reasons explaining why some parents and children choose HPL over SM. The survey showed that most of the teachers did not think that collecting HPL in classroom and delivering them to cafeteria for lunchtime is a burden. Morevover, more than half of the teachers considered that HPL are more nutritious than SM and that students are likely to eat more food if they have HPL.

Chapter 5 presents the second paper which examines the main reasons why parents pack lunches for their children and how key psychosocial factors and perceptions related to HPL in parents. Key determinants assessed include demographic characteristics, perceived difficulties, self-efficacy for preparing a healthy HPL in difficult situations, self-efficacy for enacting healthy diet behaviors in their children, nutrition knowledge, perceived benefits and constraints of HPL, parental feeding styles and parental perception of peer-pressure. The main reasons for not buying school meals reported were that parents preferred to choose what their child eats; they considered that the food served is not healthy and their child would not eat the school lunch. Self-efficacy for preparing a healthy HPL in difficult situations was negatively correlated with parents perceived constraints of HPL. Parental restrictive attitude and their tendency to pressure their child to eat were positively associated with parental perception of peer-pressure. After adjusting

for covariates and other variables, parents' perceived benefits of HPL was positively correlated with their self-efficacy for enacting healthy diet behaviors in their children.

Chapter 6 presents the last paper which evaluates which parents' key psychosocial variables are associated with their child's diet quality. Parents (n=71) reported their child's food intake using the Automated Self-Administered 24-hour Recall (ASA24-2016) and the diet quality was measured using the Healthy Eating Index-2010 (HEI-2010) and the new Healthy Eating Index-2015 (HEI-2015). After adjusting for covariates and other variables, children's overall diet quality was positively associated with parents' self-efficacy for enacting healthy diet behaviors in their children and parents' monitoring of their child's intake. Regarding component scores, after adjustment for covariates and other variables, children of parents with higher self-efficacy for enacting healthy diet behaviors in their children had better Total vegetable scores notably higher intake from their HPL. They also had better Empty calories scores and more precisely they had better Added sugars scores when using the HEI-2015. This association was also found when looking only at the children's intake of added sugar from their HPL.

Chapter 7 highlights the conclusions of this dissertation and discuss their possible applications in future interventions targeting this population. Strength and limitations of the study design are also discussed.

# CHAPTER 2 : LITERATURE REVIEW

This chapter describes the importance of healthy eating behaviors during childhood and factors that impact the acquisition of eating habits, such as parental feeding styles and peer-modeling. It also reports the nutritional differences between SM, nutrition standards and HPL studied in the US and in other countries. After explaining the history, requirements and challenges facing the NSLP, this chapter describes personal and environmental factors impacting the consumption of HPL. A conceptual framework based on the Social Cognitive Theory (SCT) illustrating the relationship between personal factors, environmental factors and behavior influencing the diet quality of young school children is also presented.

## 2.1 Importance of healthy eating behaviors during childhood

The acquisition of healthy dietary habits at a young age is crucial as we know that it will persist through to adulthood (Brown & Ogden, 2004). Moreover, children's nutritional needs are fairly important, as childhood is notably a time of growth. This chapter highlights the nutritional intake of school children in the US compared to their nutritional requirements and the consequences of an unhealthy diet in this age group.

### 2.1.1 Nutritional intake of school children in the US

Estimated daily calorie needs for boys and girls between the age of 5-8 years old range from 1,200 kcal to 1,400 kcal when sedentary, 1,400 kcal and 1,600 kcal when moderately active and 1,600 kcal to 1,800 kcal for active girls and 1,600 kcal to 2,000 kcal for active boys (Condon et al., 2015). Each segment of the population should have nutritional intakes at an appropriate energy level that meet their Dietary Reference Intakes (DRIs). These DRIs represent nutrients needs of healthy populations. In the US, lunches should provide 33% of a child's Recommended

Dietary Allowances (RDAs) in energy and key nutrients (protein, vitamin C, vitamin A, calcium and iron) (Condon et al., 2015). A recent study assessed the prevalence of adequate and excessive nutrient intake in school children in the US. In a sample of children aged 5 to 18 years old (n=833) who attended a school which participated in the NSLP. Each participant had a complete dietary recall on a weekday (Monday through Friday) during which lunch was consumed at school (Condon et al., 2015). The mean daily calorie intake among 5-8 year old children was 1,864 (±30.4) kcal with 1,972 (±44.3) kcal for boys and 1,750 (±41.6) kcal for girls. The prevalence of adequate usual intakes of vitamins and minerals was assessed by comparing the intakes of these school children to their Estimated Average Requirements (EARs). They found that almost all sampled children had adequate usual intakes of riboflavin (99%), niacin (98%), thiamin (98%), iron (97%), vitamin B12 (97%), vitamin B6 (96%), folate (94%), and zinc (93%). The prevalence of adequate usual intakes was lower for magnesium (59%) and calcium (49%) and the lowest for vitamin E (12%) and vitamin D (8%) (Condon et al., 2015). Mean usual intakes of some nutrients such as potassium, fiber, or sodium were compared to the Adequate Intake (AI) as EARs are not defined for these nutrients. AI are defined as “recommended intake levels that are assumed to be adequate for healthy individuals in a life stage and gender group” (Institute of Medicine (US) Food and Nutrition Board, 1998). For all studied children, mean usual intakes of potassium were 52% of the AI and slightly less than 50% for fiber (Condon et al., 2015). The majority of these children (95%) had usual sodium intakes that exceeded the Tolerable Upper Intake Level. The Institute of Medicine defines the Acceptable Macronutrient Distribution Ranges (AMDRs) for intakes of macronutrients as “percentages of total calorie intakes and reflect a range of usual intakes associated with reduced risk of chronic disease, while also providing adequate intakes of other essential nutrients” (Institute of Medicine (U.S.). Panel

on Macronutrients. & Institute of Medicine (U.S.). Standing Committee on the Scientific Evaluation of Dietary Reference Intakes., 2005). In this study, almost all children had usual intakes of protein (99%) and carbohydrate (98%) that were consistent with their AMDRs. 74% had usual intake of total fat that were consistent with the AMDR and the others mainly exceeded the recommended range (Condon et al., 2015). The authors noted that only 16% of studied children had usual intakes of saturated fat that were consistent with the Dietary Guidelines. If we focus on our targeted age group (i.e. children 5–8 years old), the study showed that approximately 35% of their total calorie intake came from empty calories, exceeding the maximum limit of 9 to 10% specified for this age group (Condon et al., 2015).

Table 2.1 summarizes all DRIs established for our targeted age-group, i.e. children between the ages of 5-8 years old and their intake as reported in this study (Condon et al., 2015).

**Table 2.1:Usual Daily Intakes and corresponding Dietary Reference Intakes (DRIs)**

| Children 4-8 y | Usual Daily Intakes | RDA/AI | EAR | AMDR |
|---|---|---|---|---|
| Total Water (L/d) | | 1.7 | | |
| Carbohydrate (g/d) | 254 | 130 | 100 | 45-65% |
| Protein (g/d) | 63 | 19 | 0.76 | 10-30% |
| Total Fiber (g/d) | 12.9 | 25 | | |
| Fat (g/d) | 69 | ND | | 25-35% |
| Linoleic Acid (g/d) | 12.2 | 10 | | 5-10% |
| α-linolenic (g/d) | | 0.9 | | 0.6-1.2% |
| Calcium (mg/d) | 1039 | 1000 | 800 | |
| Vitamin A (µg/d) | 610 | 400 | 275 | |
| Vitamin C (mg/d) | 83 | 25 | 22 | |
| Vitamin D (µg/d) | 6.2 | 15 | 10 | |
| Vitamin E (mg/d) | 5.6 | 7 | 6 | |
| Vitamin K (µg/d) | | 55 | | |
| Thiamin (mg/d) | 1.5 | 0.6 | 0.5 | |
| Riboflavin (mg/d) | 2.1 | 0.6 | 0.5 | |
| Niacin (mg/d) | 19.5 | 8 | 6 | |
| Vitamin $B_6$ (mg/d) | 1.6 | 0.6 | 0.5 | |
| Folate (µg/d) | 506 | 200 | 160 | |
| Vitamin $B_{12}$ (mg/d) | 4.8 | 1.2 | 1 | |
| Copper (µg/d) | 0.96 | 440 | 340 | |
| Iodine (µg/d) | | 90 | 65 | |
| Iron (mg/d) | 13.5 | 10 | 4.1 | |
| Magnesium (mg/d) | 221 | 130 | 110 | |
| Potassium (g/d) | 2.2 | 3.8 | | |
| Sodium (g/d) | 2704 | 1.2 | | |
| Phosphorus (mg/d) | 1225 | 500 | 405 | |
| Selenium (µg/d) | 82 | 30 | 23 | |
| Zinc (mg/d) | 10 | 5 | 4 | |

Source: Food and Nutrition Board, Institute of Medicine, National Academies, 2010. Condon et al. 2015.

This study also looked at school children's Food Patterns equivalents data using the MyPyramid Equivalents Database (MPED) (Condon et al., 2015). They found that, over 24 hours, 58% of school children between the age of 5-18 years old, consumed a discrete vegetable, and 31% consumed at least one discrete vegetable at lunch, which were cooked potatoes for 54% of them. Half of cooked potatoes were fried. Almost half of the school children reported

consuming milk or milk products at lunch and 76% over 24 hours. 20% consumed a discrete meat or meat alternate at lunch and 55% over 24 hours. 36% consumed at least one type of sweet or dessert at lunch and 21% consumed a salty snack food (Condon et al., 2015).

Regarding the diet quality of children aged 5-8 years, several studies found that they scored 52 out of possible 100 points (Banfield, Liu, Davis, Chang, & Frazier-Wood, 2015; Condon et al., 2015).

### 2.1.2 Consequences of an unhealthy diet in school children

*Early BMI rebound*: Children are expected to gain about 30 cm in height and 12 kg in weight between the ages of 5 and 10 years. During this period, the rate of height gain slows gradually, and at the same time weight gain increases slowly (Weichselbaum & Buttriss, 2011). The timing of the nadir[1] does not differ between sexes (Goran & Sothern, 2006). The Body Mass Index (BMI) rebound occurs generally between the ages of 5 to 6 years old, thus when most children are entering kindergarten. An early nadir will lead to a greater BMI. Thus, an early BMI rebound is a risk factor for future obesity (Goran & Sothern, 2006). Moreover, the Literature shows that an early BMI rebound is associated with greater fat deposition in the abdominal cavity, which may then predispose to insulin resistance, glucose intolerance and type 2 diabetes mellitus (Goran & Sothern, 2006).

*Early-onset chronic diseases*: In the US, childhood obesity has more than tripled since the 1970s (CDC, 2017). Currently 18% of children ages 6–11 have a BMI equal or greater than 95$^{th}$ percentile compared to 7% in 1980 ("CDC - Obesity - Facts" 2015). Studies have shown that childhood obesity increases the risk of high blood pressure and high cholesterol, which are metabolic risk factors associated with heart disease (David S. Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007; Hong YM, 2010; Lambert et al., 2008; Pulgarón, 2013). Moreover,

[1] The nadir of the BMI is what is called the adiposity rebound or BMI rebound.

some researchers have found that the atherosclerotic process begins in youth, as early as 2 years old (Gidding et al., 2006; Hong YM, 2010) and that this accumulation of fatty streaks-lipid-engorged macrophages and T lymphocytes in the intima of the arteries increase the risk of development of vascular plaque in the third and fourth decades of life (Gidding et al., 2006). Freedman et al., 1999 found that in a population-based sample approximately 60% of overweight children aged 5-10 years had at least one cardiovascular disease (CVD) risk factor, such as elevated total cholesterol, triglycerides, insulin, or blood pressure and 25% had two or more CVD risk factors (D. S. Freedman, Dietz, Srinivasan, & Berenson, 1999). In addition to a predisposition to CVD, childhood obesity increases the risk of bone and joint problems, and sleep apnea, social and psychological problems such as stigmatization and poor self-esteem (CDC, 2017; Pulgarón, 2013).

*Psychosocial aspects*: Some studies found that overweight school-aged children are more likely to be the victims or perpetrators of bullying behaviors and experience higher rates of social isolation than normal-weight children (Bacchini et al., 2015; Janssen, Craig, Boyce, & Pickett, 2004). Another study showed that overweight and obese children were twice as likely to have an attention-deficit hyperactivity disorder diagnosis (OR= 2.0, 95% CI, 1.23–3.11) after controlling for age, sex and socioeconomic status (Golley et al., 2010). A study using data from the Early Childhood Longitudinal Study-Kindergarten class (a nationally representative sample of kindergartners in the United States (n = 9949)) found that overweight girls had greater odds of having behavior problems (reported by teachers) compared with girls who were not overweight (OR = 1.81, 95% CI, 1.23–2.68) (Datar A & Sturm R, 2004).

*School performance*: Unhealthy dietary behaviors also have an impact on academic performance beginning as early as kindergarten (Gable, Krull, & Chang, 2012). A longitudinal

study examined the relationship between boys' and girls' weight status and math performance (n=6250) (Gable et al., 2012). The results indicated poorer performance on the math assessment for obese children than non-obese children. Data on 13,680 children in third grade from the Early Childhood Longitudinal Study showed that overweight children had significantly lower math and reading test scores compared with non-overweight children. However, these differences became insignificant after including socioeconomic and maternal education variables (Judge & Jahns, 2007). Obesity and being overweight are not the only variables impacting school performance in children as unhealthy eating patterns showed a similar association (Fu, Cheng, Tu, & Pan, 2007; Golley et al., 2010). The results of a cohort study conducted on elementary school children (n=2,222) in Taiwan showed that unfavorable overall school performance was positively associated with unhealthy eating patterns. These unhealthy eating patterns were characterized as high intake of low-quality foods (e.g., sweets and fried foods, 3$^{rd}$ tertiles (OR=1.65, 95% CI: 1.09-2.48)) and low intake of high-quality foods such as dairy products (association not statistically significant) and vegetables, fruits, meat, fish, and eggs (OR=1.63, 95%: 1.11-2.38) (Fu et al., 2007). Several studies found that academic performance (i.e. academic scores) improved significantly after enhancement of the nutritional quality of SM (Anderson, Gallagher, & Ritchie, 2017; Belot & James, 2011; Hollar et al., 2010).

In summary, children's diet quality is an important contributing factor to their overall health and well-being as a child and later on. An unhealthy dietary pattern in childhood increases the risk of social and psychological problems and non-communicable diseases like obesity, being overweight and CVD in adulthood and reduces academic performance.

## 2.2 Acquisition of eating habits during childhood

Although a range of interpersonal and environmental factors influence the acquisition of children's eating habits, the main focus of this sub-chapter will be to assess how parents and peers affect this acquisition and to understand how it might impact HPL content and consumption.

### 2.2.1 Parental influences

*Early influences on the development of food preferences*: The literature suggests that children's experiences with foods influence both preferences and intake (Cooke, 2007). Fetus and infants are already exposed to what their mothers choose to eat as flavors are transmitted from the maternal diet to amniotic fluid and breast milk (Trabulsi & Mennella, 2012). These sensory experiences might shape preferences and the diversity of these experiences early in life could help the development of healthier food habits (Cooke, 2007; Mennella, 2014). In addition to these early experiences, young children have an innate preference for sweet and salty foods, and are predisposed to reject bitter and sour foods which might protect them from consuming potentially toxic foods (Mennella, 2014; C. Schwartz, Issanchou, & Nicklaus, 2009). Thus, at an early age, children seem to be inherently predisposed to dislike healthier foods which contain less salt, refined sugars and are lower in energy such as vegetables. As they are particularly vulnerable to the western food environment containing mainly foods high in refined sugar and salt, repeated exposure to healthier foods and dietary variety are crucial at a younger age (Mennella, 2014). Some longitudinal studies have shown that food habits established during infancy stay into childhood and adolescence (Nicklaus, Boggio, Chabanet, & Issanchou, 2004) for both nutrient-dense and nutrient poor foods (Lioret, McNaughton, Spence, Crawford, & Campbell, 2013). These observational studies suggest that early and repeated exposure to healthy

foods having a wide range of flavor may improve diet later in life as these adults would have learned to like the tastes of these foods during their childhood (Mennella, 2014; Nicklaus et al., 2004).

*Parents act as model*: Parents play a very influential primary role as models and providers of healthy foods (Leann L. Birch & Davison, 2001). Obviously, parents/caregivers are responsible for food and beverage availability within the home and it has been shown that consumption of healthy/unhealthy foods and beverages are significantly predicted by their home availability (Kratt, Reynolds, & Shewchuk, 2000). Parents/caregivers are also responsible for the organization and delivery of these meals. Some studies have shown significant positive associations between family meal frequency and children's nutritional and food group intake and inverse associations with consumption of soft drinks and high-fat foods and obesity (Gable, Chang, & Krull, 2007; Gillman et al., 2000).

*Parental feeding style:* Parents/caregivers' attitude toward their children while they eat or plan to eat has a strong impact on child's eating behavior. Scaglioni et al., 2008 found that excessive control over child's food intake, may contribute to childhood overweight (Scaglioni, Salvioni, & Galimberti, 2008). The authors explained two primary aspects of control: "*restriction*, which involves restricting children's access to junk foods and the total amount of food, and *pressure*, which involves pressuring children to eat healthy foods (i.e. fruits and vegetables) and to eat more in general" (Scaglioni et al., 2008). Birch et al., 2001 assessed parents' use of controlling child feeding strategies with three factors: monitoring (i.e. extent to which parents oversee their child's intake), restriction (i.e. extent to which parents restrict their child's access to foods) and pressure to eat (i.e. parents' tendency to pressure their children to eat more food) (Leann L Birch et al., 2001). Hubbs-Tait et al., 2008 have established a nomenclature

of parenting style in the context of child-feeding practices (Hubbs-Tait, Kennedy, Page, Topham, & Harrist, 2008). As defined by the authors, authoritative parenting is characterized by high parental affection and responsivity as well as high expectations or respectful limit setting. These parents will balance their concerns for healthful intake with the child's food preferences (Hubbs-Tait et al., 2008). Authoritative parenting is associated with increased independence and self-control (Hubbs-Tait et al., 2008). Authoritarian parenting employs strict discipline, may be insensitive to the child's emotional needs, and may result in children motivated by external controls (Hubbs-Tait et al., 2008). Authoritarian feeding practices include restricting specific foods and attempting to control the child's intake with little regard for the child's food preferences (Leann L Birch et al., 2001). Permissive parenting is characterized by parents who may have low expectations for their child's self-control and/or set few limits, potentially leading to children with poor self-regulation of behavior (Hubbs-Tait et al., 2008). Permissive practices are more indulgent and allow the child to control their food intakes (Hubbs-Tait et al., 2008). A recent systematic review including papers with participants aged 4-12 years old showed that restriction was more often used by parents of children with a high BMI and pressure to eat applied to children with a lower BMI (Shloim, Edelson, Martin, & Hetherington, 2015).

*Impact on children's food intake*: Studies have shown that parenting and feeding styles might have an impact on child food intake and body weight. A recent review showed that the authoritative parenting and feeding style is associated with increased fruit and/or vegetable, dairy intake, and physical activity, and lower intake of low-nutrient dense foods and fats and oils and a lower risk of childhood obesity (Vollmer & Mobley, 2013). The permissive parenting style appears to put children at higher risk for developing overweight or obesity (Vollmer & Mobley, 2013). The review showed that the authoritarian parenting style influences a child to gain

excessive weight but the authoritarian feeding style was not linked to child weight status (Vollmer & Mobley, 2013). However, the cross-sectional design of these studies does not allow us to understand the direction of these associations (Ventura & Birch, 2008; Vollmer & Mobley, 2013). A recent cross-sectional data analysis conducted on parents of primary school children (6-13 years) showed that children of parents (n=644) with the highest control over their child's intake had lower odds of eating unhealthy snacks more than once per day (OR:0.57, 95% CI 0.42 to 0.76) (Wang et al., 2017).

In summary, parents/caregivers act as models and providers of food but their parental feeding style also strongly influences their children's eating behaviors and body weight. Thus, it is important to understand parental feeding styles when assessing HPL consumption.

### 2.2.2 Specificity of peer-modeling

*Definition and extent of peer-modeling*: Children learn and acquire eating behaviors through direct experiences with food and by observing others (L. Birch, Savage, & Ventura, 2007). For many children in the United States, lunch is the most consistently social meal of the day (Hendy, 2002). Peer-modeling can be defined as "the modeling of food intake, whereby people directly adapt their food intake to the one of their eating companion" (Cruwys et al., 2015). At school during lunchtime, these eating companions are the classmates. We know that modeling is a primary determinant of eating behavior and starts as young as 1 year old and that younger children are more affected by peer modeling than older children. Although modeling effects do occur; repeated exposures seem needed to maintain the effect (Leann Lipps Birch, 1980; Cruwys et al., 2015). The literature shows that children readily modeled snack food consumption, and this social influence can be maintained for a few days even after a single exposure (Cruwys et al., 2015). Children who observe peers eating food they dislike promote their willingness to

choose and eat the same food (Leann L. Birch & Doub, 2014). However, peer-influence can also have a negative impact as children are unwilling to eat novel foods after negative comments by their peers (Greenhalgh et al., 2009).

*Interventions using peer-influence*: To understand if peer modeling could improve diet quality, several intervention studies were conducted. In two inner-city London primary schools (UK), an intervention study used peer-modeling and rewards to increase children's fruit and vegetable consumption (Horne et al., 2004). Over 16 days, children watched video adventures featuring heroic peers (the Food Dudes) who enjoy eating fruit and vegetables, and received small rewards for eating these foods themselves. Horne et al. explain that after 16 days there were no more videos and the rewards became more intermittent. The authors found that compared to the control school, lunchtime consumption of fruits and vegetables in the experimental school was substantially higher at intervention and follow-up than baseline ($p<0.001$), while snack time consumption was higher at intervention than baseline ($p<0.001$). The lunchtime data showed particularly large increases among those who initially ate very little. This increase of consumption was also reported at home ($p<0.05$) (Horne et al., 2004). The 'Food Dudes' has been shown to influence actual consumption patterns in the short and medium term (Horne et al., 2008; Lowe, Horne, Tapper, Bowdery, & Egerton, 2004). In Italy, this intervention was also conducted in a large cohort of children (n=560) aged 6 to 9 years old (Laureati et al., 2014). The study showed that the intervention was effective in reducing food neophobia. This effect was persistent even 6 months after the intervention. The authors explain that the program was also effective in increasing liking for fruits and vegetables; however, this effect was maintained only for fruit after 6 months (Laureati et al., 2014). Another study conducted in Pennsylvania, examined the effectiveness of trained peer models to encourage food

acceptance in children during preschool meals (Hendy, 2002). They found that girl models were more effective than boy models and that effectiveness of trained peer models does not last beyond the modeled meals (Hendy, 2002).

In summary, peer-influence can have positive and negative impacts on children's eating behavior and it can last if the exposure is repeated. As lunch might be the only social meal of the day for young school children, peer influence should be taken into account when considering determinants impacting children's food consumption and dietary habit acquisition.

## 2.3 School food environment

School food environment includes not only the nutritional quality of foods available in school but also the setting and ambiance in the cafeteria, as well as all school policies impacting food consumption. This sub-chapter will focus on components of the school environment which impact food consumption during lunchtime.

### 2.3.1 The National School Lunch Program: history and requirements

*Eligibility*: The National School Lunch Program (NSLP) was established under the National School Lunch Act (NSLA) in 1946. Currently, the program operates in over 101,000 public and non-profit private schools and residential child care centers and reaches 30.4 million children (Food and Nutrition Service, 2017b). All children in participating schools are eligible to receive NSLP lunches. Children from low-income families (whose annual household income is at or below 130% of the DHHS poverty guideline) are eligible to receive free lunches. Children from families whose annual income are between 130% and 185% (between $31,980 and $45,510 US for a family of four in 2017) of the poverty level are eligible to receive reduced-price lunches (Food and Nutrition Service, 2017a). Children from higher-income families can purchase

lunches at full price with slightly subsidized rate. Schools receive reimbursement for all lunches served, with higher reimbursements paid for meals served free or at a reduced-price (Cole & Fox, 2008).

*Nutrition Standards*: In 1995, the USDA issued the School Meals Initiative for Healthy Children regulations, which required that meals under the NSLP met the Dietary Guidelines for Americans (School Meals Initiative for Healthy Children, 1995). These regulations applied to foods offered to students. In 2012, the USDA issued new standards for nutrition in the National School Lunch and School Breakfast Program which were required by the Healthy Hunger-Free Kids Act (HHFKA) of 2010. The rule requires most schools to increase the availability of certain foods: fruit, vegetables, whole grains, and fat-free or low-fat milk and reduce the levels of sodium, saturated fats and trans-fats, in school breakfasts and lunches (Food and Nutrition Service (FNS), 2012). Table 2.2 represents the lunch meal pattern requirements following the nutrition standards.

**Table 2.2: Lunch Meal Pattern following the NSLP standards (grades k-5)**

| Meal Pattern | Amount of food per week (Minimum per day) |
|---|---|
| Fruits | 2.5 (0.5) cups (fresh, frozen without added sugar, canned in juice/light syrup, or dried fruit options)<br>✓ No more than half the offerings may be in the form of 100 % juice.<br>✓ ¼ cup dried fruit = ½ cup fruit |
| Vegetables | 3.75 (0.75) cups (excludes juice and lettuce on a sandwich) |
| Dark green | ✓ 0.5 (Larger amounts may be served) |
| Red/Orange | ✓ 0.75 (Larger amounts may be served) |
| Beans/Peas (Legumes) | ✓ 0.5 (Larger amounts may be served) |
| Starchy | ✓ 0.5 (Larger amounts may be served) |
| Other | ✓ 0.5 |
| Additional Veg to reach total | 1 (Any vegetable subgroup may be offered to meet the total weekly vegetable requirement) |
| Grains[2] | 8-9 (1) oz. eq.from bread, rice, pasta, cereal and granola. |
| Meat/Meat alternate | 8-10 (1) oz. eq. min. |
| Fluid Milk | 5 (1) cups (must be fat-free (unflavored/flavored) or 1% low fat (unflavored)) |

Source: National School Lunch Program Meal Pattern, USDA, 2012.

The lunch must be more than 550 kcal and less than 650 kcal, saturated fat must represent less than 10% of total calories and sodium less than 640 mg. To be eligible for Federal reimbursement, meals served through the NSLP must meet these defined nutrition standards. On May 1, 2017, USDA Secretary issued a proclamation announcing flexibilities with respect to sodium, whole grains and flavored milk ("Child Nutrition Programs," 2017; Food and Nutrition Service, 2017c).

### 2.3.2 Challenges faced by the NSLP

*Participation rates*: For several years, participation in the NSLP has been rising among low-income children and declining among children not eligible for free or reduced-price meals (The Food Research and Action Center, 2015). Participation in the NSLP declined by 1.4 million children (or 4.5%) from school year 2010-2011 through school year 2013-2014 (United States

[2] Since July 1, 2014, all grains must be whole grain rich.

Government Accountability Office, 2015). The participation rate (i.e. proportion of all students in schools that take part in the NSLP who ate SM) declined from 62% in school year 2010-2011 to 58% in school year 2013-2014. The Government Accountability Office published a report which assessed challenges school food authorities and schools reported they have faced since the NS. Seven of eight states interviewed reported that changes made to comply with new federal nutrition requirements were not accepted by students and contributed to the decrease in participation but the extent of this association is unclear (United States Government Accountability Office, 2015). Moreover, in another study, students' eligibility for free or reduced price meals was significantly associated with higher odds of students eating SM (OR 5.59, 95% CI 3.03–10.30) (Ohri-Vachaspati, 2014). Data from the NHANES 1999-2004 showed that only 43% of the children between 5-8 years old with higher income participated in the NSLP (Cole & Fox, 2008). The fourth School Nutrition Dietary Assessment Study found that about 46% of elementary school children who are not eligible for school meal benefits will not buy the school meal (USDA, 2012). Furthermore, the factors known to decrease paid student participation are recession, increased charges for paid meals and sales of competitive foods (The Food Research and Action Center, 2015).

*School meal consumption controversy*: A recent systematic review reported that fruits and vegetables were often reported to be the foods wasted in the largest quantities in the NSLP (Shanks, Banna, & Serrano, 2017). An observational study compared elementary school children's fruits and vegetables selection, consumption, and waste before (10 school visits, 498 tray observations) and after (11 school visits, 944 tray observations) implementation of the new USDA requirements (Amin, Yon, Taylor, & Johnson, 2015). More children selected fruits and vegetables in higher amounts when fruits and vegetables were required compared with when

they were optional (0.69 cups vs. 0.89 cups, p<0.001). However, consumption decreased slightly (0.51 cups vs. 0.45 cups, p=0.01) and waste increased (0.25 cups vs. 0.39 cups, p<0.001) (Amin et al., 2015). However, another observational study conducted in a low-income, urban district examined component selection and consumption data from students before the school meals standards and after. They found that the percentage of students choosing fruit significantly increased from 54% (in 2012) to 66% (in 2014) and fruit consumption remained high at 74%. Student selection of fruit increased by 9% for each additional type of fruit offered with the meal. The proportion of students who chose a vegetable dropped from 68% to 52%, but students selecting vegetables ate nearly 20% more of them, effectively lowering vegetable waste (M. B. Schwartz, Henderson, Read, Danna, & Ickovics, 2015).

*Relationship between parents' perception and children's participation*: In a random digit dial phone survey, 1220 parents/guardians with at least one school child aged from 3 to 18 years old living in five low-income New Jersey cities were asked to rate the nutritional quality of the foods provided by his/her school. Compared to children whose parents perceived the lunch to be somewhat unhealthy (71.6%), a significantly higher proportion of students whose parents perceived the SM as somewhat healthy (89%) or very healthy (92%) ate lunch served at school. Thus, compared to students whose parents perceived the meals served at school as very healthy, students whose parents perceived the meals to be very unhealthy (OR = 0.40, 95% CI: 0.15–1.03) or unhealthy (OR = 0.24, 95% CI: 0.11–0.53) had lower odds of eating lunch served at school. The results show that parents' perception of school food offerings is a strong predictor of student SM participation (Ohri-Vachaspati, 2014).

In summary, the current literature shows that NSLP participation has been declining among children not eligible for free or reduced-price meals. These results show that the decrease in

participation cannot be attributed to the new regulations alone. These children might be choosing to eat HPL for which the nutritional quality does not follow any required standard.

### 2.3.3 School cafeteria's environment and school policies

The literature published on the improvement of school cafeteria's environment for children who eat a HPL is limited. None of the published papers look at the facilities (e.g. refrigeration, microwaves) available for children who eat a HPL in the US. This sub-chapter will describe how the ambiance in the cafeteria is influenced by the environment (i.e. cafeteria and lunch room setting), length of time and time of day made available to eat, schedule of recess and cafeteria workers behaviors.

*Nutritional quality of foods available and environmental cues*: Most of the current research is focused on improving the quality of food served in the cafeteria and creating better ambiance and product placement (Golley et al., 2010; Gustafson, Abbey, & Heelan, 2017; Kessler, 2016; Story, Nanney, & Schwartz, 2009; Williamson, Han, Johnson, Martin, & Newton, 2013). The fourth School Nutrition Dietary Assessment Study showed that competitive foods are widely available in schools which may contribute to poor diet quality depending on the nature of the foods sold (Fox & Hall, 2012). Even if vending machines are rare in elementary schools (only 13%), 82% of elementary schools had a la carte offerings available at lunch. Many schools are trying to improve children's dietary intake by offering and marketing healthier options at SM (Fox & Hall, 2012). For example, the "Smarter Lunchroom"[3] is a set of best practices that have been shown to help encourage kids to make healthy choices. These best practices use environmental cues such as better product placement and use of creative names for healthier foods, to increase student selection of healthier items and reduce plate waste (Food and Nutrition Service, 2014).

[3] Developed by the Cornell Center for Behavioral Economics in Child Nutrition Programs (BEN)

However, other environmental factors, such as the ambiance in the cafeteria, might also strongly impact children's dietary intake.

*Length of time and time of day made available to eat*: A case study conducted in Wales involving 11 primary schools showed that overcrowded and multi-purpose cafeteria environment coupled with time pressures detract from the eating experience and the ability of staff to encourage children to eat (Moore et al., 2010). In the US, there are no national standards for school lunch period length (Cohen et al., 2015). On average, children take between 13-35 minutes to eat including service, time at table, and bussing (Conklin & Lambert, 2001). Moore et al., 2010 found that children bringing a HPL usually had less supervision and were less hurried out of the cafeteria (Moore et al., 2010). A study showed that waiting in line is the most commonly reported factor contributing to student dissatisfaction with SM and 34% of schools included in this study provided the last student in the lunch line with only 10 minutes or less to eat his or her lunch which discourages students from purchasing and eating complete lunch (Henderson & Environment & Human Health, 2004). Another study examined the effect of lunch period length on students' food choices and intake (Cohen et al., 2015). They observed 1,001 students in six elementary and middle schools, with lunch periods ranging from 20 to 30 minutes, in a low-income urban school district in Massachusetts, as part of the Modifying Eating and Lifestyles at School (MEALS) study (Cohen et al., 2015). They analyzed the students' food selection and consumption by monitoring what was left on their plates at the end of the lunch period. This study showed that students with less than 20 minutes to eat lunch consumed 12.8% less of their main course (64.4% vs 77.2%, $p<0.0001$), 12% less of their vegetables (34.8% vs 46.6%, $p<0.0001$), and 10% less of their milk (62.3% vs 72.6%, $p<0.0001$) than students who had at least 25 minutes to eat (Cohen et al., 2015). While there were no notable differences

between the groups in terms of entrée, milk, or vegetable selections, those with less time to eat were significantly less likely to select a fruit (44% versus 57%, $p<0.0001$). Also, there was more food waste among groups with less time to eat. The authors concluded that policies that enable students to have at least 25 minutes of seated time might lead to improvements in students' diets and decrease plate waste in school cafeterias (Cohen et al., 2015).

*Schedule of recess:* A study conducted by the National Food Service Management Institute found that most elementary schools studied scheduled recess after lunch (Conklin & Lambert, 2001). An observational study evaluated if moving recess before lunch has an effect on the amount of fruits and vegetables elementary school children eat from their SM (Price & Just, 2015). Participants were in $1^{st}$–$6^{th}$ grade from three schools that switched recess from after to before lunch and from four similar schools that continued to hold recess after lunch (control group). Data was collected for all students receiving a SM. Observers accessed plate waste during 14 days at each school. The authors reported that the schools where recess was scheduled before lunch experienced a 0.157 serving increase in fruit and vegetable consumption (a 54% increase relative to the baseline rates at these schools, $p=0.001$) and 10.1% point increase in the percentage of children eating at least one serving of fruits and vegetables (a 45% increase, $p=0.005$) (Price & Just, 2015). Another study found that recess before lunch increased milk consumption in elementary school children (Hunsberger et al., 2014). Focus groups involving teachers found that they perceived recess before lunch to be beneficial for classroom behavior and readiness to concentrate following lunch (Hunsberger et al., 2014).

*Cafeteria workers behaviors*: Eating behaviors can be influenced through the feeding strategies (e.g. verbal encouragements and praise) adopted by cafeteria workers (Hanks, Just, & Wansink, 2013; M. B. Schwartz, 2007). An observational pilot study evaluated an environmental

intervention intended to increase consumption of fruit serving among elementary school children participating in the NSLP. In the intervention school, cafeteria workers provided a verbal prompt, "Would you like fruit or juice with your lunch?" as the children stood in line in front of fruit serving options. In the control school the cafeteria workers did not provide this verbal prompt (M. B. Schwartz, 2007). The author was assessing two variables. Firstly she wanted to know if the children had left the lunch line with a fruit serving and secondly if they ate it. Half of the children in each school purchased the SM. In the intervention school, 76% purchased a piece of fruit (70% ate it) and 21% a carton of juice (64% drank it). In the control school, 45% purchased a piece of fruit (69% ate it) and 20% took juice (58% drank it). Children in the intervention school were 3.5 more likely to eat their fruit compared to children from the control school. Thus the author concluded that a simple verbal prompt appeared to have a significant impact on fruit consumption (M. B. Schwartz, 2007).

In summary, school cafeteria's environment such as the lunchroom setting, the length of time and time of day made available to eat, and cafeteria workers behavior might all impact the consumption of HPL.

### 2.4 Parents/caregivers' perception of home-packed lunches and school meals

The literature on parents' and children's perceptions of HPL is limited. We know that parents' food packing behaviors are influenced by various factors.

*Parents' perception of their food packing behavior*: A study conducted in Australia aimed to describe the factors affecting food selection for HPL by parents (n=58) of young children attending low socioeconomic schools in Perth (Bathgate & Begley, 2011). The authors conducted nine focus groups. Parents were asked about the food their children ate at school and

their opinions on school food resources. Focus group discussion centered on the themes of the challenge of being a good parent by providing healthy HPL; making compromises in what their children eat at school and the barriers to healthy eating in the school environment. The results of these focus groups showed that children's preferences, convenience, cost and food safety prevented them from including healthier food in the HPL. School-based barriers such as the length of time allowed for eating and the lack of refrigeration impacted the type and amount of food selected (Bathgate & Begley, 2011). Another Australian study aimed to explore parents' views regarding factors that influence children's food choices and parents' decision-making regarding the food they provide (K. J. Campbell, Crawford, & Hesketh, 2007). The authors conducted in-depth one-on-one interviews with parents (n=17) of children in their first year of formal schooling (5–6 years old) (K. J. Campbell et al., 2007). Results from these in-depth interviews showed that some parents offered food on the basis of the child's tastes or preferences and they believed that food marketing and food made available influenced their preferences and what they ate (K. J. Campbell et al., 2007). These parents also believed that peers were influencing their child's food preferences and eating behavior. Involving children in the preparation of food was seen by parents as having a positive impact on children's food choices (K. J. Campbell et al., 2007). In an observational study which aimed to examine differences between SM and HPL, the authors also interviewed several parents that sent HPL. Many of these parents reported that "they pack high-fat/high-sugar foods because their child refuses to eat healthier options and may even discard these healthier foods if packed in their lunch". Parents reported that they do not want to waste foods and worried that if their children do not eat their lunch it may have negative impacts on their children academic performance (Johnston et al., 2012).

*Parents' decision to prepare HPL*: A study conducted in the UK, aimed to explore parents' views about making their children's HPL and identify influences on food choice and find ways to improve HPL content (Griffin & Barker, 2008). Their sample included parents (9 fathers, 22 mothers) from staff at the University of Sheffield, thus from a relatively-high socio-economic population, who were regularly and frequently (3 times per week, n=26) making a packed lunch. Their children (n=47, 22 girls) were aged between 4 and 11 years (7.41 ± 1.98 years). The main reasons for giving HPL were: parental concern over quality of SM, children's taste preferences and children wishing to sit with their friends at lunchtime (Griffin & Barker, 2008). Parents did not classify making HPL as an enjoyable activity but it was still part of the household routine. Parents reported that their children's food preferences were driven by peer influence and pressure to consume lunch quickly. The authors also reported that lack of refrigeration facilities at schools influenced content as parents discussed food safety concerns relating to lunchbox storage (Griffin & Barker, 2008). HPL were considered a cheaper option than SM. In terms of improving HPL nutritional quality, the authors suggested integrating dining facilities for school dinners and packed lunches, increasing time to eat and providing cold storage facilities for HPL (Griffin & Barker, 2008). The authors concluded that interventions may help to reduce negative peer pressure around 'healthy' food, and directly address negative stereotypes associated with SM (Griffin & Barker, 2008). In another study conducted in the US, an online survey was completed by caregivers of elementary school students in a rural and diverse socio-economic school system (Farris et al., 2016). The authors reported that the questionnaire included 34 questions assessing perceived benefits and challenges of SM and HPL. Caregivers (n=106) were asked to rate different statements from strongly disagree (1) to strongly agree (5). Key beliefs for choosing the SM included: nutritional value (mean score of 4.03 with 75.7% indicating

agreement); variety of choice (3.02; 38.7%); and amount of food (3.03; 31.1%). For choosing HPL, key beliefs included: the SM did not offer enough food (4.08; 73.2%), they would save money (3.79; 64.9%), and the child would eat more (3.73; 64.9%). Few caregivers believed they could pack more nutritious meals than SM (2.02; 9.3%), and the new nutrition standards did not affect how often their child participated in the NSLP (2.76; 42.5%) (Farris et al., 2016).

In summary, perceived children's preferences, convenience, concern over quality of SM, cost and food safety are strong determinants of food packing decisions. School-based barriers such as the lenght of time allowed for eating and lack of refrigeration impacted the type and amount of food selected. Parents also believed that food marketing and peers influenced their child's food preferences. However, these studies do not assess parents' self-efficacy to pack a healthy HPL, their knowledge in nutrition and parental feeding style.

### 2.5 Nutritional differences between school meals and home-packed lunches

Recent studies have been conducted to assess and characterize the content of HPL by school children and compare it with nutrition standards or with SM. These studies tend to show that HPL need improvement and do not fulfill the nutrition standards.

#### 2.5.1 Studies conducted in the United States of America

*Studies conducted before the new nutrition standards*: Three observational studies were conducted before the new nutrition standards and compared HPL with SM. The first one conducted in Southeastern Michigan on 2$^{nd}$ to 4$^{th}$ grade children (SM: n=281; HPL: n= 289) found that SM provided less fat than HPL (29% vs. 33% $p \leq 0.0001$), but no significant difference in saturated fat. SM provided more protein, fiber, vitamin A, vitamin D, vitamin B6, vitamin B9, vitamin B12, vitamin B1, vitamin B2 ($p \leq 0.0001$), vitamin B3 ($p=0.003$) and calcium, iron and

zinc ($p \leq 0.0001$) (see Appendix 5). HPL were significantly higher ($p \leq 0.001$) in carbohydrates, fat, sugar and vitamin C (Rainville, 2001). SM also had significantly more food items (3.7 ± 1.1) than HPL (3.4 ± 1.0). Thus, SM provided more food variety than HPL (Rainville, 2001). The second study was conducted on 4th and 5th graders (SM: n=85; HPL: n= 44) in 2 suburban elementary schools from 1 school district within the Minneapolis, Minnesota metropolitan area participating in a whole grain intervention program from February to May 2005 (Hur, Burgess-Champoux, & Reicks, 2011). This study showed that intake of energy, total fat, monounsaturated fatty acids, polyunsaturated fatty acids, and carbohydrate from lunch was significantly lower for children who ate a SM compared with those who ate a HPL (Hur et al., 2011). Total and added sugars and energy density were also significantly lower for children who ate a SM compared with those who ate a HPL. Children who ate a SM consumed significantly more protein, omega-3 fatty acids ($p$=0.047), and vegetables than those who ate a HPL. However, they consumed less fruit and whole grain foods compared with children who ate a HPL (Hur et al., 2011). The third study was conducted in a local school district in southeast Texas on 2$^{nd}$ graders, trained observers reported 2107 lunches including 38.5% of HPL. They found that HPL contained significantly less fruits (45.3% vs.75.9%), vegetables (13.2% vs. 29.1%) and dairy (41.8% vs. 70.0%) than school lunches ($p < 0.001$). HPL were also more likely to have snacks high in sugar and/or fat (60.0% vs. 17.5%) and non 100% fruit juice (47.2% vs. 0.3%) ($p < 0.001$) than SM (Johnston et al., 2012). The main limitation of this study is that the actual consumption was not examined. Indeed, only the presence or absence of foods was noted (Johnston et al., 2012).

*Studies comparing HPL with new nutrition standards*: Three recent observational studies have compared HPL with new nutrition standards. The first one is a cross-sectional analysis which characterized foods and beverages brought in HPL by elementary school children in 3$^{rd}$

and 4th grade (Hubbard et al., 2014). The authors compared the quality of HPL with NSLP standards and packed snacks with Child and Adult Care Food Program requirements. In this study, 48% (n=301) of participants (mean age of 9.1 ± 0.6 years) ate a HPL (Hubbard et al., 2014). Among the lunches, 97% (n=291) were brought with a snack and 3% (n=10) without a snack. The median number of items brought for lunch was 3 (range = 1 to 7), consisting of 2 foods (range = 1 to 6) and 1 beverage (range = 1 to 3). The authors reported that the typical HPL consisted of water, a sandwich, and a snack food and the most common foods provided were sandwiches (59%), snack foods (42%), fruit (34%), and dessert (28%). The authors added that less common foods included leftovers (17%), dairy foods (17%), and vegetables (11%). 73% of lunches contained a beverage, mainly water (28%) followed by sugar-sweetened beverages (SSB) (24%). As a result, the authors reported that only 27% of lunches met at least three of five NSLP standards (Hubbard et al., 2014). Some of the limitations in this study were that the authors did not know who packed the lunch or snack, some foods and beverages might have been assigned to the incorrect eating occasion and actual food consumption was not measured. Thus, some of these foods could have been thrown out, shared or returned home (Hubbard et al., 2014). The second observational study was conducted in pre-kindergarten and kindergarten children from 3 schools in rural Virginia (Farris et al., 2014). Trained observers filled a checklist to record the meal components of the day's specific menu and items commonly consumed in HPL. They recorded the presence of all food and drinks served as part of the NSLP. The checklist also had write-in sections for additional foods which were not part of the checklist. The authors collected 1,314 observations for 5 consecutive school days and found that 42.8% (n=562) were HPL and 57.2% (n=752) were SM. Using the nutrient analysis provided by the school foodservice director and the Nutritionist Pro Diet Analysis software, their data analysis showed

that energy, carbohydrate, fat, saturated fat, sugar, vitamin C, and iron were significantly higher ($p$<0.001) for HPL compared with SM. However, protein, sodium, fiber, vitamin A, and calcium were significantly lower ($p$<0.001) for HPL compared with SM (Farris et al., 2014). HPL were less likely to contain fruits (54% vs. 67%), vegetables (17% vs. 61%), juice with no sugar (10% vs. 22%), and milk (20% vs. 96%) than SM. They also contained more savory snacks such as chips and crackers (57% vs. 5%) and SSB (40% vs. 0%). Some of the most commonly brought food items in HPL were peanut butter sandwiches (n=155), single-serving chips (n=145), single-serving yogurt items (cups and tubes) (n=117), Capri Sun drink pouches (n=112), and Lunchables (i.e. prepackaged food and drink combinations) (n=102). 61% of HPL contained a dessert item (i.e. grain-based desserts, chocolate bars, dairy-based desserts, gummies, and candy) and 17% contained > 1 dessert item. The SM did not provide dessert items to students. One of the largest limitations of this study was that actual consumption of food items was not measured (Farris et al., 2014). The third observational study was conducted in one Houston, Texas, area school district and included 242 elementary and 95 intermediate school students who ate HPL (Caruso & Cullen, 2015). This study was conducted prior to the implementation of the HHFKA but nutrient and food group content were compared with current NSLP guidelines. Amounts eaten were recorded along with foods brought, grade and sex of the students. As a result, HPL contained more sodium (1110 vs. ≤ 640 mg for elementary and 1003 vs. ≤ 710 mg for intermediate students) and fewer servings of fruits (0.33 cup for elementary and 0.29 cup for intermediate students vs. 0.50 cup per the NSLP guidelines), vegetables (0.07 cup for elementary and 0.11 cup for intermediate students vs. 0.75 cup per the NSLP guidelines), whole grains (0.22-oz equivalent for elementary and 0.31-oz equivalent for intermediate students vs. 0.50-oz minimum per the NLSP guidelines), and fluid milk (0.08 cup for elementary and 0.02 cup for

intermediate students vs. 1 cup per the NSLP guidelines). About 90% of HPL contained desserts, snack chips, and SSB but these foods are not permitted in the nutrition standards (Caruso & Cullen, 2015). This study data have some limited precision because data collectors were unable to clarify lunch contents with students or weigh food waste. A common limitation in these three studies is that standards for SM do not guarantee consumption of SM components. Indeed as the authors explained there could be great variability between the SM guidelines and the quality of student SM consumption.

*Studies comparing elementary school students diet quality when eating school lunch or not*: A study conducted by USDA, analyzed the diet quality of American school children by NSPL participation status using the Healthy Eating Index (HEI)-2005 (Condon et al., 2015). This diet quality index assesses conformance to the Dietary Guidelines for Americans. This study used data from the National Health and Nutrition Examination Survey (NHANES) which constitute a nationally representative sample of school children (5-18 years old) in the US. The overall school children HEI-2005 total score was 58. Among income-eligible children, NSLP participants had a higher HEI-2005 total score than their nonparticipant counterparts (60.5 vs. 55.1). There were no differences in total HEI-2005 scores between higher-income NSLP participants and nonparticipants (Condon et al., 2015). Among income-eligible children, NSLP participants had a higher score than nonparticipants for “total vegetables” (2.5 vs. 2.2) and “milk” (9.1 vs. 6.8). Income-eligible NSLP participants also had a higher score than their nonparticipant counterparts for “empty calories”, indicating a lower consumption of this component (10.3 vs. 8.0). Among higher-income children, NSLP participants had a lower score than nonparticipants for “total fruit” (2.7 vs. 3.4) and “whole fruit” (3.2 vs. 4.1). On the other hand, higher-income NSLP participants had a higher score than their nonparticipant counterparts

for “milk” (9.5 vs. 7.6) (Condon et al., 2015). Among children 5–8 years old, income-eligible NSLP participants had a higher mean usual intake of potassium (62% of AI versus 50% of AI), fiber (54% of AI vs 42% of AI), sodium (235% of AI versus 210% of AI), than income-eligible nonparticipants (Condon et al., 2015). Another study examined the diet quality of fourth- and fifth grade students (n=3203) in relation to their source of breakfast and lunch. Children’s dietary intake was collected using diary-assisted 24-hour recall interviews conducted by trained interviewers and their diet quality was assessed using the HEI-2010 (Au, Rosen, Fenton, Hecht, & Ritchie, 2016). They found that children who ate SM had a better diet quality compared to those who ate a HPL (HEI-2010=49.0±11.3 vs. 46.1±12.2; $p$=0.02), higher scores for dairy (7.9±2.8 vs. 5.9±3.4, $p$<0.0001) and for empty calories (12.9±5.4 vs 11.4±5.2, $p$=0.007) (Au et al., 2016). However, this study was conducted prior to the implementation of the HHFKA, which might have impacted those results.

In summary, these results tend to show that HPL contain fewer vegetables and less milk, more desserts, more snack foods, more fruits and more SSB. In term of nutrient intake, only one recent study actually measured nutritional intake and found that sodium intakes exceeded guidelines. None of these studies assessed the diet quality of young school children who frequently eat HPL using a validated diet quality index.

**2.5.2 Studies conducted in other countries**

*United Kingdom (UK)*: In the UK, more than half of primary school children eat a HPL. In 2006, the British government established food-based standards, and in 2008, nutrient-based standards for SM. A meta-analysis compared SM and HPL including surveys in which data were collected from January 1990 up to December 2009 and measurement of energy and nutrient intakes. This study reported that seven out of eight studies reported higher energy intakes in

HPL. The pool estimates were higher in HPL for energy intake (543 kJ, 95 % CI 233-854); total sugar intake (14.0 g, 95 % CI 10.3-17.7); non-milk extrinsic sugar intake (11.7 g, 95 % CI 7.3-16.2); saturated fat intake (4.7 g, 95 % CI 2.4-7.1) and sodium intake (357 mg, 95 % CI 174-539) (Charlotte E L Evans, Cleghorn, Greenwood, & Cade, 2010). Differences between SM and HPL were larger for all nutrients after the introduction of food-based standards compared with the period without standards (Charlotte E L Evans et al., 2010). However, differences between before and after standards were not statistically significant. The authors concluded that the nutritional quality of HPL is poor compared with SM and the food-based standards for SM introduced in 2006 has slightly widened the nutritional gap (Charlotte E L Evans et al., 2010). Another study, conducted in England, collected data in a nationally representative sample of 136 elementary schools after the introduction of nutrition standards for school food. They assessed 6580 SM and 3422 HPL and found that the mean intake of protein, fat, saturated fat and vitamin C from both types of lunches met the nutrient-based standards (Pearce, Harper, Haroun, Wood, & Nelson, 2011). Children eating SM on average consumed significantly ($p \leq 0.001$) more protein (15.1 g vs. 13.5 g), non-starch polysaccharides (3.6 g vs. 2.7 g), vitamin A (242.5 µg vs. 115.9 µg), folate (49.8 µg vs. 38.1 µg), zinc (1.7 mg vs. 1.5 mg) and less fat (13.3 g vs. 17.3 g), saturated fat (5 g vs. 6.5 g), non-milk extrinsic sugars (10.8 % vs. 15.1%), sodium (443.3 mg vs. 626.9 mg), calcium (167.5 mg vs. 211.6 mg), vitamin C (17.3 mg vs. 25.9 mg) and iron (1.9 mg vs. 2 mg) than children eating a HPL (Pearce et al., 2011). The authors also found that energy intakes were low in both groups (Pearce et al., 2011). Another cross-sectional analysis of 680, 24-h dietary recalls from 311 school children aged 4-11 years from low income households, showed that for younger students (4-7 years), HPL provided less folate, more sodium and more fat and saturated fatty acids than SM (Stevens & Nelson, 2011).

A cross-sectional survey, also conducted in UK, using a validated 24h estimated food diary, determined the nutritional and dietary intakes of children consuming either SM (n=1053) or HPL (n=1320) (C. E. Evans, Mandl, Christian, & Cade, 2015). They found that children eating HPL consumed on average 11.0 g more total sugars (95% CI 6.6, 15.3 g) and 101 mg more sodium (95% CI 29, 173 mg) over the whole day. Conversely, children eating SM consumed, on average, 4.0 g more protein (95% CI 2.3, 5.7 g), 0.9 g more fibre (95% CI 0.5, 1.3 g) and 0.4 mg more zinc (95% CI 0.1, 0.6 mg). There was no difference in daily energy intake by lunch type. Over the whole day, children eating a HPL were more likely to consume snacks and sweetened drinks; while children having a SM were more likely to consume different types of vegetables (C. E. Evans et al., 2015).

*Canada*: A cross-sectional survey, completed by students in 5th and 6th grade (n=1980), data showed that foods purchased at school were higher in nutrient density for ten micronutrients: calcium (1203.8 mg vs. 375 mg), magnesium (156.2 mg vs. 114.2 mg) , potassium (2012 mg vs.1179.5 mg), zinc (5.7 mg vs. 3.6 mg), vitamin A (611.2 RAE[4] vs. 197.7 RAE), vitamin D (9.5 µg vs. 0.78 µg), riboflavin (1.94 mg vs. 0.8 mg), niacin (14.1 mg vs. 13.5 mg), vitamin B6 (0.62 mg vs. 0.56 mg) and vitamin B12 (4.2 µg vs. 1.11 µg) compared with HPL. HPL were higher in 3 micronutrients: iron (6.8 mg vs. 4.3 mg), vitamin C (92.6 mg vs. 44.5 mg) and folate (199.5 µg vs. 134.5 µg). SM were higher in sugar (84.5 g vs. 68.5 g) and lipid (35.5 g vs. 31.1 g) than HPL which were higher in carbohydrates (152.8 g vs. 126.8 g), fiber (9.1 g vs. 5.6 g) and sodium (2020.8 mg vs. 1473.1 mg) than SM (Taylor et al., 2012).

*Denmark*: The OPUS[5] School Meal Study investigated the effects on the intake of foods and nutrients of introducing SM based on the principles of the New Nordic Diet (NND) covering

[4] RAE: Retinol Activity Equivalents
[5] Optimal well-being, development and health for Danish children through a healthy New Nordic Diet

lunch and all snacks during the school day in a cluster-randomized cross-over design (Andersen et al., 2014). Thus, for two 3-month periods, Danish children aged 8–11 years from 46 school classes at 9 schools received SM following the principles of the NND (n=700) or their usual HPL (control, n=704) in random order. The whole diet of the children was recorded over seven consecutive days using a validated Web-based Dietary Assessment Software completed by children aided by their parents (Damsgaard et al., 2012). The NND resulted in higher intakes of potatoes (130%, 95% CI 2.07, 2.58), fish (48 %, 95% CI 1.33, 1.65), cheese (25 %, 95% CI 1.15, 1.36), vegetables (16 %, 95% CI 1.10, 1.21), eggs (10 %, 95% CI 1.01, 1.19) and beverages (6 %, 95% CI 1.02, 1.09), and lower intakes of bread (13 %, 95% CI 0.84, 0.89) and fats (6 %, 95% CI 0.90, 0.98) were found among the children during the NND period than in the HPL period (all, $p<0.05$) (Andersen et al., 2014). For micronutrient intakes, the largest differences were found for vitamin D (42 %, 95% CI 1.32, 1.53) and iodine (11 %, 95% CI 1.08, 1.15) due to the higher fish intake (Andersen et al., 2014). The authors concluded that the overall dietary intake was improved when children's habitual HPL were replaced by SM following the principles of the NND (Andersen et al., 2014).

These studies conducted in highly developed countries found that HPL tend to contain more total sugar, non-milk extrinsic sugar intake, saturated fat, sodium, iron, vitamin C, snack foods and sweetened beverages than SM following NS. These results are similar with what was found in studies conducted in the United-States.

### 2.6 Conceptual Framework

The conceptual framework that guided the study is based on the Social Cognitive Theory (SCT) (A. Bandura, 1989) and is presented in Figure 1. The framework illustrates the dynamic

interplay among children's and parents' related factors, environmental factors and behavior affecting the diet quality and consumption of HPL. At an individual level, we have two populations involved: child related factors will interplay with parent related factors. For example, children's tastes and preferences might impact the preparation of HPL by parents/caregivers and be influenced by parental feeding style and peer-pressure. Children observe and learn from models (e.g. caregivers and peers present in the cafeteria). The parents/caregivers' behaviors are also impacted by their self-efficacy, which refers to their confidence in cooking and preparing a healthier lunch. Environmental factors such as the availability of refrigeration, time allocated to eat, recess schedule, the ambiance and the number and behavior of lunch aids might play a role in lunch consumption in children and parents' decision related to NSLP participation and/or lunch packing behavior.

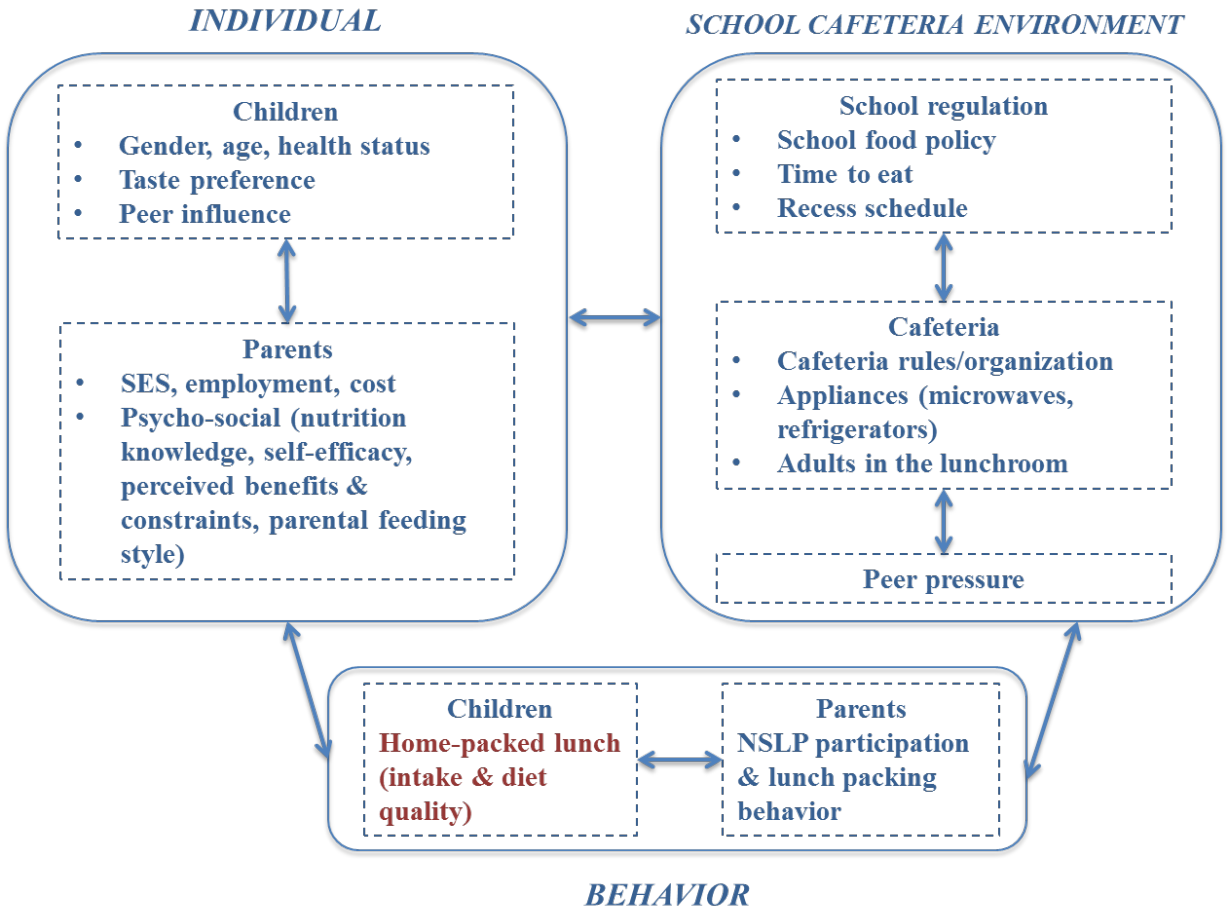



**Figure 2.1: Conceptual framework illustrating the relationship between personal factors, environmental factors and behavior regarding the diet quality of HPL**

# CHAPTER 3 : METHODS

## 3.1 Study design and setting

This formative study has a cross-sectional design and was conducted in one school district in Maryland, USA.

The free and reduced-price meals (FARMS) percentage can be used as a proxy measure for the concentration of low-income students within a school (NCES, 2015). The selected county covered a range of population with different income and contained a fair amount of elementary schools widespread all over this economic disparity.

Previous studies have shown that children not eligible for free and reduced prices meals (i.e. children from families with incomes over 185% of the poverty level) are less likely to participate in the NSLP (Ohri-Vachaspati, 2014). In 2011, the Office of Legislative Oversight of this school district reported that 78% of students who qualify for FARMS participated in the NSLP compared to only 23% of students who paid full-price. These data implied that, in this County, parents of students who have to pay for their lunch prefer to choose other options such as bringing their own foods. Also, we could assume that no other foods would be bought by study participants, as vending machines cannot be used by students in elementary schools during lunch time. Indeed, in this county, the vending machines are turned off for 30 minutes after classes end for the day.

## 3.2 Recruitment and study participants

### 3.2.1 School recruitment

Data were collected from October 2016 to June 2017 from 9 schools. Using stratified random sampling, 133 elementary schools in the selected school district were divided into four groups

based on their FARMS percentage using the thresholds developed by the National Center for Education Statistics (NCES, 2015). Groups were defined as “Low-poverty,” “Mid-low poverty,” “Mid-high poverty” and “High-poverty.” Within each group, two strata were created based on schools’ size using data on total enrollment during the 2015/2016 school year in order to recruit an equal number of large and small schools. “Large schools” were defined as those with an enrollment number greater than the median of that group, while “Small schools” were defined as those with an enrollment number less than the median. Schools were randomly selected from each stratum using Excel version 14.6.0.

Elementary school principals from randomly selected schools were contacted via email or telephone. If they were unwilling to participate, another school was randomly selected from the relevant group and stratum in order to reach one school in each stratum.

Four schools were recruited in the groups “Low-poverty” and “Mid-low poverty,” respectively (i.e. one large school and one small school in each group) and fours schools in the “High-poverty” group and “Mid-high poverty” group (one large school and three small schools agreed to participate). As the parents’ participation rate was very low in the schools from the “Mid-high poverty” and “High-poverty” groups, an additional school from the “Low-poverty” group was randomly selected.

### 3.2.2 Recruitment of study participants

Elementary school principals from randomly selected schools were contacted via email or telephone. If they were unwilling to participate, the first author then contacted the next school in the same group. Four schools out of the 15 contacted agreed to participate in the “Low-poverty” and “Mid-low poverty” groups, respectively (i.e. one large school and one small school in each

group) and four schools out of the 36 contacted agreed to participate in the “High-poverty” group and the “Mid-high poverty” group (one large school and three small schools agreed to participate). As it was challenging to recruit participants in the schools from the “Mid-high poverty” and “High-poverty” groups, an additional school from the “Low-poverty” group was recruited.

After approval from the principal, using the school staff directory, the first author sent a group email to all teachers of kindergarten and first grade classes (n=84) aiming to recruit at least four teachers per FARMS group and inviting them to complete a survey.

Parents of children in kindergarten and first grade, aged 5 to 8 years old and who frequently consume a HPL (i.e. at least three times a week) were invited to participate in this study. This young age group was targeted as it has not been studied in this manner in the US and because childhood is a critical time to promote healthy eating habits and to establish nutritional interventions. Parents also needed to be the parent most frequently responsible for the HPL preparation.

Teachers and principals were asked to communicate information (i.e. aims and requirements) on the study to the parents in their class. This information was either sent by email or via the “take home” folder depending on what was considered less burdensome by teachers and principals. Recruitment flyers were available in English and Spanish to allow parents who could not read English to participate in the study. Parents willing to participate could reply directly to the survey or contact the first author who would then send the link of the survey. All communications with participants occurred via emails. As compensation, participating parents could choose a new lunch box with their child’s favorite character that was brought to the school by the first’s author and distributed by the school’s staff.

### 3.3 Ethical approval

The study protocol and the consent documents were reviewed and approved by the ethics committee of the Institutional Review Board (IRB) at the University of Maryland, College Park and the Office of Shared Accountability of the selected school district.

Principals and vice-principals signed a consent form before the interview. Concerning the web-based surveys, the consent form was presented to parents and teachers online before completing the questionnaire. A sentence at the end of the consent page reminded parents and teachers that they were providing their consent by clicking the submit button.

### 3.4 Data collection instruments

This study combined qualitative and quantitative data collection methods, including structured surveys, web-based 24-hour dietary recalls and in-depth interviews (see Table 3.1). Thus, the instruments used to collect data included an in-depth interview guide used to interview principals and vice-principals, a structured survey that was completed by teachers, and a structured survey that was completed by parents/caregivers. The surveys were online and the links were sent via email when possible to decrease the burden for the respondent and still allow participation of parents with lower computer/Internet skills (Pouchieu et al., 2015). Web-based surveys were created using the website Qualtrics®, and participants could either use their computer or a mobile device to complete the survey. The survey for parents was translated in Spanish using a back-and-forth translation by one native speaker in Spanish and one native speaker in English and Spanish. The translation was conducted as the schools communicate in both languages to their parents (e.g. newsletters, forms, etc.).

**Table 3.1: Data collection instruments**

| Instrument | Format | Target group |
|---|---|---|
| **In-depth interviews** | In-person | School administrators, |
| **Structured survey** | Online | Teachers |
| **Structured survey** | Online | Parents/caregivers |
| **Demographics**<br>**HPL preparation,**<br>**Psychosocial factors (self-efficacy, nutrition knowledge, perceived benefits and constraints)**<br>**Parental feeding styles**<br>**Perceived child preferences and peer-pressure** | | |
| **24-hr dietary recall/Healthy Eating Index** | Online | Parents/caregivers with their child |

### 3.4.1. In-depth interview

The interview guide was developed to explore three main topics: the school policies for lunch and recess including factors affecting lunch/recess schedules and duration; the school cafeteria environment and operation including appliances available to store and reheat HPL and their perceived effect on the content of HPL, the role of lunch aids/volunteers in the cafeteria and possible effect on food intake of children with HPL and the rules they are supposed to follow when children are trading food or does not eat HPL; and finally their perceived quality and consumption of HPL (see Appendix 1).

### 3.4.2. Web-based survey for teachers

The goal of the survey administered to teachers was to assess if they perceive HPL as being beneficial or detrimental for their students' lunch intakes and content and to understand any possible implications of HPL on their class organization (e.g. perceived burden of collecting and storing children's lunch boxes before lunchtime) (see Appendix 2).

### 3.4.3. Web-based survey for parents

A web-based survey was developed and completed by parents to understand key drivers of parental lunch packing behaviors including reasons for packing lunch, self-efficacy for preparing a healthy HPL in difficult situations and for enacting healthy diet behaviors in their children, nutrition knowledge, perceived benefits and constraints of HPL, parental feeding styles, parental perceived child preferences and peer-pressure. A series of scales was adapted from previously validated studies or developed if validated tools were not available (see Appendix 3).

### 3.4.4. Automated Self-administered 24-hour Recall (ASA24)

Dietary intake cannot be estimated without a certain amount of error (Collins, Watson, & Burrows, 2010). The literature shows that young children cannot accurately self-report their dietary intakes before the age of 9 years old (Collins et al., 2010). Under the age of 8 years old, children cannot conceptualize frequency and need adult assistance to provide dietary information as they have limited reading skills, memory, knowledge of food, limited attention span and do not control their food environment (Livingstone & Robson, 2000; Livingstone, Robson, & Wallace, 2004; McPherson, Hoelscher, Alexander, Scanlon, & Serdula, 2000). The presence of a surrogate knowledgeable of the child's diet was then necessary.

In this study, 24-hour dietary recalls were used to collect children's dietary intake as it presents the advantage that it captures intake with less bias than food-frequency questionnaires and is less affected by reactivity than food records ("24-hour Dietary Recall (24HR) At a Glance | Dietary Assessment Primer," 2015).

24-hour dietary recalls were collected using the Automated Self-Administered 24-hour Recall (ASA24) developed by the National Cancer Institute (Subar et al., 2012). This is a free web-based tool that includes user-friendly features such as icons and pictures and is available in

English or Spanish. The ASA24 dietary recall allows the parents/caregivers to complete the recall with their child as it can be done at the end of the day when the child is back from school. In terms of validity, the ASA24 development team conducted numerous small-scale cognitive and usability tests on the ASA24-2014 Respondent Web sites. Results suggested acceptable face validity (i.e., calorie, nutrient, and food group estimates that are consistent with data from the National Health and Nutrition Examination Survey) and very close agreement between ASA24 and standardized interviewer-administered 24-hour recalls. However all evaluation's studies were conducted using the ASA24-2011 (Kirkpatrick et al., 2014; Schap et al., 2014; Thompson et al., 2015; Zimmerman et al., 2015).

In this study the latest version of ASA24 (i.e. ASA24-2016) was used (see Appendix 5), even if no evaluation studies were conducted using this version, the National Cancer Institute reported having no reason to believe that previous validation findings would be different using the latest version ("ASA24® Evaluation & Validation," 2017, p. 24). ASA24-2016 consists of a respondent web site used to collect recall data and a researcher web site used to manage study logistics and obtain data analyses. The ASA24-2016 guides the respondents through the 24-hour recall interview using a modified version of the USDA's Automated Multiple-Pass Method, including a minimum of seven steps. In addition to allow parents to find foods and drinks to report by browsing food groups or searching from a list, the ASA24-2016 also uses images to assist participants in reporting portion size (see screenshot appendix 4). The interview process includes a meal-based quick list, meal gap review, detail pass, final review, forgotten foods, last chance and question about whether the day's intake was usual or not. The analytic output files from the ASA24-2016 include nutrient and food group analyses, i.e. a summary of respondents'

quick list entries, food codes, energy, nutrients/dietary constituents and Food Pattern Equivalents.

With the agreement of the principals, during the data collection period, parents were instructed to tell their children not to discard any uneaten food from the lunch box and ask their children if they trade foods during lunch time. This allowed parents to accurately estimate the amount of food eaten by their child. Parents were asked to report their child's intakes for two weekdays during two different weeks. Reporting dates (i.e., the day on which respondents accessed the system to complete dietary recall) were calculated to be one day after the intake date. Parents were contacted via email on reporting dates and asked to report children's food intake if it was a day when their child did not buy lunch. If the child had bought a school meal on "intake date," another reporting date was determined and the parents were contacted again. Parents were also asked to report eating occasion and time of consumption, location of consumption, who ate with the child and if television or computer was used during the meals.

### 3.4.5. Measure of diet quality: the Healthy Eating Index

The HEI is a diet quality index that measures conformance with federal dietary guidance (Guenther et al., 2014). The diet quality is assessed from two perspectives. The first perspective is related to "adequacy" and contains nine dietary components to increase which means that increasing levels of intake receive increasingly higher scores. The second perspective is related to "moderation" and includes three dietary components in the HEI-2010 and four dietary components in the HEI-2015 to decrease which means that increasing levels of intake receive decreasingly lower scores (Guenther et al., 2013). The US Department of Agriculture Food Patterns translate key recommendations from the Dietary Guidelines for Americans into specific quantified recommendations for types and amounts of foods to consume at 12 calories levels

which are used to calculate HEI scores. When considering intakes between the minimum and maximum standards, HEI scores are rated proportionately. Table 3.2 shows the HEI-2010 and HEI-2015 components and standards established for scoring. The HEI-2010 and HEI-2015 capture the key recommendations of the 2010 and 2015 Dietary Guidelines (Guenther et al., 2013).

**Table 3.2: Healthy Eating Index-2010 and 2015 components and standards for scoring**

| Component | Maximum points | Standard for maximum score | Standard for minimum score of zero |
|---|---|---|---|
| **Adequacy[1]:** | | | |
| Total fruit[2] | 5 | ≥ 0.8 cup equivalent per 1,000 kcal | No Fruit |
| Whole fruit[3] | 5 | ≥ 0.4 cup equivalent per 1,000 kcal | No Whole Fruit |
| Total vegetables[4] | 5 | ≥ 1.1 cup equivalents per 1,000 kcal | No Vegetables |
| Greens and Beans [4] | 5 | ≥ 0.2 cup equivalent per 1,000 kcal | No Dark Green Vegetables or Beans and Peas |
| Whole Grains | 10 | ≥ 1.5 oz. equivalents per 1,000 kcal | No Whole Grains |
| Dairy[5] | 10 | ≥ 1.3 cup equivalents per 1,000 kcal | No Dairy |
| Total Protein Foods[6] | 5 | ≥ 2.5 oz. equivalents per 1,000 kcal | No Protein Foods |
| Seafood and Plant Proteins[6,7] | 5 | ≥ 0.8 oz. equivalent per 1,000 kcal | No Seafood or Plant Proteins |
| Fatty Acids[8] | 10 | (PUFAs+MUFAs)/SFAs >2.5 | (PUFAs+MUFAs)/SFAs ≤ 1.2 |
| **Moderation:** | | | |
| Refined Grains | 10 | ≤1.8 oz. equivalents per 1,000 kcal | ≥ 4.3 oz. equivalents per 1,000 kcal |
| Sodium | 10 | ≤1.1 g per 1,000 kcal | ≥2.0 g per 1,000 kcal |
| Empty Calories[9] | 20 | ≤19% of energy | ≥50% of energy |
| **Replaced in HEI-2015 by** | | | |
| Added Sugars | 10 | ≤ 6.5 % of energy | ≥26% of energy |
| Saturated Fats | 10 | ≤ 8% of energy | ≥16% of energy |

1. Intakes between the minimum and maximum standards are scored proportionately.
2. Includes 100% fruit juice.
3. Includes all forms except juice.
4. Includes any beans and peas not counted as Total Protein Foods. In HEI-2015, legumes are no longer allocated to either the protein components or the vegetable components. Instead, legumes are allocated in all of these components, including Total Vegetables, Greens and Beans, Total Protein Foods, and Seafood and Plant Proteins.
5. Includes all milk products, such as fluid milk, yogurt, and cheese, and fortified soy beverages.
6. In HEI-2010, beans and peas are included here (and not with vegetables) when the Total Protein Foods standard is otherwise not met.
7. Includes seafood, nuts, seeds, soy products (other than beverages) as well as beans and peas counted as Total Protein Foods.
8. Ratio of polyunsaturated fatty acids (PUFAs) and monounsaturated fatty acids (MUFAs) to saturated fatty acids (SFAs).
9. In HEI-2010, calories from solid fats, alcohol, and added sugars; threshold for counting alcohol is >13 g/1,000 kcal. In 2015, the Empty Calories component was replaced with two discrete categories, Saturated Fat and Added Sugars, because the 2015 Dietary Guidelines emphasized limiting added sugars in the diet, and for the first time recommended that consumption of added sugars be kept to less than 10% of caloric intake. Also, solid fats were replaced by saturated fatty acids for the purpose of calculating the standard; and alcohol was removed as an item that contributes an effect to a specific component. Though excessive calories from alcohol are now no longer included within a separate component, total alcohol calories are included in the total calories (the denominator by which almost all standards are calculated); thus these calories are still accounted for in that way.

Source: https://epi.grants.cancer.gov/hei/comparing.html

For all components, higher scores indicate closer agreement with dietary guidance. The scoring standards are density-based (per 1,000 calories) which mean that the relative mix of foods is evaluated rather than total calories consumed (Guenther et al., 2013). It employs least restrictive standards, i.e. those that are easiest to achieve among recommendations that vary by energy level, sex, and/or age (Guenther et al., 2014).

Validity and reliability studies scored exemplary menus and used two 24-h dietary recalls from participants from the 2003–2004 National Health And Nutrition Examination Survey (NHANES) to estimate multivariate usual intake distributions (Guenther et al., 2014). They found that HEI-2010 scores were at or near the maximum levels for the exemplary menus. These data also allowed them to assess whether the HEI-2010 has a distribution wide enough to detect meaningful differences in diet quality among individuals, distinguishes between groups with known differences in diet quality by using t-tests, and measures diet quality independently of energy intake by using Pearson correlation coefficients (Guenther et al., 2014). The validation study found that the distribution of scores among the population was wide (5th percentile = 31.7; 95th percentile = 70.4). Low correlations with energy were observed for HEI-2010 total and component scores ($|r| \leq 0.21$). The authors reported a Cronbach's coefficient $\alpha$ equal to 0.68, which support the reliability of the HEI-2010 total score as an indicator of overall diet quality (Guenther et al., 2014). The authors explained that these data were also used to assess whether HEI-2010 has more than one underlying dimension by using principal components analysis (PCA). They found that PCA indicated multiple underlying dimensions, which highlight the fact that the component scores are equally as important as the total score.

### 3.4.6. Dietary intakes from HPL expressed as food groups

One of the output file from the ASA24-2016, called “Daily Total Pyramid Equivalents” includes dietary intake expressed as food groups in cup- or once-equivalents. Data from participants’ lunches were extracted. In order to compare component scores calculated with the HEI, whole grains and refined grains were kept separate as well as fats naturally present in vegetable sources and fats naturally present in meat sources. Table 3.3 presents the ten food groups used for assessing intakes coming from children’s HPL.

**Table 3.3 Ten food groups used for assessing intakes coming from children's HPL**

| Food Groups | Food categories | Food sub-categories |
|---|---|---|
| Total fruits (cup equivalents) | Whole citrus, melons, berries<br>Whole other fruits<br>Fruit juices | |
| Total vegetables (cup equivalents) | Dark green vegetables | |
| | Total red and orange vegetables | Tomatoes and tomato products<br>Other red and orange vegetables |
| | Total starchy vegetables | White potatoes<br>Other starchy vegetables |
| | All other vegetables | |
| Legumes (cup equivalents) | Beans and peas computed as vegetables | |
| | Beans and peas computes as protein foods | |
| Total whole grains (ounce equivalents) | | |
| Total refined grains (ounce equivalents) | | |
| Total meat (includes eggs, soy, nuts and seeds; excludes legumes) (ounce equivalents) | Total meat (excluding eggs and vegetable sources) | Beef, veal, pork, lamb and game meat<br>Cured meats<br>Organ meat<br>Poultry |
| | Seafood high in n-3 fatty acids | |
| | Seafood low in n-3 fatty acids | |
| | Eggs and egg substitutes | |
| | Soy products excluding soy milk<br>Peanuts, tree nuts and seeds | |
| Dairy (cup equivalents) | Fluid milk products | |
| Total milk, yogurt, cheese, and whey | Yogurt | |
| | Cheese | |
| Fats naturally present in vegetable sources (grams) | | |
| Fats naturally present in meat sources (grams) | | |
| Added Sugar (teaspoon equivalents) | | |

### 3.5 Data analysis

In order to answer aim 1, the transcribed data from the in-depth interviews were coded by themes and sub-themes using the content analysis techniques (Bryman, 2012; Ryan & Bernard, 2003). Sentences were labeled and coded. Codes were then combined creating sub-themes and themes. A selection of quotes was used to illustrate those themes and sub-themes.

Regarding the structured surveys, all questionnaire responses were downloaded from the Qualtrics® website.

Descriptive statistics were used to characterize teachers' responses to the web-based survey. Answers rated "Agree" and "Strongly agree" by the teachers were combined to determine the frequency of agreement for perceived benefits and perceived constraints of HPL.

With the intention of answering aim 2, descriptive statistics were used to summarize the parents' characteristics. Spearman correlations were used to examine the association between self-efficacy, parental feeding practices, perceived benefits and constraints of HPL and parental perception of peer-pressure. Multiple linear regression analysis was performed to identify correlates of parental perceived benefits of HPL.

With the purpose of answering aim 3, the diet quality of total dietary intakes was estimated using the HEI-2010 and HEI-2015. The National Cancer Institute (NCI) provides SAS programs to calculate the HEI-2010 and HEI-2015 using ASA24 dietary intake data ("HEI Tools for Researchers," 2017). The programs allow to calculate one HEI score per participant across all days of recalls, even if the number of intake days vary. This means that in this program, the cup equivalents of total "component" summed over x days is divided by the total energy summed over the x days. This ratio is then compared with the HEI standard on a cup equivalent/1000 kcal ("HEI Tools for Researchers," 2017).

In order to determine dietary intake coming from the lunch in food cup-equivalent results from the Food Patterns Equivalents Database (FPED) output file were used. The FPED converts foods and beverages in the Food and Nutrient Database for Dietary Studies to 37 USDA Food Patterns (FP) components ("Food Surveys : FPED overview," 2017). FPED was formerly known as the MyPyramid Equivalents Database (MPED).

For parents, differences by level of participation were assessed using Fisher's Exact tests as some groups were small for categorical variables and Student's *t* test was used to examine differences for age as this variable was normally distributed (Shapiro-Wilk test p=0.5474).

For children, differences by grade and sex were assessed using Chi-square test. Pearson correlations were used for normally distributed data (Total HEI scores, self-efficacy: healthy eating behaviors) whereas Spearman rank-correlation coefficients were calculated for data with skewed distributions (all the other variables) in order to conduct bivariate correlations.

Hierarchical multiple regression analyses were performed to assess the impact of determinants of parental food-packing behaviors as the primary independent variables on the total HEI-2010, HEI-2015 scores and food groups' equivalents as the outcome variables. In order to identify predictors that are significantly associated with the outcome variable, a stepwise procedure was performed. Generalized linear regression analyses (proc GENMOD) were performed for pertinent component scores that had shown significant associations with explanatory variables using Spearman correlations. Independent variables that were found statistically different by level of participation in the study were controlled for in the analysis. Models were adjusted for number of children, race/ethnicity and income (Baseline model), and then for any additionally independent variables that were found significant at less than the 10% level in the bivariate correlations.

Among the explanatory variables, age, scores of self-efficacy, perceived benefits and constraints of HPL, parental feeding style, and parental perception of child preferences and peer-pressure were treated as continuous variables. Race/ethnicity, income levels, number of children, working status, spouse working status, and marital status were all represented by categorical variables. Collinearity analyses using variance inflation factor (VIF) were used without identification of significant VIFs for any of the variables (all < 10). Thus, no independent variables in the regression models were found to be collinear. Statistical significance was declared when a p-value was <0.05. All statistical analyses were conducted using SAS Studio, version 9.4 (SAS Institute Inc., Cary, NC, USA).

# CHAPTER 4 : EFFECT OF SCHOOL LUNCH POLICIES AND CAFETERIA ENVIRONMENT ON HOME-PACKED LUNCHES: PERSPECTIVES OF SCHOOL ADMINISTRATORS AND TEACHERS.

## 4.1 Abstract

**Objective:** The school lunch policies and cafeteria environment are crucial in shaping the diet of school children. Considering that about 46% of children who are not eligible for school meal benefits might bring home-packed lunches (HPL), their possible effect on HPL should be explored. Compared to school meals, however, there is a paucity of studies that specifically examine HPL-related factors. This study examines how the school cafeteria environment and relevant school lunch policies affect the nutritional contents and consumption of HPL from the perspectives of school administrators. In addition, teachers' perceived benefits and constraints of bringing HPL are presented.

**Study design and setting:** Mixed methods, public elementary schools (n=9) in one school district in Maryland, USA.

**Study participants:** School administrators (n=15) and teachers (n=19).

**Methods:** Semi-structured interviews were conducted with elementary school principals/vice-principals to explore their perspectives of the impact of school lunch policy and the cafeteria setting (e.g. lunch and recess schedule, duration, the appliances available for students who bring HPL and the lunchroom staff organization) on HPL. Also, kindergarten and first grade teachers completed a web-based survey to provide their perspectives on the benefits and constraints of bringing HPL.

**Data analysis**: The transcribed data from in-depth interviews were analyzed using content analysis techniques to identify key themes and sub-themes. Descriptive statistics were used to summarize the findings of web-based surveys.

**Results:** The interview data revealed that the main reasons explaining lunch and recess schedules related to the lunchroom capacity and children's behavior. Principals and vice-principals did not want to have their lunchroom too crowded by having too many children eating or being at recess at the same time. They also reported that children with HPL have more time to eat than those who eat a school meal, particularly when the menu is popular leading to a longer waiting-line. None of the participating schools had any appliances available for use by students who bring HPL, which impacts what parents can pack. School administrators reported that lunch aids and other adults such as the principals, vice-principals and parents' volunteers play a crucial role in students' food intake, as they help children open their containers, motivate children to eat the food from their HPL and verify the suitability of those lunches. School administrators perceived that HPL contain too much food, are nutritionally diverse depending on children's country of origin, and allow some degree of freedom to the students and parents in what the child is eating. Principals and vice-principals expressed those benefits as possible reasons explaining why some parents and children choose HPL over school meals.

Results from the web-based survey showed that 94.7% of the teachers did not think that collecting HPL in the classroom and delivering them to the cafeteria for lunchtime is a burden. Respectively, 12 and 13 out of 19 teachers responded that "Packed lunches are more nutritious than school meals" and "Students are likely to eat more food if they have a packed lunch."

**Conclusions**

The nutrient content and intake of HPL as part of healthy eating for school-aged children have been explored much less than school meals. Future interventions targeting the improvement of HPL should take into account school lunch/recess policies and the cafeteria environment. Also, great importance should be placed on establishing recommended dietary guidelines for HPL and communication channel between home and school.

## 4.2 Introduction

Childhood obesity has more than tripled since the 1970s (CDC, 2017). A healthy diet in early life is key to enabling healthy adulthood and aging ("WHO | Children's diet," 2015). Diet quality among school children is crucial, as proper nutrition strengthens their learning potential and well-being and decreases the risk of non-communicable diseases (NCDs) including obesity, cardiovascular diseases, cancer and eating disorders ("WHO | Children's diet," 2015).

Children consume on average 35% of their daily food intake at school. The school food environment, including the setting and ambiance in the cafeteria and relevant school policies, is pivotal as it affects children's food choices and eating behaviors (Kubik MY, Lytle LA, Hannan PJ, Perry CL, & Story M, 2003; Osowski, Göranzon, & Fjellström, 2012; Story et al., 2009; Williamson et al., 2013). In particular, the ambiance in the cafeteria is influenced by the lunch room setting, time allocated to eat, and cafeteria workers' behavior (Moore et al., 2010).

The fourth School Nutrition Dietary Assessment Study found that about 46% of elementary school children who are not eligible for school meal benefits will not buy the school meal (USDA, 2012) and bring home-packed lunches (HPL) instead. Even though previous studies have found that HPL have lower nutritional quality than school meals (Caruso & Cullen, 2015; Farris et al., 2014; Hubbard et al., 2014; Johnston et al., 2012; Rainville, 2001), the majority of studies has focused on improving the quality of school meals served in the cafeteria and creating better product placement (Golley et al., 2010; Story et al., 2009; Williamson et al., 2013). Many schools are trying to improve children's dietary intake by offering and marketing healthier options for school meals (Fox & Hall, 2012). Thus, compared to school meals, limited research attention has been given to improve the nutritional quality and content of HPL. Since school administrators and teachers decide most of the school day organization, understanding their

perception on how school lunch policies and the cafeteria environment affect children who bring HPL is crucial to improving their dietary intake and the quality of HPL.

The purpose of this study was to examine how school administrators and teachers perceive their school cafeteria environment, relevant school lunch policies and their possible effect on HPL's nutritional contents and consumption in young school children.

## 4.3 Methods

### 4.3.1. Study setting and design

For the present study, in-depth interviews with principals and/or vice principals (n=15) were conducted to examine their perceptions of the school cafeteria environment and its possible effect on HPL. Additional information was also collected using web-based surveys from teachers of kindergarten and first grade classes (n=19). The data helped us understand their perceptions of the benefits and barriers of HPL as well as the procedures for collecting, storing and delivering HPL for younger students.

The study was conducted in one school district in Maryland, USA, which includes 133 elementary schools. Table 4.1 shows the characteristics of county's public elementary schools. Based on Free and Reduced Price Meals (FARMS) percentage and school size, stratified random sampling was employed to recruit a representative sample. Schools were first divided into four groups based on their FARMS percentage using the thresholds developed by the National Center for Education Statistics (NCES, 2015). Within each group, two strata were created based on schools' size (i.e. total enrollment) during the 2015/2016 school year. "Large schools" were defined as those with an enrollment number greater than the median of that group, while "Small schools" were defined as those with an enrollment number less than the median. A total of nine schools participated in the study. Data were collected from October 2016 to June 2017.

**Table 4.1: Public elementary schools' characteristics in selected district, Maryland**

| | Less-poverty schools | | More-poverty schools | | |
|---|---|---|---|---|---|
| | Low-poverty | Mid-low poverty | Mid-high poverty | High-poverty | All schools |
| **FARMS %** | <25 | 25.1-50 | 50.1-75 | >75.1- | |
| **Ave. FARMS ± SD** | 12.7 ± 6.7 | 36.7 ± 8.4 | 62.2 ± 7.3 | 81.4 ± 5.6 | 40.4 ± 26.3 |
| **# of students (size)** | 166-1046 | 318-837 | 385-893 | 403-863 | 166-1046 |
| **Total # of schools** | 54 | 29 | 33 | 17 | 133 |
| **Median size** | 519 | 613 | 554 | 672 | |
| **# of schools included** | 3 | 2 | 3 | 1 | 9 |

Source: Data from the 2015-2016 County report card and the National Center for Education Statistics; descriptive statistics calculated using Excel version 14.6.0

### 4.3.2. Recruitment of study participants

Elementary school principals from randomly selected schools were contacted via email or telephone. If they were unwilling to participate, the first author then contacted the next school in the same group. Four schools out of the 15 contacted agreed to participate in the "Low-poverty" and "Mid-low poverty" groups, respectively (i.e. one large school and one small school in each group) and four schools out of the 36 contacted agreed to participate in the "High-poverty" group and the "Mid-high poverty" group (one large school and three small schools agreed to participate). As it was challenging to recruit participants in the schools from the "Mid-high poverty" and "High-poverty" groups, an additional school from the "Low-poverty" group was recruited.

After approval from the principal, using the school staff directory, the first author sent a group email to all teachers of kindergarten and first grade classes (n=84) aiming to recruit at least four teachers per FARMS group and inviting them to complete a survey. A total of 19 teachers completed the survey. A web-based survey was used to accommodate teachers' busy teaching schedule. Teachers provided their consent by clicking the submit button in the web-based survey.

The study protocol and the consent documents were reviewed and approved by the ethics committee of the Institutional Review Board (IRB) at the University of Maryland, College Park and the Office of Shared Accountability of the participating school district.

### 4.3.3. Data collection instruments

#### *In-depth interview guide*

The first author conducted in-depth interviews with the principal and/or vice-principal (n = 15) in each participating school using semi-structured interview guidelines. Each interview lasted 30 minutes. Throughout the interview, the interviewer took field notes to summarize responses based upon the in-depth interview protocol. Additionally, all discussions were audio recorded with the permission of interviewees. Principals and vice-principals signed a consent form before the interview. The goal of the in-depth interviews was to examine the school administrators' perceptions of the cafeteria environment, the school lunch policy and their potential impact on HPL to provide a context for diet quality and the types of food frequently packed and to understand relevant rules. The interview guide was developed to explore three main topics (see Table 4.2).

**Table 4.2: In-depth interview questions on school food environment during lunchtime**

| Key themes | Sub-themes |
|---|---|
| School policies for lunch and recess | • Factors affecting lunch/recess schedules<br>• Factors affecting lunch/recess duration |
| School cafeteria environment and operation | • Appliances available to store and reheat HPL and their perceived effect on the content of HPL<br>• Role of lunch aids/volunteers in the cafeteria and possible effect on food intake of children with HPL<br>• Rules lunch aids/volunteers are supposed to follow when children are trading food or does not eat HPL |
| Perceived quality and consumption of HPL | • Personal opinion on the food quality and consumption of children who bring HPL |

***Web-based survey***

The goal of the survey administered to teachers was to assess if they perceive HPL as being beneficial or detrimental for their students' lunch intakes and content and to understand any possible implications of HPL on their class organization (e.g. perceived burden of collecting and storing children's lunch boxes before lunchtime). The web-based survey was developed using Qualtrics® and the estimated time for survey was about 10-15 minutes. The responses were rated using a 5-point Likert-type scale of "Strongly disagree" (1) to "Strongly agree" (5).

**4.3.4. Data analysis**

The transcribed data from the in-depth interviews were coded by themes and sub-themes using content analysis techniques (Bryman, 2012; Ryan & Bernard, 2003). Sentences were labeled and coded. Codes were then combined creating sub-themes and themes. A selection of quotes is used in this paper to illustrate those themes and sub-themes.

Descriptive statistics were used to characterize teachers' responses to the web-based survey. The statistical analyses were conducted using SAS Studio, version 9.4 (SAS Institute Inc., Cary, NC, USA).

## 4.4 Results

### 4.4.1 Sample characteristics

A total of 15 school administrators (9 principals, 6 vice-principals) participated in the in-depth interviews. At six schools both principals and vice-principals participated in the interviews. Otherwise, at three schools only the principals were interviewed because the vice-principals recently joined the school or the principal did not consider necessary that the vice-principal was also interviewed. 19 kindergarten and 1st grade teachers completed the web-based survey. 13 teachers taught first grade and 6 taught kindergarten. 13 out of 19 included nutrition education in their teaching schedule. 17 out of 19 teachers responded that their students were interested in nutrition education. Also, 8 out of 19 teachers reported that more than half of their students frequently (at least 3 times per week) bring HPL, and only one teacher reported communicating with parents regarding the nutritional quality of HPL.

### 4.4.2 In-depth interviews

**Theme 1: School policies for lunch/recess schedule and duration**

*Factors affecting lunch/recess schedule:* Principals and vice-principals were asked how the schedules of lunch and recess for kindergarteners and 1st graders were organized. Among the nine schools included, seven had kindergarten classes scheduled to have recess after lunch and five had first grade classes following the same schedule. Independent of school size, the main reasons for this schedule related to the lunchroom capacity and children's behavior. Principals and vice-principals did not want the lunchroom to get too crowded by having too many children eating or being at recess at the same time.

Also, school administrators perceived children's behavior has been strongly affected by events happening during recess, so they preferred having recess before lunch for academic

reasons. Indeed, more than half of the principals explained that students often need time to settle up situations that happened during recess, so principals and their staffs often try to have this occur during lunch instead of academic time.

> *"We are actually a school that because of our size we have a limited amount of time for recess. If you eat lunch after recess, it calms the recess behavior. Anything that might have gone wrong at recess, calm down after lunch."*-Less poverty school.
>
> *"The reason for scheduling the recess before lunch is because there are a lot of behaviors that come off at recess so when it is time to go back to class kids are still in the office for something that happened at recess. It gives them time to calm down."*-More poverty school.

*Factors affecting lunch/recess duration*: All principals and vice-principals explained that the duration of lunch and recess was decided by the County Board of Education following a recent bell time change. Since the 2015/2016 school year, the elementary school day was lengthened by 10 minutes that are used for lunch and recess.

> *"They changed the bell time, which added 10 min for lunch and recess. So they have 35 min for lunch and 35 min for recess."*-Less poverty school.

All Principals and vice-principals also reported that the time children spend eating is strongly reduced by the time they spend socializing with each other. Additionally, they reported that young children with HPL such as kindergarteners and some 1st graders need help opening their food packaging/thermoses, which also reduces the time children have to eat.

> "*They just have to learn that they need to eat and not just talk*."-More poverty school.
>
> "*I think the issue is the socialization, i.e. how much time kids spend socializing versus eating*"-Less poverty school.
>
> "*Kids like to socialize especially kindergardeners. They eat slow and they have 35 min which is a good amount of time for them but still they socialize so it takes time.*"-More poverty school.

> *"If a child cannot open something and have to sit and wait, it might have an impact. […] it is opening up the thermos […] when you do not know all of those things it takes longer for the kindergarteners."*-More poverty school.

The majority of principals and vice-principals perceived that parents considered the school's lunch line as being too long. The length of time that students wait in line was explained by the lack of experience of young children, leading them to take an increased amount of time when typing their personal identification numbers to pay for their meals. Respondents also felt that lines are longer when the school meal is popular (e.g. on pizza day). Therefore, school administrators reported that some parents decide to pack a lunch because their children do not want to wait in line. Several principals and vice-principals noted that children with HPL have more time to eat than those who eat a school meal, particularly when the menu is popular but other considered that it was just an impression.

> *"It's absolutely an impression and it could cost parents to forgo participating in the school lunch and sending HPL instead."*-Less poverty school.

> *"If they brought their lunch they will be done, because when they walk into the lunchroom, the teachers bring them down or sometimes it is the recess people. The kids who have a lunch can go straight to the table and start eating. The kids who need to go buy a lunch have to wait in line and that line can take 5 to 10 min."*-Less poverty school.

> "*The line can get really slow especially when it is a popular lunch and more kids buy."*-Less poverty school.

> *"It depends on what they sell. It could be up to 7-8 min difference."*-Less poverty school.

However, all principals and vice-principals noted that efforts were made to reduce the time children spend in lunch line, such as by helping kindergarteners remember or type their personal identification numbers. Thus, parents' decision to pack lunch to allow their child to have more time to eat might be less frequent throughout the school year.

> "*Parents often think that children do not have enough time to eat and in particular in those first months of school. It can be a little bit challenging for our youngest kids to*

*learn the routine and to get through the line in an efficient manner.”*-Less poverty school.

“*We have tricks that we use. For example, if kindergarteners are buying, the teacher will write down their [identification] numbers on a paper before they leave their classroom. The cafeteria manager can type the numbers or teach them how to type them; otherwise the line would take forever*.”-Less poverty school.

*“One of the parents or the aids is helping the kids with their PIN. So it is faster.”*-More poverty school.

**Theme 2: School cafeteria environment and operation**

*Storing and reheating HPL (appliance availability)*: HPL may include foods that need to be kept cold or leftovers that need to be kept warm or reheated. Appliances such as refrigerators and microwaves were not available for children bringing their HPL in all participating schools, mainly due to security reasons. The schools would not have enough lunch aids to help children handling those appliances and because they are only allowed to be used by children with medical needs.

*“So there will be significant operational challenges especially if you have a cafeteria with 150 students in there and a third of them brought something that needs to be microwaved… I mean the amount of time that they would be spending in line waiting for the microwave would be significant. Not only that, for safety reasons we also don’t want them there.”*-Less poverty school.

When asked if they thought that this might have an impact on lunch box content or if children and/or parents were complaining about the lack of appliances, principals and vice-principals unanimously replied that it was not an issue. They agreed, however, that it might impact what can be packed. Most of the principals had discussed this with the parents during their orientation day.

“*You have to be mindful about what you are bringing. It has to be things that can sit with just an ice pack level of refrigeration.*”-Less poverty school.

“*We talk about some of the things that they can and cannot bring for lunch and things, like the microwave and refrigerator that they cannot use*.”-More poverty school.

> *"So I will tell them very plainly that we just do not have the ability to do that and they have to plan accordingly."*-Less poverty school.

> *"The first month of school we do a lot of training. Some children will ask for their food to be heated because that is what they do at home but most of them do not want to eat it "hot hot" so if it is room temperature or warm they will be happy with it."*-Less poverty school.

*Role of lunch aids and volunteers in the cafeteria:* All school administrators explained that the number of aids is mostly decided by the local education agency of the participating schools and the budget allocated by the principals.

> *"We have a ratio of 1/50 or 1/55 depending on where you are but we are always overstaffed in the lunch room especially for the younger kids. At a minimum, I will have 3 staff members but it could be anywhere up to 5 or 6 depending upon which grade level the students are. There is a ratio that we need to respect and then we have additional support."*-Less poverty school.

When asked about the roles of lunch aides in the cafeteria, the interviewees reported that they manage children's behaviors, verify that children do not trade food, monitor their movements and help them open their containers. Moreover, school staffs and volunteers in the cafeteria try to teach the children how to open packages/containers packed in their lunch box and help them become more independent.

> *"There are two cafeteria workers who serve lunch to the kids and then we have para-educators for lunch and recess staff helping kids […] monitor behaviors."*-Less poverty school.

> *"We do have plenty of parents who volunteer […] their job is to manage the behavior in the lunchroom."*-Less poverty school.

> "*One of the first things I do in the cafeteria at the beginning of the year is to go with the kindergardeners and show them how to open the milk container*."-Less poverty school.

> "*We try to teach the kids how to be independent but we will absolutely open containers, open cellophane lids when it is too hard.*"-More poverty school.

Participating school administrators explained that the cafeteria aids and themselves usually try to give a positive prompt to children unwilling to eat their HPL and communicate with the school counselor or the teacher.

> *"They will say: "you need to eat your sandwich. Do not just eat your desert.""*-Less poverty school.

> "*Aids try to encourage the kids but we can't force them. They try.*"-More poverty school.

> "*They will say something to the kids. The goal for them it is to empty their lunch box. Aids will spend a lot of time getting them to eat."*-More poverty school.

> *"If they see that the kid is not eating the lunch that was sent from home, they will often communicate to the administration, the counselor, or the classroom teachers."*-Less poverty school.

In fact, counselors and teachers are also asked to contact the parents when the content of the HPL is considered very unhealthy or insufficient by the cafeteria aids or the principals themselves. Parents will also be contacted if their child regularly does not eat his/her HPL.

> "*Honestly there have been aids that have come to us because they were concerned about kids who maybe just bring a bag of chips and cookies. So we get involved in trying to help them. So if they [lunch aids] notice that a child is not eating they will work with the child and then it comes to us or it comes to their teachers so that we can let the parents know that they are not eating."*-Less poverty school.

> *"Aids and myself check that the kids are eating their foods and that they have foods to eat, because sometimes a child will bring an empty lunch box or they will bring a lunch box that only has some cookies in it."*-Less poverty school.

> "*We notify the teachers and the teachers notify the parents."*-Less poverty school.

However, one vice-principal reported that children who bring a HPL are usually more willing to eat their lunch than those who buy a school meal.

> *"Most of the children refusing to eat are those eating the school lunch. It is usually not the kids who have a HPL."* - Less poverty school.

**Theme 3: Perceived quality and consumption of HPL**

When asked about the quality of food included in HPL, principals and vice-principals reported differences depending on children's country of origin. For example, children from Asian countries were packing more elaborate meals, including rice, meat and vegetables, whereas children of American origin were more frequently packing sandwiches and pre-packed foods. Several principals even thought that students' country of origin helped explain why some children were packing their lunch. The quality of food included in the HPL of children of American origin seemed to be lower in schools with more poverty than in schools with less poverty.

> "*Some of the families have very unique foods that they bring; children from Latin American families will have […] more often leftovers."*-Less poverty school.

> *"Americans will bring Lunchables and prepacked foods and children from other cultures will have more thermoses and containers."*-More poverty school.

> *"We have lots of Asian foods happening. They will have a thermos of rice, meat and vegetables. They might have dumpling, some sushi, and Indian food. My American children will have a sandwich and a yogurt, some fruits and some crackers and a dessert."*-Less poverty schools.

> *"They are not really used to the American food yet when they start school. The longer they are in school they get more familiar with the American food and then they transform."*-More poverty schools.

Several principals and vice-principals also noted that too much food was packed.

> *"Often, we have to remind our community that they cannot send a six courses meal because they are probably not going to be able to go through it."*-Less poverty school.

> *"The parents pack too much for K and 1st grade."*-Less poverty school.

> *"Way too much food. Some kids try to eat it all, so they are there forever."*-Less poverty school.

### 4.4.2 Teachers' survey

To assess teachers' perception of the impact of having students bringing HPL, kindergarten and first grade teachers were asked to complete a web-based survey. Tables 4.3 presents teachers' perceived benefits and constraints of bringing HPL for their students. Regarding teachers' perceived benefits of HPL for their students, 9 out of 19 teachers and 12 out of 19 teachers respectively agreed that "My students prefer HPL over school lunches" and "Packed lunches are more nutritious than school meals." Also, 13 out of 19 teachers agreed that "My students are likely to eat more food if they have a packed lunch." Almost all teachers agreed that "Packed lunches allow parents to give organic and sustainable foods to their child".

Regarding teachers' perceived constraints of HPL for their students, 18 out of 19 of the teachers did not view the collection of students' lunch boxes as extra work. No teachers agreed that their students with HPL do not have enough food to eat. Only one agreed that students eating packed lunches trade more foods than students eating school meals. 11 out of 19 teachers agreed that some students cannot open the packaging of their food items.

**Table 4.3: Teacher's perceived benefits and constraints of HPL (n=19)**

| Question | Disagree or strongly disagree | Neither agree nor disagree | Agree or strongly agree |
|---|---|---|---|
| **Perceived benefits of HPL, n (%)** | | | |
| My students prefer home-packed lunches over school lunches | 2 (10.5) | 7 (37.0) | 9 (52.5) |
| Packed lunches are more convenient for me than school lunches | 4 (21.0) | 9 (47.4) | 6 (31.6) |
| Packed lunches are more nutritious than school meals | 3 (16.0) | 4 (21.0) | 12 (63.0) |
| My students are likely to eat more food if they have a packed a lunch | 2 (10.5) | 4 (21.0) | 13 (68.5) |
| Packed lunches allow parents to give organic and sustainable foods | 1 (5.3) | 0 (0.0) | 18 (94.7) |
| **Perceived constraints of HPL, n (%)** | | | |
| Collection of student's lunch boxes gives me extra work | 18 (94.7) | 0 (0.0) | 1 (5.3) |
| My students with packed lunches do not have enough food to eat | 9 (47.4) | 10 (52.6) | 0 (0.0) |
| Students eating packed lunches trade more foods than students eating schools meals | 7 (36.8) | 11 (58.0) | 1 (5.3) |
| Some students cannot open the packing of their food items | 4 (21.0) | 4 (21.0) | 11 (58.0) |

## 4.5 Discussion

The findings of this exploratory study provide key information regarding main factors affecting the schedule and duration of school lunch and recess and their potential effects on the content and intake of HPL. Also, it describes how the school cafeteria environment and operation and students' cultural backgrounds possibly influence the dietary intakes of young kindergarten and 1$^{st}$ grade students who bring HPL (see Figure 1).

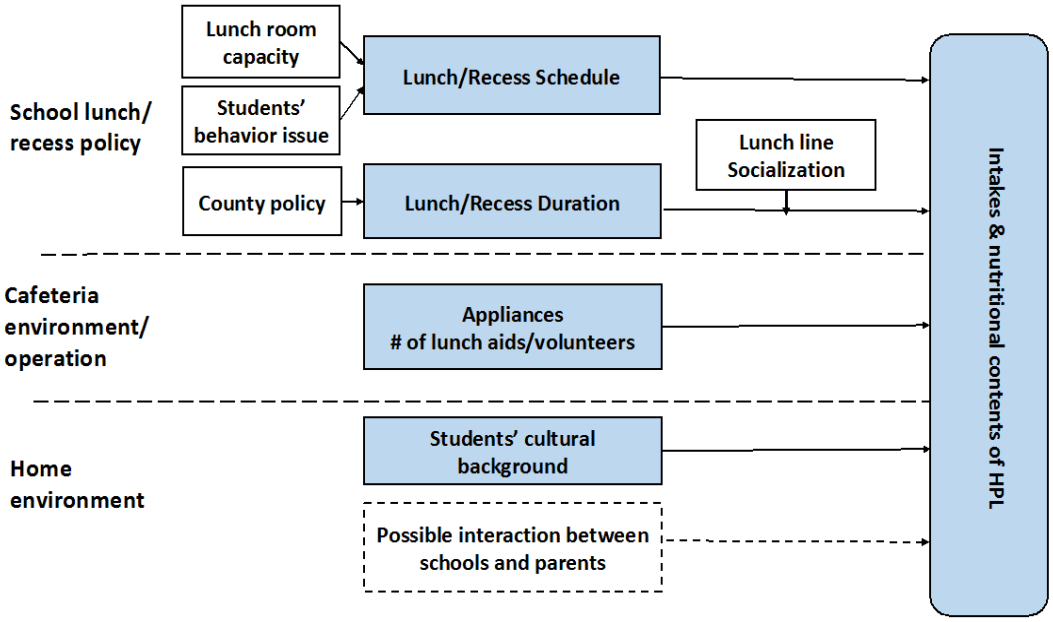



**Figure 4.1. Overview of the main aspects affecting home-packed lunches**

The participating principals and vice-principals in this study perceived recess before lunch to be beneficial for classroom behavior, which is consistent with previous studies (Bark, Stenberg, Sutherland, & Hayes, 2010; Hunsberger et al., 2014). Several studies also highlighted that scheduling recess before lunch improved lunch consumption and decreased food waste (Bergman, Buergel, Englund, & Femrite, 2004; Chapman, Cohen, Canterberry, & Carton, 2017; Cline & Harper, 2008; Hunsberger et al., 2014). However, most of the participating schools followed a reversed schedule due to restricted lunchroom capacity or a lack of lunch and recess aids.

Principals and vice-principals reported that children who bring HPL usually benefit from a little more time to eat than those who buy a school meal on days when the lunch line can be long (e.g. when a popular school meal is served, or at the beginning of the year when it takes more time for young students to go through the line), which is also consistent with a previous study's results (Moore et al., 2010). The time to eat was not seen as an issue, as principals and vice-

principals noted that children spend a large portion of their allocated lunchtime socializing instead of eating. As previously reported, the time spent waiting in line is perceived as a contributor of dissatisfaction with school meals (Henderson & Environment & Human Health, 2004) and one principal specifically mentioned that it is one of the reasons why parents and children prefer to bring HPL. Study participants reported that some of the packaging and containers are difficult to open for young children. Depending on lunch aids' availability it might impact the children's time to eat their HPL. In order to help the children become faster and independent, they all mentioned spending a great amount of time helping and educating them on how to properly open their containers.

The nutritional quality of HPL is not necessarily subject to monitoring by the school but, depending on the schools, lunch aids notice and report it to the teachers, the counselor or the principal. If the quality or the quantity of the food that has been packed is regularly considered inappropriate, a school staff will contact the parents. This study did not specifically explore potential protocols used by schools to communicate with parents when a situation is not improving. Thus, future studies can be further examined to understand suitable ways of communication between home and schools.

Moreover, in cases when children refuse to eat their HPL, school staff members try to give supportive prompts to encourage them. It could be expected that those prompts positively impact children's intake, as previous studies have found that cafeteria workers can influence children's eating behaviors using feeding strategies such as verbal encouragements and praise (French & Stables, 2003; Perry et al., 2004; M. B. Schwartz, 2007).

The participating school administrators also reported that HPL allowed some degree of freedom to the students and parents in what the child was eating. Control over quantities and

food quality and respect of students' cultural food habits were mentioned as being some of the advantages and reasons for sending HPL. The content of HPL was seen as being associated with children's country of origin. Compared to children of American origin, children from other countries were having culturally familiar and more nutritionally balanced foods independent of the poverty level of their schools. On the other hand, the nutritional contents of HPL among children of American origin seemed to be different according to the school poverty level. For example, the diet quality of HPL among children of American origin in more-poverty schools is lower than that of children of American origin in less-poverty schools. Principals and vice-principals also considered that too much food was packed which explained why children often did not have enough time to eat everything their parents had packed. These results show the necessity of future dietary guidelines for children bringing HPL tailored by their country of origin and their ethnicity in order to improve the nutritional quality and quantity of HPL to reduce food waste.

This study also shows that appliances (i.e., microwaves or refrigerators) are not available for children who bring HPL. The participating school administrators agreed that even if children have access to an insulated lunch bag and ice-pack, parents have to be mindful of what they are packing and children might not be happy with the temperature of their meal. Although it is explained to the parents at the beginning of the school year, schools should consider communicating with parents on a regular basis in regard to the quality and contents of food, and they should also give dietary suggestion for HPL throughout the school year.

The survey completed by the teachers showed that they generally perceive HPL has being beneficial for their students' lunch intakes. Indeed, more than half of the teachers considered that HPL are more nutritious than school meals. Those perceptions are in contradiction with results

from previous studies showing that school meals following the Nutrition Standards are of better nutritional quality than HPL (Caruso & Cullen, 2015; Farris et al., 2014; Hubbs-Tait et al., 2008). Our survey also showed that teachers perceived that students are likely to eat more food if they have a HPL. This could be explained by the fact that parents who pack lunch take into account their child's preferences (Bathgate & Begley, 2011; Farris et al., 2016). Additionally, those teachers did not perceive that HPL negatively impact their class organization. Since teachers can serve as a positive role model for their young students' eating habits and are able to observe students' eating behavior and communicate with parents regarding the content of HPL, future studies should explore the reasons explaining these highlighted perceptions (Arcan et al., 2013; Rossiter, Glanville, Taylor, & Blum, 2007).

While the findings of this study should be interpreted with caution, as the sample size is small, these results show that the intake of children who bring HPL might be affected by several factors coming from the school cafeteria environment and school lunch policy that need to be taken into account in future interventions. Those interventions should target the improvement of the quality of food consumed by school children globally by including HPL and being specifically tailored by children's cultural food habits. Those interventions should take into account the school cafeteria environment such as lunch and recess schedules, the availability of appliances and the number and roles of lunch aids/volunteers.

# CHAPTER 5 : UNDERSTANDING KEY DRIVERS OF LUNCH-PACKING BEHAVIORS IN PARENTS OF YOUNG SCHOOL-AGE CHILDREN

## 5.1 Abstract

**Objective**: In the U.S., about 46% of elementary students who are not eligible for school meal benefits may not participate in the National School Lunch Program (NSLP) and bring home-packed lunches (HPL). Recent studies suggest that HPL's nutritional quality is lower than school meals. While, reimbursable meals offered by schools are required to comply with the recommendation of the dietary Guidelines for Americans, such dietary standards, however, do not exist for HPL. Considering that parents play a key role in shaping children's eating habits and food choices, examining parents' perceptions and psychosocial aspects related to lunch packing is crucial because it potentially influences the contents and quality of HPL. The objective of this study was to understand the main reasons why parents pack lunches for their children and to examine key psychosocial factors and perceptions related to HPL in parents.

**Study design and setting**: Cross-sectional online study, Maryland, USA.

**Study participants:** Parents of children in kindergarten and first grade who frequently consume HPL (n=100) were recruited from public elementary schools (n=9)

**Methods**: A web-based survey was developed and completed by parents to understand key drivers of parental lunch packing behaviors including reasons for packing lunch, self-efficacy for preparing a healthy HPL in difficult situations and for enacting healthy diet behaviors in their children, nutrition knowledge, perceived benefits and constraints of HPL, parental feeding practices and parental perception of peer-pressure. A series of scales was adapted from previously validated studies or developed if validated tools were not available.

**Data analysis:** Descriptive statistics were used to summarize the sample characteristics. Spearman correlations were used to examine the association between self-efficacy, parental feeding practices, perceived benefits and constraints of HPL and parental perception of peer-pressure. Multiple linear regression analysis was performed to identify correlates of parental perceived benefits of HPL.

**Results**: When asked about the main reasons for not buying school meals, the participating parents responded that they preferred to choose what their child eats (53%), the food served is unhealthy (49%) and their child would not eat the school lunch (40%). Additionally, 80% of parents reported that HPL preparation was not difficult. The unadjusted bivariate analysis showed that self-efficacy for preparing a healthy HPL in difficult situations was negatively correlated with parents perceived constraints of HPL ($\rho$=-0.35, $p$=0.0004) and self-efficacy for enacting healthy diet behaviors in their children was rated higher with higher levels of parental monitoring of child's eating ($\rho$=0.38, $p$=0.0001). The more parents perceived their child's peers influenced their child's food choices, the more they perceived that HPL have constraints ($\rho$=0.27, $p$=0.006), showed restrictive attitude ($\rho$=0.26, $p$=0.009) and tended to pressure their child to eat ($\rho$=0.24, $p$=0.02). The adjusted analysis showed that parents perceived more benefits in HPL when their self-efficacy for enacting healthy diet behaviors in their children was rated higher ($\beta$=0.23, $p$=0.001). Also, Asian parents perceived more benefits in HPL compared to Caucasian parents ($\beta$=-3.1, $p$=0.008).

**Conclusions**: Parents tended to consider school meals unhealthy and preferred to choose what their child eats. The taste of school meals was also an issue. Parents who perceived more benefits in HPL had higher self-efficacy for enacting healthy diet behaviors in their children and were

more likely to be Asian. Thus, parents' self-efficacy and their race/ethnicity should be taken into account in future school meal policies.

## 5.2 Introduction

In 1946, the National School Lunch Program (NSLP) was established under the National School Lunch Act and the Healthy, Hunger-Free Kids Act of 2010 required the U.S. Department of Agriculture to update the Nutrition Standards to improve the nutritional quality of school meals provided by the NSLP (Food and Nutrition Service, 2013). In 2016, 5 billion lunches were served in the U.S. among which 73.3% were free or reduced price (USDA, 2016). Students' eligibility for free or reduced price meals is significantly associated with higher odds of students eating school meals (Ohri-Vachaspati, 2014; The Food Research and Action Center, 2015).

The fourth School Nutrition Dietary Assessment Study found that in elementary schools 54% of children who were not eligible for meal benefits would still participate in the NSLP. Thus it can be reasonably assumed that about 46% of children not eligible for school meal benefits might have brought home-packed lunches (HPL) instead (USDA, 2012). With considerable criticism directed at the NSLP, parents perceive that the school meal does not offer enough food (73.2%); they would save money by packing HPL (64.9%); and the child would eat more of a HPL (64.9%) and HPL respond better to their children's taste and appetite than school lunches (Farris & Serrano, 2014; Ohri-Vachaspati, 2014).

However, previous studies have found that HPL have lower nutritional quality than school meals (Caruso & Cullen, 2015; Farris et al., 2014; Hubbard et al., 2014; Johnston et al., 2012; Rainville, 2001). Studies comparing HPL with the Nutrition Standards found that HPL contained more savory snacks such as chips, crackers and sugar-sweetened beverages and fewer servings of fruits, vegetables, whole grains and fluid milk (Caruso & Cullen, 2015; Farris et al., 2014; Hubbard et al., 2014).

Also, a few previous studies reported that parents' perception of their children's taste preference, convenience of HPL, concern over quality of school meals, cost and food safety were strong determinants of food packing decisions. Moreover parents believed that food marketing and peer-pressure influenced their child's food preferences and what they ate (Bathgate & Begley, 2011; K. J. Campbell et al., 2007; Farris et al., 2016; Griffin & Barker, 2008). Another observational study reported that parents do not want to waste foods and worry about adverse effects of insufficient lunch intake on the academic performance of their children (Johnston et al., 2012).

While strenuous efforts have been made to improve intakes from schools meals (Kessler, 2016), not much attention has been paid to the contents and diet quality of HPL, in spite of a pretty significant proportion of students bringing HPL. To our knowledge, there have been no studies that examine psychosocial factors and perceptions of parents and how these factors are inter-related in the context of HPL. The purpose of this study is to understand the main reasons why parents pack lunches for their children and to examine key psychosocial factors and perceptions related to HPL in parents.

## 5.3 Methods

### 5.3.1. Study design and setting

Using a cross-sectional design, the study was conducted in one school district in Maryland, USA, which includes 133 elementary schools. Based on Free and Reduced Price Meals (FARMS) percentage and school size, stratified random sampling was employed to recruit a representative sample.

### 5.3.2. Recruitment of study participants

Elementary school principals from randomly selected schools were contacted via email or telephone. After approval from the principal, the first author sent a group email to all teachers of kindergarten and first grade classes in participating schools. Then, teachers included recruitment flyers in children's "take home" folders. Those flyers described the study, included the link to the survey and were available in English and Spanish. Some principals also sent the same information via email to the parents of children in those classes as they usually do for other communication purposes. Parents of children in kindergarten and first grade, aged 5 to 8 years old and who frequently consume a HPL (i.e. at least three times a week) were invited to participate in this study. Parents who were willing to participate in the study directly replied to the survey by copying the link in the flyer or by contacting the first author who would then send the link to the survey via email. Participating parents were asked to read the instructions and provided their consent by clicking the submit button in the web-based survey.

The study protocol and the consent documents were reviewed and approved by the ethics committee of the Institutional Review Board (IRB) at the University of Maryland, College Park and the Office of Shared Accountability of the participating school district.

### 5.3.3. A theory-driven web-based structured survey

The study guided by the Social Cognitive Theory (A. Bandura, 1989) underscores the dynamic interplay among individual and environmental factors and behavior affecting the diet quality and consumption of HPL. At an individual level, child related factors interplay with parent related factors. For example, parental perception of food preferences in children might affect the contents and preparation of HPL, which is also affected by parental feeding style. Further, parent's self-efficacy and other psychosocial aspects for cooking and preparing a

healthier lunch influence their lunch packing behaviors. In this context, examining HPL-related psychosocial factors of parents and the interrelation of these factors is essential to improve the quality of packed lunches.

Using Qualtrics®, a semi-structured, web-based survey was developed to assess socio-demographic characteristics, HPL preparation, self-efficacy, nutrition knowledge, perceived benefits and constraints of HPL, parental feeding practices and parental perception of peer-pressure**.** The authors developed a series of scales and adapted others from previously validated studies. The survey was also translated in Spanish using a forward-backward translation ("WHO | Process of translation and adaptation of instruments," 2017) as the schools communicate in both languages to their parents (e.g. newsletters, forms, etc.). The survey was pre-tested with a convenience sample of 15 parents (13 in English and 2 in Spanish) to verify that all words were properly understood. It was estimated to be completed in 15-20 minutes. Data were collected between October 2016 and June 2017 from parents whose child attended one of the participating schools (n=9).

**5.3.4. Measures**

*Socio-demographic characteristics:* age, gender, education level, marital status, race/ethnicity, number of children, household annual income, working status of the respondent and the spouse were asked.

*HPL preparation* was assessed using multiple choice and open-ended questions. Those questions asked reasons for sending HPL, the frequency of HPL per week, who decides what is in the lunch box, when the main course of the lunch is prepared, when the lunch's items are assembled, and how long parents spend preparing HPL per week. Parents were also asked if they

consider that preparing HPL is difficult. If the parents answered positively, a text box was adjacent for them to explain why.

In particular, the reasons for sending children to school with HPL instead of participating in the NSLP were asked using both open-ended and multiple choices questions. Those two formats of questions allowed the reasons to be cross-verified and gave the opportunity for parents to sufficiently express their motivations.

*Parental self-efficacy for preparing a healthy HPL in difficult situations* was assessed using eight items developed by the authors. Using a 5-point Likert-type scale, parents were asked to specify their level of agreement with eight difficult situations such as "*Preparing a healthy home-packed lunch is difficult when I feel tired at the end of the day, when my kid asks for the same food every day, when I have other meals to prepare such as dinner, etc.*" The highest score, 5, was assigned to "strongly agree" responses and the scores were summed. The scores ranged from 8 to 40 with a mean of 25.5 ± 6.4. The Cronbach's alpha coefficient equals to 0.72.

*Parental self-efficacy for enacting healthy eating behaviors in children* was measured by using summed scores for 10 items extracted from the "dietary behaviors" subscale of a questionnaire developed by Decker et al. (Decker, 2012). The original questionnaire has 34 items and includes two subscales i.e. dietary behaviors developed using the USDA pyramid guidelines for healthy diet and physical activity behaviors (Decker, 2012). Its Cronbach's alpha coefficient was 0.94 which demonstrates good internal consistency reliability. Furthermore, construct validity, assessed using factor and items analyses, showed that items were correlated with their own subscale (Decker, 2012).

In this survey, 10 items were extracted from the 'dietary behaviors' subscale (Cronbach's alpha coefficient = 0.93). These items asked parents to rate their confidence to make their

children have healthy eating behaviors including "*Your child eats at least 2 servings of vegetables every day*", "*Your child eats foods with low sodium (salt) content or added sodium (salt)*", "*Your child drinks very few drinks with added sugar (i.e. soda, juices)*", etc. A 5-point Likert-type scale of "Not confident at all" to "Extremely confident" was used. The highest score, 5, was assigned to "Extremely confident" responses. The scores ranged from 10 to 50 with a mean of 29.4 ± 8.2. This self-efficacy scale has demonstrated moderate reliability (alpha = 0.86).

*Nutrition knowledge* was adapted from the "Nutrition Knowledge Questionnaire" developed by Jones et al. 2015. The original Nutrition Knowledge Questionnaire consists of 54 items divided into four subscales: "Familiarity with MyPyramid and the *Dietary Guidelines for Americans 2005*" (20 items); "Nutrient content of Foods" (15 items), "Everyday Food Choices" (11 items) and "Diet and Disease Relationships" (8 items). This questionnaire is intended for use in the general American population of English-literate adults aged ≥ 18 years. In the original questionnaire the subscale "Familiarity with MyPyramid and the *Dietary Guidelines for Americans 2005*" had the best internal consistency (Cronbach's alpha = 0.85) in comparison to other subscales (i.e. Nutrient Content of Foods, Everyday Food Choices and Diet–Disease Relationships), and the test-retest reliability was equal to 0.93. Construct and content validity were also assessed by comparing scores from respondents who had taken at least one college-level nutrition class with respondents who had never taken a college-level nutrition class (Jones et al., 2015).

In the present study, 4-items from the subscale "Familiarity with MyPyramid and the *Dietary Guidelines for Americans 2005*" were used to measure parental nutrition knowledge. Another item was developed by the authors to assess the level of knowledge parents have on which food groups should be found in HPL. Four correct answers were based on the nutrition standards

applied to the NSLP. Each correct answer received a score of 1 with a perfect score of 8. The scores ranged from 0 to 8 with a mean of 4.6 ± 1.5. The Cronbach's alpha coefficient equals to 0.45.

*Perceived benefits of HPL* was assessed using ten items such as "*My child is likely to eat more food if I pack a lunch*," "*I save money by making packed lunches*", etc. Those items were adapted from two other questionnaires intended to measure parents' packed lunch perceptions (Farris & Serrano, 2014; Steinmetz, 2012) and modified for the present study. Steinmetz et al. assessed parents' perception of HPL using 10 items and Farris et al. used 12 items to assess motivating factors for packing lunches (Farris, 2015; Steinmetz, 2012). For the present study, 10-items were rated using a 5-point Likert-type scale and the highest score, 5, was assigned to "strongly agree" responses. The scores were summed and ranged from 10 to 50 with a mean of 37.3 ± 6.1. The Cronbach's alpha coefficient equals to 0.78.

*Perceived constraints of HPL* was assessed using nine items developed by the authors such as "*Warm meals cannot be heated before consumption and are cold at lunch time*", "*My child cannot open some of the commercial packaging and no one helps her/him*", "*My child does not enjoy her/his lunch box content*."

9-items were rated using a 5-point Likert-type scale and the highest score, 5, was assigned to "strongly agree" responses. The scores were summed and ranged from 9 to 45 with a mean of 23.0 ± 6.4. The Cronbach's alpha coefficient equals to 0.76.

*Parental feeding practices* were measured using 15 items from the Child Feeding Questionnaire (CFQ) which is a self-report measure to assess parental beliefs related to child's obesity proneness, attitudes, and practices regarding child feeding (Leann L Birch et al., 2001). The CFQ is appropriate for use in research settings with parents of normally developing children,

ranging in age from the preschool period through middle childhood (Leann L Birch et al., 2001). The original CFQ consists of 31 items and seven subscales, which includes four subscales measuring parental beliefs related to child's obesity proneness, and three subscales measuring parental control practices and attitudes regarding child feeding.

For this study, subscales assessing parental attitudes and practices related to their feeding strategies such as "restriction" (8 items), "pressure to eat" (4 items), and "monitoring" (3 items) were used. A 5-point Likert-type scale of "Strongly disagree" to "Strongly agree" was used for "restriction" and "pressure to eat" and "Never" to "Always" for "monitoring". The highest score, 5, was assigned to "Strongly agree" and "Always" responses. The scores were then summed.

"*Restriction"* assesses the extent to which parents restrict their child's access to foods and includes questions such as *"I have to be sure that my child does not eat too many sweets"* and "*I intentionally keep some foods out of my child's reach*." The scores ranged from 8 to 40 with a mean of 26.9 ± 6.5. The Cronbach's alpha coefficient equals to 0.76.

"*Pressure to eat"* assesses parents' tendency to pressure their children to eat more food and includes questions such as "*My child should always eat all of the food on her plate*," and "*I have to be especially careful to make sure my child eats enough*." The scores ranged from 4 to 20 with a mean of 11.0 ± 3.9. The Cronbach's alpha coefficient equals to 0.73.

"*Monitoring"* assesses the extent to which parents oversee their child's eating and includes questions such as, "*How much do you keep track of the sweets that your child eats*?" and "*How much do you keep track of the snack food that your child eats?*" The scores ranged from 3 to 15 with a mean of 12.0 ± 2.9. The Cronbach's alpha coefficient equals to 0.92.

*Parental perception of peer-pressure* was assessed using three items developed by the authors such as, "*My child does not eat her/his lunch if her/his classmate makes negative*

*comments about it*." "*I pack foods that are not going to cause negative comments from my child's classmate", "My child always wants food that they see in other children's lunch boxes."*

Those 3-items were rated using a 5-point Likert-type scale and the highest score, 5, was assigned to "strongly agree" responses. The scores were then summed. The scores ranged from 3 to 15 with a mean of 7.3 ± 2.9. The Cronbach's alpha coefficient equals to 0.72.

**5.3.5. Data analysis**

All questionnaire responses were downloaded from the Qualtrics® website. Descriptive statistics were used to describe prevalence of socio-demographic categorical characteristics such as marital status, race/ethnicity, working status, level of education.

Spearman correlations were used to examine the association between self-efficacy, parental feeding practices, perceived benefits and constraints of HPL, and parental perception of peer-pressure.

Multiple linear regression analysis was performed to assess the relationship between parental food-packing-related psychosocial factors as the primary independent variables and the perceived benefits of HPL as the outcome variable. In the present study, it was hypothesized that parents are more likely to send HPL rather than participating in NSLP if they perceive more benefits of HPL. So, we wanted to explore underlying psychosocial factors of parents affecting their perceived benefit of HPL. Nutrition knowledge was excluded from these analyses as its reliability was low.

In order to reduce the number of independent variables, a stepwise procedure was performed, using $p<0.15$ for entry of covariates into the regression model. Statistical significance was declared when a p-value was $<0.05$. All statistical analyses were conducted using SAS Studio, version 9.4 (SAS Institute Inc., Cary, NC, USA).

## 5.4 Results

### 5.4.1. Sample characteristics

A total of 100 parents completed the web-based survey. The descriptive statistics of the sample are shown in Table 5.1. It was observed that 88% of the participants were women, 93% were married or in domestic partnership, 77% had at least 2 or 3 children, 54% were Caucasian and 23% were Asian. Regarding working status, about 60% of participants and 88.4% of spouses were working full-time, 67% were earning over $100,000 and 51% had an advanced degree.

With respect to HPL preparation, most of the parents reported to prepare the lunch's main course and assemble lunch items in the morning and almost half of them spend less than one hour per week to prepare their child's HPL. Although a majority of parents reported that they decided the content of HPL, 60% of parents reported that their child was also a decision maker in what would be packed.

When participating parents were divided by their schools' percentage of FARMS, the characteristics of parents whose children were in schools with less-poverty (i.e. less or equal to 50% of students eligible for FARMS) were similar with parents whose children were in schools with more poverty (i.e. more than 50% of students eligible for FARMS).

**Table 5.1: Socio-demographic characteristics of participating parents (n=100)**

| Variables | Average or n (%) |
|---|---|
| **Age** in years, mean (±SD) | 38.6 (±5.2) |
| **Gender**, female | 88 (88) |
| **Marital status** (n=98)[a], Married/Domestic partner | 91 (92.9) |
| **Number of children** | |
| 1 | 14 (14) |
| 2 - 3 | 77 (77) |
| 4 and more | 9 (9) |
| **Race/ethnicity** | |
| Asian | 23 (23) |
| African-American/Black | 6 (6) |
| Caucasian | 54 (54) |
| Hispanic | 14 (14) |
| Other | 3 (3) |
| **Household income (n=94)** | |
| < $40,000 | 5 (5.3) |
| $40,001-$60,000 | 10 (10.6) |
| $60,001-$80,000 | 6 (6.4) |
| $80,001- $100,000 | 10 (10.6) |
| Over $100,000 | 63 (67) |
| **Working status (n=99)** | |
| Working full time | 59 (59.6) |
| Working part-time | 22 (22.2) |
| Unemployed | 18 (18.2) |
| **Spouse working status (n=95)** | |
| Working full time | 84 (88.4) |
| Working part-time | 5 (5.3) |
| Unemployed | 6 (6.3) |
| **Level of education (n=99)** | |
| High school graduate | 12 (12.1) |
| 2-y college degree | 11 (11.1) |
| 4-y college degree | 25 (25.3) |
| Advanced degree | 51 (51.5) |
| **HPL frequency,** ≥4x/week | 88 (88) |
| **Person who decides the content of HPL[b]** | |
| Child | 61 (61) |
| Respondent | 94 (94) |
| Spouse | 28 (28) |
| **Time main dishes are prepared** | |
| Morning | 68 (68) |
| Previous day/evening | 28 (28) |
| During the week-end | 4 (4) |
| **Time lunch items are assembled** | |
| Items assembled in the morning | 75 (75) |

| | |
|---|---|
| Previous day/evening | 20 (20) |
| During the week-end | 5 (5) |
| **Perceived difficulty to prepare HPL** | |
| Yes | 20 (20) |
| No | 80 (80) |
| **Time spent preparing HPL/week** | |
| <1h | 49 (49) |
| 1h- 2h | 39 (39) |
| > 2h | 12 (12) |

[a] 2 respondents did not report their marital status, 6 did not report their household income.
[b] Several answers could be selected by the respondents

### 5.4.2. Main reasons for not buying school meals and preparing HPL for their child

To understand reasons for not buying school meals and instead preparing HPL, parents' were asked why they did not buy school meals. Table 5.2 presents the results of this multiple-choice question. 53% and 49% of parents, respectively, reported that they prefer to choose what their child eats and that the food served was not healthy. Also, 40% indicated that their child would not eat the school lunch and 33% considered that the food served does not taste good. Other responses included that the menus are too repetitive, school lunches were too expensive and parents did not want their child to wait in line to buy food.

**Table 5.2 Mains reasons for not buying a school lunch (n=100)**

| Mains reasons for not buying school lunch | % |
|---|---|
| I prefer to choose what my child eat | 53 |
| Food is unhealthy | 49 |
| My child will not eat the lunch | 40 |
| Food does not taste good | 33 |
| Menus too repetitive | 17 |
| Too expensive | 16 |
| Waiting time to buy food | 14 |

In order to cross-verify those answers and capture other possible responses, an almost identical question (reason for sending their child to school with a HPL) was asked using an open-ended question. The most frequently reported reason was to provide a healthier lunch to their

child. Some examples of the response were "*Healthier options*", "*Better quality food/healthier*", and "*I want them to eat healthy foods*". Parents also reported sending HPL to satisfy their child's taste: "*She does not like school cafeteria food*", "*They don't like the school menu*", "*My daughter does not like options that the school offers*". Other responses included that they and their child wanted to choose the foods and control quantities: "*Because we can make the choices for and with our children*". A few parents also considered HPL to be less expensive than school meals.

### 5.4.3. Parental psychosocial factors related to HPL

Understanding parent psychosocial factors including their perception of HPL, self-efficacy for enacting healthy eating behaviors in their children, their nutrition knowledge, and parental feeding styles are potentially pivotal to improve the quality of HPL and its consumption (Table 5.3).

**Table 5.3: Mean and range of scores of key psychosocial factors influencing parents' lunch packing behavior**

| Variables (score ranges) | Score ranges | Mean ± SD |
|---|---|---|
| Perceived benefits of HPL | 10-50 | 37.3 ± 6.1 |
| Perceived constraints of HPL | 9-45 | 23.0 ± 6.4 |
| Self-efficacy for preparing HPL in difficult situations | 8-40 | 25.5 ± 6.4 |
| Self-efficacy for enacting healthy eating behaviors | 10-50 | 29.4 ± 8.2 |
| Nutrition knowledge | 0-8 | 4.6 ± 1.5 |
| Parental feeding style | | |
| Restriction | 8-40 | 26.9 ± 6.5 |
| Pressure | 4-20 | 11.0 ± 3.9 |
| Monitoring | 3-15 | 12.0 ± 2.9 |
| Parental perception of peer-pressure | 3-15 | 7.3 ± 2.9 |

*Parents' perceived benefits and constraints of HPL*

Overall, parents tend to perceive that HPL is more nutritious, preferred by their children and allow more flexibility in food choices compared to school meals (Table 5.4). 86% of parents

considered that their child prefers HPL to school lunches and 74.5% that HPL are more nutritious than school lunches. Also, about 75% and 78% of parents, respectively, agreed that HPL allow them to give different types of food each day including organic and sustainable foods. On the other hand, a relatively small number of parents consider that HPL have an impact on their child's academic results and their child is less sick when they eat HPL.

Concerning perceived constraints of HPL, insufficient time to eat was mentioned as a major barrier of HPL. 64% and 61% of parents agreed that their child prefers to speak with her/his friends rather than to eat and their child does not have enough time to eat their HPL. About 42% agreed that their child hurries to go to recess. Very few parents agreed with constraints related to the packaging (commercial or containers from home) or their child's taste. About 39% and 24% agreed that warm meals and cold foods are not at the right temperature at lunch time.

**Table 5.4 Parents' perceived benefits and constraints of HPL**

| Statement | Strongly/ Somewhat Agree | Neutral | Strongly/ Somewhat Disagree |
|---|---|---|---|
| **Perceived benefits of HPL, %** | | | |
| My child prefers packed lunches over school lunches | 85.9 | 10.1 | 4.0 |
| Packed lunches are more convenient than school lunches | 33.3 | 20.2 | 46.5 |
| Packed lunches are more nutritious than school lunches | 74.5 | 20.4 | 5.1 |
| My child is likely to eat more food if I pack a lunch | 71.8 | 21.2 | 7.1 |
| Packed lunches allow me to give different types of food each day | 74.7 | 11.1 | 14.1 |
| Packed lunches allow me to give organic and sustainable foods | 77.8 | 16.2 | 6.0 |
| I save money by making packed lunches | 56.6 | 21.2 | 22.2 |
| Packed lunches allow my child to have more time to eat because my child does not have to wait in line | 64.6 | 25.2 | 10.1 |
| When I pack a lunch, my child has better academic result in school | 14.1 | 77.8 | 8.1 |
| When I pack a lunch, my child is less sick than when he eats a school meal | 19.4 | 66.3 | 14.2 |
| **Perceived constraints of HPL, %** | | | |
| Warm meals cannot be heated before consumption and are cold at lunch time | 38.7 | 24.5 | 36.8 |
| Cold foods are not cold anymore at lunch time | 24.5 | 30.6 | 44.9 |
| My child prefers what is in her/his classmate's lunch box or tray and trades foods | 9.1 | 19.4 | 71.5 |
| My child cannot open some of the commercial packaging and no one helps her/him | 14.3 | 14.3 | 71.4 |
| My child cannot open the containers I use and no one is available to help her/him | 7.2 | 13.4 | 79.4 |
| My child does not have enough time to eat | 60.9 | 12.4 | 26.8 |
| My child hurries to go to recess | 41.8 | 21.4 | 36.7 |
| My child prefers to speak with her/his friends rather than to eat | 64.3 | 17.3 | 18.3 |
| My child does not enjoy her/his lunch box content | 11.2 | 18.4 | 70.4 |

*Self-efficacy for preparing a healthy HPL in difficult situations and enacting healthy eating behaviors in their children*

Table 5.5 presents detailed items of parent self-efficacy for preparing a healthy HPL in difficult situations and enacting healthy eating behaviors in their children. When asked about preparing a healthy HPL in difficult situations, more than half of parents agreed that preparing a healthy HPL is difficult when their child asks for the same food every day, when lots of

unhealthy foods are available in the house, “when lacking ideas and recipes”. Also, 42% and 47% respectively reported lack of self-efficacy in situations such as when they have other meals to prepare and when their child comes back from school with a lunch box full of food.

With regards to self-efficacy for enacting healthy eating behaviors in their children, parents showed different levels of self-efficacy depending on food groups. 56% and 53% of participating parents, respectively, were confident that they could make their child eat very few solid fats (i.e., butter, margarine, shortening, lard and foods that contain those) and foods with low sodium content. Although 73% of parents were confident that they could make their child drink very few drinks with added sugar (i.e., soda, juices), it was the case for only 39% when asked about foods with added sugar (i.e., candy, cakes). In addition, even if 56% were confident that they could make their child eat a variety of vegetables (i.e., green, orange, yellow or red) and 50% that they could make them eat at least two servings of vegetables every day, only 22% were confident that their child would eat vegetables, if they did not enjoy the taste.

**Table 5.5 Parental self-efficacy for preparing HPL in difficult situations and enacting healthy eating behaviors in their children**

| Statement | Strongly/ Somewhat Agree | Neutral | Strongly/ Somewhat Disagree |
|---|---|---|---|
| **Parent self-efficacy for preparing healthy HPL in difficult situations, %** | | | |
| When I feel tired at the end of the day | 36.4 | 19.2 | 44.4 |
| When I have other meals to prepare such as dinner. | 42.4 | 18.2 | 39.3 |
| When I don't have enough time to prepare packed lunch in the morning. | 23.0 | 9.0 | 68.0 |
| When lots of unhealthy foods that my kid loves are available in the house | 53.5 | 18.2 | 28.3 |
| When my kid asks for the same food every day. | 54.1 | 12.2 | 33.6 |
| When my kid comes back from school with a lunch box full of food. | 47.0 | 30.6 | 22.4 |
| When my kid tell me that she/he trades food | 37.7 | 23.5 | 38.7 |
| When I am lacking ideas/recipes | 51.0 | 11.0 | 38.0 |
| **Parent self-efficacy for enacting healthy behaviors in children** | | | |
| Your child eats at least 2 servings of vegetables every day? | 50.0 | 26.0 | 24.0 |
| Your child will eat vegetables, even if they do not enjoy the taste? | 22.0 | 18.0 | 60.0 |
| Your child eats only 3 servings of starchy vegetables (i.e., white potatoes, corn, French fries) each week? | 43.0 | 18.0 | 39.0 |
| Your child eats a variety of vegetables (i.e., green, orange, yellow or red)? | 56.0 | 13.0 | 31.0 |
| Your child eats very few solid fats (i.e., butter, margarine, shortening, lard) and foods that contain these? | 56.0 | 24.0 | 20.0 |
| Your child eats very few saturated fats (found in dairy, meat, butter, and chocolate) or trans fats (partially hydrogenated oils)? | 45.0 | 27.0 | 28.0 |
| Your child eats foods with low sodium (salt) content or added sodium (salt)? | 53.0 | 22.0 | 24.0 |
| Your child eats very few foods with added sugar (i.e., candy, cakes)? | 39.0 | 20.0 | 41.0 |
| Your child drinks very few drinks with added sugar (i.e., soda, juices)? | 73.0 | 8.0 | 19.0 |

*Parental feeding practices*

Table 5.6 presents detailed items of parental feeding practices. Overall, most of the parents restrict their child access to sweets (85.7%), high-fat foods (77.3%) and intentionally keep some foods out of their reach (72.1%). Also, 58.8% and 58.4% of parents respectively, consider that they have to regulate their child or they would eat too many junk foods or too much of their

favorite foods. However, few of them use foods as a reward (33.0%) or in exchange for good behavior (26.8%). Few parents tended to put pressure on their child to eat but 44.7% reported that they are careful to make sure their child eats enough. Lastly, most of the parents monitored their child's eating as 81.2% kept tracks of the sweets, 80.4% of the snack foods and 73.2% of the high-fat foods.

**Table 5.6 Parental feeding practices**

| Statement | Strongly/ Somewhat Agree | Neutral | Strongly/ Somewhat Disagree |
|---|---|---|---|
| **Restriction: extent to which parents restrict their child's access to foods, %** | | | |
| I have to be sure that my child does not eat too many sweets (candy, ice cream, cake or pastries) | 85.7 | 6.1 | 8.2 |
| I have to be sure that my child does not eat too many high-fat foods | 77.3 | 4.1 | 18.5 |
| I have to be sure that my child does not eat too much of her/his favorite foods | 41.2 | 28.9 | 29.9 |
| I intentionally keep some foods out of my child's reach | 72.1 | 13.4 | 14.4 |
| I offer sweets (candy, ice cream, cake, pastries) to my child as a reward for good behavior | 33 | 12.4 | 54.7 |
| I offer my child her/his favorite foods in exchange for good behavior | 26.8 | 16.5 | 56.7 |
| If I did not guide or regulate my child's eating, she/he would eat too many junk foods | 58.8 | 10.3 | 30.9 |
| If I did not guide or regulate my child's eating, she/he would eat too much of her/his favorite foods | 58.4 | 16.7 | 25 |
| **Pressure to eat: parents' tendency to pressure their children to eat more food, %** | | | |
| My child should always eat all of the food on her plate | 35.4 | 10.4 | 54.1 |
| I have to be especially careful to make sure my child eats enough | 44.7 | 11.7 | 43.6 |
| If my child says ``I'm not hungry'', I try to get her to eat anyway | 42.1 | 13.7 | 44.2 |
| If I did not guide or regulate my child's eating, she would eat much less than she should | 29.2 | 14.6 | 56.3 |
| **Statement** | **Always/Mostly** | **Sometimes** | **Never/Rarely** |
| **Monitoring: extent to which parents oversee their child's eating, %** | | | |
| How much do you keep track of the sweets (candy, ice cream cake, pies, and pastries) that your child eats? | 81.2 | 11.5 | 7.3 |
| How much do you keep track of the snack food (potato chips, Doritos, cheese puffs) that your child eats? | 80.4 | 11.3 | 8.2 |
| How much do you keep track of the high-fat foods that your child eats? | 73.2 | 13.4 | 13.3 |

### 5.4.4. Bivariate correlation among key parental psychosocial variables related to HPL

In order to understand how parental psychosocial factors and perceptions were correlated with each other, Spearman correlations were conducted (Table 5.7).

Self-efficacy for preparing a healthy HPL in difficult situations was positively correlated with parents' self-efficacy for enacting healthy diet behaviors in their children ($\rho$=0.29, $p$=0.003) and negatively correlated with parents perceived constraints of HPL ($\rho$=-0.35, $p$=0.0004).

Parents who are more confident in enacting healthy eating behaviors in their children are more likely to perceive more benefits in HPL ($\rho$=0.27, $p$=0.006).

With respect to parental feeding practices, higher levels of parental monitoring of child's eating were associated with greater self-efficacy for enacting healthy diet behaviors in their children ($\rho$=0.38, $p$=0.0001). Parents who rated higher their restrictive attitude and their tendency to pressure their child to eat perceived more that their child's food choices and intake were influenced by his/her peers ($\rho$=0.26, $p$=0.009 and $\rho$=0.24, $p$=0.02). Parental perception of peer-pressure was also positively associated with perceived constraints of HPL ($\rho$=0.27, $p$=0.006).

**Table 5.7: Spearman's correlation coefficients among HPL related psychosocial variables and perceptions in parents (n=100)**

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1. Age** | 1 | | | | | | | | | | | | | | |
| **2. # of children** | -0.18 | 1 | | | | | | | | | | | | | |
| **3. Race/Ethnicity** | -0.07 | 0.18 | 1 | | | | | | | | | | | | |
| **4. Income** | 0.32* | -0.13 | -0.09 | 1 | | | | | | | | | | | |
| **5. Working status** | 0.12 | 0.08 | 0.01 | -0.15 | 1 | | | | | | | | | | |
| **6. Spouse working status** | 0.01 | -0.04 | 0.13 | -0.19 | -0.30* | 1 | | | | | | | | | |
| **7. Education** | 0.32* | -0.25* | -0.24* | 0.48** | -0.35** | 0.14 | 1 | | | | | | | | |
| **8. Self-efficacy for preparing HPL in difficult situation** | 0.07 | -0.07 | -0.04 | 0.01 | -0.00 | 0.17 | 0.00 | 1 | | | | | | | |
| **9. Self-efficacy for enacting healthy intake** | -0.15 | -0.20 | -0.26* | -0.02 | -0.08 | -0.10 | 0.14 | 0.29* | 1 | | | | | | |
| **Parental feeding practice** | | | | | | | | | | | | | | | |
| **10. Restriction** | 0.00 | 0.18 | -0.11 | 0.16 | -0.05 | 0.09 | 0.11 | -0.08 | -0.16 | 1 | | | | | |
| **11. Pressure to eat** | 0.03 | 0.03 | -0.17 | 0.09 | 0.06 | 0.06 | -0.03 | -0.05 | -0.15 | 0.31* | 1 | | | | |
| **12. Monitoring** | -0.20 | 0.00 | -0.07 | -0.16 | 0.15 | 0.02 | -0.12 | 0.15 | 0.38** | 0.11 | 0.04 | 1 | | | |
| **13. Perceived benefits of HPL** | -0.21* | 0.06 | -0.15 | -0.16 | -0.10 | -0.06 | -0.01 | 0.16 | 0.27* | -0.06 | 0.07 | 0.16 | 1 | | |
| **14. Perceived constraints of HPL** | -0.10 | 0.16 | 0.17 | -0.04 | 0.07 | -0.07 | -0.16 | -0.35** | -0.10 | 0.11 | 0.08 | -0.14 | -0.01 | 1 | |
| **15. Parental perception of peer-pressure** | 0.00 | 0.11 | -0.03 | -0.01 | -0.02 | -0.05 | -0.00 | -0.14 | -0.17 | 0.26* | 0.24* | -0.08 | -0.10 | 0.27* | 1 |

*p<0.05 **p<0.001

### 5.4.5. Regression analysis to identify correlates of parents perceived benefits of HPL

It is hypothesized that parents are more likely to send children with HPL rather than buying school meals if they perceive HPL are more beneficial for their children. Multiple linear regression was conducted to understand how perceived benefits of HPL in parents are associated with other psychosocial factors and what underlying factors make parents pack lunches.

The independent variables entered during the stepwise procedure include age, race/ethnicity, income, marital status, working status, spouse working status, self-efficacy for preparing a healthy HPL in difficult situations, self-efficacy for enacting healthy diet behaviors in their children, perceived constraints of HPL, parental feeding practices, parental perception of peer-pressure. The procedure selected race/ethnicity and parents' self-efficacy for enacting healthy eating behaviors in their children as the independent variables explaining perceived benefits of HPL. Parents' self-efficacy was the variable that best explained the variation in perceived benefits scores (10%). Being Caucasian explained 5% of that variation. The results of the multiple regression analysis to identify correlates of parental perceived benefits of HPL are presented in Table 5.8. The results show that parental perceived benefits of HPL tend to increase with parents' self-efficacy for enacting healthy diet behaviors in their children ($\beta$=0.23, $p$=0.001) and to decrease when parents are Caucasian in comparison to when they are Asian ($\beta$=-3.1, $p$=0.008) (other race/ethnicities were not selected in the model).

**Table 5.8**: **Multiple linear regression model relating parental perceived benefits of HPL to their psychosocial variables (n=99).**

| **Perceived benefits of HPL (F=9.86; *P*=.0001, adjusted $R^2$=0.15)** | |
|---|---|
| **Selected independent variables** | Beta ±SE (*p-value)* |
| **Race/ethnicity** | |
| Asian | ref |
| Caucasian | -3.1±1.15 (*0.008)* |
| **Self-efficacy for enacting healthy eating behaviors in their children** | 0.23±0.07 (*0.001)* |

## 5.5 Discussion

A large body of literature shows that parents' perceptions of their children's taste preferences, convenience of HPL, concern over quality of school meals, cost and food safety are strong determinants of food packing decisions. However, little has been discussed regarding how the key psychosocial factors and perceptions related to HPL in parents.

The major findings of this survey indicate that about half of participating parents responded that they mainly pack a lunch for their child because school meals are unhealthy and their child would not like it; thus, they would rather choose what their child eats. Similarly, a previous study conducted in the US found that the second most commonly cited barrier of buying school meals was nutritional and food quality and the first one was taste and preference (Farris et al., 2016). Also, another study conducted in the UK found that the main reasons for providing HPL were parental concern over quality of school meals, children's taste preferences and children wishing to sit with their friends at lunchtime (Griffin & Barker, 2008). Those parents did not classify making HPL as an enjoyable activity but it was still part of the household routine. Parents reported that their children's food preferences were driven by peer influence and pressure to consume lunch quickly. HPL were considered a cheaper option than school meals (Griffin & Barker, 2008). In this study, most of the respondents considered that preparing lunch is not

difficult; however more than half of the parents reported a lack of self-efficacy for preparing a healthy HPL in difficult situations when their child is repeatedly asking for the same food and when they do not eat what has been packed. Nevertheless, perceived constraints of HPL were mostly related to the school lunch time allocated for children to eat their HPL. Most of the parents considered that HPL are more nutritious than school meals and that packing their child's lunch gives them control over the type of food they consume. However, parents did not consider that HPL have an impact on their child's academic results, which is in contradiction with previous studies that have found that academic performance (i.e. academic scores) improved significantly after enhancement of the nutritional quality of school lunches (Anderson et al., 2017; Belot & James, 2011; Hollar et al., 2010). In a study conducted in Australia which aimed to describe the factors affecting food selection for HPL by parents of young children attending low socioeconomic schools, they found that providing a healthy HPL was considered challenging for parents (Bathgate & Begley, 2011). Another study in Australia found that parents believed that peers were influencing their child's preferences (K. J. Campbell et al., 2007). Similarly, this study also found that parents, who perceived that their child's food choices and intake were influenced by their peers, also perceived that HPL had more constraints. Regarding parental feeding styles, parents who monitored their child's eating more tended to have better self-efficacy for enacting healthy diet behaviors in their children. Also, parents with better self-efficacy for enacting healthy eating behaviors in their children were confident that they could make their child drink very few drinks with added sugar (i.e., soda, juices) but not necessarily less foods with added sugar (i.e., candy, cakes). In addition, those confident that they could make their child eat a variety of vegetables were only confident if their child enjoys the taste of those vegetables.

The principal limitations of this study are the size of its sample, the lack of generalizability of its findings to other regions with high minority populations, that the survey needed Internet access to be completed and that the nutrition knowledge scale had a low reliability. However, this study shows that parents with better self-efficacy for preparing a healthy HPL in difficult situations also have better self-efficacy for enacting healthy diet behaviors in their children and perceived less constraints of HPL than parents with lower self-efficacy. Moreover, parents with the highest knowledge in nutrition were significantly more confident in their ability to get their child have healthy eating behaviors. Self-efficacy for enacting healthy diet behaviors in their children was rated higher in parents who perceived more benefits in HPL and those parents were more likely to be Asian.

Future interventions targeting the improvement of HPL should take into account parents' self-efficacy and their race/ethnicity. Examining how parent psychosocial factors affect the diet quality and contents of HPL is crucial and it should be studied further.

# CHAPTER 6 : INFLUENCES OF PARENTS PSYCHOSOCIAL FACTORS ON THE DIET QUALITY OF YOUNG SCHOOL-AGE CHILDREN WHO FREQUENTLY CONSUME A HOME-PACKED LUNCH

## 6.1 Abstract

**Objective**: Although existing studies suggest that home-packed lunches (HPL) fall short of dietary guidelines and need nutritional improvement, there have been very few studies focusing on the dietary quality of children who frequently eat a HPL. This study examined how parents' psychosocial factors affecting their lunch packing behaviors were associated with their child's diet quality.

**Study design and setting:** Cross-sectional study, Maryland, USA.

**Study participants:** Parents of kindergartener and first grade children who regularly consume home-packed lunches (n=71).

**Methods:** Using a semi-structured survey, parents' key psychosocial variables affecting their child's diet quality were collected such as main reasons for packing lunch, self-efficacy, nutrition knowledge, perceived benefits and constraints of HPL, and parental feeding practices. Parents also reported their child's food intake using the Automated Self-Administered 24-hour Recall (ASA24-2016). The diet quality was assessed using the Healthy Eating Index-2010 (HEI-2010) and the new Healthy Eating Index-2015 (HEI-2015).

**Data analysis**: Descriptive statistics, correlations and multiple linear regressions were conducted.

**Results**: Parents mainly pack a lunch for their child because they believe that school meals are unhealthy and that their child would not like it; thus, they would rather choose what their child eats. Parents who perceived more benefits in HPL rated higher their self-efficacy for enacting

healthy diet behaviors in their children. The mean HEI-2015 score was 63.0 (± 11.1). Children's overall diet quality tends to increase with parents' self-efficacy for enacting healthy diet behaviors in their children (β=0.57, $p$=0.002) and parents' monitoring (β=1.01, $p$=0.03). Children's Total vegetable scores and Whole fruit scores tended to increase with their parents' self-efficacy for enacting healthy diet behaviors in their children (β=0.13, $p$<0.0001 and β=0.06, $p$=0.001, respectively). Children's score in Greens and Beans significantly increased with parental monitoring of their child's eating (β=0.22, $p$=0.008) and parental knowledge in nutrition (β=0.35, $p$=0.03). Children's Added sugars scores, meaning those consuming fewer added sugars, significantly increased with their parents' self-efficacy for enacting healthy diet behaviors in their children (β=0.15, $p$<0.0001). However, children's score in Whole fruit tended to decrease with parents' tendency to pressure their children to eat more food (β=0.06, $p$=0.001).

**Conclusions**: Future interventions adapted for young school-age children who frequently eat HPL in a school setting are required in order to improve their diet quality. These interventions should incorporate parents' key psychosocial variables to enact healthy lifestyles in their children, their parental feeding style, and the working status of each caregiver.

## 6.2 Introduction

The dietary intake of school children has legitimately been a concern in the US for more than a century, as children consume on average 35% of their daily food intake at school (Briefel, Wilson, & Gleason, 2009). In 1946, the National School Lunch Program (NSLP) was established under the National School Lunch Act. Sixty-six years later, the Healthy, Hunger-Free Kids Act included Nutrition Standards intended to improve the nutritional quality of school meals provided by the NSLP. In 2016, 5 billions lunches were served in the US of which 73.3% were free or of reduced price (USDA, 2016). However, students' eligibility for free or reduced price meals is significantly associated with higher odds of students eating a school meal (Ohri-Vachaspati, 2014; The Food Research and Action Center, 2015). The fourth School Nutrition Dietary Assessment Study found that in elementary schools 46% of children who are not eligible for meals benefits will not participate in the NSLP and might bring home-packed lunches (HPL) instead (USDA, 2012). Indeed, with considerable criticism directed at the NSLP, parents may believe that the lunches they pack respond better to their children's tastes and appetites than the lunches provided by the school (Ohri-Vachaspati, 2014). However, studies that have compared school meals (SM) to HPL have found that most of HPL needed nutritional improvement. Studies conducted in the US before the new Nutrition Standards found that SM contained less total sugar, added sugar, total fat and more food diversity than HPL (Hur et al., 2011; Johnston et al., 2012; Rainville, 2001). Studies comparing HPL with the new Nutrition Standards found that HPL contained more savory snacks such as chips, crackers and sugar-sweetened beverages and fewer servings of fruits, vegetables, whole grains and fluid milk (Caruso & Cullen, 2015; Farris et al., 2014; Hubbard et al., 2014). In one of those studies only 27% of lunches met at least three of five NSLP standards (Hubbard et al., 2014). Fewer studies compared the diet quality of

children using the Healthy Eating Index-2010 (HEI-2010). A recent study conducted on children in 4th and 5th grade found that children eating school meals had a mean score of 49.0 ±11.3 compared to children eating HPL who had a mean score of 46.1±12.2 (p=0.02) (Au et al., 2016). A second study conducted by USDA analyzed the diet quality of American school children by NSPL participation status using data from the National Health and Nutrition Examination Survey (NHANES) (Condon et al., 2015). A non-statistical significant difference was found for children 5-8 years old who scored 51.9 out of possible 100 points when they were NSLP participants compared to 48 for nonparticipants using the Healthy Eating Index-2010 (Condon et al., 2015). These studies show that HPL seem to be of a lower nutritional quality than SM and young children who regularly consume HPL have a lower diet quality index score. However none of these studies explore which key determinants affecting parents' lunch packing behaviors is associated with their child's diet quality. Therefore, the objective of this study was to assess which key determinants of parental food-packing behaviors affect the diet quality scores of their young school-age children.

## 6.3 Methods

### 6.3.1. Study design, setting and recruitment of schools

In this cross-sectional study, 133 elementary schools in one school district in Maryland, were grouped based on their Free and Reduced-price Meals (FARMS) percentage and stratified using student enrollment to recruit equally large and small schools from diverse income schools. Data were collected from October 2016 to June 2017 from 9 randomly selected schools from each group.

### 6.3.2. Participants recruitment

Parents of children in kindergarten and first grade, aged 5 to 8 years old and who frequently consume a HPL (i.e. at least three times a week) were invited to participate in this study. Participating teachers included recruitment flyers, available in English and Spanish, in children's "take home" folders and principals sent the same information via email when possible. Parents who were willing to participate directly replied to the survey or contacted the first author who would then send the link to the survey. Parents provided their consent by clicking the submit button in the web-based survey. All communications with participants occurred via emails.

Among 100 parents who replied to the survey, 71 parents completed both the survey and at least one 24h-dietary recall (i.e. 56 completed two recalls during two different weeks and 15 completed one recall) and 7 reported only their child's lunch intake.

The study protocol and the consent documents were reviewed and approved by the ethics committee of the Institutional Review Board (IRB) at the University of Maryland, College Park and the Office of Shared Accountability of the participating schools.

### 6.3.3. Measures

#### *1) Dietary intake and diet quality*

*Automated Self-Administered 24-hour Recall (ASA24-2016)*: Parents reported their child's food intake using the latest version of the Automated Self-Administered 24-hour Recall (i.e. ASA24-2016) developed by the National Cancer Institute (Subar et al., 2012), as the children were only aged 5 to 8 years old and too young to complete it themselves (Livingstone & Robson, 2000; Livingstone et al., 2004; McPherson et al., 2000). The software allows the participant to be guided through the 24-hour recall interview using a modified version of the USDA's Automated Multiple-Pass Method. The interview process includes a minimum of seven steps: a meal-based

quick list, meal gap review, detail pass, final review, forgotten foods, last chance and question about whether the day's intake was usual or not.

With the agreement of the principals, during the data collection period, parents were instructed via emails to tell their children not to discard any uneaten food from the lunch box. This allowed parents to accurately estimate the amount of food eaten by their child. The first author predetermined food intake dates. Reporting dates (i.e., the day on which respondents accessed the system to complete dietary recall) were calculated to be one day after the intake date. Parents were contacted via email on reporting dates and asked to report children's food intake if it was a day when their child did not buy lunch. If the child had bought a school meal on "intake date," another reporting date was determined by the first author and the parents were contacted again.

*Dietary intakes from HPL expressed as food groups*: Notably, the output file from the ASA24-2016 includes dietary intake expressed as food groups in cup-equivalents. Data from participants' lunches were extracted. In order to compare component scores calculated with the HEI, whole grains and refined grains were kept separate as well as fats naturally present in vegetable sources and fats naturally present in meat sources (see Table 6.1).

**Table 6.1: Ten food groups used for assessing intakes coming from children's HPL**

| Food Groups | Food categories | Food sub-categories |
|---|---|---|
| Total fruits (cup equivalents) | Whole citrus, melons, berries<br>Whole other fruits<br>Fruit juices | |
| Total vegetables (cup equivalents) | Dark green vegetables | |
| | Total red and orange vegetables | Tomatoes and tomato products<br>Other red and orange vegetables |
| | Total starchy vegetables | White potatoes<br>Other starchy vegetables |
| | All other vegetables | |
| Legumes (cup equivalents) | Beans and peas computed as vegetables | |
| | Beans and peas computes as protein foods | |
| Total whole grains (ounce equivalents) | | |
| Total refined grains (ounce equivalents) | | |
| Total meat (includes eggs, soy, nuts and seeds; excludes legumes) (ounce equivalents) | Total meat (excluding eggs and vegetable sources) | Beef, veal, pork, lamb and game meat<br>Cured meats<br>Organ meat<br>Poultry |
| | Seafood high in n-3 fatty acids | |
| | Seafood low in n-3 fatty acids | |
| | Eggs and egg substitutes | |
| | Soy products excluding soy milk<br>Peanuts, tree nuts and seeds | |
| Dairy (cup equivalents) | Fluid milk products | |
| Total milk, yogurt, cheese, and whey | Yogurt | |
| | Cheese | |
| Fats naturally present in vegetable sources (grams) | | |
| Fats naturally present in meat sources (grams) | | |
| Added Sugar (teaspoon equivalents) | | |

*Healthy Eating Index (HEI)*: The diet quality was assessed using the HEI-2010 and HEI-2015. The HEI is a diet quality index that measures conformance with federal dietary guidelines (Guenther et al., 2014). The diet quality is assessed from two perspectives. The first perspective is related to "adequacy", which refers to dietary components that should be increasingly consumed and contains nine dietary components to increase (i.e. increasing levels of intake receive increasingly higher scores). The second perspective is related to "moderation", referring to dietary components that should be less consumed, includes three dietary components to decrease in the HEI-2010 and four dietary components in the HEI-2015 (i.e. increasing levels of intake receive decreasingly lower scores) (Guenther et al., 2013). In summary, for all components, higher scores demonstrate closer conformance with the latest dietary guidelines.

**Table 6.2: Healthy Eating Index-2010 and 2015 components and standards for scoring**

| Component | Maximum points | Standard for maximum score | Standard for minimum score of zero |
|---|---|---|---|
| **Adequacy[1]:** | | | |
| Total fruit[2] | 5 | ≥ 0.8 cup equivalent per 1,000 kcal | No Fruit |
| Whole fruit[3] | 5 | ≥ 0.4 cup equivalent per 1,000 kcal | No Whole Fruit |
| Total vegetables[4] | 5 | ≥ 1.1 cup equivalents per 1,000 kcal | No Vegetables |
| Greens and Beans [4] | 5 | ≥ 0.2 cup equivalent per 1,000 kcal | No Dark Green Vegetables or Beans and Peas |
| Whole Grains | 10 | ≥ 1.5 oz. equivalents per 1,000 kcal | No Whole Grains |
| Dairy[5] | 10 | ≥ 1.3 cup equivalents per 1,000 kcal | No Dairy |
| Total Protein Foods[6] | 5 | ≥ 2.5 oz. equivalents per 1,000 kcal | No Protein Foods |
| Seafood and Plant Proteins[6,7] | 5 | ≥ 0.8 oz. equivalent per 1,000 kcal | No Seafood or Plant Proteins |
| Fatty Acids[8] | 10 | (PUFAs+MUFAs)/SFAs >2.5 | (PUFAs+MUFAs)/SFAs ≤ 1.2 |
| **Moderation:** | | | |
| Refined Grains | 10 | ≤1.8 oz. equivalents per 1,000 kcal | ≥ 4.3 oz. equivalents per 1,000 kcal |
| Sodium | 10 | ≤1.1 g per 1,000 kcal | ≥2.0 g per 1,000 kcal |
| Empty Calories[9] | 20 | ≤19% of energy | ≥50% of energy |
| **Replaced in HEI-2015 by** | | | |
| Added Sugars | 10 | ≤ 6.5 % of energy | ≥26% of energy |
| Saturated Fats | 10 | ≤ 8% of energy | ≥16% of energy |

1. Intakes between the minimum and maximum standards are scored proportionately.
2. Includes 100% fruit juice.
3. Includes all forms except juice.
4. Includes any beans and peas not counted as Total Protein Foods. In HEI-2015, legumes are no longer allocated to either the protein components or the vegetable components. Instead, legumes are allocated in all of these components, including Total Vegetables, Greens and Beans, Total Protein Foods, and Seafood and Plant Proteins.
5. Includes all milk products, such as fluid milk, yogurt, and cheese, and fortified soy beverages.
6. In HEI-2010, beans and peas are included here (and not with vegetables) when the Total Protein Foods standard is otherwise not met.
7. Includes seafood, nuts, seeds, soy products (other than beverages) as well as beans and peas counted as Total Protein Foods.
8. Ratio of polyunsaturated fatty acids (PUFAs) and monounsaturated fatty acids (MUFAs) to saturated fatty acids (SFAs).
9. In HEI-2010, calories from solid fats, alcohol, and added sugars; threshold for counting alcohol is >13 g/1,000 kcal. In 2015, the Empty Calories component was replaced with two discrete categories, Saturated Fat and Added Sugars, because the 2015 Dietary Guidelines emphasized limiting added sugars in the diet, and for the first time recommended that consumption of added sugars be kept to less than 10% of caloric intake. Also, solid fats were replaced by saturated fatty acids for the purpose of calculating the standard; and alcohol was removed as an item that contributes an effect to a specific component. Though excessive calories from alcohol are now no longer included within a separate component, total alcohol calories are included in the total calories (the denominator by which almost all standards are calculated); thus these calories are still accounted for in that way.

Source: https://epi.grants.cancer.gov/hei/comparing.html

*2) Web-based survey*

The survey included both open-ended questions and several Likert-type scales to assess socio-demographic characteristics, HPL preparation, self-efficacy for preparing a healthy HPL in difficult situations and for enacting healthy diet behaviors in their children, nutrition knowledge, perceived benefits and constraints of HPL, parental feeding practices and parental perception of child preferences and peer-pressure. The web-based survey was developed using Qualtrics® and was translated in Spanish using a forward-backward translation ("WHO | Process of translation and adaptation of instruments," 2017). The translation was conducted as the schools communicate in both languages to their parents (e.g. newsletters, forms, etc.). The survey was pre-tested with a convenience sample of 15 parents (13 in English and 2 in Spanish) to verify that all words were properly understood. It was estimated to be completed in 15-20 minutes.

**6.3.4. Data analysis**

Means and standard deviations were calculated for continuous variables and the percentage in each group was calculated for categorical variables. HEI scores were calculated using SAS code provided by the National Cancer Institute.

For parents, differences by level of participation were assessed using Fisher's Exact tests as some groups were small for categorical variables and Student's *t* test was used to examine differences for age as this variable was normally distributed (Shapiro-Wilk test p=0.5474). For children, differences by grade and sex were assessed using Chi-square test. Pearson correlations were used for normally distributed data (Total HEI scores, self-efficacy: healthy eating behaviors) whereas Spearman rank-correlation coefficients were calculated for data with skewed distributions (all the other variables). Spearman rank-correlation coefficients were calculated in order to conduct bivariate correlations between perceived children preferences and HEI scores.

Hierarchical multiple regression analyses were performed to assess the impact of determinants of parental food-packing behaviors as the primary independent variables on the total HEI-2010, HEI-2015 scores and food groups' equivalents as the outcome variables. In order to identify predictors that are significantly associated with the outcome variable, a stepwise procedure was performed. Generalized linear regression analyses (proc GENMOD) were performed for pertinent component scores that had shown significant associations with explanatory variables using Spearman correlations. Independent variables that were found statistically different by level of participation in the study were controlled for in the analysis. Models were adjusted for number of children, race/ethnicity and income (Baseline model), and then for any additionally independent variables that were found significant at less than the 10% level in the bivariate correlations.

Among the explanatory variables, age, scores of self-efficacy, perceived benefits and constraints of HPL, parental feeding style, and parental perception of peer-pressure were treated as continuous variables. Nutrition knowledge was excluded from these analyses as its reliability was low. Races, incomes level, number of children, working status, spouse working status, and marital status were all represented by categorical variables. Collinearity analyses using variance inflation factor (VIF) were used without identification of significant VIFs for any of the variables (all < 10). Thus, no independent variables in the regression models were found to be collinear. Statistical significance was declared when a p-value was <0.05. All statistical analyses were conducted using SAS Studio, version 9.4 (SAS Institute Inc., Cary, NC, USA).

## 6.4 Results

### 6.4.1. Basic sample characteristics

A total of 71 parents who completed both the survey and at least one 24-hour dietary recall were included in the present study. The characteristics of the analytic sample are shown in Table 6.3. 88% were female, 91% were married or in domestic partnership, 77% had two or three children and 54.5% were Caucasian. Also, 59% were working full-time, 67% were earning over $100,000 and 51% had an advanced degree. The parents who completed only the survey (n= 29) were not included in the present study, but their characteristics were largely similar to those who were included in the final analysis except for income. Parents who completed the survey and at least one complete 24h dietary recall were more likely to have higher income (Student's *t* test, p=0.03). Children whose dietary intakes were reported by participating parents showed similar distributions over grade (kindergarten and 1$^{st}$ grade) and gender.

**Table 6.3: Socio-demographic characteristics of participating parents (n=71)**

| Variables | Average or n (%) |
|---|---|
| Age in years, mean (±SD) | 38.8 (± 5.2) |
| Gender, female | 63 (88.7) |
| Marital status, Married/Domestic partner | 67 (95.7) |
| Number of children | |
| 1 | 10 (14.1) |
| 2 - 3 | 54 (76.0) |
| 4 and more | 7 (10.0) |
| Race/ethnicity | |
| Asian | 17 (23.9) |
| African-American/Black | 3 (4.2) |
| Caucasian | 43 (60.6) |
| Hispanic | 6 (8.4) |
| Other | 2 (2.8) |
| Household income (n=66) | |
| < $40,000 | 1 (1.5) |
| $40,001-$60,000 | 5 (7.6) |
| $60,001-$80,000 | 5 (7.6) |
| $80,001- $100,000 | 6 (9.1) |
| Over $100,000 | 49 (74.2) |
| Working status (n=70) | |
| Working full time | 40 (57.1) |
| Working part-time | 16 (22.9) |
| Unemployed | 14 (20.0) |
| Level of education (n=70) | |
| High school graduate | 5 (7.1) |
| 2-y college degree | 7 (10.0) |
| 4-y college degree | 18 (25.7) |
| Advanced degree | 40 (57.1) |
| Strata | |
| Low-poverty | 44 (62.0) |
| Mid-low poverty | 16 (22.5) |
| Mid-high poverty | 9 (12.7) |
| High-poverty | 2 (2.8) |

### 6.4.2. Diet quality of children who frequently consume HPL

As results from the HEI-2010 and HEI-2015 are very similar (see Table 6.4) only those from the HEI-2015 are reported in the analyses and discussed except for the component score Empty Calories that has been replaced by two component scores in the HEI-2015 and thus discussed in this paper. The mean Total HEI- 2015 score was equal to 63.0 (± 11.1). Component scores are

represented in Table 6.4 and Figure 1. Those results show that several components had very low scores, such as Total vegetable (57% of HEI-2015 maximum score), Greens and Beans (46% of HEI-2015 maximum score), Whole grains (52% of HEI-2015 maximum score), Fatty Acids (41% of HEI-2015 maximum score) and Sodium (52% of HEI-2015 maximum score). The mean sodium intake was equal to 2284 mg (± 899).

**Table 6.4: Total and component scores HEI-2010 and HEI-2015 (n=71)**

| | **HEI-2010** Mean (± SD) | **HEI-2015** Mean (± SD) |
|---|---|---|
| **Total score** | 63.9 (±12.2) | 63.0 (±11.1) |
| **Component scores** | | |
| **Adequacy** | | |
| Total fruit | 4.3 (±1.3) | 4.3 (±1.3) |
| Whole fruit | 4.5 (±1.3) | 4.5 (±1.3) |
| Total vegetables | 2.8 (±1.6) | 2.8 (±1.6) |
| Greens and Beans | 1.9 (±2.1) | 2.3 (±2.1) |
| Whole Grains | 5.2 (±3.6) | 5.2 (±3.6) |
| Dairy | 7.8 (±2.8) | 7.8 (±2.8) |
| Total Protein Foods | 3.7 (±1.4) | 3.7 (±1.4) |
| Seafood and Plant Proteins | 2.9 (±2.1) | 3.0 (±2.1) |
| Fatty Acids | 4.1 (±3.4) | 4.1 (±3.4) |
| **Moderation:** | | |
| Refined Grains | 6.0 (±3.3) | 6.0 (±3.3) |
| Sodium | 5.2 (±3.2) | 5.2 (±3.2) |
| Empty Calories | 15.5 (±4.4) | |
| Saturated fat | | 6.4 (±2.9) |
| Added sugar | | 7.7 (±2.4) |

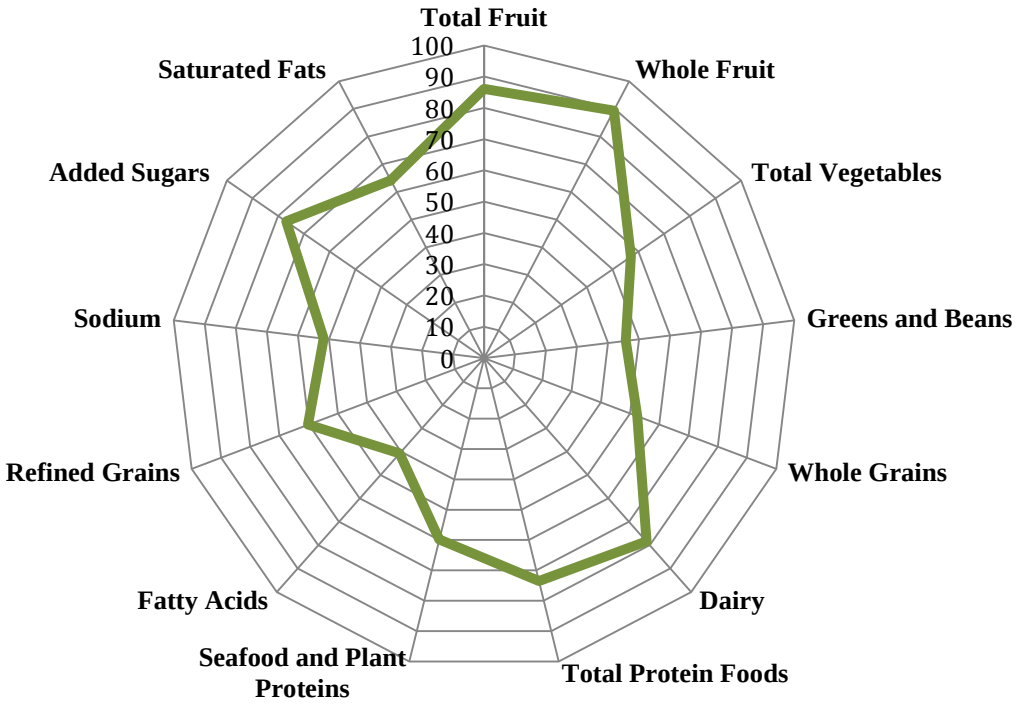



**Figure 1: HEI-2015 component scores in kindergarten and first grade children who frequently consume a HPL (mean total HEI-2015 score= 63.0 (±11.1)**

### 6.4.3. Key parents' psychosocial factors affecting the diet quality of children's who frequently consume HPL

Correlation analyses were performed using Pearson and Spearman's method and hierarchical multiple regression analyses were conducted to examine how parents' psychosocial characteristics influence their child's overall diet quality (Table 6.5)

The baseline model included number of children, race/ethnicity and income. Together, these variables explained 4.5% of the variance with no variables making any significant independent contribution. All subsequent models were adjusted for this baseline model. Model 1 included parents' self-efficacy for enacting healthy diet behaviors in their children and explained an additional 13.1% of the variance in children's overall diet quality (β=0.57, *p*=0.002). In model 2,

parents' tendency to monitor their child's eating was added, explaining an additional 4.5% of the variance (β=1.01 *p*=0.03). The final model explained 22.1% of the total variance in children's overall diet quality.

**Table 6.5: Univariate correlations and hierarchical multiple regression analyses relating total HEI-2015 scores in kindergartener and 1st grader to their parents' lunch packing behaviors.**

| | | | **Total HEI-score (n=71)** | |
|---|---|---|---|---|
| | Unadjusted correlation | | Adjusted analysis | |
| **Selected independent variables** | ρ | *p-value* | Beta ±SE | *p-value* |
| **Baseline model**, adjusted $R^2$=0.045 | | | | |
| Number of children | | | | |
| 1 | Ref | Ref | Ref | Ref |
| 4 | -0.27 | 0.02 | -10.9±5.75 | 0.063 |
| Race/ethnicity | | *NS* | | *NS* |
| Household income | | *NS* | | *NS* |
| **Model 1,** adjusted $R^2$=0.176 | | | | |
| Baseline model | | | | |
| + Self-efficacy: Enacting healthy diet behaviors | 0.37 | 0.002 | 0.57±0.18 | *0.002* |
| **Model 2,** adjusted $R^2$=0.221 | | | | |
| Baseline model | | | | |
| + Self-efficacy: Enacting healthy diet behaviors | 0.37 | 0.002 | 0.51±0.19 | *0.009* |
| + Parental feeding style: Monitoring | 0.20 | 0.089 | 1.01±0.47 | *0.037* |

### 6.4.4. Key parents' psychosocial factors affecting component scores of children's who frequently consume HPL

Regarding component scores, pertinent component scores that had shown several significant associations with explanatory variables using Spearman correlations were examined further using Generalized linear regression analyses. Results are presented in Table 6.6 for Total vegetable scores, Table 6.7 for Greens and Beans scores and Table 6.8 for Whole fruits scores. As in the HEI-2015, the Empty Calories component score (Table 6.9) was replaced with two

discrete categories “Saturated Fat” and “Added Sugars”, results for Added sugars scores are presented separately in Tables 6.10. For every component scores, the baseline model included number of children, race/ethnicity and income.

Regarding Total vegetable scores, Model 1 included parents’ self-efficacy for enacting healthy diet behaviors in their children and explained an additional 27.1% of the variance (β=0.13, *p*<0.0001)

**Table 6.6: Univariate correlations and hierarchical multiple regression analyses (proc genmod) relating Total vegetables scores in kindergarteners and 1st graders to their parents’ lunch packing behaviors (n=71).**

| | **Total Vegetable scores** | | | |
|---|---|---|---|---|
| | Unadjusted correlation | | Adjusted analysis | |
| **Selected independent variables** | ρ | *p-value* | Beta ±SE | *p-value* |
| **Baseline model,** adjusted $R^2$=0.00 | | | | |
| Number of children | | *NS* | | *NS* |
| Race/ethnicity | | *NS* | | *NS* |
| Household income | | *NS* | | *NS* |
| **Model 1**, adjusted $R^2$=0.271 | | | | |
| Baseline model | | | | |
| + Self-efficacy: Enacting healthy diet behaviors | 0.55 | *<0.0001* | 0.13±0.02 | *<0.0001* |

For Greens and Beans scores, Model 1 included parents’ self-efficacy for enacting healthy diet behaviors in their children and explained 7.6% of the variance (β=0.09, *p*=0.01). In model 2, parents’ tendency to monitor their child’s eating was added, explaining an additional 8.1% of the variance (β=0.22, *p*=0.008).

**Table 6.7: Univariate correlations and hierarchical multiple regression analyses (proc genmod) relating Green and Beans scores in kindergarteners and 1st graders to their parents' lunch packing behaviors (n=71).**

| | Green and Beans scores | | | |
|---|---|---|---|---|
| | Unadjusted correlation | | Adjusted analysis | |
| **Selected independent variables** | ρ | *p-value* | Beta ±SE | *p-value* |
| **Baseline model,** adjusted $R^2$=0.00 | | | | |
| Number of children | | *NS* | | *NS* |
| Race/ethnicity | | *NS* | | *NS* |
| Household income | | *NS* | | *NS* |
| **Model 1,** adjusted $R^2$=0.076 | | | | |
| Baseline model | | | | |
| + Self-efficacy: Enacting healthy diet behaviors | 0.35 | *0.002* | 0.09±0.03 | *0.003* |
| **Model 2,** adjusted $R^2$=0.157 | | | | |
| Baseline model | | | | |
| + Self-efficacy: Enacting healthy diet behaviors | 0.35 | *0.002* | 0.09±0.03 | *0.004* |
| + Parental feeding style: Monitoring | 0.35 | *0.003* | 0.22±0.08 | *0.008* |

With regards to Whole fruit scores, the baseline model explained 2.5% of the variance with no variables making any significant independent contribution. Model 1 included parents' self-efficacy for enacting healthy diet behaviors in their children and explained an additional 11.5% of the variance (β=0.06, *p*=0.001). In Model 2, parental tendency to pressure their child to eat was added and explained an additional 2.1% of the variance (β=-0.10, *p*=0.006).

**Table 6.8: Univariate correlations and hierarchical multiple regression analyses (proc genmod) relating Whole fruits scores in kindergarteners and 1st graders to their parents' lunch packing behaviors (n=71).**

| | Whole fruits scores | | | |
|---|---|---|---|---|
| | Unadjusted correlation | | Adjusted analysis | |
| **Selected independent variables** | ρ | *p-value* | Beta ±SE | *p-value* |
| **Baseline model,** adjusted $R^2$=0.025 | | | | |
| Number of children | | *NS* | | *NS* |
| Race/ethnicity | | *NS* | | *NS* |
| Household income | | *NS* | | *NS* |
| **Model 1,** adjusted $R^2$=0.140 | | | | |
| Baseline model | | | | |
| + Self-efficacy: Enacting healthy diet behaviors | 0.33 | *0.005* | 0.06±0.02 | *0.001* |
| **Model 2,** adjusted $R^2$=0.161 | | | | |
| Baseline model | | | | |
| + Self-efficacy: Enacting healthy diet behaviors | 0.33 | *0.005* | 0.04±0.02 | *0.03* |
| + Parental feeding style: Pressure | -0.31 | *0.008* | -0.10±0.04 | *0.006* |

Regarding Empty calories scores, the baseline model explained 10.1% of the variance with only household income between $40,001-$60,000 compare to over $100,000 making a significant independent contribution (β=-4.54, $p$=0.02). Model 1 included the parents' self-efficacy for enacting healthy diet behaviors in their children and explained an additional 14.7% of the variance (β=0.24, $p$<0.0001). For Added sugar scores, the baseline model explained 22.1% of the variance with household income between $40,001-$60,000 compare to over $100,000 making a significant independent contribution (β=-3.77, $p$<0.0001) and having more than 4 children compare to one child (β=-7.71, $p$=0.001). Model 1 included parents' self-efficacy for enacting healthy diet behaviors in their children and explained an additional 20.8% of the variance (β=0.15, $p$<0.0001). Thus, parents of children's with better Empty calories scores, meaning those consuming fewer empty calories, also had greater self-efficacy for enacting

healthy diet behaviors in their children; more precisely, they had better Added sugars scores when using the HEI-2015.

**Table 6.9: Univariate correlations and hierarchical multiple regression analyses (proc genmod) relating Empty Calories scores in kindergarteners and 1st graders to their parents' lunch packing behaviors (n=71).**

| | **Empty Calories HEI-2010** | | | |
|---|---|---|---|---|
| | Unadjusted correlation | | Adjusted analysis | |
| **Selected independent variables** | ρ | *p-value* | Beta ±SE | *p-value* |
| **Baseline model,** adjusted $R^2$=0.101 | | | | |
| Number of children | | *NS* | | *NS* |
| Race/ethnicity | | | | |
| Household income | | *NS* | | *NS* |
| Over $100,000 | Ref | *Ref* | Ref | *Ref* |
| $40,001-$60,000 | -0.19 | *0.10* | -4.54±1.92 | *0.02* |
| **Model 1,** adjusted $R^2$=0.248 | | | | |
| Baseline model | | | | |
| + Self-efficacy: Enacting healthy diet behaviors | 0.42 | *0.0003* | 0.24±0.06 | *<0.0001* |

**Table 6.10: Univariate correlations and hierarchical multiple regression analyses (proc genmod) relating Added sugars scores in kindergarteners and 1st graders to their parents' lunch packing behaviors (n=71).**

| | **Added sugars** | | | |
|---|---|---|---|---|
| | Unadjusted correlation | | Adjusted analysis | |
| **Selected independent variables** | ρ | *p-value* | Beta ±SE | *p-value* |
| **Baseline model,** adjusted $R^2$=0.221 | | | | |
| Number of children | | | | |
| 1 | Ref | *Ref* | Ref | *Ref* |
| more than 4 | -0.20 | *0.08* | -7.71±2.03 | *0.0001* |
| Race/ethnicity | | *NS* | | *NS* |
| Household income | | | | |
| Over $100,000 | Ref | *Ref* | Ref | *Ref* |
| $40,001-$60,000 | -0.27 | *0.02* | -3.78±0.95 | *<0.0001* |
| **Model 1,** adjusted $R^2$=0.428 | | | | |
| Baseline model | | | | |
| + Self-efficacy: Enacting healthy diet behaviors | 0.50 | *<0.0001* | 0.15±0.03 | *<0.0001* |

Thus, with respect to parental feeding practice, higher levels of parental monitoring of child's eating were associated with better Greens and Beans scores. However, parents who rated higher tendency to pressure their child to eat had children with lower Whole fruits scores.

### 6.4.5. Determinants of cup-equivalent when focusing only on lunch's intake

When assessing food intake only from the lunch using cup-equivalent, significant associations with explanatory variables using Spearman correlations were examined further using Generalized linear regression analyses. Those associations were found for vegetables and added-sugars intakes and results are presented in Tables 6.11 and 6.12.

Regarding children's intake in vegetables coming from their lunch, the baseline model included number of children, race/ethnicity and income. The subsequent model was adjusted for this baseline model. Model 1 included parents' self-efficacy for enacting healthy diet behaviors in their children and explained an additional 21.4% of the variance in children's intake in vegetables coming from their lunch ($\beta$=0.03, $p$<0.0001).

With respect to children's intake in added sugars, the baseline model explained 4.2% of the variance with household income between $40,001-$60,000 compare to over $100,000 making a significant independent contribution ($\beta$=3.06, $p$=0.008) and having more than four children compare to one child ($\beta$=5.79, $p$=0.03). Model 1 included parents' self-efficacy for enacting healthy diet behaviors in their children and explained an additional 12.6% of the variance ($\beta$=-0.12, $p$=0.0016).

**Table 6.11: Univariate correlations and hierarchical multiple regression analyses (proc genmod) relating vegetable intake coming from HPL in kindergartener and 1st grader to their parents' lunch packing behaviors (n=78).**

| | Vegetables cup-equivalent | | | |
|---|---|---|---|---|
| | Unadjusted correlation | | Adjusted analysis | |
| **Selected independent variables** | ρ | *p-value* | Beta ±SE | *p-value* |
| **Baseline model,** adjusted $R^2$=0.00 | | | | |
| Number of children | | *NS* | | *NS* |
| Race/ethnicity | | *NS* | | *NS* |
| Household income | | *NS* | | *NS* |
| **Model 1,** adjusted $R^2$=0.214 | | | | |
| Baseline model | | | | |
| + Self-efficacy: Enacting healthy diet behaviors | 0.49 | *<0.0001* | 0.03±0.00 | *<0.0001* |

**Table 6.12: Univariate correlations and hierarchical multiple regression analyses (proc genmod) relating added sugars intake coming from HPL in kindergartener and 1st grader to their parents' lunch packing behaviors (n=78).**

| | Added-sugars cup-equivalent | | | |
|---|---|---|---|---|
| | Unadjusted correlation | | Adjusted analysis | |
| **Selected independent variables** | ρ | *p-value* | Beta ±SE | *p-value* |
| **Baseline model,** adjusted $R^2$=0.042 | | | | |
| Number of children | | | | |
| 1 | Ref | *Ref* | Ref | *Ref* |
| more than 4 | 0.17 | *0.12* | 5.79±2.60 | *0.03* |
| Race/ethnicity | | *NS* | | *NS* |
| Household income | | | | |
| Over $100,000 | Ref | *Ref* | Ref | *Ref* |
| $40,001-$60,000 | 0.22 | *0.05* | 3.06±1.12 | *0.008* |
| **Model 1,** adjusted $R^2$=0.168 | | | | |
| Baseline model | | | | |
| + Self-efficacy: Enacting healthy diet behaviors | -0.31 | *0.006* | -0.12±0.03 | *0.0003* |

### 6.4.6. Relationships between perceived children preferences and their diet quality

As the objective of this study was to explore which key determinants affecting parents' lunch packing behaviors are associated with their child's diet quality, we assessed the relationship

between parental perceived child preferences and their diet quality assessed using the HEI-2015. Correlation analyses were performed using Spearman's method. Results are displayed in Table 6.13. Results showed that parental perception of the child's food preference is reflected in their diet quality. Indeed, higher parent ratings of their child's taste for fruits and vegetables was significantly positively correlated with their child's overall diet quality ($p$=0.03), their Total vegetables ($p$=0.03), Greens and beans ($p$=0.002) and Whole grains scores ($p$=0.03). Similarly, higher parent ratings of their child's taste for whole grains were significantly positively correlated with their child's whole grains score ($p$=0.003) and preference for dairy was significantly positively correlated with their child's Dairy score ($p$=0.008). Moreover, children who were perceived as having a taste for fish also had better diet quality, such as Total HEI-score ($p$=0.004), Total vegetables score ($p$=0.0003) and Greens and beans score ($p$=0.04). Also, the fact that parents rated higher their child's taste in beans was significantly positively correlated with their child's Total protein food score ($p$=0.03). However, children who were perceived as having a taste for dairies was significantly negatively associated with their child's Total vegetables score ($p$=0.04), Fatty acids score ($p$=0.02) and Empty calories ($p$=0.04) or more precisely their Saturated fat scores ($p$=0.04). Also, higher parent ratings of their child's taste for meat had higher refined grain score ($p$=0.02).

**Table 6.13: Spearman's correlation coefficients between perceived child preferences and HEI 2015-scores (n=71)**

| | Corelation Coefficient ρ | | | | | |
|---|---|---|---|---|---|---|
| | Child likes | | | | | |
| | **Fruits & vegetables** | **Whole grains** | **Fish** | **Meat** | **Beans** | **Dairy** |
| **Total HEI score** | **0.26*** | 0.06 | **0.33*** | 0.19 | 0.09 | -0.03 |
| **Total fruit** | 0.23 | 0.15 | 0.07 | 0.13 | 0.05 | 0.13 |
| **Whole fruit** | 0.13 | 0.09 | 0.23 | 0.09 | 0.02 | -0.01 |
| **Total vegetables** | **0.25*** | 0.01 | **0.41**** | 0.16 | **0.25*** | **-0.23*** |
| **Greens and beans** | **0.36*** | -0.04 | **0.24*** | 0.02 | 0.18 | 0.09 |
| **Whole grains** | **0.25*** | **0.34*** | 0.03 | 0.21 | 0.03 | 0.17 |
| **Dairy** | 0.06 | -0.04 | 0.13 | 0.03 | 0.00 | **0.31*** |
| **Total protein foods** | 0.14 | -0.01 | 0.23 | 0.03 | **0.26*** | -0.16 |
| **Fatty acids** | -0.02 | -0.06 | 0.02 | 0.00 | 0.05 | **-0.27*** |
| **Refined grains** | -0.01 | 0.01 | 0.22 | **0.27*** | 0.05 | -0.02 |
| **Sodium** | -0.11 | 0.08 | -0.21 | -0.15 | -0.19 | 0.23 |
| **Saturated fats** | -0.01 | -0.04 | 0.06 | 0.10 | 0.01 | **-0.23*** |
| **Added sugars** | 0.16 | -0.04 | 0.16 | 0.02 | -0.01 | -0.17 |

*p<0.05 **p<0.001

## 6.5 Discussion

This study of Kindergarten and 1st grade children who frequently consume a HPL showed that their overall diet quality was better when parents scored higher their self-efficacy for enacting healthy diet behaviors in their children and when parents were more closely monitoring their child's food intake.

Regarding component scores, after adjustment for number of children, race/ethnicity and income, children of parents with higher self-efficacy for enacting healthy diet behaviors in their children had better Total vegetable scores. This association was also found when looking only at the children's intake of vegetables from their HPL. They also had better Empty calories scores, meaning they were consuming fewer empty calories, and more precisely they had better Added sugars scores when using the HEI-2015. This association was also found when looking only at

the children's intake of added sugar from their HPL. As explained by Bandura (1997), perceived self-efficacy is a good predictor of the behavior (Albert Bandura, 1997). Those results are consistent with previous studies that have been conducted in preschool children (K. Campbell, Hesketh, Silverii, & Abbott, 2010; Fletcher et al., 2013).

This study also found that parents' knowledge in nutrition was significantly positively associated with children's scores in Greens and beans but did not find any significant associations for other component scores and the overall diet quality. Those results are consistent with a previous study showing that mother's knowledge in nutrition, had statistically insignificant effect in the school-aged child's total HEI (Blaylock, Variyam, Lin, & United States. Department of Agriculture. Economic Research Service., 1999).

As seen in previous studies, parental feeding styles had an impact on their child's food intake (Vollmer & Mobley, 2013). In this study, children's Greens and beans scores significantly increased with parental monitoring (i.e. the extent to which parents oversee their child's eating). Also, children's Whole fruit scores tended to decrease with parents' tendency to pressure their children to eat more food.

Parents' perceptions of their children's preferences showed an association with most of their children's respective HEI scores. These results suggest that parents who frequently pack a lunch for their child take into account their child's preference, and those preferences are reflected in their intakes. Another study in Australia found that some parents offered food primarily on the basis of the child's tastes or preferences and they believed that peers were influencing children's preferences (K. J. Campbell et al., 2007).

Therefore, even though this study was cross-sectional, did not include many parents who are lower-income although not eligible for FARMS and included a limited number of participants,

the analyses highlighted several significant determinants of packing behaviors. To our knowledge, this is the first study to examine the associations between parents' decisional balance to prepare HPL, their food packing behavior and key psychosocial variables and their child's diet quality.

Interventions adapted for young school-aged children who frequently eat HPL in a school setting are needed in order to improve their diet quality. This study showed that parents with the lowest self-efficacy for enacting healthy diet behaviors in their children have a tendency to include fewer vegetables and more added sugars in their child's diet and their HPL, resulting in lower overall diet quality. Parental feeding styles, such as monitoring of the child's eating and pressure to eat were also determinants of several component scores. Thus, future interventions should target improving parents' self-efficacy while taking into account their parental feeding style and their socio-economic status.

# CHAPTER 7 : SUMMARY AND IMPLICATIONS

## 7.1 Summary of findings and conclusions

Understanding key factors associated with the diet quality of HPL in young school children is crucial to improving the diet quality of American children.

The aim of the first paper was to explore elementary school administrators and teachers perspectives of the effect of school lunch policies and cafeteria environment on HPL. This study found that parents of young children in public elementary schools who decide to frequently pack a lunch for their child have to take into consideration several school cafeteria environment constraints. These include the absence of appliances (i.e., microwaves or refrigerators) that would allow their child to heat their meal or keep it cold while stored, the time available for their child to eat what has been packed and the limited number of adults present in the cafeteria to help their child with difficult to open containers/packaging.

The aim of the second paper was to examine the main reasons why parents pack lunches for their children and how key psychosocial factors and perceptions related to HPL in parents.. This study provided a better understanding of the psychosocial variables associated with parents' decision process when preparing HPL and their perceptions of HPL. The findings suggest that parents mainly pack a lunch for their child because they believe that school meals are unhealthy and that their child would not like it; thus, they would rather choose what their child eats. Most parents considered that preparing lunch is not difficult; however parents who rated lower their self-efficacy for preparing a healthy HPL in difficult situations (e.g. when their child comes back from school with a full lunch box, when their child tells them that they had trade their food, etc.) were more likely to consider that HPL have constraints. Parental perception of peer-pressure was also positively correlated with perceived constraints of HPL. Also, self-efficacy for enacting

healthy diet behaviors in their children was rated higher in parents who perceived more benefits in HPL. Regarding parental feeding styles, parents who were more closely monitoring their child's food intake rated higher their self-efficacy for enacting healthy diet behaviors in their children. Moreover, parental restrictive attitude and their tendency to pressure their child to eat were significantly positively associated with parental perception of peer-pressure.

Finally the aim of the last paper was to assess which key parents' psychosocial variables are associated with their child's diet quality. This study found that after adjustement for covariates and other variables, children's overall diet quality was better when parents scored higher their self-efficacy for enacting healthy diet behaviors in their children and when parents were more closely monitoring their child's food intake. Regarding component scores, children of parents with higher self-efficacy for enacting healthy diet behaviors in their children had better Total vegetable scores and higher consumption of vegetables from their HPL. They also had better Added sugars scores (i.e. lower consumption) and notably lower intake of added sugars from their HPL. Moreover, children's Greens and beans scores significantly increased with parental monitoring (i.e. the extent to which parents oversee their child's eating). Also, children's Whole fruit scores tended to decrease with parents' tendency to pressure their children to eat more food.

Also, parents' perceptions of their children's preferences were positively correlated with most of their children's respective HEI component scores. These results suggest that parents who frequently pack a lunch for their child take into account their child's preference, and those preferences are reflected in their intakes.

### 7.2 Strength and limitations

*Strengths*: This research provides insight of the school cafeteria environment during lunchtime from elementary school administrators and teachers and its impact on parental

decision to pack lunches using a combination of quantitative and qualitative methods. Also, it describes how the school cafeteria environment and operation and students' cultural backgrounds possibly influence the dietary intakes of young kindergarten and 1st grade students who bring HPL. One major findings of this study indicate that about half of participating parents responded that they mainly pack a lunch for their child because school meals are unhealthy and their child would not like it; thus, they would rather choose what their child eats. Also, parents who perceived more benefits in HPL had higher self-efficacy for enacting healthy diet behaviors in their children and were more likely to be Asian than Caucasian. This study also showed that parents with the lowest self-efficacy for enacting healthy diet behaviors in their children have a tendency to include fewer vegetables and more added sugars in their child's diet and their HPL, resulting in lower overall diet quality.

To our knowledge, this is the first study to assess which key parental psychosocial variables are associated with their young (5-8 years) school children's diet quality. Previous similar studies have collected information on foods present in HPL by using observations without recording foods actually consumed except two studies (Au et al., 2016; Caruso & Cullen, 2015) and did not analyze how HPL content and those children's diet quality was associated with their parents' psychosocial variables. These findings provide valuable information to develop interventions targeting the improvement of HPL's nutritional quality and more broadly the diet quality of young children who frequently consume HPL instead of school meals.

*Limitations*: This research included very few parents with lower income which limits generalizability of the study results. Even though parents are more likely to pack lunch when they are not eligible for FARMS, this study mostly recruited high-income parents and fewer parents that would not have been eligible for FARMS but still have limited income for the area

(i.e. only 16% of participants had income below $60,000 per year) (Ohri-Vachaspati, 2014). Those parents who might have been recruited in schools from the group "High poverty" participated less as only one school from this group agreed to participate and fewer parents responded to the survey than in the "Low-poverty" group. This lack of participation from lower income group was also observed in previous clinical and behavioral studies on low-income patients and researchers recommended to reduce participant burden and provide support for individuals who do not speak English to improve low-income group's participation (Bernard-Davila et al., 2015; Cui, Seburg, Sherwood, Faith, & Ward, 2015; Newington & Metcalfe, 2014; Robinson, Adair, Coffey, Harris, & Burnside, 2016; Unger, Gralow, Albain, Ramsey, & Hershman, 2016). Nevertheless, to reduce the impact of that limitation the findings of this dissertation research were adjusted for race/ethnicity, income and number of children. Attrition rate was equal to 29.7% which is notable and could be explained by the respondent burden of completing 24h dietary recalls. However, the characteristics of parents who did not report at least a complete day of their child's food intake were largely similar to those for which those data were available, except for income.

### 7.3 Recommendations for future interventions and policies

Future interventions targeting improvement of the nutritional quality of food consumed by school children should also take into account HPL. Several key recommendations emerge from this study for future interventions and policies.

This dissertation study shows that interventions should target the improvement of the quality of food consumed by school children globally by including HPL and being specifically tailored by children's cultural food habits. It also shows that children who bring HPL require additional time and assistance from adults in the cafeteria (i.e. lunch aids, principals, parents-volunteers,

etc.) as they may need help opening HPL containers/packaging. The time spent to open those containers might be limiting and might impact children's lunch consumption as well as the school lunch/recess schedule. Thus, future interventions should help schools schedule recess before lunch and ensure a sufficient number of adults present in the cafeteria to help the children open their containers and give them supportive prompts to encourage them to eat. Those interventions should also assess the communication channel used by the school to communicate with parents when HPL are considered unhealthy.

This study also found that parents' self-efficacy and their feeding styles were strong determinants of their child's diet quality. Thus, future interventions should focus on improving parents' self-efficacy to make their child have healthy eating behaviors and on encouraging parents to monitor their child's eating without pressuring them. Those interventions should avoid focusing only on improving parental nutrition knowledge and giving practical advice such as recipes and food preparation tips, as previous interventions targeting that population such as the SMART lunch box conducted in UK, only led to small improvements (Cleghorn, Evans, Kitchen, & Cade, 2010; C. E. L. Evans et al., 2010).

In the US, an interesting intervention has been developed for children in early care and education centers called "Lunch is in the Bag". This behavioral intervention was designed to increase fruits, vegetables and whole grains in HPL prepared for preschool children by providing parent handouts, teacher training, child classroom activities and parent and child activity stations (Roberts-Gray et al., 2016). Those in-class and at-home activities involving parents and children could be adapted for young elementary students by taking into account parental psychosocial variables highlighted in our study and could be tailored by children's cultural food habits.

These findings show that policies regarding the NSLP should take into consideration parents' reasons for sending HPL in order to improve NSLP participation. This study confirms that parents consider school meals unhealthy and that their child would not eat it. Policies should then focus on improving school meals' nutritional quality as well as food taste.

# APPENDICES

## Appendix 1: In-depth interview guide

Date:

Time:

School:

Interviewee's name/position:

I want to thank you for taking the time to meet with me today. My name is Perrine Nadaud and this interview is being conducted as part of a study I am conducting to complete my PhD degree. I am hoping to learn about your school's lunch policies. If you agree, I will ask questions about the cafeteria rules when kindergartener and 1st grader eat and the time and equipment constraints that you have. The interview should last about 30 minutes.

If you agree, I will record our conversation so that I can minimize note taking. I assure you that all your comments will remain confidential and I will ensure that any information I include in my report does not identify you as the respondent. If you agree to this interview and the tape recording, please sign the consent form.

1. **Topic: School policies and time allocated to lunch and recess**

I would like to start our interview by asking some questions about your school policies during lunch time.

Could you explain to me, what is the current lunch schedule in your school?

More precisely, could you explain the lunch schedule for kindergarten and 1st grade's children? For example, could you explain to me if they eat at the same time? Is their recess schedule at the same time? Why is it organized this way in your school?

Please tell me if you personally think this organization (i.e. time allocated to eat, schedule of lunch) works well for the students' food consumption?

If I summarize…

2. **Topic: Food preservation and reheating availability**

I am now going to ask you questions about facilities available for children who bring their lunch from home.

Could you describe what types of facilities, such as refrigerators, microwaves, etc. are available for kindergarten and 1st grade's students who bring their lunch from home?

Could you explain why these facilities are available or not?

Could you explain if these facilities or lack of facilities might impact the foods children bring in the lunch boxes?

Do you personally think these facilities or lack of facilities might have an impact on these children's consumption during lunch time?

If I summarize…

3. **Topic: Cafeteria workers and volunteers**

I am now going to ask you questions about adults present in the cafeteria while kindergarten and 1st grade's students eat.

Could you explain to me the role of each adult/caregiver present in the cafeteria as an employee or as a volunteer?

Could you explain how their roles might impact food intake of children who bring their lunch from home?

Could you explain to me the rules adults are supposed to follow if a child does not eat anything from his/her lunch box?

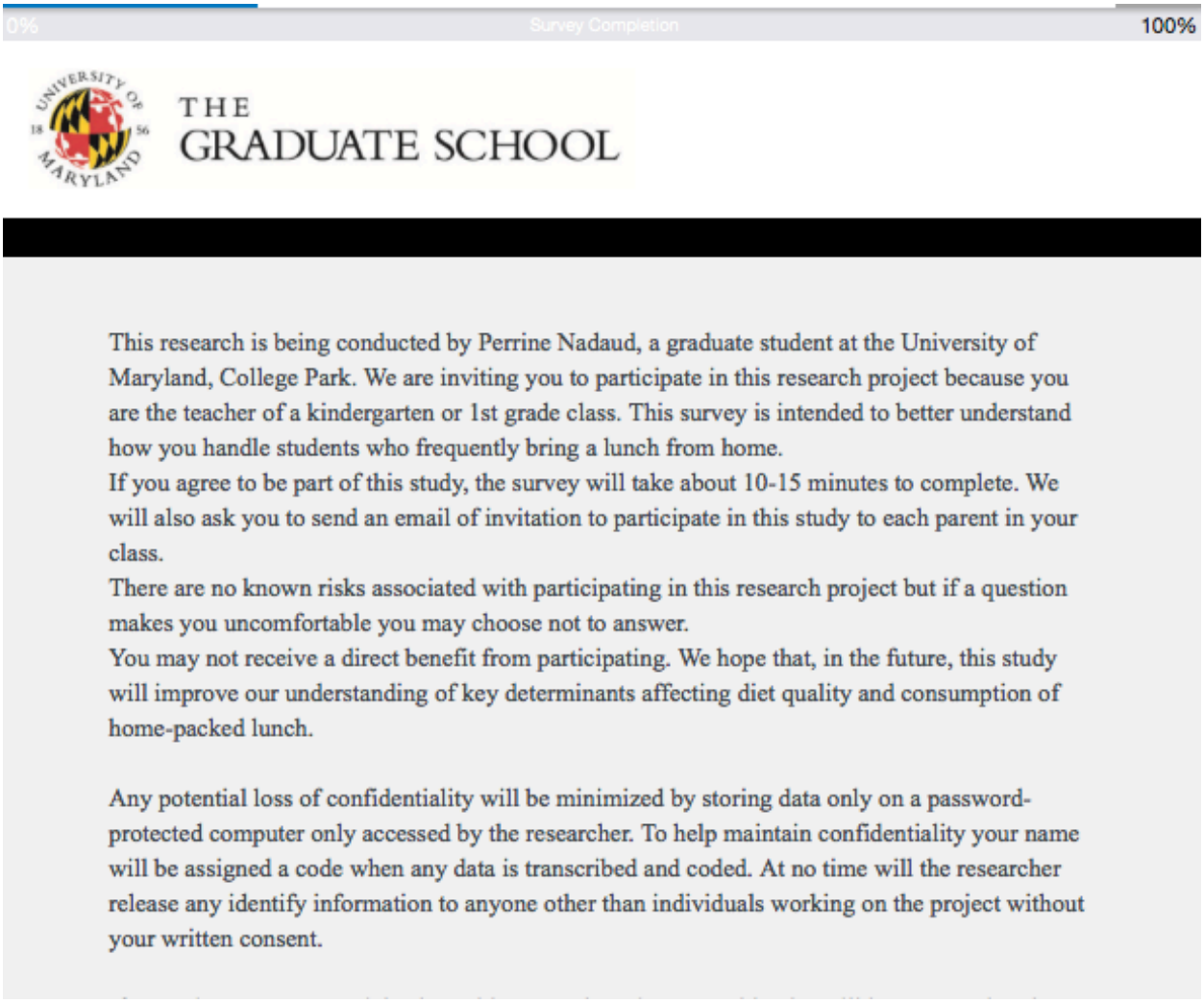
Could you explain to me the rules, cafeteria workers/volunteers are supposed to follow when children are trading food?

If I summarize…

4. **Topic: Level of awareness regarding HPL**

I am now going to ask you how you think the food quality and consumption of children who bring their lunch from home could be improved.

## Appendix 2: Teachers survey



If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this survey, you may stop participating at any time. If you decide not to participate or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.

If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the survey, please contact the investigator:

**Perrine Nadaud**
**pnadaud@umd.edu**
Advisor:
**Dr. Hee-Jung Song**
**hjsong@umd.edu**
Address: 0112 Skinner Building, Department of Nutrition and Food Science, University of Maryland College Park, 20742
Telephone number: 301-405-8898

If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:

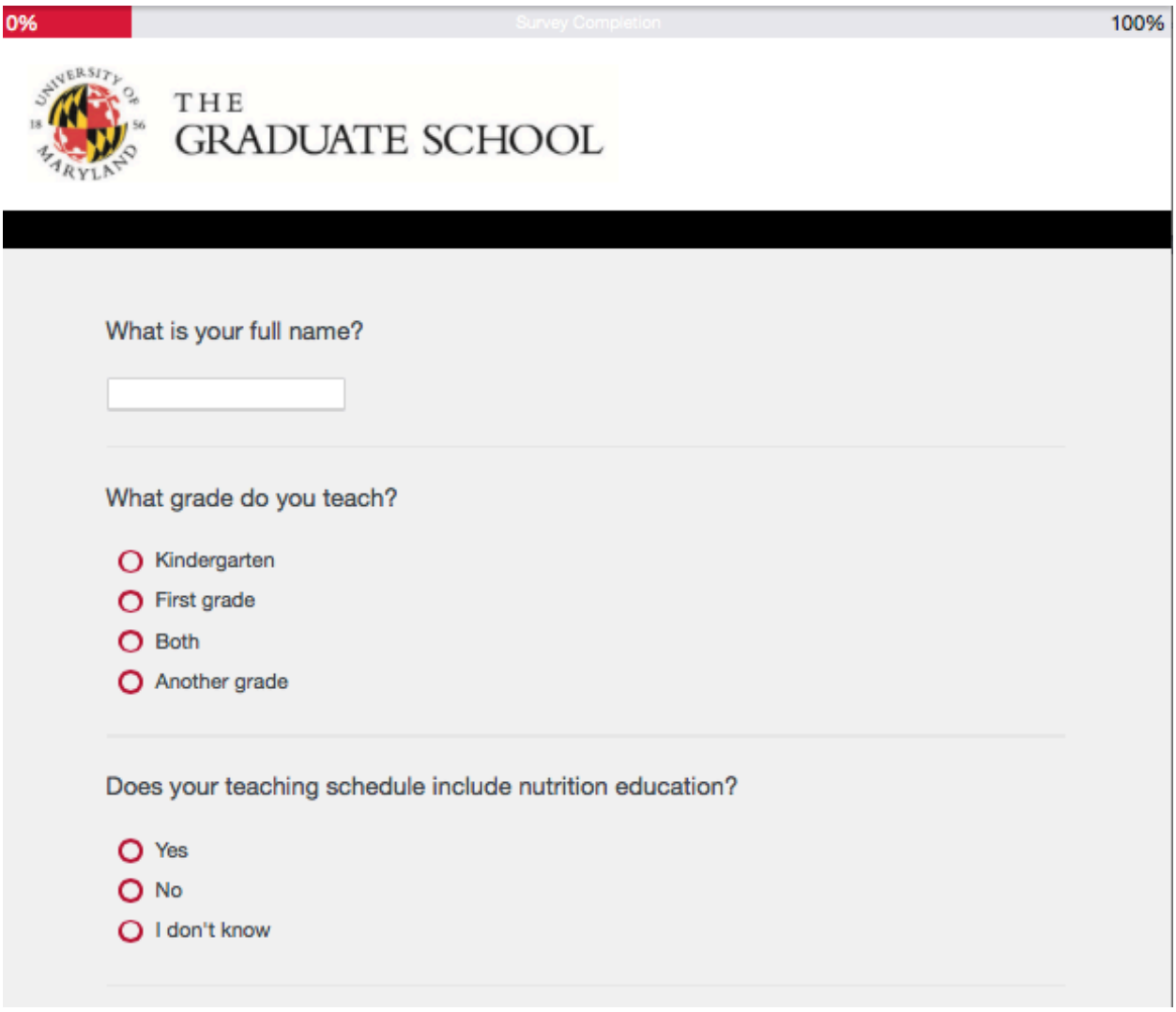
**University of Maryland College Park**
**Institutional Review Board Office**
**1204 Marie Mount Hall**
**College Park, Maryland, 20742**
**E-mail: irb@umd.edu**
**Telephone: 301-405-0678**

This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.

By clicking the submit button you are consenting to participate in this research.

Thank you for taking the time to complete this survey.

Next


0%
Survey Completion
100%
THE
GRADUATE SCHOOL
What is your full name?
What grade do you teach?
Kindergarten
First grade
Both
Another grade
Does your teaching schedule include nutrition education?
Yes
No
I don't know

Do you think children in your class are interested in nutrition education?

- ○ Yes
- ○ No
- ○ I don't know

Do you communicate with parents regarding home-packed lunch nutritional quality?

- ○ Yes
- ○ No
- ○ I don't know
- ○ If yes, how:

How many children in your class frequently (3 times per week) bring a lunch from home?

- ○ Less than 25%
- ○ 25-50%
- ○ 50-75%
- ○ More than 75%

Benefits: please rate how much you agree or disagree with the statement

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| My students prefer home-packed lunches over school lunches | O | O | O | O | O |
| Packed lunches are more convenient for me than school lunches | O | O | O | O | O |
| Packed lunches are more nutritious than school meals | O | O | O | O | O |
| My students are likely to eat more food if they have a packed a lunch | O | O | O | O | O |
| Packed lunches allow parents to give organic and sustainable foods | O | O | O | O | O |
| Students eating packed lunches are more concentrate than students eating school meals | O | O | O | O | O |
| Students eating home-packed lunches miss less days of school than students eating school meals | O | O | O | O | O |

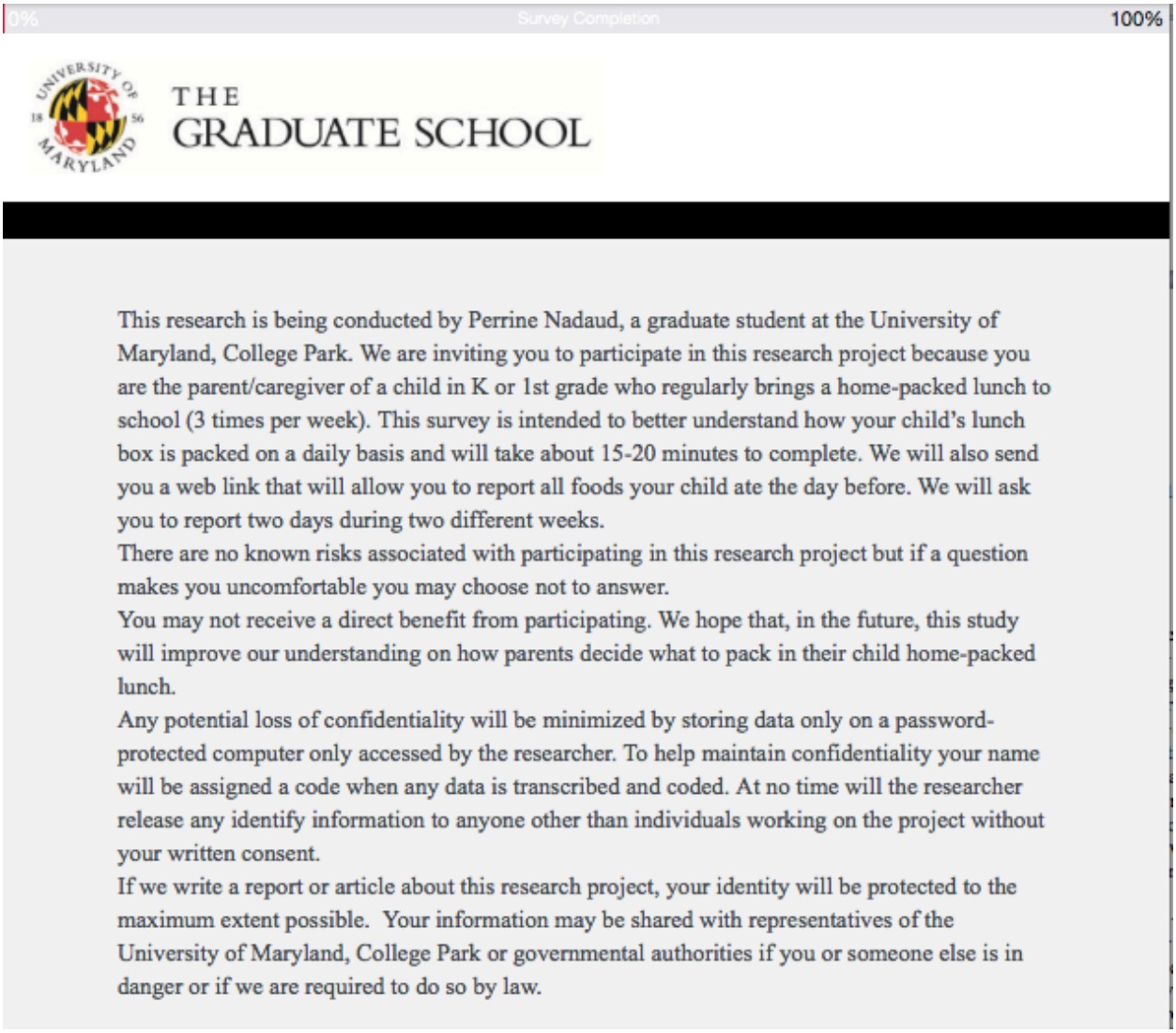
Next

Constraints: Please rate how much you agree or disagree with the statement

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| Collection of student's lunch boxes gives me extra work | ○ | ○ | ○ | ○ | ○ |
| When collecting the lunch boxes, I believe I am following food safety and sanitation regulations | ○ | ○ | ○ | ○ | ○ |
| My students with packed lunches do not have enough food to eat | ○ | ○ | ○ | ○ | ○ |
| Foods contained in my students lunch boxes are not nutritious | ○ | ○ | ○ | ○ | ○ |
| Students eating packed lunches trade more foods than students eating schools meals | ○ | ○ | ○ | ○ | ○ |
| Some students cannot open the packing of their food items | ○ | ○ | ○ | ○ | ○ |

Submit

## Appendix 3: Parents/caregivers survey



As compensation for your participation, you will receive a lunch box that can be used for the lunch of your child.

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.

If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the project coordinator:
**Perrine Nadaud**
pnadaud@umd.edu
Telephone number: 202-746-1166
Advisor:
**Dr. Hee-Jung Song**
hjsong@umd.edu
Address: 0112 Skinner Building, Department of Nutrition and Food Science, University of Maryland College Park, 20742
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E-mail: irb@umd.edu

Telephone: 301-405-0678

This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.

By clicking the submit button you are consenting to participate in this research.

Thank you for taking the time to complete this survey.

Next

0% Survey Completion 100%

THE GRADUATE SCHOOL

What is your name?

What is your email address?

What is your sex?

- Male
- Female

What is your age?

Which of the following best describes your current relationship status?

- Married/Domestic partnership
- Widowed
- Divorced
- Separated
- Single

How many children are you parent or guardian for and live in your household?

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ More than 4

Which race/ethinicity best describes you? (Please only choose one)

- ○ American Indian/Native American
- ○ Asian
- ○ African-American
- ○ Caucasian
- ○ Hispanic
- ○ Pacific Islander
- ○ Other (please specify):

What is your current average household annual income?

- ○ Under $20,000
- ○ $20,000 to $40,000
- ○ $40,001 to $60,000
- ○ $60,001 to $80,000
- ○ $80,001 to $100,000
- ○ Over $100,000

What is the highest level of education you have completed?

- Less than high school education
- High school graduate or equivalent
- 2-year college degree
- 4-year college degree
- Advanced degree

What is your working status?

- Working full time
- Working part-time
- Retired
- Unemployed
- Other:

What is the working status of your spouse?

- Working full time
- Working part-time
- Retired
- Unemployed
- Other

Next

0% Survey Completion 100%

THE GRADUATE SCHOOL

How many times do you send your child to school with a home-packed lunch each week?

Write the reason for sending your child to school with a home-packed lunch?

Write the reason for not buying school meals (check all that applies)

- [ ] It is too expensive
- [ ] The food served does not taste good
- [ ] The food served is not healthy
- [ ] I don't want my children to wait in line to buy food
- [ ] The menus are too repetitive
- [ ] My child will not eat the school lunch
- [ ] I prefer to choose what my children will eat
- [ ] Other (please specify):

Who decides what is in the home-packed lunch (check all that applies)?

- [ ] Child
- [ ] You
- [ ] Your spouse
- [ ] Another caregiver

In general, when is the main course (e.g. sandwich, macaroni, etc.) of the lunch prepared?

- ◯ During the week-end
- ◯ Previous day/evening
- ◯ Morning
- ◯ Other (please specify):

When are the lunch's items assembled?

- ◯ During the week-end
- ◯ Previous day/evening
- ◯ Morning
- ◯ Other (please specify):

How many hours do you spend per week to prepare home-packed lunch?

- ◯ Less than 1h
- ◯ 1h-2h
- ◯ 2h-3h
- ◯ More than 3h

Do you think that preparing lunch is difficult?

- ◯ Yes, can you explain why:
- ◯ No

A number of situations are described below that can make it hard to prepare a healthy home-packed lunch. Please indicate how much you agree or disagree with the statement below?

Preparing a healthy home-packed lunch is difficult...

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| when I feel tired at the end of the day | ○ | ○ | ○ | ○ | ○ |
| when I have other meals to prepare such as dinner | ○ | ○ | ○ | ○ | ○ |
| when I don't have enough time to prepare packed lunch in the morning | ○ | ○ | ○ | ○ | ○ |
| when lots of unhealthy foods that my kid loves are available in the house | ○ | ○ | ○ | ○ | ○ |
| when my kid asks for the same food every day | ○ | ○ | ○ | ○ | ○ |
| when my kid comes back from school with a lunch box full of food | ○ | ○ | ○ | ○ | ○ |
| when my kid tell me that she/he trades food | ○ | ○ | ○ | ○ | ○ |
| when I am lacking ideas/recipes | ○ | ○ | ○ | ○ | ○ |

Below is a list of behaviors and strategies that parents might use while trying to get their children to adopt healthy diet behaviors. Please rate how certain you are that your 5-8 year-old child will engage in the behaviors described below.

| | Not confident at all | Slightly confident | Somewhat confident | Quite confident | Extremely confident |
|---|---|---|---|---|---|
| Your child eats at least 2 servings of vegetables every day? | ○ | ○ | ○ | ○ | ○ |
| Your child will eat vegetables, even if they do not enjoy the taste? | ○ | ○ | ○ | ○ | ○ |
| Your child eats only 3 servings of starchy vegetables (i.e., white potatoes, corn, French fries) each week? | ○ | ○ | ○ | ○ | ○ |
| Your child eats a variety of vegetables (i.e., green, orange, yellow or red)? | ○ | ○ | ○ | ○ | ○ |
| Your child eats very few solid fats (i.e., butter, margarine, shortening, lard) and foods that contain these? | ○ | ○ | ○ | ○ | ○ |

| | | | | | |
|---|---|---|---|---|---|
| Your child eats very few saturated fats (found in dairy, meat, butter, and chocolate) or trans fats (partially hydrogenated oils)? | ○ | ○ | ○ | ○ | ○ |
| Your child eats foods with low sodium (salt) content or added sodium (salt)? | ○ | ○ | ○ | ○ | ○ |
| Your child eats very few foods with added sugar (i.e., candy, cakes)? | ○ | ○ | ○ | ○ | ○ |
| Your child drinks very few drinks with added sugar (i.e., soda, juices)? | ○ | ○ | ○ | ○ | ○ |

Next

0% Survey Completion 100%

THE GRADUATE SCHOOL

Please answer the following questions without regard for your personal preferences.

Based on what you know, grains are an important source of...(select one)

- Vitamin D
- Vitamin K
- B vitamins
- Vitamin C
- Not sure

Based on what you know, fruit is an important source of... (select one)

- Protein
- Vitamin C
- Calcium
- Vitamin B12
- Not sure

Based on what you know, which of the following are some calcium-rich alternatives to milk? (select one)

- Calcium-fortified juice
- Canned fish with bones (such as sardines)
- Kale and collard greens
- All of the above
- Not sure

As far as you know, how are oils like olive and canola oil different from solid fats like butter and shortening? (Select one)

- Oils are usually lower in saturated fat
- Oils raise LDL (bad) cholesterol
- Oils are usually higher in saturated fat
- Oils are always hydrogenated
- Not sure

Which of the following are true (you can choose several answers)?

- [ ] Every lunch box should contain fruits and vegetables
- [ ] Every lunch box should contain fruit juices
- [ ] Every lunch box should contain dairy products
- [ ] Every lunch box should contain bread or rice or pasta
- [ ] Every lunch box should contain meat or a meat alternative (hummus, eggs, etc.)
- [ ] All of the above

0% Survey Completion 100%

THE GRADUATE SCHOOL

Please rate each of the reason your child eats home-packed lunch.

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| My child prefers packed lunches over school lunches | ○ | ○ | ○ | ○ | ○ |
| Packed lunches are more convenient than school lunches | ○ | ○ | ○ | ○ | ○ |
| Packed lunches are more nutritious than school lunches | ○ | ○ | ○ | ○ | ○ |
| My child is likely to eat more food if I pack a lunch | ○ | ○ | ○ | ○ | ○ |
| Packed lunches allow me to give different types of food each day | ○ | ○ | ○ | ○ | ○ |
| Packed lunches allow me to give organic and sustainable foods | ○ | ○ | ○ | ○ | ○ |
| I save money by making packed lunches | ○ | ○ | ○ | ○ | ○ |

| | | | | | |
|---|---|---|---|---|---|
| Packed lunches allow my child to have more time to eat because my child does not have to wait in line | ○ | ○ | ○ | ○ | ○ |
| When I pack a lunch, my child has better academic result in school | ○ | ○ | ○ | ○ | ○ |
| When I pack a lunch, my child is less sick than when he eats a school meal | ○ | ○ | ○ | ○ | ○ |

Please rate each of the reasons your child does not eat her/his home-packed lunch.

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| Warm meals cannot be heated before consumption and are cold at lunch time | ○ | ○ | ○ | ○ | ○ |
| Cold foods are not cold anymore at lunch time | ○ | ○ | ○ | ○ | ○ |
| My child prefers what is in her/his classmate's lunch box or tray and trades foods | ○ | ○ | ○ | ○ | ○ |
| My child cannot open some of the commercial packaging and no one helps her/him | ○ | ○ | ○ | ○ | ○ |
| My child cannot open the containers I use and no one is available to help her/him | ○ | ○ | ○ | ○ | ○ |
| My child does not have enough time to eat | ○ | ○ | ○ | ○ | ○ |
| My child hurries to go to recess | ○ | ○ | ○ | ○ | ○ |
| My child prefers to speak with her/his friends rather than to eat | ○ | ○ | ○ | ○ | ○ |
| My child does not enjoy her/his lunch box content | ○ | ○ | ○ | ○ | ○ |

Please rate how much you agree or disagree with the statement.

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| I have to be sure that my child does not eat too many sweets (candy, ice cream, cake or pastries) | ○ | ○ | ○ | ○ | ○ |
| I have to be sure that my child does not eat too many high-fat foods | ○ | ○ | ○ | ○ | ○ |
| I have to be sure that my child does not eat too much of her/his favorite foods | ○ | ○ | ○ | ○ | ○ |
| I intentionally keep some foods out of my child's reach | ○ | ○ | ○ | ○ | ○ |
| I offer sweets (candy, ice cream, cake, pastries) to my child as a reward for good behavior | ○ | ○ | ○ | ○ | ○ |
| I offer my child her favorite foods in exchange for good behavior | ○ | ○ | ○ | ○ | ○ |
| If I did not guide or regulate my child's eating, she would eat too many junk foods | ○ | ○ | ○ | ○ | ○ |
| If I did not guide or regulate my child's eating, she would eat too much of her/his favorite foods | ○ | ○ | ○ | ○ | ○ |

Please rate how much you agree or disagree with the following statements

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| My child should always eat all of the food on her plate | ○ | ○ | ○ | ○ | ○ |
| I have to be especially careful to make sure my child eats enough | ○ | ○ | ○ | ○ | ○ |
| If my child says "I'm not hungry", I try to get her to eat anyway | ○ | ○ | ○ | ○ | ○ |
| If I did not guide or regulate my child's eating, she would eat much less than she should | ○ | ○ | ○ | ○ | ○ |

Please rate how often you do the following:

| | Never | Rarely | Sometimes | Mostly | Always |
|---|---|---|---|---|---|
| How much do you keep track of the sweets (candy, ice cream cake, pies, and pastries) that your child eats? | ○ | ○ | ○ | ○ | ○ |
| How much do you keep track of the snack food (potato chips, Doritos, cheese puffs) that your child eats? | ○ | ○ | ○ | ○ | ○ |
| How much do you keep track of the high-fat foods that your child eats? | ○ | ○ | ○ | ○ | ○ |

Next

Child preferences: please rate how much you agree or disagree with the statement

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| My child likes fruits and vegetables | ○ | ○ | ○ | ○ | ○ |
| My child likes starchy foods (cereals bread, pasta, rice) | ○ | ○ | ○ | ○ | ○ |
| My child likes whole grains (cereals, bread, pasta, rice) | ○ | ○ | ○ | ○ | ○ |
| My child likes fish | ○ | ○ | ○ | ○ | ○ |
| My child likes meat | ○ | ○ | ○ | ○ | ○ |
| My child likes beans | ○ | ○ | ○ | ○ | ○ |
| My child likes eggs | ○ | ○ | ○ | ○ | ○ |
| My child likes salty foods | ○ | ○ | ○ | ○ | ○ |
| My child likes dairy (milk, yogurt, cheese) | ○ | ○ | ○ | ○ | ○ |

Peer pressure: please rate how much you agree or disagree with the statement

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| My child does not eat his lunch if her/his classmate make negative comments about it | ○ | ○ | ○ | ○ | ○ |
| I pack foods that are not going to cause negative comments from my child's classmate | ○ | ○ | ○ | ○ | ○ |
| My child always wants food that they see in other child lunch box | ○ | ○ | ○ | ○ | ○ |

Submit

## Appendix 4: Parents/caregivers survey in spanish

Como compensación por su participación, recibirá una lonchera que se puede utilizar para el almuerzo de su hijo.

Su participación en esta investigación es completamente voluntaria. Usted puede optar por no participar en absoluto. Si decide participar en esta investigación, puede dejar de participar en cualquier momento. Si decide no participar en este estudio o si deja de participar en cualquier momento, usted no será penalizado o perderá todos los beneficios a los que califica de otro modo.

Si decide dejar de tomar parte en el estudio, si tiene preguntas, inquietudes o quejas, o si necesita reportar una lesión relacionada con la investigación, por favor, póngase en contacto con la coordinadora del proyecto:

**Perrine Nadaud**
pnadaud@umd.edu
Número de teléfono: 202-746-1166
Tutor:
**Dr. Hee-Jung Song**
hjsong@umd.edu
Dirección: 0112 Skinner Building, Department of Nutrition and Food Science, University of Maryland College Park, 20742
Número de teléfono: 301-405-8898

Si tiene alguna pregunta sobre sus derechos como participante en una investigación o desea reportar una lesión relacionada con la investigación, por favor, póngase en contacto con:

University of Maryland College Park
Institutional Review Board Office
1204 Marie Mount Hall
College Park, Maryland, 20742
E-mail: irb@umd.edu
Telephone: 301-405-0678

Esta investigación ha sido revisada de acuerdo con la Universidad de Maryland, College Park procedimientos IRB para la investigación en seres humanos.

Al hacer clic en el botón de envío indica que usted da su consentimiento para participar en esta investigación.

Gracias por tomarse el tiempo para completar esta encuesta.

Siguiente

0% Survey Completion 100%

THE GRADUATE SCHOOL

Nombre del entrevistado:

Dirección de correo electrónico:

El sexo del encuestado:

- ○ Femenino
- ○ Masculino

Edad del encuestado:

¿Cuál de las siguientes opciones describe mejor su estado civil actual?

- ◯ Casado/Asociación doméstica
- ◯ Viudo
- ◯ Divorciado
- ◯ Apartado
- ◯ Soltero

Cuántos hijos tiene?

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5 o más

Raza / origen étnico

- ◯ Indígena-Americano/NativoAmericano
- ◯ Asiática
- ◯ Afro-Americano
- ◯ Europeo
- ◯ Hispano
- ◯ Islas del pacífico
- ◯ Otros:

¿Cuál es su ingreso anual actual?

- ◯ Menos de $20,000
- ◯ $20,000 a $40,000
- ◯ $40,001 a $60,000
- ◯ $60,001 a $80,000
- ◯ $80,001 a $100,000
- ◯ Largo de $100,000

¿Cuál es el nivel educativo más alto que ha alcanzado?

- ◯ Menos de educación secundaria
- ◯ Graduado de escuela secundaria o su equivalente
- ◯ Grado universitario de 2 años
- ◯ Grado universitario de 4 años
- ◯ Titulo avanzado

Estado de trabajo:

- ◯ Trabajando a tiempo completo
- ◯ Trabajando e medio tiempo o tiempo parcial
- ◯ Baja
- ◯ Desempleado
- ◯ Otros:

El estado de trabajo de su cónyuge:

- ◯ Trabajando a tiempo completo
- ◯ Trabajando e medio tiempo o tiempo parcial
- ◯ Baja
- ◯ Desempleados
- ◯ Otros

¿Cuántas veces por semana envía a su hijo/hija a la escuela con un almuerzo preparado en casa?

¿Escriba las razones por las cuales envía a su hijo a la escuela con un almuerzo preparado en casa?

Seleccione razones para no participar en NSLP (marque todo lo que aplica)

- [ ] Es demasiado caro
- [ ] La comida que se sirve no tiene buen sabor
- [ ] La comida que se sirve no es saludable
- [ ] No quiero que mis hijos esperen en la fila para comprar alimentos
- [ ] Los menús son demasiado repetitivos
- [ ] Mi hijo no come el almuerzo escolar
- [ ] Prefiero elegir lo que mis hijos van a comer
- [ ] Otros:

¿Quién en su casa decide que se prepara para el almuerzo en la lonchera (marque todo lo que aplica)?

- ○ Niño
- ○ Usted
- ○ Su cónyuge
- ○ Otra madre

¿En general, cuando se prepara el plato principal (sándwich por ejemplo, macarrones, etc.) del almuerzo?

- ○ Durante el fin de semana
- ○ El día anterior / noche
- ○ Por la mañana
- ○ Otros:

¿Cuándo se ensamblan los elementos del almuerzo?

- ◯ Durante el fin de semana
- ◯ El día anterior / noche
- ◯ Por la mañana
- ◯ Otros:

¿Cuántas horas pasan en casa por semana preparando el almuerzo?

- ◯ Menos de 1 h
- ◯ 1-2 h
- ◯ 2-3 h
- ◯ Más de 3 h

¿Cree que preparar el almuerzo es difícil?

- ◯ Sí, ¿puede explicar por qué:
- ◯ No

0% Survey Completion 100%

THE GRADUATE SCHOOL

Una serie de situaciones que se describen a continuación pueden hacer que sea difícil preparar un almuerzo saludable en casa. **Por favor, en qué grado está de acuerdo o en desacuerdo con la declaración.** Preparar un almuerzo saludable en casa lleno de es difícil ...

| | Muy en desacuerdo | Algo en desacuerdo | Neutral | Parcialmente de acuerdo | Muy de acuerdo |
|---|---|---|---|---|---|
| Cuando me siento cansado al final del día | ○ | ○ | ○ | ○ | ○ |
| Cuando tengo otras comidas para preparar tales como la cena | ○ | ○ | ○ | ○ | ○ |
| Cuando no tengo tiempo suficiente para preparar comida para llevar en la mañana | ○ | ○ | ○ | ○ | ○ |
| Cuando una gran cantidad de alimentos poco saludables que a mis hijos/hijas le gustan están disponibles en la casa | ○ | ○ | ○ | ○ | ○ |
| Cuando mi hijo/hija me pide la misma comida cada día | ○ | ○ | ○ | ○ | ○ |
| Cuando mi hijo/hija regresa de la escuela con una lonchera llena de comida | ○ | ○ | ○ | ○ | ○ |
| Cuando mi hijo me dice que él / ella compra alimentos | ○ | ○ | ○ | ○ | ○ |
| Cuando me faltan ideas / recetas | ○ | ○ | ○ | ○ | ○ |

A continuación se muestra una lista de comportamientos y estrategias que los padres pueden utilizar mientras que intentan conseguir que sus hijos adoptenconductas de dieta saludable. Por favor, califique cuánta certeza tiene que su hijo/hija de 5-8 años de edad, seguirá las conductas descritas a continuación.

| | No confiado | Algo confiado | Medio confiado | Muy confiado | Extremadamente confiado |
|---|---|---|---|---|---|
| ¿Qué tan seguro está de que su hijo come al menos 2 porciones de verduras todos los días? | ○ | ○ | ○ | ○ | ○ |
| ¿Qué tan seguro está de que su hijo va a comer verduras, incluso si no disfruta el sabor? | ○ | ○ | ○ | ○ | ○ |
| ¿Qué tan seguro está de que su hijo come sólo 3 porciones de vegetales ricos en almidón (es decir, las patatas blancas, maíz, patatas fritas) cada semana? | ○ | ○ | ○ | ○ | ○ |
| ¿Qué tan seguro está de que su hijo come una variedad de vegetales (es decir, verde, naranja, amarillo o rojo)? | ○ | ○ | ○ | ○ | ○ |

| | | | | | |
|---|---|---|---|---|---|
| ¿Qué tan seguro está de que su hijo come muy pocas grasas sólidas (es decir, la mantequilla, la margarina, manteca, manteca de cerdo) y alimentos que contienen estos? | ○ | ○ | ○ | ○ | ○ |
| ¿Qué tan seguro está de que su hijo come muy pocas grasas saturadas (que se encuentran en los productos lácteos, la carne, la mantequilla y el chocolate) o grasas trans (aceites parcialmente hidrogenados)? | ○ | ○ | ○ | ○ | ○ |
| ¿Qué tan seguro está de que su hijo coma alimentos con bajo contenido de sodio (sal) o de sodio añadido (sal)? | ○ | ○ | ○ | ○ | ○ |
| ¿Qué tan seguro está de que su hijo come muy pocos alimentos con azúcar añadido (dulces, pasteles)? | ○ | ○ | ○ | ○ | ○ |
| ¿Qué tan seguro está de que su hijo tome muy pocas bebidas con azúcar añadido (refrescos, zumos)? | ○ | ○ | ○ | ○ | ○ |

Siguiente

0% Survey Completion 100%

THE GRADUATE SCHOOL

Sobre la base de lo que sabe, los granos son una fuente importante de ... (Seleccione uno)

- Vitamina D
- Vitamina K
- Vitaminas del grupo B
- Vitamina C
- No es seguro

Sobre la base de lo que sabe, la fruta es una fuente importante de cuál de estos nutrientes? (Seleccione uno)

- Proteína
- Vitamina C
- Calcio
- Vitamina B12
- No es seguro

Sobre la base de lo que sabe, ¿cuál de las siguientes son algunas de las alternativas a la leche ricas en calcio? (Seleccione uno)

- Jugo fortificado con calico
- Pescado enlatado con espinas (como la sardine)
- La col rizada y berza
- Todo lo de arriba
- No es seguro

Por lo que usted sabe, ¿cómo son los aceites como el de oliva y aceite de canola diferentes de grasas sólidas a la mantequilla y la manteca? (Seleccione uno)

- Los aceites son generalmente más bajos en grasa saturada
- Los aceites son el colesterol LDL (malo)
- Los aceites son generalmente más altos en grasas saturadas
- Aceites siempre se hidrogenan
- No es seguro

¿Cuál de lo siguiente es cierto? (se puede elegir varias respuestas)

- [ ] Cada lonchera debe contener frutas y verduras
- [ ] Cada loncheradebe contener los jugos de frutas
- [ ] Cada loncheradebe contener productos lácteos
- [ ] Cada loncheradebe contener pan o arroz o pasta
- [ ] Cada loncheradebe contener carne o una alternativa de comida (hummus, huevos, etc.)
- [ ] Todo lo de arriba

Siguiente

0% Survey Completion 100%


THE GRADUATE SCHOOL

Por favor califique cada una de las razones por las que su hijo come comida para llevar.

| | Muy en desacuerdo | Algo en desacuerdo | Neutral | Parcialmente de acuerdo | Muy de acuerdo |
|---|---|---|---|---|---|
| Mi hijo prefiere almuerzos empacados en casa a los almuerzos escolares | ○ | ○ | ○ | ○ | ○ |
| Almuerzos empacados en casa son más convenientes que los almuerzos escolares | ○ | ○ | ○ | ○ | ○ |
| Almuerzos empacados en casa son más nutritivos que los almuerzos escolares | ○ | ○ | ○ | ○ | ○ |

| | | | | | |
|---|---|---|---|---|---|
| Es probable que mi hijo coma más alimentos si son de almuerzos empacados en casa | ○ | ○ | ○ | ○ | ○ |
| Almuerzos empacados en casa me permiten dar diferentes tipos de alimentos cada día | ○ | ○ | ○ | ○ | ○ |
| Almuerzos empacados en casa me permitendar alimentos orgánicos y sostenibles | ○ | ○ | ○ | ○ | ○ |
| Ahorro dinero al hacer almuerzos empacados en casa | ○ | ○ | ○ | ○ | ○ |
| Almuerzos empacados en casa permiten que mi hijo tenga más tiempo para comer porque mi hijo no tiene que esperar en línea | ○ | ○ | ○ | ○ | ○ |
| Cuando mando almuerzos empacados en casa, mi hijo tiene un mejor resultado académico en la escuela | ○ | ○ | ○ | ○ | ○ |
| Cuando mando almuerzos empacados en casa , mi hijo se enferma menos que cuando se come una comida escolar | ○ | ○ | ○ | ○ | ○ |

Por favor calificar cada una de las razones por las que su hijo no come su / su comida para llevar a casa.

| | Muy en desacuerdo | Algo en desacuerdo | Neutral | Parcialmente de acuerdo | Muy de acuerdo |
|---|---|---|---|---|---|
| Comidas calientes no pueden ser calentados antes de su consumo y están frías a la hora del almuerzo | ○ | ○ | ○ | ○ | ○ |
| Los alimentos fríos ya no están fríos a la hora del almuerzo | ○ | ○ | ○ | ○ | ○ |
| Mi hij/hija prefiere lo que está en la lonchera o en la bandeja de su compañero y intercambia alimentos | ○ | ○ | ○ | ○ | ○ |

| | | | | | |
|---|---|---|---|---|---|
| Mi hijo/hija no puede abrir algunos de los envases comerciales y nadie lo ayuda a él /ella | ○ | ○ | ○ | ○ | ○ |
| Mi hijo/hija no puede abrir los recipientes que utilizo y no hay nadie disponible para ayudar a él /ella | ○ | ○ | ○ | ○ | ○ |
| Mi hijo/hija no tiene tiempo suficiente para comer | ○ | ○ | ○ | ○ | ○ |
| Mi hijo/hija se apresura para ir al recreo | ○ | ○ | ○ | ○ | ○ |
| Mi hijo/hija prefiere hablar con sus amigos en lugar de comer | ○ | ○ | ○ | ○ | ○ |
| Mi hijo/hija no le gusta lo que hay en su lonchera | ○ | ○ | ○ | ○ | ○ |

Por favor, en qué grado está de acuerdo o en desacuerdo con la declaración.

| | Muy en desacuerdo | Algo en desacuerdo | Neutral | Parcialmente de acuerdo | Muy de acuerdo |
|---|---|---|---|---|---|
| Tengo que estar seguro de que mi hijo/hija no coma demasiados dulces (caramelos, helados, pasteles o pastas) | ○ | ○ | ○ | ○ | ○ |
| Tengo que estar seguro de que mi hijo/hija no coma demasiados alimentos altos en grasa | ○ | ○ | ○ | ○ | ○ |
| Tengo que estar seguro de que mi hijo/hija no come demasiado de sus alimentos favoritos | ○ | ○ | ○ | ○ | ○ |
| Dejo intencionadamente algunos alimentos fuera del alcance de mi hijo | ○ | ○ | ○ | ○ | ○ |

| | | | | | |
|---|---|---|---|---|---|
| Ofrezco dulces (caramelos, helados, pasteles, pasteles) a mi hijo como recompensa por su buen comportamiento | ○ | ○ | ○ | ○ | ○ |
| Ofrezco mi hijo sus comidas favoritas, a cambio de un buen comportamiento | ○ | ○ | ○ | ○ | ○ |
| Si no guío o regulo la alimentación de mi hijo/hija, comería demasiados alimentos chatarra (chucherías) | ○ | ○ | ○ | ○ | ○ |
| Si no me guío o regulo la alimentación de mi hijo/hija, comería demasiado de sus alimentos favoritos | ○ | ○ | ○ | ○ | ○ |

Por favor, en qué grado está de acuerdo o en desacuerdo con la declaración.

| | Muy en desacuerdo | Algo en desacuerdo | Neutral | Parcialmente de acuerdo | Muy de acuerdo |
|---|---|---|---|---|---|
| Mi hijo/hija siempre debe comer toda la comida en su plato | ○ | ○ | ○ | ○ | ○ |
| Tengo que tener especial cuidado para asegurarse de que mi hijo come lo suficiente | ○ | ○ | ○ | ○ | ○ |
| Si mi hijo dice "No tengo hambre", trato de hacerla comer de todos modos | ○ | ○ | ○ | ○ | ○ |
| Si no me guío o regulo la alimentación de mi hijo, comería mucho menos de lo que debería | ○ | ○ | ○ | ○ | ○ |

Por favor, califica a la frecuencia con que hacer lo siguiente:

| | Nunca | Raramente | A veces | Principalmente | Siempre |
|---|---|---|---|---|---|
| ¿Cuánto realiza un seguimiento de los dulces (caramelos, pastel de helado, pasteles y pastas) que consume su hijo? | ○ | ○ | ○ | ○ | ○ |
| ¿Cuánto mantiene un registro de los alimentos de aperitivos (patatas fritas, Doritos, bolitas de queso) que consume su hijo? | ○ | ○ | ○ | ○ | ○ |
| ¿Cuánto mantiene un registro de los alimentos altos en grasa que consume su hijo? | ○ | ○ | ○ | ○ | ○ |

Siguiente

0% Survey Completion 100%

THE GRADUATE SCHOOL

Las preferencias de los niños: por favor, en qué grado está de acuerdo o en desacuerdo con la declaración.

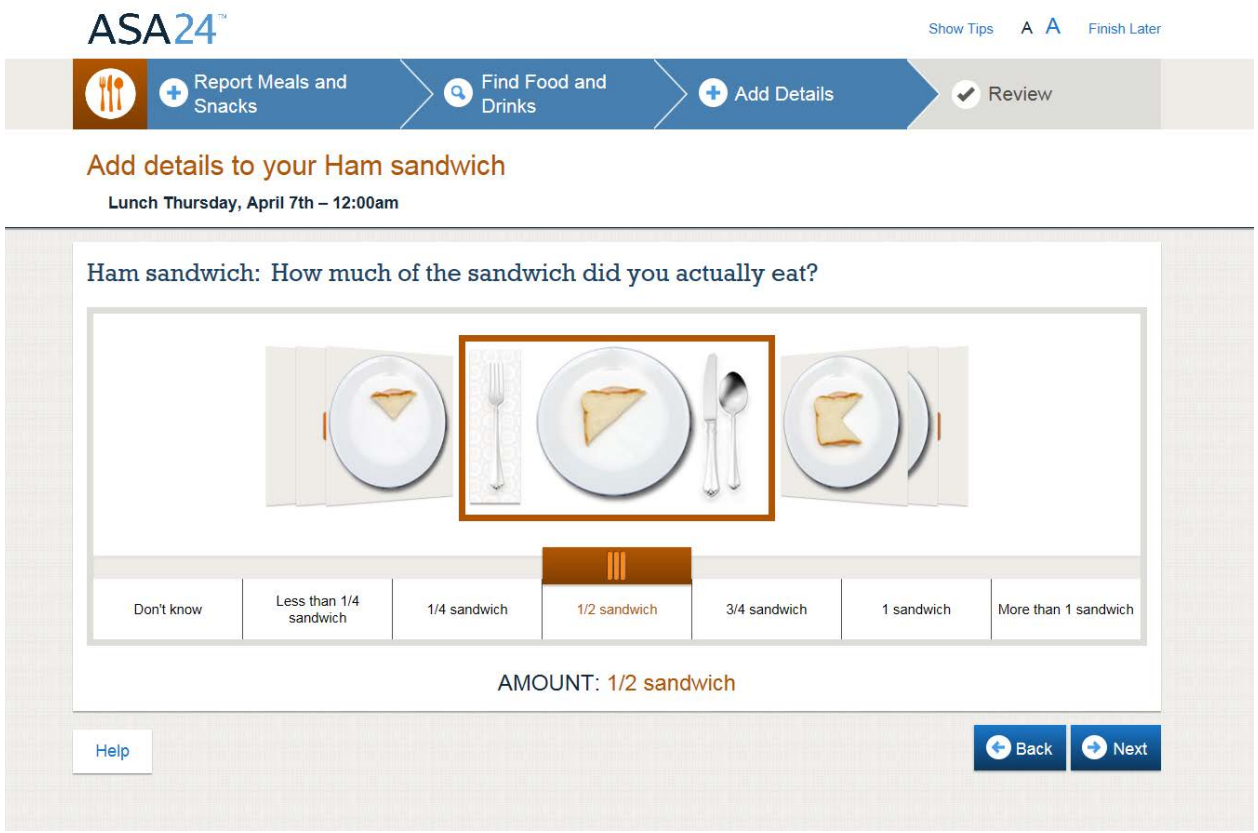
| | Muy en desacuerdo | Algo en desacuerdo | Neutral | Parcialmente de acuerdo | Muy de acuerdo |
|---|---|---|---|---|---|
| A mi hijo le gustan las frutas y/o hortalizas | ○ | ○ | ○ | ○ | ○ |
| A mi hijo le gustan los alimentos con almidón (cereales pan, pasta, arroz) | ○ | ○ | ○ | ○ | ○ |
| A mi hijo le gusta los cereales integrales (cereales, pan, pasta, arroz) | ○ | ○ | ○ | ○ | ○ |
| A mi hijo le gusta el pescado | ○ | ○ | ○ | ○ | ○ |
| A mi hijo le gusta la carne | ○ | ○ | ○ | ○ | ○ |
| A mi hijo le gustan las habas | ○ | ○ | ○ | ○ | ○ |
| A mi hijo le gustan los huevos | ○ | ○ | ○ | ○ | ○ |
| A mi hijo le gustan los alimentos salados | ○ | ○ | ○ | ○ | ○ |
| A mi hijo le gustan los productos lácteos (leche, yogurt, queso) | ○ | ○ | ○ | ○ | ○ |

La percepción de la presión de grupo: por favor, en qué grado está de acuerdo o en desacuerdo con la declaración.

| | Muy en desacuerdo | Algo en desacuerdo | Neutral | Parcialmente de acuerdo | Muy de acuerdo |
|---|---|---|---|---|---|
| Mi hijo no come su almuerzo si su compañero le hace comentarios negativos sobre el almuerzo | ○ | ○ | ○ | ○ | ○ |
| Incluyo los alimentos que no van a provocar comentarios negativos de compañeros de clase de mi hijo | ○ | ○ | ○ | ○ | ○ |
| Mi hijo siempre quiere comida que ve en otras loncheras de los niños | ○ | ○ | ○ | ○ | ○ |

Enviar

## Appendix 5: Screenshot of the ASA24



**Appendix 6: Summary of studies conducted in the United-States of America**

| Article | Study Characteristics | Study Population | Dietary Assessment Method | Significant Results | Limitations |
|---|---|---|---|---|---|
| **Rainville et al. 2001**<br><br>HPL vs SM | Observational study.<br>Conducted in Southeastern Michigan | 2nd to 4th grade children (SM n=281; HPL n= 289) | Trained observers visually estimated food waste. | **Total fat:** SM=29% vs. HPL=33% or 18.4g vs. 22.1 g; p≤0.0001.<br>**Carbohydrate**: SM=77 g vs. HPL=85.4; p=0.001<br>**Protein:** SM=23.2 g vs. HPL=15.6 g; *p*≤0.0001<br>**Fiber:** SM= 4.4 g vs. HPL=3.8 g; *p*=0.007<br>**Vitamin C**: SM=16 mg vs. HPL=38 mg; *p*≤0.0001<br>**Vitamin A**: SM= 402.4 RE vs. HPL=125.4 RE; *p*≤0.0001<br>**Vitamin D**: SM=2.27 µg vs. HPL=0.44 µg; *p*≤0.0001<br>**Vitamin B6:** SM=0.33 mg vs. HPL=0.25 mg; *p*≤0.0001<br>**Vitamin B9**: SM=52.5 µg vs. HPL=42.3 µg; *p*=0.002<br>**Vitamin B12**: SM=1.11 µg vs. HPL= 0.36 µg; *p*≤0.0001<br>**Vitamin B1**: SM=0.48 mg vs. HPL=0.35 mg; *p*≤0.0001<br>**Vitamin B2**: SM=0.75 mg vs. HPL=0.29 mg, *p*≤0.0001<br>**Vitamin B3:** SM=4.9 mg vs. HPL=4.2 mg, p=0.003<br>**Calcium:** SM=415.1 mg vs. HPL=160.9 mg, *p*≤0.0001 | Conducted before NS |

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| | | | | **Iron**: SM=4 mg vs. HPL=2.7 mg; $p \leq 0.0001$<br>**Zinc:** SM=2 mg vs. HPL=1.4 mg; $p \leq 0.0001$ | |
| **Hur et al. 2011**<br><br>HPL vs SM | Cross-sectional study. Conducted in 2 suburban elementary schools (Minneapolis, Minnesota, metropolitan area) | 129 children (n = 69 boys, n = 60 girls). 4th and 5th graders.<br>SM: n=85<br>HPL: n= 44 | Meal observations (5 observers). 3 children observed simultaneously. Researchers stood close to the tables. | **Total fat:** SM=15.6g (SD=8.1) vs. HPL=20.7g (SD=11) $p$=0.003<br>**Total sugar**: SM= 24.3g (SD=12.9) vs. HPL= 36 g (SD=20.1) $p$<0.001.<br>**Added sugar**: SM=11.5g (SD=9.5) vs. HPL= 26.4 g (SD=18.5) $p$<0.001.<br>**Energy density**: SM= 1.2g (SD=0.4) vs. HPL= 1.5 g (SD=0.8) $p$=0.006.<br>**Protein:** SM=21.3g (SD=10.3) vs. HPL=14.9 g (SD=8.2) $p$<0.001.<br>**Omega-3:** SM= 0.3g (SD=0.4) vs. HPL=0.2 g (SD=0.2) $p$=0.047.<br>**Fruits:** SM= 0.4 cups (SD=0.5) vs. HPL=0.5 cups (SD=0.7) $p$<0.001.<br>**Vegetables:** SM=0.5 cups (SD=0.7) vs. HPL=0.1 cups (SD=0.2) $p$<0.001.<br>**Fruits and vegetables**: SM= 1.0 cup (SD=0.8) vs. HPL=0.6 cups (SD=0.7) $p$=0.005.<br>**Whole grains**: SM= 0.02 oz. eq (SD=0.09) vs. HPL=0.23 oz. eq (SD=0.54) p<0.001). | Use of data from only 1 meal. Findings cannot be generalized to a broader sample of children. Researcher presence during the meal might have an impact on consumption. |
| **Johnson et al 2012** | Cross-sectional study. Conducted in 7 schools in Southeast Texas | 2nd grade 2107 observations (38.5% HPL) SM=1296 HPL=811 | Research assistants observed lunches. Lunches coded for presence or absence of selected foods and beverages items. | **Fruits**: HPL = 45.3% vs.SM = 75.9%, p<0.001.<br>**Vegetables:** HPL = 13.2% vs. SM = 29.1%, p<0.001.<br>**Dairy**: HPL= 41.8% vs. SM= 70.0%, p<0.001.<br>**Snacks high in sugar and/or fat**: HPL= 60.0% vs. SM = 17.5%, $p < 0.001$ | **Actual consumption not examined**. |

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| | | | Observations during 3 randomly selected days. | **Non 100% fruit juice:** HPL = 47.2% vs. 0.3%, $p < 0.001$ | |
| **Hubbard et al. 2014**<br><br>HPL vs. NS | Cross-sectional analysis.12 schools within 6 Eastern Massachusetts public school districts | 301 elementary schoolchildren ate a HPL. 3rd and 4th graders (mean age of 9.1 years (SD=0.6)) | Observer characterize foods and beverages using digital photography and a supplemental food checklist | Median number of items brought for lunch was 3 (range = 1 to 7).Most common lunch foods provided were sandwiches (59%), snack foods (42%), fruit (34%), and dessert (28%). 27% of lunches met at least three of five NS | Some foods and beverages in the HPL might have been assigned to the incorrect eating occasion. **Actual food consumption was not measured** |
| **Farris et al. 2014**<br><br>HPL vs. SM vs NS | 3 schools in rural Virginia | 1,314 observations collected pre-k and k | 5 consecutive school days. Observational checklist. Each researcher observed 10 students and collected contents and intake. | Energy, carbohydrate, fat, saturated fat, sugar, vitamin C, and iron were significantly **higher** ($p$<0.001) **for HPL vs. SM.**<br>Protein, sodium, fiber, vitamin A, and calcium were significantly **lower** ($p$<0.001) **for HPL vs SM**.<br>More savory snacks such as chips and crackers (57% vs 5%) and sugar-sweetened beverages (40% vs 0%) in **HPL**.<br>Most commonly brought food items were peanut butter sandwiches (n=155), single-serving chips (n=145), single-serving yogurt items, including yogurt cups and yogurt tubes (n=117), Capri Sun drink pouches (n=112), and Lunchables (prepackaged food and drink combinations) (n=102). | The sample was restricted to young elementary students in a rural area in Virginia and may not be applicable to urban, ethnically diverse, or older students. **Actual consumption of food items was not measured.** |

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| **Caruso et al. 2015**<br><br>HPL vs NS | 12 schools (8 elementary and 4 intermediate) in one Houston, Texas, area school district. | 242 elementary and 95 intermediate school students HPL | Foods brought and amounts eaten were recorded with an observational checklist. | **Sodium (**HPL=1110 vs NS ≤ 640 mg for elementary & 1003 vs NS ≤ 710 mg for intermediate students)<br>**Servings of fruits** (**(**HPL=0.33 cup for elementary & 0.29 cup for intermediate students vs NS=0.50 cup)<br>**Vegetables** (HPL=0.07 cup for elementary & 0.11 cup for intermediate students vs NS=0.75 cup)<br>**Whole grains** (HPL=0.22-oz eq. for elementary & 0.31-oz eq. for intermediate students vs NS=0.50-oz min)<br>**Fluid milk** (HPL=0.08 cup for elementary & 0.02 cup for intermediate students vs NS=1 cup).<br>Desserts, snack chips, and sweetened beverages (HPL=90%; NS=0%) | Data collectors were unable to clarify lunch contents with students or weigh food waste. study was conducted prior to the implementation of the HHFKA. **Method of intake assessment not clearly explained.** |
| **Au et al. 2016**<br><br>HPL vs SM | Observational study. Conducted in San Diego, CA | 4th and 5th graders (SM=2286; HPL=662) | Diary-assisted 24-hour recall interviews conducted by trained interviewers | **Total HEI-2010 score:** SM=49.0±11.3 vs. HPL=46.1±12.2; *p*=0.02<br>**Dairy:** SM=7.9±2.8 vs. HPL=5.9±3.4, *p* <0.0001<br>**Empty calories:** SM=12.9±5.4 vs HPL=11.4±5.2, *p*=0.007<br>**Seafood and plant proteins:** SM=1.1±1.8 vs HPL=2.1±2.3, *p*<0.0001<br>**Fatty acids:** SM=4.1±3.3 vs HPL=4.5±3.5, *p*=0.02<br>**Refined grain:** SM=4.2±3.5 vs HPL=3.7±3.5, *p*=0.03 | Conducted before NS |

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