Consumption of packaged foods and sugar-sweetened beverages and the associations with undernutrition among 24-month old Cambodian children

By

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ABSTRACT

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Child undernutrition remains a significant issue in Cambodia despite recent progress. Among children under the age of 5, 41% were stunted or severely stunted and 12% were wasted or severely wasted at the time of the last Demographic Health Survey in 2014. Thus, despite progress, there is still much work to be done in improving child nutrition in this country. Between the ages of 6 to 24 months, when infants are consuming complementary foods, sugar-sweetened beverages and foods of low nutritional value may be contributing to child undernutrition by replacing nutrient-dense foods. The aim of this study was to assess the consumption of packaged foods and sugar-sweetened beverages, as well as the association of these foods and beverages with anthropometric measures undernutrition, among children 24 months of age in rural and semi-rural Cambodia. Using secondary data from the Cambodia SMILE study, a cross-sectional analysis of 362 24-month olds in rural and semi-urban areas of the Kampong Speu province was performed. It was found that 70% of infants had consumed packaged salty snacks or sweets and 25% had consumed a fruit juice or other sugar-sweetened beverage on the previous day. On average, caregivers reported first introducing their infants to

packaged salty snacks at 3.3 months, packaged sweets at 2.8 months, and fruit juice or other sugar-sweetened beverage at 2.4 months of age. Reported infant intake of fruit juice or other sugar-sweetened beverage on the previous day was found to be significantly associated with increased odds of stunting and wasting. Meanwhile, reported infant intake of two or more packaged snacks, in comparison to no intake of these foods, was found to be associated with decreased odds of stunting. These findings indicate that, among children in rural and semi-rural Cambodia, foods and beverages of low nutritional value are being consumed at inappropriately high rates and at ages much earlier than recommended. It also suggests that sugar-sweetened beverages may be slowing national progress towards improving child nutritional status. Given the rapid economic development occurring in Cambodia, as well as the rising rates of obesity and overweight in neighboring countries, these findings emphasize the urgent need for interventions that support and educate caregivers in healthy feeding practices of infants and young children in Cambodia.

DEDICATION

To my parents who have shown me the meaning of resilience and strength in the midst of facing the unimaginable.

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PART I: LITERATURE REVIEW

I. Defining Undernutrition

Global child undernutrition, while on the decline, remains at an alarmingly high rate especially in many low- and middle- income countries (LMICs). It is estimated that undernutrition is a cause of 3.1 million child deaths annually, or 45% of all child deaths in 2011[1]. Undernutrition also has significant adverse implications for a child's physical, cognitive, and behavioral development[2].

Of course, in order to study undernutrition, it is important to have standardized definitions by which to track and understand this phenomenon. While nutritional status can be assessed in a variety of ways, such as clinically (e.g. physical examination) or biochemically (e.g. blood analysis), one of the most common means used to measure nutritional status, especially in epidemiological studies, is anthropometric data (e.g. height and weight). There are several key anthropometric measures used to describe nutritional status.

Stunting, or being too short for one's age, reflects a failure to achieve full linear growth potential as a result of long-standing inadequate maternal and early childhood nutrition. Thus, it is often used as a proxy for measuring chronic undernutrition. Children who are stunted have a height-for-age Z-score (HAZ) below minus two standard deviations (-2 SD) from the median of the reference population. Furthermore, those children who are below -3 SD from the mean of the reference population are considered severely stunted. On the other hand, wasting reflects significant weight loss or failure to gain weight as a result of recent famine or disease. Thus, it is considered a proxy for acute malnutrition. Children whose weight-for-height z-score (WHZ) is below minus two standard deviations (-2 SD) from the mean of the reference population are considered wasted, or thin for their height. Children with a WHZ below minus three standard deviations (-3 SD) are considered severely wasted[3]**.** Recent estimates suggest that stunting and wasting between the ages of 1-59 months contributes to 14% and 12.6% of child deaths under the age of five.

II. Global Prevalence and Burden of Undernutrition

In recent years, the global community has made great steps towards alleviating child undernutrition. Globally, between 2000 and 2015, the prevalence of stunting among children under the age of 5 has decreased from 32.7% to 23.2%[4]. This decrease represents a change from 198 million children in 2000 to 156 million children in 2015[4]. Thus, while this decrease in stunting prevalence is commendable, there is still a long way to go. Additionally, in 2015, approximately an additional 50 million children were wasted[4].
Furthermore, this burden does not fall evenly across the globe. Stunting is largely perpetuated by factors rooted in poverty including food insecurity and parental lack of education, and more. Thus, low-income and lower-middle-income countries bear the majority of the stunting burden, as 90% of all stunted children live in these countries[4]. Additionally, by geographic measures, Africa and Asia bear the greatest burden of stunting with a prevalence of 37% and 56% respectively[4]. Of course, even within these countries, stunting varies by region. For example,

South Asian countries have made less progress in reducing stunting than Eastern Asian counterparts[4].

III. Cambodia's Child Health and Undernutrition

Prevalence, burden, and progress of childhood undernutrition

Cambodia is a lower-middle income country in Southeast Asia that has made considerable gains in improving child health over the past decade. However, the country still has a high rates of child mortality and undernutrition. According to the 2014 Cambodia Demographic Health Survey (DHS), under-5 mortality had declined in the recent years from 54 deaths per 1,000 live births to 35 deaths per 1,000 live births between 2010 and 2014. Despite this progress, this means that one in every 29 Cambodian children does not survive to their fifth birthday[5]. It is approximated that 60.4% of these deaths, in Cambodia, can be attributed to indicators of undernutrition (i.e. maternal malnutrition, child underweight and wasting, suboptimal breastfeeding or micronutrient deficiencies)[6].

According to the Cambodian 2014 DHS, 32% of Cambodian children under the age of 5 are stunted and 9% are severely stunted[5]. Overall, stunting increases with the age of the child, rising from 13% among children age 6-8 months to 40% between the ages of 36-47 months[5]. This dramatic increase in the prevalence of stunting with age, occurring around the time period of complementary feeding, demonstrates the critical nature of this time period in child nutrition and development. In fact, it is well recognized that the first 1000 days of a child's life, from conception to two years of age, is a key "window of opportunity" for reducing stunting[7].

Fewer children in Cambodia are wasted than are stunted. According to the 2014 Cambodian DHS, 10% of children under the age of 5 were wasted and 2% were severely wasted[5]. Several key associations have been found in Cambodia among children who are wasted. Children who are born to thin mothers (BMI <18.5), live in rural areas, or are small at birth are much more likely to be wasted[5]. Though since 2000 the prevalence of wasting has decreased from 17% to 10%, this decrease has not been systematic. For example, in 2005, the prevalence of wasting dropped to 8% but subsequently rose in follow years to the current rate[5].

The factors perpetuating undernutrition and stunting in Cambodia are multifold. However, before beginning to understand these factors, it is first essential to understand the implications of child undernutrition, which range from a child's ability to mount an immune response to infection to behavioral outcomes.

IV. Effects of infant and young child undernutrition on health and development

While malnutrition has significant impacts on the health of all ages, infants and young children are particular vulnerable to its negative consequences due to the critical development and growth that occurs during this age. The time between birth and 24 months of age is especially critical for children, with most growth faltering occurring during this time period[7]. Undernutrition during early childhood has implications not only for mortality, as previously elucidated, but also for cognitive and behavioral development. Thus, it has implications for school performance as well

as work productivity. This section will explore some of these effects, including those on: immunity, behavior, cognitive development, and chronic disease.

Immunity

The interplay between child immunity and undernutrition is bi-directional. Serious infectious diseases in childhood are significant contributor to undernutrition. For example, in low-income countries, it has been shown that diarrheal episodes increase the odds of stunting before 24 months of age[8]. However, undernutrition is also an important predisposing factor to infectious disease. Suboptimal growth in childhood, which includes stunting, wasting, and being underweight, has been shown to increase the risk of death from infectious disease[9]. Even children with mild anthropometric deficits (-2 SD < Z < -1 SD) have significantly higher mortality rates from infectious causes such as malaria, measles, etc[10]. It is thought that poor growth is associated with this increased mortality risk due to secondary immune suppression[10]. In Cambodia, this interaction between immunity and nutritional status is also present. In 2014, 19-20% of Cambodian children between the ages of 6-24 months reported diarrhea in the last two weeks[5]. Not surprisingly, it has been shown in Cambodia that diarrhea is also associated with stunting[11].

Behavioral Development

Undernutrition during childhood also has important implications for behavioral and cognitive development. Children who are stunted can show behavioral differences such as reduced activity and play. For example, in a study of infants in Mexico, stunting as well as other markers of undernutrition (e.g. iron deficiency) increased the odds of decreased activity and exploration[12]. Children in this study who had poorer nutritional status also spent significantly more time attached to their mother than well-nourished children[12]. These behavioral effects may also be long-lasting. One study of stunted and nonstunted children in Jamaica found that children who were stunted before 2 years old had poorer emotional and behavioral outcomes in adolescence[13]. Interestingly, there were no available studies which investigated the effect of stunting on behavioral outcomes in Cambodia.

Cognitive Development

Given that children of poorer nutrition status are less likely to engage in exploration of their surroundings, it is unsurprising that undernutrition also has effects on a child's cognitive development. In fact, stunting is a well-established risk factor for poorer child development[2]. Studies have shown that stunting before the age of 2-3 years old is associated with poorer cognitive and educational outcomes in later life[14]. Since stunting, through its effects on cognitive development, may lead to poorer educational outcomes, it can also prevent individuals from increasing their socioeconomic status[15].

In Cambodia, these cognitive effects of stunting have also been seen. One such study in Cambodia found that severely stunted children scored significantly lower than children who were not stunted on three different cognitive tests. Furthermore, children who were *moderately* stunted scored significantly lower on two-out-of-three cognitive tests compared to children who were not

stunted. Additionally, other micronutrient deficiencies (e.g. iron deficiency) have also been associated with lower cognitive scoring[16]. Furthermore, diminished cognitive ability in childhood has implications for work performance and productivity. For example, children who are stunted are more likely to miss school and complete fewer years of schooling[17]. Through its adverse effect on cognitive development, undernutrition can be understood as a vicious cycle. Children who are undernourished in childhood may not develop properly leading to cognitive deficits, lower performance in school, and decreased work performance and income in adulthood. In fact, it has been estimated that stunting, through the loss of schooling, results in 22.2% loss in income as an adult[18]. Because of this loss of income, this cycle of undernutrition and its effects continues across generations.

With economic growth of a country and decreased poverty, nutrition outcomes should improve. Thus, economic losses from malnutrition not only slow economic growth but also improvements in overall nutritional status of the population. In Cambodia, through analysis of malnutrition indicators, it has been estimated that malnutrition costs the national economy of Cambodia more that $400 million annually or 2.5% of GDP[6]. Stunting alone was estimated to represent over a quarter of these losses due to decreased work performance and productivity[6]. Thus, stunting affects not only economic and nutritional progress at the household level but also at a national level.

V. Causes of infant and young child undernutrition

The factors that underlie and perpetuate undernutrition range from structural factors, such as poverty, food insecurity and inadequate housing, to more proximate factors such as infection and inappropriate feeding practices. In the following sections, a few of these contributing factors of undernutrition are examined with an emphasis on infant and young child feeding practices.

Structural Factors

In general, undernutrition tends to decrease in prevalence with increased household wealth, improved sanitation and water supply, and increased parental education among other factors. For example, has been estimated that in most countries stunting prevalence among children under five is 2.5 times higher in the lowest wealth quintiles compared to the highest wealth quintiles[2]. Other factors such as maternal lack of education have also been shown to strongly contribute to child stunting[19]. Notably, stunting also varies with sex. In the countries with data, stunting prevalence is slightly higher in boys than in girls[20].

Similar patterns are seen in Cambodia. For example, there are clear inequalities in stunting between rural and urban areas. The prevalence of stunting in Cambodia was 11% higher in rural areas compared to urban areas[21]. For example, in Preah Vihear, a rural village in the North of Cambodia, the prevalence of stunting among children under 5 is 44%. On the other hand, in Phnom Penh, the urban capital of Cambodia, the prevalence of stunting is 18%[5]. Notably, however, modelling has suggested that this regional difference is related to differences in household wealth as opposed to regional differences[21].

Socioeconomic status is indeed related to stunting rates in Cambodia, as in many other countries. Stunting is about two times higher in children of the poorest wealth quintile than in those of the wealthiest quintile[21]. Wasting also showed this same association[21]. Furthermore, in Cambodia, it has been shown that parental education, household wealth, toilet facilities, and type of residence

are all associated with reduced stunting[22]. Other studies have also shown that undernutrition in Cambodia is highest among those whose mothers had no education[21]. Unfortunately, in 2005, a quarter of Cambodia's women had no education[22].

Maternal Factors

Stunting exerts its effects in an intergenerational fashion. Stunted female infants, for example, may become stunted mothers. It has been shown that maternal stunting, or a height less than 145 cm, increases the risk of small-for-gestational-age (SGA) infants[2]. Being SGA then puts these infants at risk of stunting. Furthermore, it was shown in analysis of multiple LMICs that maternal stature is inversely associated with stunting, along with infant mortality and underweight[23].

These same factors hold true for Cambodia. Analysis of DHS data from Cambodia showed that stunting was associated with low birth weight and low mother body mass index (BMI). Furthermore, a study investigating the economic effects of malnutrition in Cambodia, found that nearly half of the money lost due to malnutrition occurs from indicators that are independent of childhood measurements. In other words, these losses were derived from factors such as maternal nutrition and anemia, breastfeeding, and folic acid deficiency in utero[6]. Finally, women in Cambodia who did not have prenatal care had higher odds of having stunted children than women with prenatal care[22].

Breastfeeding

Inadequate breastfeeding likewise plays a significant role in undernutrition globally. It is currently recommended that babies should be exclusively breastfed for the first six months of life[24]. However, only 36% of infants younger than six months were exclusively breastfed in 2011[25]. Not only does breastfeeding, through the provision of ideal nutrition, prevent infant morbidity and mortality, it also promotes cognitive and social development of infants[14]. However, while exclusive breastfeeding during the first 6 months has been shown to improve infant survival and health, randomized interventions to promote breastfeeding have failed to show an impact on stunting[2].

In Cambodia, rates of breastfeeding are relatively high. According to 2014 DHS data, 73% of children age 0-3 months are exclusively breastfed. However, only 65% of children age 0-5 months are exclusively breastfed[5]. Studies in Cambodia have shown that early initiation of breastfeeding, exclusive breastfeeding under 6 months, and continued breastfeeding at 1 year were associated with decreased risk of underweight in infants[26]. Furthermore, breastfeeding was found to be one of the most influential factors in the overall decrease in malnutrition rates between 2000 and 2005 in Cambodia[21]. However, these breastfeeding indicators were not associated with other growth outcomes, such as stunting[26].

VI. Complementary feeding

In the Global Context

During the time period between 6-23 months of age, the prevalence of malnutrition increases substantially in many countries because of increased infection and poor feeing practices. For example, as previously mentioned, in Cambodia the rate of stunting increases from 13% among children age 6-8 months to 40% between the ages of 36-47 months[5]. This dramatic increase is largely due to the transition to complementary foods in addition to breastmilk at this age. Beginning around 6 months of age, breastfeeding alone is no longer able to meet the nutritional demands of the growing infant. For this reason, at 6 months of age, it is recommended that infants begin receiving complementary foods to fill this nutritional gap[24]. Complementary feeding refers to the introduction of safe and nutritionally rich foods at about 6 months of age when breastfeeding is no longer enough. It is typically provided between the ages of 6-23 months in addition to breast milk[27].

According to the WHO, appropriate complementary feeding must be timely, adequate, safe, and properly fed. Timeliness refers to the introduction of complementary foods when the need for energy and nutrients exceeds what can be provided by breastfeeding alone, usually around 6 months. Complementary foods must also be adequate in energy and nutrients (e.g. micronutrients, protein) as well as safe, or hygienically stored and prepared, so as to prevent infection. Finally, complementary foods must also be fed in a manner consistent with a child's appetite, meal frequency recommendations, and appropriate methods for the child's age[27].

One way of conceptualizing adequacy regarding complementary feeding is that foods must have adequate dietary diversity and be provided at adequate frequency. The WHO has published several core indicators related to complementary feeding, which include the following. Minimum dietary diversity is the proportion of children 6-23 months of age who receive foods from 4 or more food groups during the previous day. In addition, minimum meal frequency is the proportion of breastfed and non-breasted children 6-23 months of age who receive solid, semi-solid, or soft foods the minimum number of times for their age grouping (e.g. 3 times a day for children 9-23 months of age who are breast fed)[28]. And, finally, minimum acceptable diet is the proportion of children 6-23 months who receive the minimum dietary diversity and minimum meal frequency.

Globally, in 2010, fewer than one-third of children 6-23 months of age met the minimum criteria for diversity and approximately 50% did not reach minimum meal frequency[25]. This is concerning especially when it's been found that minimum dietary diversity is one of the most consistent indicators of child length or height[29].

Ideally, during the period of complementary feeding, infants should be receiving some of the most nutrient rich foods available in the household. However, in many low-income settings, infants instead receive starchy, watery porridges that are nutrient poor[30]. There are multiple problems with this. First these porridges tend to be low in energy density and second, through shear bulk, these porridges may "crowd out" other foods by taking up stomach capacity[31]. Other additional poor feeding practices such as late introduction of complementary foods, poor feeding methods, and poor hygiene can also contribute to undernutrition during this period[32].

In the Cambodian context

In Cambodia, 76% of children begin eating complementary foods at age 6-8 months, while 15% continue to be either exclusively breastfed or given plain water in addition to breastmilk[5]. However, only 32% of children meet the minimum acceptable diet based on the food frequency and dietary diversity[5]. The percent children receiving grains was 63%, animal sources was 50%, and fruits and vegetables were 38%[5].

As in many other low-income countries, in Cambodia, is very common for children to receive traditional rice-based complementary foods that tend to be low in energy and nutrient content. One study that examined the energy and nutrient densities of these complementary diets found that among those children who were partially breast-fed, between the ages of 12-23 months, it was found that the micronutrient densities of the complementary diets were all less than 80% of the desired level[33]. Additionally, it was found that snack foods were the primary source of both energy and these micronutrients among the partially and non- breastfed toddlers[33]. These snack foods included items such as crisps, biscuits, and sponge cake in addition to beverages including sweetened condensed milk and other sugary drinks[33]. Nutrient intakes for thiamine, calcium, iron, and zinc were also below the WHO estimated needs[33].

Disparities in complementary feeding also emerged by age in Cambodia. One study found that younger children were less likely to reach the minimum dietary diversity standards compared to older children. For example, only 42.5% of children 6-11 months of age were fed the minimum number of food groups while 62.3% of children 18-23 months of age were fed the minimum number of food groups[34].

VII. Infant and young child "overnutrition" and chronic disease

Given the rising global prevalence of childhood overweight and obesity, it is important to contextualize infant and young child undernutrition within the broader context of malnutrition. By doing so, it becomes possible to understand the implications of early child undernutrition on overweight and chronic disease in later life. While malnutrition is often understood as undernutrition, it more broadly and correctly means "a lack of proper nutrition". Thus, malnutrition may also occur in the form of overnutrition or being overweight. Children are considered overweight when their weight-for-age is above two standard deviations (+2 SD) above the mean[35].

Unlike stunting for which, globally, the prevalence is falling, the number of children who are overweight is only rising. As of 2015, approximately 6.2% of children under the age of five were overweight. In other words, 42 million children under the age of five were overweight[4]. Between 1990 and 2010 the worldwide prevalence of childhood overweight and obesity increased from 4.2% to 6.7%[36]; this is a 50% increase over 20 years. If this trend continues, this prevalence is expected to hit 9.5% or 60 million children by 2020[36]. While the prevalence of child overweight is highest in high-income countries, increasing prevalence of child overweight is now occurring LMIC. In fact, due to shear population size, the largest number of overweight children under the age of five live in LMICs[2].

While in Cambodia only a small proportion of the children are currently overweight, it is important to consider the likelihood of increasing overweight prevalence given Cambodia's rapid economic development. As of Cambodia's 2014 DHS, only 2% of children below the age of 5

were overweight[5]. Over recent years, the national prevalence of overweight children did not increase in Cambodia, as it did neighboring developing countries including Vietnam and Thailand. However, it did change between populations within Cambodia. For example, overweight prevalence has increased in urban areas and decreased in rural areas[21]. Furthermore, differences between socioeconomic groups in Cambodia are also prevalent. In fact, being in the highest quintile of wealth was considered a risk factor for being overweight compared to the lowest quintile[21].

As undernutrition in childhood, followed by rapid weight gain, may predispose individuals to chronic disease in later years, Cambodia's high prevalence of stunting in the face of increasing prevalence of overweight, is worrisome. Analyses have shown that undernutrition is a risk factor for high blood glucose levels, high blood pressure levels, and harmful lipid profiles even when adjusted for height and body-mass index. It is thought that these effects may be mediated through rapid weight gain in childhood[37]. Additionally, those infants with faltered growth who later gain weight rapidly in childhood may be at additional risk of adult obesity and the chronic disease that come with it[37]. In this context, Cambodia's high stunting rate may have significant adverse effects on the future rise of obesity and chronic disease in the country.

VIII. Infant and young child consumption of commercially produced "junk" foods

Rising consumption of commercially produced "junk" foods

According to the nutrition transition model, as the economies of LMIC's grow, a dietary shift from traditional foods low in fat and high in fiber towards foods high in fat and added sugar will occur[38]. Indeed, this trend is occurring globally. For example, the consumption of commercially produced snack foods and beverages, which tend to be low in nutritional value and high in fat, salt, and/or sugar content, is increasing globally. This consumption trend can be seen in Asia as well as other regions undergoing rapid economic growth such as Latin America and Africa[39].

Notably, this rising consumption of commercially produced snack foods has also been seen in the context of complementary feeding. A recent analysis of DHS's from 18 countries in Asia and Africa showed a consumption of sugary snack foods by up to 75% of Asian children and 46% of African children by the second year of life. Additionally, the proportion of children in this age group consuming sugary snack foods was generally higher than the proportion receiving fortified cereals, eggs, or fruit[40]. Many of these countries where snack food consumption is increasing have a high prevalence of undernutrition while overweight rates are rising[2].

The problem with commercially produced "junk" foods as complementary foods

There are many problems with infants consuming commercially produced foods as complementary foods. Firstly, these commercially produced foods can be thought of as foods of low nutritional value (FLNV). These sugary or salty snack foods tend to have low nutritional value but be high in energy content, added sugar, and salt[41]. The consumption of these foods, which consist largely of refined carbohydrates and sugar also leads to higher blood triglycerides[42]. Furthermore, increased salt intake during the first two years of life has been associated with higher blood pressure in adulthood[43]. These impacts – increased blood triglycerides and blood pressure – present serious risks for the development of chronic disease in

adulthood. One such chronic health concern that is gaining attention is the impact that commercially produced foods, especially those high in sugar content, have on oral health and the development of dental caries. Refined carbohydrates such as those found in biscuits, for example, are associated with an increased risk in dental caries[44].

Finally, an additional concern regarding the consumption of commercially produced foods that are high in salt and/or sugar is the impact on the taste development of children. It has been found infants exposed to starchy foods, preferred salty solutions at 6 months of age compared to those who had not been exposed to starchy foods[45]. Additionally, the repeated exposure to high processed and sweetened foods can predispose individuals to sweet tastes[46]. This is concerning given the implications for future malnutrition, especially overweight, in the future if a child is predisposed to liking sweet or salty foods.

Commercially produced "junk" food consumption in Cambodia

Recent evidence from Cambodia has suggested a rising consumption of packaged foods as complementary foods among infants and young children. This is particularly worrisome given Cambodia's high rate of undernutrition, which may be exacerbated by the consumption of these foods of low nutritional value during this critical time period of child development.

A recent study done by Pries et al 2016, found that of children 6-23 months of age living in Phnom Penh, 55.0% had consumed a commercially produced snack food on the previous day and 80.6% had consumed one in the prior week[34]. This commercially produced snack food was then categorized to include some common food products such as chips, candy, etc. that are available in Cambodia. The following consumption prevalence in the past week were reported: chips/crisps (46.8%), bread (33.8%), candy/chocolate (27.3%), and cake/doughnut (19.5%)[34]. This study reflects similar analyses of DHS data. According to the DHS data, 44% of Cambodian children aged 6-23 months had consumed sugary foods on the previous day[40]. Considering that children of this age should ideally not be consuming these foods at all, this high prevalence is alarming.

The consumption of these commercially produced foods was not limited to snacks but also extended to beverages. In the Pries et al 2016 study, 32% of children 6-23 months of age had consumed a sugar sweetened beverage on the day prior with branded juice drinks and chocolate milks being the most common[34]. Another study found that 89.2% of preschool children were given sweet drinks greater than or equal to 2 times per day[47]. These consumptions of sweet drinks among infants is not limited to branded juice drinks and other sugar sweetened beverages like sodas. A study conducted to examine the experience of caries in children in Cambodia, for example, found that 70% of mothers reported using sweetened canned milk to infant's bottles. When other solutions were used in bottles, a high proportion of mothers also reported adding extra sugar to the drinks[48].

Notably, these studies are some of the few describing this phenomenon in Cambodia. They also are restricted solely to Phnom Penh, the urban capital of Cambodia. It is critical to note that the capital, as mentioned previously, has one of the lowest rates of undernutrition.

IX. Access to commercial foods in Cambodia

Cost

The consumption of commercially produced snacks in high-income countries is generally accepted to be high[49]. However, total sugar, fat and salt consumption from processed foods has actually begun to plateau in high income-countries while increasing in upper and lower-middle income countries[50]. Within Asia, irrespective of country income, carbonated soft drinks are the most significant source of sugar while added oils and fats are the most significant source of fat[50]. This transition, from traditional diets to diets high in added sugar and fat, is not unexpected given nutrition transition theories[38].

A study done by Huffman et al. 2014 examined DHS data from 18 countries in Asia and Africa in order to characterize the consumption of sugary snack foods amongst infants 6-23 months of age. They found that the consumption of sugary snack foods increased with child's age and household wealth. Additionally, consumption tended to be higher in urban areas compared to rural areas[40].

In Cambodia, the effect of wealth on packaged snack consumption is still unclear. One study, for example, found that that the consumption of sugary snack foods increased with wealth quintile in all study countries including Cambodia[40]. They likewise found that sugary snack foods were more likely to be consumed by urban children than by rural children[40]. However, another study done in Cambodia found that mothers of all socioeconomic statuses, who purchased commercially produced snack foods for their children, spent the same amount on average on these foods[34]. This meant that mothers in the study, who purchased these foods for their children 0-23 months of age, spent $0.20 per day on cookies, $0.08 per day on candy/chocolate, $0.19 per day on chips/savory snacks, and $0.32 cakes and doughnuts[34].

Proximity, Advertising, and Feeding Practices

Physical access to commercially produced foods is also not an issue in Cambodia. Infant cereals, for example, were found to be the most commonly available commercially packaged complementary foods in stores in Phnom Penh. Additionally, over half of the stores sold "infant snacks" consistent of crackers, biscuits, dried fruit, etc. [51]. Note that many of these "infant snacks" would not be considered acceptable complementary foods by WHO standards.

Advertising for these commercially produced foods is also prevalent. One study, in Cambodia, found that almost all mothers (96.9%) of children age 6-23 months had observed a promotion for a commercially produced snack product[34]. The desire to please children also played a role in mother's purchasing of these foods. In the study, the majority of mothers who fed their children commercially produced snack foods reported doing so because their "child likes it" and many also reported that their child "cried for it"[34]. Feeding practices surrounding these foods is also problematic. Anderson et al. 2008 reported that the major role of inappropriate snacks in the diets of Cambodian children was particularly concerning given that the purchasing and consumption of these snacks was not frequently supervised by an adult[33].

X. Conclusion

Given Cambodia's high prevalence of stunting coupled with rapid economic growth, it is more critical than ever to understand how commercially packaged foods might be affecting infant health in this country. Since commercially packaged foods tend to be low in nutritional value they may be perpetuating the high levels of child undernutrition and contributing to increasing rates of child obesity in the country. Additionally, as Cambodia develops, the consumption of these foods will likely increase given adherence to the nutrition transition model[38]. This means that commercially packaged foods will likely play an important contributing factor to rising chronic disease in Cambodia. Currently, however, the study by Pries et al 2016 is the only one to describe the consumption of these foods in infanthood and the study was limited solely to the urban capital of Phnom Penh, where undernutrition rates are lowest. Thus, is a need to improve the data regarding the extent and reasons for the consumption of commercially produced "junk" foods by young children as well as the association between this consumption and child malnutrition in order to best inform the importance of this issue and next steps.

PART II: THESIS

I. Introduction

Global child undernutrition, while on the decline, remains at alarmingly high levels especially in many low- and middle- income countries (LMICs). It is estimated that undernutrition is a cause of 3.1 million child deaths annually, or 45% of all child deaths in 2011[1]. Additionally, undernutrition has significant adverse implications for a child's physical, cognitive, and behavioral development[2].

Cambodia is one such country that still has a high level of child undernutrition. A lower-middle income country in Southeast Asia, Cambodia has made considerable gains in improving child health over the past decade. According to the 2014 Cambodia Demographic Health Survey (DHS), under-5 mortality had declined in the recent years from 54 deaths per 1,000 live births to 35 deaths per 1,000 live births between 2010 and 2014. Despite this progress, this means that one in every 29 Cambodian children does not survive to their fifth birthday[5]. It is estimated that 60% of these deaths, in Cambodia, can be attributed to indicators of undernutrition (i.e. maternal malnutrition, child underweight and wasting, suboptimal breastfeeding or micronutrient deficiencies)[6].

In 2014, of Cambodian children under the age of five years old, 41% were moderately or severely stunted and 34% were moderately or severely underweight[5]. The high prevalence of stunting, or being too short for one's age, is particularly concerning due to its largely irreversible consequences. Stunting reflects a failure to achieve full linear growth potential as a result of long-standing inadequate maternal and early childhood nutrition. Thus, it is often used as a proxy for measuring chronic undernutrition. In Cambodia, the prevalence of stunting is 13% among children age 6-8 months and rises to a peak of 40% between the ages of 36-47 months[5]. This dramatic increase in the prevalence of stunting with age, occurring around the time period of complementary feeding, demonstrates the critical nature of this time period in child nutrition and development. In fact, it is well recognized that the first 1000 days of a child's life, from conception to two years of age, is a key "window of opportunity" for reducing stunting[7].

In order to achieve a further decrease in the levels of undernutrition amongst Cambodia children, it is critical to pay attention to feeding practices during this "window of opportunity". Complementary feeding practices particularly demand attention. The World Health Organization (WHO) recommends the introduction of solid foods to infants around the age of 6 months when breast milk alone can no longer meet a child's nutrient needs for appropriate growth. In Cambodia, it has been reported that 76% of children begin eating complementary foods around 6-8 months; thus, around the recommended time frame[5]. However, in Cambodia, these complementary foods often do not meet the recommended requirements of infants. One study that examined the energy and nutrient densities of complementary diets in Cambodia found that, among those children who were partially breast-fed, between the ages of 12-23 months, the micronutrient densities of the complementary food diets were less than 80% of the desired level[33]. Additionally, the study found that snack foods were the primary source of both energy and these micronutrients both among the partially and non- breastfed toddlers[33]. These snack

foods included items such as crisps, biscuits, and sponge cake in addition to beverages including sweetened condensed milk and other sugary drinks[33].

The alarming rates of increased snack food consumption among Cambodian infants and young children as well as the health implications to this population are not well characterized. The few studies that do exist are restricted to Phnom Penh, Cambodia's urban capital, and do not demonstrate whether this phenomenon extends to more rural areas of Cambodia. Understanding this dietary change is important not only for addressing undernutrition in Cambodia now but also for preparing for Cambodia's future. Given Cambodia's rapid economic development, as well as the rising rates of obesity and overweight in neighboring countries, consumption of packaged foods and sugar-sweetened beverages will likely have important implications for the development of a double burden of malnutrition in Cambodia as has been seen elsewhere[38]. With this in mind, the aim of this study was to assess the consumption of packaged foods and sugar-sweetened beverages, as well as the association of these foods and beverages with anthropometric measures undernutrition, among children 24 months of age in rural and semi-rural Cambodia.

II. Methods

Study design and data collection

Data to be analyzed were originally collected through the Cambodia SMILE study. A pilot study, the Cambodia SMILE study was initiated with the aim of determining the effectiveness of a community-based health promotion program in reducing dental caries in young children (from birth to 24 months of age) in Cambodia. There was a control arm and an intervention arm of the study. The intervention arm received fluoride varnish application along with oral hygiene instruction and oral health education. This intervention was delivered at the same time as existing well-child health programs (i.e. the delivery of vaccinations, vitamin A supplementation, and de-worming tablets). The control arm did not receive the oral health intervention. Participants for the intervention arm were recruited from community health centers (CHCs) in two districts of the rural and semi-urban Kampong Speu Province and participants from the control arm were recruited from a different district in Kampong Speu. It was determined that the desired sample size was 392 participants (196 in the control arm and 196 in the intervention arm). However, there was an assumed 30% loss to follow-up rate given the difficulty of retaining participants in the Cambodian environment. As a result, the final goal for recruitment was 520 child-caregiver dyads.

Data were collected by trained primary health care providers at each data collection phase (9, 12, 15, 18, 24 months) using research examination forms. Data used for the analysis of this paper were limited to the 24-month cross-sectional time-point due to the lack of nutritional and anthropometric data at other time points. All data were collected between 2015 and 2017.

At 24-months, socioeconomic indicators, oral health indicators, responses to oral health education questions, anthropometric data, a checklist of selected foods consumed on the previous day, and responses to child behavior questions were collected. In regards to the checklist of foods consumed on the previous day, caretakers were asked to report child consumption of

selected foods on the previous day at multiple time points (i.e. morning, middle of the day, afternoon, evening, night). Consumption of dietary staples (e.g. rice, meat, fruit, vegetables, egg) and foods of low nutritional value (e.g. packaged snacks, packaged sweets, Khmer sweet cake) were assessed in addition to beverages (e.g. breastmilk, bottled milk formula, bottled rice water, sugar-sweetened beverages). Additionally, start dates for the initial introduction of the food and beverage items was recorded.

Statistical analysis

Data was entered into and cleaned in STATA 15 SE. The control and intervention 24-month data sets were merged to increase the sample size. The rationale behind this was that the original intervention for Cambodia SMILE had minimal nutritional intervention; therefore, the intervention was unlikely to directly affect nutrition outcomes. A binary intervention variable was also created to control for the intervention in later logistic regressions. For the 24-hour dietary recall, the multiple time points (i.e. morning, middle of the day, afternoon, evening, night) were condensed to give overall consumption for the previous day. Additionally, two composite variables were created to represent types of foods. This included a variable "foods of low nutritional value" which was created by combining packaged salty snacks, packaged sweets, and Khmer sweet cake; and a variable "packaged food" created by combining packaged salty snacks and packaged sweets.

The zanthro package was used to calculate length-for-age z-score/height-for-age z-score (LAZ/HAZ), weight-for-age z-score (WAZ), BMI-for-age z-score (BMZ), and weight-for-height z-score (WHZ) according to WHO Child Growth Standards 2005. This anthropometric data was then used to categorize children as stunted (LAZ/HAZ < -2 SD), wasted (WHZ < -2 SD), and underweight (WAZ < -2 SD).

Cross-sectional analysis was then performed. Initial descriptive analysis assessed the level of consumption of each respective food item (e.g. initial introduction, frequency of consumption). Descriptive analysis was also conducted for anthropometric measures. The reported dates of the first introduction of foods at 24-months was cross-checked with 24-hour dietary recall data from previous time points (e.g. 12, 18, 21 months) to look for inconsistencies. There were no inconsistencies found.

The association between stunting at 24 months and intake of foods of low nutritional value on the previous day was assessed with multivariate logistic regression models. Variables to be included in multivariate adjusted models were first analyzed by bivariate analysis. Those variables that were found to have a p-value <0.20 were then moved forward to multivariate analysis. Wald tests were then performed to remove variables from the models that did not significantly impact the outcome in the multivariate model. A minimum of three models were built for each of the anthropometric outcomes - underweight, stunting, and wasting. At a minimum the three models included controls for sociodemographic covariates (Model 1), sociodemographic and health covariates (Model 2), and sociodemographic and other food covariates (Model 3). The full models can be found in the attached appendix.

III. Results

Study population sociodemographics

Data from 373 infants at 24-months of age were available for secondary analysis after eliminating participants for whom anthropometric data was missing. The total sample represented 10 villages spanning rural to semi-urban environments in the Kampong Speu Province.

Table 1 describes participant characteristics. Infant age was 22.7 months ± 2.9 SD at the 24-month time point. There was an approximately equal representation of sexes with 55.2% of the population being female.
The study population was overall low-income with parents having low education levels as was expected given the relatively rural study location. The monthly income of households was <$250 or less than $8.20 per day for approximately 69% of the study population. For the majority of parents, the highest level of education was primary school education or less. Among the sociodemographic indicators, most households had electricity (84.7%) but lacked running water (73.7%).

Additionally, 24.8% of parents reported their infant having diarrhea of greater than 3-days, and 20.6% of parents reported their infant taking antibiotics in the last month. Finally, 43.3% of parents reported that their infant had been admitted to the hospital.

Table 1 Sociodemographic characteristics of study population

		Mean ± SD or N (%), n=373
Child characteristics	Sex	
	Male	169 (44.8)
	Female	208 (55.2)
	Child age (months)	22.7 ± 2.9
Household characteristics	Monthly income	
	<$50	29 (8.1)
	$51-150	87 (24.2)
	$151-250	130 (36.2)
	>$250	113 (31.5)
	Electricity	320 (84.7)
	Running water	103 (27.3)
	Average household size	5.0 ± 1.7
	Cooking Material	
	Wood	241 (63.9)
	Charcoal	16 (4.2)
	Gas	50 (13.3)
	Mixture	70 (18.6)
	Location	
	Rural	167 (45.0)
	Semi-urban	204 (55.0)
Parent characteristics	Parent age (years)	
	Mother	28.1 ± 5.5
	Father	30.1 ± 5.9
	Parent education	

	Illiterate	49 (13.1)
	Primary	173 (46.3)
	High School	141 (37.7)
	University	11 (2.9)
	Mother's Occupation	
	Stay at home	98 (26.0)
	Seller	19 (5.0)
	Farmer	22 (5.8)
	Government worker	3 (0.8)
	Other	235 (62.3)
	Fathers occupation	
	Stay at home	34 (9.1)
	Seller	19 (5.1)
	Farmer	39 (10.4)
	Government worker	12 (3.2)
	Other	271 (72.3)
Child health characteristics	Chest infection (in last month)	211 (55.7)
	Diarrhea (>3 days in last month)	94 (24.8)
	Hospitalized (in last month)	164 (43.3)
	Took antibiotics (in last month)	78 (20.6)
	Stunted	156 (43.1)
	Wasted	58 (15.7)
	Underweight	97 (26.8)

Anthropometric measures of nutrition by age

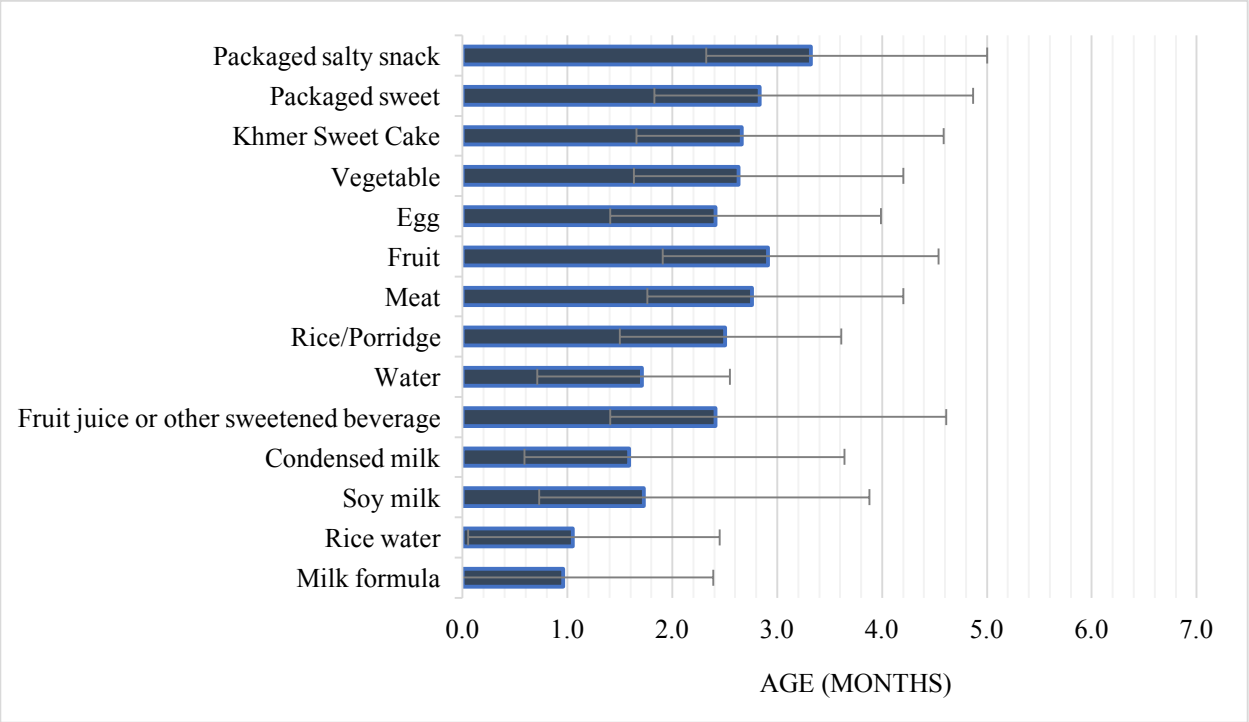
Infants in the study had high levels of undernutrition as represented by anthropometric measures: 43% of the infants were stunted, 16% of infants were wasted, and 27% were underweight (Table 1). These measures were slightly higher than national statistics.

First introduction of foods

For all food groups included in the study, the age at which the caregivers reported first introducing a food or beverage to their infant was significantly earlier than the recommended six months (Figure 1). The earliest introduced foods included milk formula at 1.0 ± 1.4 months and rice water at 1.1 ± 1.4 months.

Foods and beverages of low nutritional value were also introduced earlier than six months, very early in infancy. Packaged salty snacks were introduced at 3.3 ± 1.7 months, packaged sweets at 2.8 ± 2.0 months, and Khmer sweet cake at 2.7 ± 1.9 months. The age of introduction for fruit juice or other sweetened beverage was 2.4 ± 2.2 months, also much earlier than the recommended age.

Figure 1: Age of first introduction in months to foods and beverages



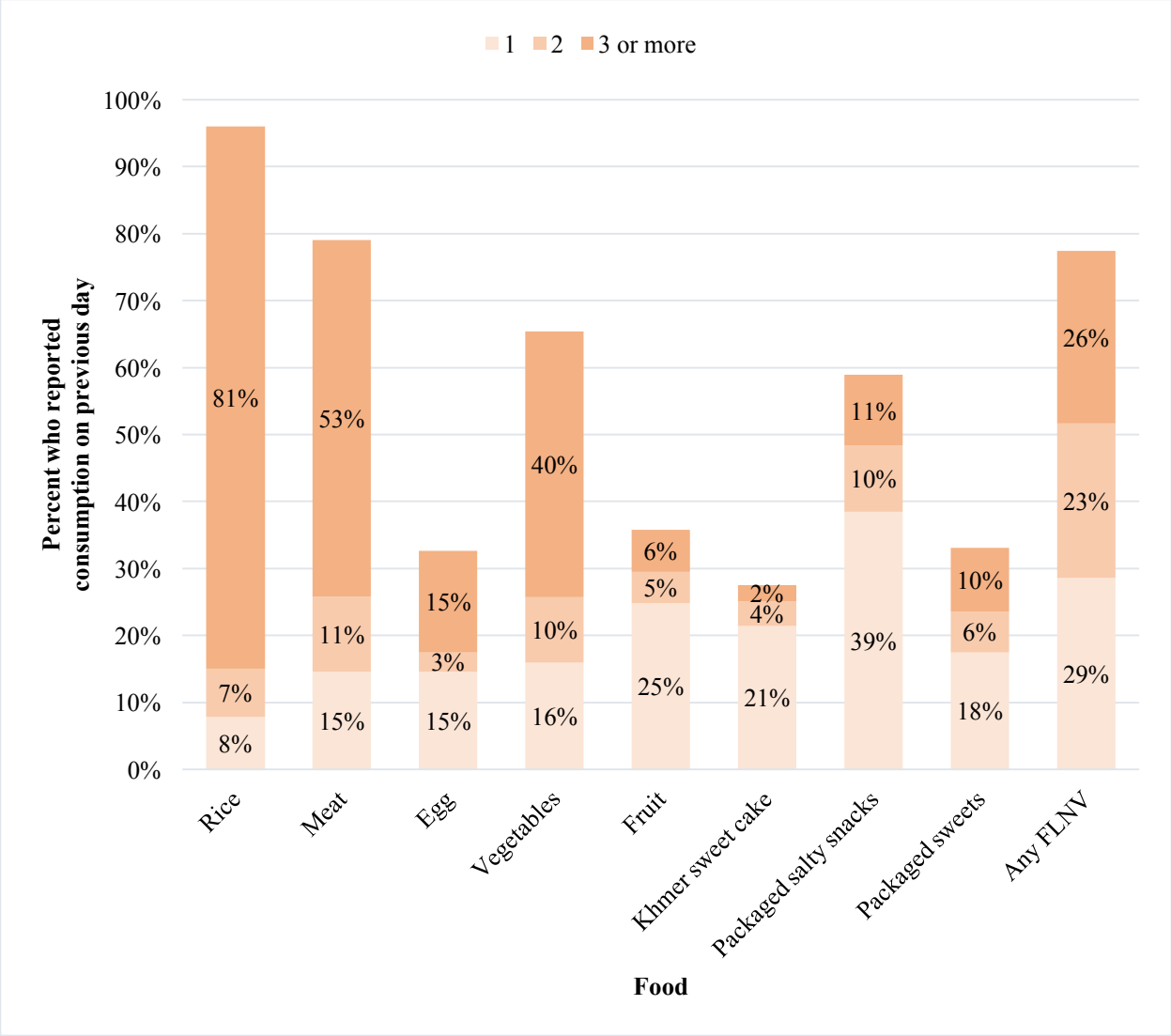
Frequency of reported intake of foods on previous day

The frequency of consumption of selected foods was analyzed using responses from the checklists regarding foods that were fed to infants on the previous day (Figure 2). Rice or rice porridge, a staple in the Cambodian diet, was consumed by 96.3% of 24-month old infants on the previous day. The next most frequently consumed food was meat, consumed by 79% of infants.

When considered as an aggregate of Khmer sweet cake, packaged salty snacks, and packaged sweets, foods of low nutritional value (FLNV) were the third most frequently consumed food with 77% of infants consuming them on the previous day. Additionally, just over a quarter of infants in the study had consumed any food of low nutritional value three or more times on the previous day.

Packaged salty snacks alone were consumed by 59% of infants on the previous day.
Other foods were consumed by the following proportions of infants on the previous day: vegetables (66%), fruit (36%), packaged sweets (34%), egg (33%), and Khmer sweet cake (27%). Notably, packaged sweets and Khmer sweet cake were consumed at approximately the same frequency as fruit and egg on the previous day.

Figure 2: Frequency of consumption of reported foods on previous day at 24-month time point



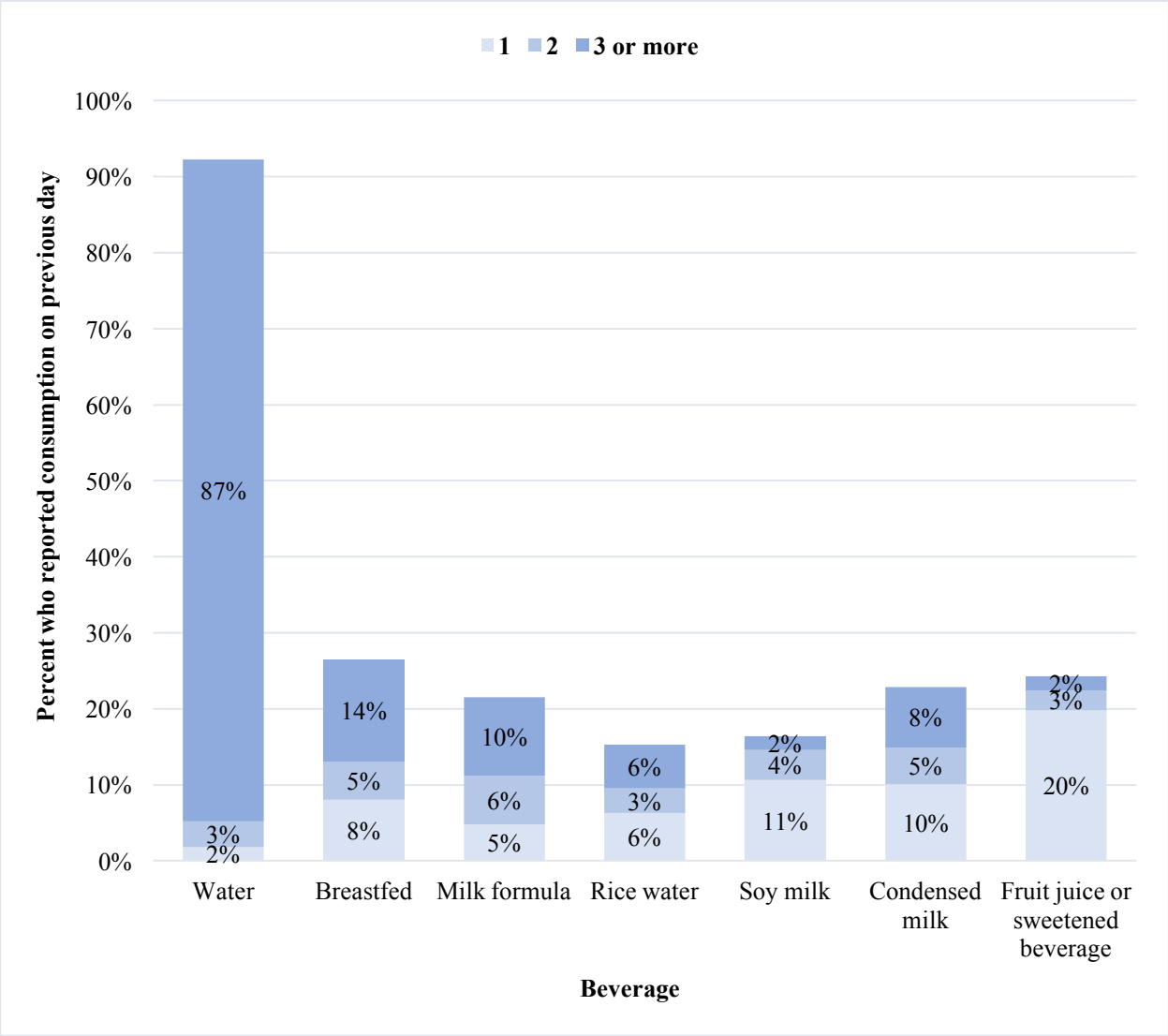
Frequency of reported intake of beverages on previous day

The frequency of consumption of selected beverages was also analyzed using responses from the checklists regarding foods that were fed to infants on the previous day (Figure 3).

Infants breastfed on the previous day made up 27% of participants. This is likely due to the fact that infants were around 24 months of age and either had stopped breastfeeding or were being weaned from breastmilk. The next most commonly-consumed beverage was fruit juice or another sweetened beverage. A quarter of infants had received fruit juice or other sweetened beverage on the previous day. This was more than any other beverage besides water, which was consumed by the majority (92%) of infants.

Condensed milk and milk formula were the next most frequently consumed beverages at 23% and 22% respectively. This was followed by soy milk at 16% and rice water at 15%.

Figure 3: Frequency of consumption of reported beverages on previous day at 24-month time point



Association between food and beverage intake on previous day and stunting at 24 months of age

Several sociodemographic characteristics were significantly associated with stunting in adjusted models (Appendix Table A1 – Model 0). Female sex was associated with lower odds of stunting compared to male sex (OR 0.58; 95% CI [0.37, 0.91]). Infants from families with an income greater than $250 per month had significantly lower odds of stunting compared to those from the reference group of families with an income of $0-50 per month (OR 0.28; 95% CI [0.11, 0.72]). Having a mother whose occupation was either a seller or farmer was significantly associated with decreased odds of stunting compared to having a mother whose occupation was a stay-at-home mom (OR 0.22; 95% CI [0.06, 0.74] and OR 0.24; 95% CI [0.07, 0.83] respectively).

Table 2 represents the association between foods and beverages of low nutritional value and stunting at 24 months of age. Consumption of a bottled fruit juice or other sweetened beverage on the previous day was significantly associated with increased odds of stunting in all models (Table 2). In Model 1, when adjusting for sociodemographic covariates, bottled fruit juice was found to be significantly associated with twice the odds of stunting at (OR 1.90; 95% CI [1.05, 3.12]). A similar association was found as well when also adjusting for health covariates, including observed white spots on child's teeth by caregiver and caregiver's prediction of child's likelihood of having a toothache (Model 2). These variables were included to adjust for possible confounding of mouth main on stunting, as improved dental hygiene has been shown to improve child appetite[52]. Similar associations were also found when adjusting for other food covariates (Model 3).

The consumption of 2 or more packaged salty snack foods was found to be significantly associated with decreased odds of stunting in Model 2 when adjusting for sociodemographic and health variables (OR 0.39; 95% CI [0.15, 0.98]). However, this association was not found when adjusting for sociodemographic and other food variables in Model 3. There was a trend towards significance found in both Model 1 and Model 3 suggesting that any consumption of packaged salty snack foods on the previous day was associated with decreased odds of stunting.

Table 2: Association between foods and beverages of low nutritional value and stunting at the 24-month time point

	Model 1: Adjusted for sociodemographic covariates		**Model 2: Adjusted for sociodemographic and health covariates**		**Model 3: Adjusted for sociodemographic and food covariates**	
	OR	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Bottled fruit juice or other sweetened beverage	1.90	[1.12, 3.23]*	2.15	[1.08, 4.29]*	1.81	[1.05, 3.12]*
Number of packaged food items						
1	0.79	[0.45, 1.39]	0.89	[0.42, 1.89]	0.85	[0.48, 1.52]
2	0.84	[0.42, 1.65]	0.66	[0.27, 1.59]	0.80	[0.40, 1.59]
3 or more	0.61	[0.31, 1.21]	0.70	[0.27, 1.81]	0.65	[0.32, 1.30]
FLNV	0.84	[0.49, 1.45]	1.03	[0.50, 2.09]	0.86	[0.50, 1.51]
Number of FLNV						
1	0.97	[0.51, 1.82]	1.27	[0.56, 2.90]	1.03	[0.54, 1.98]
2	0.93	[0.47, 1.84]	1.06	[0.43, 2.60]	0.88	[0.44, 1.77]
3 or more	0.60	[0.31, 1.19]	0.75	[0.30, 1.82]	0.64	[0.32, 1.28]
Packaged salty snack	0.64	[0.41, 1.02]^{T}	0.65	[0.35, 1.20]	0.63	[0.39, 1.01]^{T}
Number of packaged salty snacks						
1	0.68	[0.41, 1.13]	0.78	[0.40, 1.51]	0.64	[0.38, 1.07] ^{T}
2 or more	0.57	[0.30, 1.08] ^{T}	0.39	[0.15, 0.98]*	0.61	[0.32, 1.18]
Packaged sweets	0.99	[0.60, 1.61]	1.35	[0.71, 2.58]	0.98	[0.59, 1.61]
Number of packaged sweets						
1	1.17	[0.63, 2.16]	1.49	[0.68, 3.27]	1.16	[0.62, 2.19]

2 or more	0.80	[0.41, 1.57]	1.18	[0.47, 2.95]	0.79	[0.40, 1.57]

Association between food and beverage intake on previous day and wasting at 24 months of age

There were no sociodemographic characteristics found to be significantly associated with wasting in adjusted models (Appendix Table A17 – Model 0). However, infants who received the intervention from the original study design had higher odds of wasting when adjusting for sociodemographic characteristics (OR 3.35; 95% CI [1.69, 6.67]). Additionally, in adjusted models, infants who had received an antibiotic in the previous month had significantly higher odds of being wasted (OR 2.39; 95% CI [1.11, 5.16]*) (Appendix Table A17 – Model 2).

Table 2 represents the association between foods and beverages of low nutritional value and wasting at 24 months of age. Bottled fruit juice or other sweetened beverage was significantly associated with a 2 to 3-fold increased odds of wasting, in all of the models. When controlling for sociodemographic and health covariates in Model 2, bottled fruit juice or other sweetened beverage was associated with a 2.15 times the odds of wasting (95% CI [1.08, 4.29]). As in models of stunting, adjusted health covariates included observation of white spots on child's teeth by caregiver and caregiver's prediction of child's likelihood of having a toothache. These covariates were included to control for effects of poor oral health hygiene and possible resultant reductions in child appetite on child nutritional status[52]. Similar associations were also found when adjusting for other food covariates (Model 3).

There was a trend suggesting that consuming two or more packaged salty snacks on the previous decreased odds of stunting when controlling for sociodemographics (Model 1) or sociodemographics and other food covariates (Model 3). However, this trend disappeared when adjusting for sociodemographics and health covariates (Model 2). No other foods of low nutritional value were associated with wasting.

Table 3: Association between foods and beverages of low nutritional value and wasting at the 24-month time point

	Model 1: Adjusted for sociodemographic covariates		**Model 2: Adjusted for sociodemographic and health covariates**		**Model 3: Adjusted for sociodemographic and food covariates**	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Bottled fruit juice or other sweetened beverage	2.52	[1.31, 4.85]**	2.43	[1.24, 4.78]**	2.61	[1.33, 5.11]**
Number of packaged food items						
1	1.47	[0.69, 3.11]	1.45	[0.67, 3.17]	1.41	[0.65, 3.04]
2	1.75	[0.73, 4.18]	1.71	[0.70, 4.20]	1.73	[0.71, 4.19]
3 or more	0.44	[0.13, 1.43]	0.49	[0.15, 1.63]	0.44	[0.13, 1.48]
FLNV	1.31	[0.62, 2.78]	1.34	[0.61, 2.95]	1.34	[0.62, 2.88]
Number of FLNV						
1	1.26	[0.53, 2.97]	1.27	[0.51, 3.13]	1.31	[0.55, 3.14]
2	1.99	[0.81, 4.86]	1.98	[0.78, 5.03]	1.88	[0.75, 4.73]

3 or more	0.88	[0.33, 2.36]	0.95	[0.35, 2.61]	0.95	[0.35, 2.58]
Packaged salty snack	1.30	[0.69, 2.45]	1.27	[0.65, 2.46]	1.44	[0.75, 2.79]
Number of packaged salty snacks						
1	1.50	[0.76, 2.92]	1.44	[0.71, 2.91]	1.62	[0.81, 3.24]
2 or more	0.88	[0.35, 2.22]	0.93	[0.36, 2.41]	1.04	[0.40, 2.70]
Packaged sweets	0.97	[0.50, 1.88]	1.08	[0.55, 2.13]	0.84	[0.43, 1.67]
Number of packaged sweets						
1	1.80	[0.85, 3.81]	1.83	[0.84, 3.99]	1.51	[0.69, 3.28]
2 or more	0.31	[0.09, 1.07]^{T}	0.39	[0.11, 1.38]	0.29	[0.08, 1.02]^{T}

IV. Discussion

The present study found alarming levels of consumption of packaged foods and sugar-sweetened beverages, which have low nutritional value, among infants at 24 months of age. It is concerning that, among the foods analyzed in this study, infants at 24 months of age were consuming a food of low nutritional value more frequently than any other food except meat and rice. The low dietary diversity found in this study is consistent with what has been previously reported in Cambodia and is concerning given the association with undernutrition[26,53]. These high consumption rates are further put into perspective when it is considered that a quarter of infants were receiving these foods three or more times during the previous day, suggesting that these foods have become a staple of the Cambodian infant diet. In addition, over a quarter of infants had received fruit juice or other sweetened beverage on the previous day. This is concerning as these sugar-sweetened beverages have been linked to both malnutrition and obesity[41]. Previous studies in Phnom Penh have found similar results with just over half of children of 6-23 months of age consuming a packaged snack food on the previous day[34]. It is likely that the numbers reported in this study are higher than this given the older age of the study population.

Overall, these changes towards processed and packaged foods indicates that Cambodia is undergoing a nutritional transition[38]. As Cambodia continues to develop, these high levels of consumption of packaged foods and sugar-sweetened beverages will likely increase and eventually lead to increased rates of child overweight and obesity as has been noted in other countries[18,54]. The double burden of malnutrition, with undernutrition continuing to existing in rural areas and obesity increasing in urban areas, is already seen in neighboring countries such as Vietnam[55]. If these feeding patterns continue in Cambodia, it is likely this country too will soon be experiencing this double burden.

The most concerning of our findings is that caregivers reported first giving complementary foods, including these foods of low nutritional value, at a mean age of three and a half months or less. This is significantly earlier than the recommended six months of age. In particular, foods and beverages of low nutritional value were started at a mean age between two to four months of age. These findings contradict those that were found in the 2014 Cambodian DHS, which found over a majority of children were exclusively breastfed until six months of age[5]. It is possible that the different results may be attributed to the phrasing of our question which did not capture the consistency with which children received these foods after being introduced to them the first

time. However, it does point to the importance of needing to include foods of low nutritional value and sugar-sweetened beverages in future surveys of infant and young child feeding practices.

A concern with this early introduction to solid foods is the effects on infant and child development. Exclusive breastfeeding for the first six months of life is critical to healthy infant development and growth. Especially, in a rural, low-income environment such as that of this study population, introducing other foods that need to be cooked or washed may introduce infants to pathogens and thus, predispose them to illness. In addition, the infant gastrointestinal tract prior to six months is not fully developed and thus, cannot digest and extract the needed nutrients from solid foods. Feeding patterns are also known to affect the development of an infant's intestinal microbiome, which may then impact a child's ability to metabolize and produce essential vitamins among other effects[56].

Infants in the study population showed high levels of undernutrition with 43% being moderately or severely stunted and 16% being moderately wasted or severely wasted. This prevalence was similar but slightly lower than that reported for the Kampong Speu province by the 2014 Demographic Health Survey, likely due to improvements since that time[5]. Multivariate analysis found that different factors contributed to each of these outcomes, which is not surprising given that stunting represents a chronic undernutrition while wasting represents more acute undernutrition.

The causes of stunting are multifactorial and complex. In the present analysis, it was found that child male sex, lower household income, and mother's occupation as a homemaker were all associated with stunting at 24 months. Similar findings regarding child sex and household income have been previously reported in Cambodia[11]. Regarding mother's occupation, it was found that infants with mothers who were sellers or farmers were less likely to be stunted compared to those infants with mothers who were stay at home. It is possible that this finding is due to extra food, as opposed to income, that might be provided to the household and infants by having mothers in these occupations.

The only food or beverage that was found to be significantly associated with stunting was bottled fruit juice or other sweetened beverage consumption on the previous day, which was associated with twice the odds of stunting in all adjusted models. Many studies have shown sugar-sweetened beverages have been shown to be associated with weight gain and obesity[57]. However, it has also been suggested that these foods of low nutritional value could also displace more nutrient dense foods and possibly contributing to undernutrition. For example, one study showed that children with low sugar intake consume more protein, total fat, and key vitamins compared to those with high sugar intake[58]. Sugar-sweetened beverages are high in added sugar, which is a known contributor to dental caries; furthermore, the treatment of dental caries has been shown to improve child appetite[59,52]. With this in consideration, it is possible that sugar-sweetened beverages may be causing stunting through caries and subsequent appetite suppression.

In adjusted models for the outcome of wasting, antibiotic use by the infant in the past months was associated with over two times the odds of wasting. This is likely explained by the fact that

infants who received antibiotics were likely very ill; it is known that illness, in particular repeated bouts of diarrhea, can contribute to poor growth[2]. The only food or beverage that was found to be significantly associated with stunting was bottled fruit juice or other sweetened beverage consumption on the previous day, which was associated with over two times the odds of wasting in all adjusted models. Further investigation is needed to examine the direction of this relationship as it is possible children who were acutely ill were more likely to consume sugary drinks instead of solid foods due to their illness.

In general, packaged salty snacks and packaged sweets were not significantly associated with either stunting or wasting. High levels of packaged salty snack consumption (two or more on the previous day) did trend towards decreased odds of stunting. This might suggest that infants receiving these snacks are receiving more calories overall and thus, have lower odds of poor growth. However, it should be explored whether these packaged snacks and sweets may be contributing to other forms of malnutrition such as anemia or vitamin deficiencies.

This study has several limitations. The cross-sectional design of this study means that any associations found between food intake on the previous day and anthropometric measures of malnutrition cannot be causative. An assumption made by this study is that food intake on the previous day is indicative of a pattern of food consumption by infants. Additionally, nutritional composition and portion sizes of food and beverages were not available. As a result, packaged foods and beverages could not be distinguished based on their relative contributions of calories and nutrients. Given the difficulty of longitudinal studies, especially ones collecting detailed nutritional data, in a rural, low-resource population such as the one in this study, a cross-sectional analysis is the most practical for an exploratory study such as this one. Another limitation of this study is the small sample size and one limited to rural and semi-rural populations. However, it is important to note, that this is the first study to characterize packaged food and beverage consumption in rural Cambodia. And finally, maternal health characteristics known to affect child nutrition and health status in Cambodia, such as maternal height and weight, maternal tobacco use, and maternal birth during the Khmer Rouge famine, were not available for analysis[11].

There are also many strengths to this study. As previously mentioned, this study is the first to describe the consumption patterns of packaged foods and beverages among a rural Cambodian population. Previous studies on this phenomenon have only been done in the urban capital, Phnom Penh. Additionally, it contributes important data on the first introduction of packaged foods and sugar-sweetened beverages to infants that has not been previously reported. This is notable as early introduction to foods, especially foods with sweet taste, has been known to affect child's taste preferences for foods in later life[46]. And finally, this study explores and suggests an association between the consumption of these foods and beverages with indicators of undernutrition.

V. Conclusion

In conclusion, infants in rural and semi-rural Cambodia are consuming high levels of packaged foods and beverages of low in nutritional value, and starting to consume them very early within the first few months of age. Of these foods and beverages, fruit juice or other sweetened

beverage consumption on the previous day was associated with increased odds of both stunting and underweight suggesting that these beverages may be contributing substantially to child undernutrition. Further studies should investigate the ways in which these beverages may be contributing to undernutrition, such as through by displacing foods of higher nutritional value. Finally, as Cambodia continues to undergo rapid economic development, a known promoter of increased processed food and sugar-sweetened beverage consumption, it is critical to begin initiating interventions and policies to reduce the consumption of these foods and beverages in Cambodia. Such policies might include maternal and child health education programs to counsel on the negative health effects of these foods and beverages. While Cambodia has taken steps to limit the sale of these foods in schools, these policies have not had much success. In light of these results, there needs to be renewed effort to limit these sales in schools possibly by providing financial encouragement to vendors to sell more nutritious options. Without any such action, Cambodia may soon be facing the double burden of malnutrition seen in many other low and middle-income countries.

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APPENDIX

Table A1. Association of consumption of bottled fruit juice or other sweetened beverage on previous day with being stunted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		**Model 2: Adjusted for sociodemographic and health covariates**		**Model 3: Adjusted for sociodemographic and food covariates**		Model 0: Sociodemographic covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Bottled fruit juice	1.90	[1.12, 3.23]*	2.15	[1.08, 4.29]*	1.81	[1.05, 3.12]*		
Intervention	1.52	[0.95, 2.44]^{T}	0.89	[0.42, 1.86]	1.28	[0.78, 2.10]	1.55	[0.97, 2.47]^{T}
Child sex (ref: male)	0.57	[0.36, 0.90]*	0.52	[0.28, 0.95]*	0.60	[0.37, 0.96]*	0.58	[0.37, 0.91]*
Income (ref: $0-50)		*				^{T}		*
$51-150	0.51	[0.20, 1.31]	0.40	[0.10, 1.59]	0.53	[0.20, 1.36]	0.55	[0.21, 1.40]
$151-250	0.41	[0.16, 1.05]^{T}	0.24	[0.06, 0.96]*	0.43	[0.17, 1.12]^{T}	0.43	[0.17, 1.08]^{T}
>$250	0.26	[0.10, 0.68]**	0.21	[0.05, 0.85]*	0.28	[0.10, 0.74]*	0.28	[0.11, 0.72]**
Mother's occupation (ref: Stay at home)		*		**		*		*
Seller	0.18	[0.05, 0.63]**	0.08	[0.02, 0.38]**	0.20	[0.05, 0.70]*	0.22	[0.06, 0.74]*
Farmer	0.22	[0.06, 0.77]*	0.15	[0.03, 0.84]*	0.23	[0.06, 0.81]*	0.24	[0.07, 0.83]*
Government worker	0.65	[0.05, 7.90]	1.56	[0.08, 29.46]	1.22	[0.09, 17.18]	0.87	[0.07, 10.85]
Other	0.88	[0.51, 1.52]	0.73	[0.35, 1.49]	1.02	[0.57, 1.80]	0.91	[0.53, 1.56]
Household size (ref: 3 members)								
4 members	1.10	[0.52, 2.33]	1.84	[0.66, 5.12]	1.04	[0.48, 2.24]	1.11	[0.53, 2.31]
5 members	0.99	[0.46, 2.13]	1.86	[0.63, 5.51]	0.89	[0.41, 1.96]	0.98	[0.46, 2.09]
6 or more members	1.35	[0.65, 2.79]	2.95	[1.08, 8.04]*	1.30	[0.61, 2.73]	1.42	[0.70, 2.90]
White spots on child's teeth observed by caregiver			0.69	[0.37, 1.26]				
Likelihood that child will have toothache according to caregiver (ref: Very likely)								
Likely			1.33	[0.57, 3.07]				
Normal			1.57	[0.57, 4.32]				
Unlikely			1.14	[0.32, 4.01]				
Very Unlikely			0.83	[0.32, 2.18]				
Reported food consumption on previous day								
Breastfed					1.57	[0.91, 2.69]		
Bottled milk formula					0.67	[0.36, 1.25]		
Bottled soy milk					0.65	[0.34, 1.26]		
Bottled water					0.80	[0.35, 1.86]		
Rice					4.19	[0.78, 22.54]^{T}		
Constant	3.58	[0.98, 13.04]^{T}	5.63	[0.96, 33.23]^{T}	1.06	[0.12, 9.39]	3.66	[1.03, 13.07]*
Number of observations	338		217		333		339	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A2. Association of consumption of number of packaged foods on previous day with being stunted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	OR	[95% CI]	OR	[95% CI]	OR	[95% CI]
Number of packaged foods						
1	0.79	[0.45, 1.39]	0.89	[0.42, 1.89]	0.85	[0.48, 1.52]
2	0.84	[0.42, 1.65]	0.66	[0.27, 1.59]	0.80	[0.40, 1.59]
3 or more	0.61	[0.31, 1.21]	0.70	[0.27, 1.81]	0.65	[0.32, 1.30]
Intervention	1.52	[0.95, 2.44]^{T}	0.92	[0.44, 1.93]	1.28	[0.78, 2.10]
Child sex (ref: male)	0.60	[0.38, 0.95]*	0.54	[0.30, 0.98]*	0.63	[0.39, 1.00]^{T}
Income (ref: $0-50)		*				^{T}
$51-150	0.54	[0.21, 1.39]	0.39	[0.10, 1.58]	0.55	[0.21, 1.43]
$151-250	0.41	[0.16, 1.05]^{T}	0.22	[0.05, 0.91]*	0.43	[0.17, 1.11]^{T}
>$250	0.28	[0.11, 0.72]**	0.21	[0.05, 0.88]*	0.30	[0.11, 0.79]*
Mother's occupation (ref: Stay at home)						
Seller	0.24	[0.07, 0.83]*	0.11	[0.03, 0.51]**	0.25	[0.07, 0.87]*
Farmer	0.25	[0.07, 0.87]*	0.17	[0.03, 0.90]*	0.25	[0.07, 0.90]*
Government worker	0.92	[0.07, 11.63]	2.71	[0.13, 57.83]	1.67	[0.11, 26.19]
Other	0.93	[0.54, 1.60]	0.76	[0.38, 1.56]	1.06	[0.60, 1.87]
Household size (ref: 3 members)						
4 members	1.14	[0.54, 2.38]	1.96	[0.70, 5.48]	1.09	[0.51, 2.33]
5 members	1.02	[0.48, 2.18]	1.87	[0.63, 5.52]	0.94	[0.43, 2.05]
6 or more members	1.46	[0.71, 3.00]	3.34	[1.23, 9.06]*	1.44	[0.69, 3.02]
White spots on child's teeth observed by caregiver			0.69	[0.38, 1.28]		
Likelihood that child will have toothache according to caregiver (ref: Very likely)						
Likely			1.29	[0.55, 3.00]		
Normal			1.62	[0.58, 4.49]		
Unlikely			0.98	[0.28, 3.52]		
Very Unlikely			1.00	[0.38, 2.62]		
Reported food consumption on previous day						
Breastfed					1.54	[0.90, 2.64]
Bottled milk formula					0.65	[0.35, 1.20]
Bottled soy milk					0.73	[0.38, 1.41]
Bottled water					0.78	[0.34, 1.79]
Rice					4.41	[0.83, 23.58]^{T}
Constant	4.08	[1.08, 15.36]*	6.75	[1.07, 42.43]*	1.15	[0.13, 10.40]
Observations	338		218		333	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A3. Association of consumption of FLNV on previous day with being stunted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	OR	[95% CI]	OR	[95% CI]	OR	[95% CI]
FLNV	0.84	[0.49, 1.45]	1.03	[0.50, 2.09]	0.86	[0.50, 1.51]
Intervention	1.51	[0.94, 2.43]^{T}	0.93	[0.44, 1.93]	1.27	[0.78, 2.09]
Child sex (ref: male)	0.57	[0.36, 0.91]*	0.55	[0.30, 0.99]*	0.61	[0.38, 0.97]*
Income (ref: $0-50)		*				^{T}
$51-150	0.55	[0.22, 1.41]	0.38	[0.09, 1.52]	0.55	[0.22, 1.43]
$151-250	0.43	[0.17, 1.08]^{T}	0.22	[0.06, 0.89]*	0.44	[0.17, 1.13]^{T}
>$250	0.28	[0.11, 0.72]**	0.20	[0.05, 0.84]*	0.29	[0.11, 0.78]*
Mother's occupation (ref: Stay at home)		*		*		*
Seller	0.22	[0.06, 0.75]*	0.11	[0.03, 0.49]**	0.23	[0.07, 0.81]*
Farmer	0.24	[0.07, 0.84]*	0.17	[0.03, 0.91]*	0.25	[0.07, 0.88]*
Government worker	0.86	[0.07, 10.67]	2.07	[0.10, 42.72]	1.62	[0.11, 25.00]
Other	0.91	[0.53, 1.55]	0.78	[0.39, 1.58]	1.04	[0.60, 1.83]
Household size (ref: 3 members)						
4 members	1.12	[0.54, 2.35]	1.86	[0.67, 5.11]	1.09	[0.51, 2.31]
5 members	1.01	[0.47, 2.15]	1.78	[0.61, 5.22]	0.93	[0.43, 2.04]
6 or more members	1.43	[0.70, 2.93]	3.24	[1.21, 8.70]*	1.42	[0.68, 2.96]
White spots on child's teeth observed by caregiver			0.72	[0.39, 1.32]		
Likelihood that child will have toothache according to caregiver (ref: Very likely)						
Likely			1.34	[0.58, 3.12]		
Normal			1.60	[0.58, 4.40]		
Unlikely			1.10	[0.31, 3.84]		
Very Unlikely			0.97	[0.38, 2.51]		
Reported food consumption on previous day						
Breastfed					1.56	[0.91, 2.67]
Bottled milk formula					0.64	[0.35, 1.18]
Bottled soy milk					0.73	[0.38, 1.39]
Bottled water					0.79	[0.34, 1.83]
Rice					4.58	[0.86, 24.33]^{T}
Constant	4.17	[1.09, 15.97]*	5.50	[0.88, 34.36]^{T}	1.10	[0.12, 9.96]
Observations	339		218		334	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A4. Association of consumption of number of FLNV on previous day with being stunted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Number of FLNV (ref: 0)						
1	0.97	[0.51, 1.82]	1.27	[0.56, 2.90]	1.03	[0.54, 1.98]
2	0.93	[0.47, 1.84]	1.06	[0.43, 2.60]	0.88	[0.44, 1.77]
3 or more	0.60	[0.31, 1.19]	0.75	[0.30, 1.82]	0.64	[0.32, 1.28]
Intervention	1.52	[0.95, 2.46]^{T}	0.90	[0.43, 1.90]	1.28	[0.77, 2.11]
Child sex (ref: male)	0.62	[0.39, 0.98]*	0.57	[0.31, 1.03]^{T}	0.64	[0.40, 1.03]^{T}
Income (ref: $0-50)		*				^{T}
$51-150	0.52	[0.20, 1.36]	0.36	[0.09, 1.47]	0.53	[0.20, 1.39]
$151-250	0.39	[0.15, 1.00]^{T}	0.22	[0.05, 0.88]*	0.41	[0.16, 1.06]^{T}
>$250	0.27	[0.10, 0.71]**	0.20	[0.05, 0.83]*	0.28	[0.11, 0.76]*
Mother's occupation (ref: Stay at home)		*		*		*
Seller	0.24	[0.07, 0.83]*	0.12	[0.03, 0.54]**	0.24	[0.07, 0.86]*
Farmer	0.24	[0.07, 0.84]*	0.17	[0.03, 0.92]*	0.24	[0.07, 0.87]*
Government worker	0.96	[0.08, 12.32]	2.55	[0.11, 56.77]	1.71	[0.11, 27.50]
Other	0.94	[0.54, 1.61]	0.79	[0.39, 1.59]	1.06	[0.60, 1.86]
Household size (ref: 3 members)						
4 members	1.17	[0.56, 2.48]	1.94	[0.70, 5.36]	1.13	[0.53, 2.43]
5 members	1.04	[0.48, 2.25]	1.76	[0.60, 5.17]	0.96	[0.43, 2.12]
6 or more members	1.55	[0.75, 3.23]	3.45	[1.27, 9.37]*	1.52	[0.72, 3.23]
White spots on child's teeth observed by caregiver			0.70	[0.38, 1.30]		
Likelihood that child will have toothache according to caregiver (ref: Very likely)						
Likely			1.33	[0.57, 3.11]		
Normal			1.62	[0.58, 4.51]		
Unlikely			1.00	[0.28, 3.54]		
Very Unlikely			1.04	[0.40, 2.70]		
Reported food consumption on previous day						
Breastfed					1.54	[0.90, 2.64]
Bottled milk formula					0.66	[0.36, 1.23]
Bottled soy milk					0.75	[0.39, 1.44]
Bottled water					0.76	[0.33, 1.77]
Rice					4.63	[0.86, 25.01]^{T}
Constant	3.68	[0.94, 14.32]^{T}	5.35	[0.84, 34.25]^{T}	1.02	[0.11, 9.44]
Observations	337		218		332	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A5. Association of consumption of packaged snack on previous day with being stunted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Packaged snack on previous day	0.64	[0.41, 1.02]^{T}	0.65	[0.35, 1.20]	0.63	[0.39, 1.01]^{T}
Intervention	1.55	[0.97, 2.48]^{T}	0.97	[0.47, 2.03]	1.29	[0.79, 2.12]
Child sex (ref: male)	0.59	[0.37, 0.93]*	0.55	[0.31, 1.00]^{T}	0.62	[0.39, 0.99]*
Income (ref: $0-50)		*				^{T}
$51-150	0.54	[0.21, 1.39]	0.41	[0.10, 1.63]	0.55	[0.21, 1.42]
$151-250	0.41	[0.16, 1.05]^{T}	0.24	[0.06, 0.95]*	0.43	[0.17, 1.11]^{T}
>$250	0.28	[0.11, 0.73]**	0.23	[0.06, 0.95]*	0.30	[0.11, 0.79]*
Mother's occupation (ref: Stay at home)		*		*		*
Seller	0.23	[0.07, 0.79]*	0.12	[0.03, 0.51]**	0.24	[0.07, 0.85]*
Farmer	0.25	[0.07, 0.85]*	0.17	[0.03, 0.93]*	0.25	[0.07, 0.89]*
Government worker	0.92	[0.08, 11.26]	2.57	[0.12, 53.95]	1.71	[0.11, 26.36]
Other	0.91	[0.53, 1.55]	0.77	[0.38, 1.55]	1.05	[0.59, 1.84]
Household size (ref: 3 members)						
4 members	1.14	[0.54, 2.38]	1.94	[0.70, 5.38]	1.11	[0.52, 2.36]
5 members	0.99	[0.47, 2.13]	1.81	[0.62, 5.35]	0.93	[0.43, 2.03]
6 or more members	1.49	[0.73, 3.07]	3.36	[1.24, 9.10]*	1.50	[0.71, 3.14]
White spots on child's teeth observed by caregiver			0.68	[0.37, 1.25]		
Likelihood that child will have toothache according to caregiver (ref: Very likely)						
Likely			1.22	[0.52, 2.84]		
Normal			1.50	[0.55, 4.12]		
Unlikely			0.96	[0.27, 3.45]		
Very Unlikely			0.96	[0.37, 2.47]		
Reported food consumption on previous day						
Breastfed					1.55	[0.90, 2.65]
Bottled milk formula					0.62	[0.33, 1.15]
Bottled soy milk					0.73	[0.38, 1.40]
Bottled water					0.79	[0.34, 1.82]
Rice					4.80	[0.87, 26.42]^{T}
Constant	4.50	[1.22, 16.68]*	6.84	[1.15, 40.90]*	1.18	[0.13, 10.62]
Observations	339		218		334	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A6. Association of consumption of numbers of packaged snack on previous day with being stunted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	OR	[95% CI]	OR	[95% CI]	OR	[95% CI]
Number of packaged snacks						
1	0.68	[0.41, 1.13]	0.78	[0.40, 1.51]	0.64	[0.38, 1.07]^{T}
2 or more	0.57	[0.30, 1.08]^{T}	0.39	[0.15, 0.98]*	0.61	[0.32, 1.18]
Intervention	1.55	[0.97, 2.48]^{T}	0.92	[0.44, 1.94]	1.29	[0.79, 2.12]
Child sex (ref: male)	0.59	[0.37, 0.94]*	0.57	[0.31, 1.03]^{T}	0.62	[0.39, 0.99]*
Income (ref: $0-50)		*				^{T}
$51-150	0.54	[0.21, 1.40]	0.40	[0.10, 1.58]	0.55	[0.21, 1.42]
$151-250	0.41	[0.16, 1.04]^{T}	0.22	[0.05, 0.87]*	0.43	[0.16, 1.11]^{T}
>$250	0.28	[0.11, 0.73]**	0.22	[0.05, 0.90]*	0.30	[0.11, 0.79]*
Mother's occupation (ref: Stay at home)		*		*		*
Seller	0.23	[0.07, 0.80]*	0.11	[0.02, 0.49]**	0.24	[0.07, 0.85]*
Farmer	0.25	[0.07, 0.85]*	0.19	[0.04, 1.01]^{T}	0.25	[0.07, 0.89]*
Government worker	1.02	[0.08, 12.84]	4.86	[0.21, 115.09]	1.75	[0.11, 27.26]
Other	0.93	[0.54, 1.59]	0.80	[0.39, 1.63]	1.05	[0.59, 1.86]
Household size (ref: 3 members)						
4 members	1.15	[0.55, 2.41]	2.06	[0.74, 5.74]	1.11	[0.52, 2.37]
5 members	1.00	[0.47, 2.15]	1.88	[0.63, 5.56]	0.93	[0.43, 2.04]
6 or more members	1.52	[0.74, 3.14]	3.78	[1.37, 10.41]*	1.50	[0.71, 3.16]
White spots on child's teeth observed by caregiver			0.67	[0.36, 1.24]		
Likelihood that child will have toothache according to caregiver (ref: Very likely)			1.28	[0.54, 3.00]		
Likely			1.70	[0.60, 4.78]		
Normal			0.96	[0.27, 3.45]		
Unlikely			1.07	[0.41, 2.80]		
Very Unlikely					1.54	[0.90, 2.65]
Reported food consumption on previous day					0.62	[0.33, 1.15]
Breastfed					0.73	[0.38, 1.40]
Bottled milk formula					0.79	[0.34, 1.82]
Bottled soy milk					4.76	[0.86, 26.34]^{T}
Bottled water	4.40	[1.19, 16.32]*	6.29	[1.04, 37.95]*	1.19	[0.13, 10.69]
Rice	339		218		334	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A7. Association of consumption of packaged sweet on previous day with being stunted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Packaged sweet on previous day	0.99	[0.60, 1.61]	1.35	[0.71, 2.58]	0.98	[0.59, 1.61]
Intervention	1.57	[0.98, 2.50]^{T}	0.91	[0.43, 1.90]	1.31	[0.80, 2.14]
Child sex (ref: male)	0.58	[0.37, 0.92]*	0.55	[0.31, 1.00]*	0.61	[0.38, 0.98]*
Income (ref: $0-50)		*		^{T}		^{T}
$51-150	0.55	[0.21, 1.40]	0.37	[0.09, 1.49]	0.55	[0.21, 1.42]
$151-250	0.42	[0.17, 1.06]^{T}	0.22	[0.05, 0.87]*	0.44	[0.17, 1.12]^{T}
>$250	0.27	[0.11, 0.71]**	0.20	[0.05, 0.81]*	0.29	[0.11, 0.77]*
Mother's occupation (ref: Stay at home)		*		*		*
Seller	0.22	[0.06, 0.76]*	0.10	[0.02, 0.46]**	0.23	[0.07, 0.81]*
Farmer	0.25	[0.07, 0.85]*	0.16	[0.03, 0.90]*	0.25	[0.07, 0.88]*
Government worker	0.88	[0.07, 11.09]	2.25	[0.11, 46.64]	1.64	[0.11, 25.69]
Other	0.93	[0.55, 1.60]	0.79	[0.39, 1.59]	1.07	[0.61, 1.87]
Household size (ref: 3 members)						
4 members	1.10	[0.53, 2.29]	1.85	[0.68, 5.08]	1.06	[0.50, 2.25]
5 members	0.98	[0.46, 2.09]	1.77	[0.60, 5.19]	0.91	[0.42, 1.98]
6 or more members	1.39	[0.68, 2.85]	3.32	[1.23, 8.94]*	1.39	[0.66, 2.89]
White spots on child's teeth observed by caregiver			0.74	[0.40, 1.34]		
Likelihood that child will have toothache according to caregiver (ref: Very likely)						
Likely			1.39	[0.60, 3.22]		
Normal			1.56	[0.57, 4.30]		
Unlikely			1.17	[0.33, 4.11]		
Very Unlikely			0.98	[0.38, 2.52]		
Reported food consumption on previous day						
Breastfed					1.55	[0.90, 2.66]
Bottled milk formula					0.65	[0.35, 1.20]
Bottled soy milk					0.72	[0.38, 1.38]
Bottled water					0.79	[0.34, 1.82]
Rice					4.51	[0.85, 23.92]^{T}
Constant	3.55	[0.99, 12.81]^{T}	5.06	[0.87, 29.33]^{T}	0.99	[0.11, 8.61]
Observations	338		218		333	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A8. Association of consumption of number of packaged sweet on previous day with being stunted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Number of packaged sweets						
1	1.17	[0.63, 2.16]	1.49	[0.68, 3.27]	1.16	[0.62, 2.19]
2 or more	0.80	[0.41, 1.57]	1.18	[0.47, 2.95]	0.79	[0.40, 1.57]
Intervention	1.57	[0.98, 2.50]^{T}	0.89	[0.42, 1.87]	1.31	[0.80, 2.14]
Child sex (ref: male)	0.58	[0.37, 0.92]*	0.55	[0.31, 1.00]^{T}	0.62	[0.39, 0.98]*
Income (ref: $0-50)		*				^{T}
$51-150	0.56	[0.22, 1.43]	0.38	[0.09, 1.50]	0.56	[0.22, 1.45]
$151-250	0.43	[0.17, 1.10]^{T}	0.22	[0.06, 0.89]*	0.45	[0.18, 1.16]^{T}
>$250	0.28	[0.11, 0.74]**	0.20	[0.05, 0.83]*	0.30	[0.11, 0.80]*
Mother's occupation (ref: Stay at home)		*		*		*
Seller	0.23	[0.07, 0.81]*	0.11	[0.02, 0.49]**	0.24	[0.07, 0.86]*
Farmer	0.26	[0.07, 0.90]*	0.17	[0.03, 0.93]*	0.26	[0.07, 0.94]*
Government worker	0.89	[0.07, 11.14]	2.27	[0.11, 46.93]	1.66	[0.11, 25.98]
Other	0.95	[0.55, 1.63]	0.79	[0.39, 1.60]	1.08	[0.61, 1.90]
Household size (ref: 3 members)						
4 members	1.10	[0.53, 2.31]	1.86	[0.68, 5.10]	1.07	[0.50, 2.27]
5 members	0.97	[0.46, 2.08]	1.76	[0.60, 5.18]	0.90	[0.41, 1.97]
6 or more members	1.38	[0.68, 2.83]	3.29	[1.22, 8.88]*	1.38	[0.66, 2.87]
White spots on child's teeth observed by caregiver			0.73	[0.40, 1.33]		
Likelihood that child will have toothache according to caregiver (ref: Very likely)						
Likely			1.41	[0.61, 3.28]		
Normal			1.63	[0.58, 4.59]		
Unlikely			1.18	[0.34, 4.15]		
Very Unlikely			0.98	[0.38, 2.54]		
Reported food consumption on previous day						
Breastfed					1.54	[0.89, 2.64]
Bottled milk formula					0.65	[0.35, 1.20]
Bottled soy milk					0.74	[0.39, 1.41]
Bottled water					0.77	[0.33, 1.77]
Rice					4.60	[0.86, 24.69]^{T}
Constant	3.42	[0.95, 12.40]^{T}	4.98	[0.85, 28.97]^{T}	0.95	[0.11, 8.42]
Observations	338		218		333	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A9. Association of consumption of bottled fruit juice or other sweetened beverage on previous day with being underweight at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		**Model 2: Adjusted for sociodemographic and health covariates**		**Model 3: Adjusted for sociodemographic and food covariates**		Model 0: Sociodemographic covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Bottled fruit juice or other sweetened drink on the previous day	1.52	[0.86, 2.68]	1.61	[0.89, 2.90]	1.58	[0.88, 2.83]		
Intervention	1.54	[0.87, 2.74]	1.15	[0.55, 2.40]	1.63	[0.89, 2.98]	1.57	[0.88, 2.78]
Child sex (ref: male)	1.05	[0.63, 1.74]	1.06	[0.63, 1.81]	1.10	[0.65, 1.84]	1.04	[0.63, 1.73]
Income (ref: $0-50)								
$51-150	0.93	[0.37, 2.35]	0.89	[0.34, 2.34]	0.93	[0.37, 2.35]	0.98	[0.39, 2.45]
$151-250	0.50	[0.19, 1.26]	0.46	[0.18, 1.21]	0.44	[0.17, 1.13]^{T}	0.52	[0.20, 1.31]
>$250	0.52	[0.20, 1.37]	0.47	[0.17, 1.27]	0.53	[0.20, 1.41]	0.54	[0.21, 1.41]
Mother's occupation (ref: Stay at home)								
Seller	0.57	[0.17, 1.88]	0.49	[0.14, 1.73]	0.59	[0.17, 1.98]	0.63	[0.19, 2.04]
Farmer	0.90	[0.29, 2.77]	0.92	[0.29, 2.91]	0.71	[0.22, 2.34]	0.92	[0.30, 2.84]
Government worker	-		-		-		-	
Other	0.83	[0.46, 1.50]	0.79	[0.42, 1.48]	0.88	[0.47, 1.62]	0.85	[0.47, 1.53]
Electricity (ref: no electricity)	0.44	[0.22, 0.89]*	0.38	[0.18, 0.81]*	0.43	[0.21, 0.88]*	0.45	[0.22, 0.91]*
Household size (ref: 3 members)								
4 members	1.27	[0.53, 3.06]	1.33	[0.53, 3.31]	1.24	[0.50, 3.05]	1.26	[0.53, 3.01]
5 members	2.00	[0.85, 4.73]	2.34	[0.94, 5.79]^{T}	1.93	[0.79, 4.68]	1.96	[0.83, 4.58]
6 or more members	1.39	[0.59, 3.25]	1.54	[0.63, 3.76]	1.33	[0.56, 3.20]	1.42	[0.61, 3.31]
White spots on child's teeth observed by caregiver			1.89	[1.09, 3.28]*				
Likelihood that child will have toothache according to caregiver (ref: Very likely)								
Likely			1.76	[0.81, 3.79]				
Normal			0.55	[0.22, 1.37]				
Unlikely			2.11	[0.69, 6.45]				
Very Unlikely			0.66	[0.26, 1.65]				
Reported food consumption on previous day								
Breastfed					1.37	[0.77, 2.46]		
Bottled milk formula					0.81	[0.39, 1.70]		
Bottled soy milk					0.90	[0.44, 1.84]		
Bottled water					1.30	[0.52, 3.24]		
Rice					0.82	[0.20, 3.34]		
Constant	0.62	[0.14, 2.63]	0.51	[0.11, 2.37]	0.52	[0.07, 4.13]	0.64	[0.15, 2.71]
Observations	334		327		329		335	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A10. Association of consumption of number of packaged foods on previous day with being underweight at 24 months of age

	Model 1: Adjusted for sociodemographic covariates	Model 2: Adjusted for sociodemographic and health covariates	Model 3: Adjusted for sociodemographic and food covariates
VARIABLES	**OR [95% CI]**	**OR [95% CI]**	**OR [95% CI]**
Number of packaged foods			
1	0.76 [0.41, 1.41]	0.73 [0.38, 1.41]	0.79 [0.42, 1.49]
2	0.77 [0.36, 1.66]	0.70 [0.31, 1.56]	0.78 [0.36, 1.69]
3 or more	0.62 [0.28, 1.36]	0.68 [0.30, 1.54]	0.68 [0.31, 1.50]
Intervention	1.50 [0.84, 2.68]	1.18 [0.56, 2.47]	1.58 [0.87, 2.90]
Child sex (ref: male)	1.07 [0.64, 1.79]	1.08 [0.63, 1.84]	1.11 [0.66, 1.88]
Income (ref: $0-50)			
$51-150	0.97 [0.38, 2.45]	0.94 [0.36, 2.46]	0.96 [0.38, 2.45]
$151-250	0.51 [0.20, 1.31]	0.47 [0.18, 1.22]	0.45 [0.17, 1.17]
>$250	0.55 [0.21, 1.45]	0.49 [0.18, 1.33]	0.56 [0.21, 1.49]
Mother's occupation (ref: Stay at home)			
Seller	0.66 [0.20, 2.18]	0.57 [0.16, 2.02]	0.66 [0.20, 2.23]
Farmer	0.92 [0.30, 2.84]	0.93 [0.29, 2.95]	0.73 [0.22, 2.40]
Government worker	-	-	-
Other	0.82 [0.45, 1.50]	0.80 [0.43, 1.50]	0.87 [0.47, 1.61]
Electricity (ref: no electricity)	0.45 [0.22, 0.90]*	0.39 [0.19, 0.82]*	0.44 [0.21, 0.89]*
Household size (ref: 3 members)			
4 members	1.34 [0.55, 3.23]	1.42 [0.57, 3.56]	1.31 [0.53, 3.22]
5 members	2.09 [0.88, 4.95]^{T}	2.48 [0.99, 6.20]^{T}	2.01 [0.82, 4.90]
6 or more members	1.54 [0.65, 3.62]	1.72 [0.70, 4.23]	1.48 [0.62, 3.57]
White spots on child's teeth observed by caregiver		1.88 [1.08, 3.28]*	
Likelihood that child will have toothache according to caregiver (ref: Very likely)			
Likely		1.64 [0.75, 3.56]	
Normal		0.52 [0.20, 1.32]	
Unlikely		1.93 [0.63, 5.90]	
Very Unlikely		0.68 [0.27, 1.69]	
Reported food consumption on previous day			
Breastfed			1.40 [0.78, 2.51]
Bottled milk formula			0.78 [0.37, 1.62]
Bottled soy milk			0.96 [0.47, 1.98]
Bottled water			1.31 [0.52, 3.30]
Rice			0.94 [0.23, 3.80]
Constant	0.75 [0.17, 3.30]	0.64 [0.13, 3.03]	0.55 [0.07, 4.48]
Observations	334	328	329

** p<0.01, * p<0.05, ^{T} p<0.1

Table A11. Association of consumption of FLNV on previous day with being underweight at 24 months of age

	Model 1: Adjusted for sociodemographic covariates	Model 2: Adjusted for sociodemographic and health covariates	Model 3: Adjusted for sociodemographic and food covariates
VARIABLES	**OR [95% CI]**	**OR [95% CI]**	**OR [95% CI]**
Packaged food on previous day	0.73 [0.41, 1.32]	0.78 [0.42, 1.45]	0.79 [0.43, 1.44]
Intervention	1.50 [0.84, 2.68]	1.16 [0.56, 2.42]	1.59 [0.87, 2.91]
Child sex (ref: male)	1.05 [0.63, 1.74]	1.05 [0.62, 1.79]	1.09 [0.65, 1.84]
Income (ref: $0-50)			
$51-150	1.00 [0.40, 2.52]	0.95 [0.36, 2.48]	0.98 [0.38, 2.48]
$151-250	0.52 [0.20, 1.32]	0.48 [0.18, 1.25]	0.45 [0.17, 1.18]
>$250	0.55 [0.21, 1.44]	0.50 [0.18, 1.34]	0.56 [0.21, 1.48]
Mother's occupation (ref: Stay at home)			
Seller	0.64 [0.20, 2.10]	0.57 [0.17, 1.97]	0.65 [0.20, 2.18]
Farmer	0.94 [0.30, 2.89]	0.93 [0.29, 2.97]	0.74 [0.22, 2.44]
Government worker	-	-	-
Other	0.84 [0.46, 1.52]	0.81 [0.44, 1.51]	0.88 [0.48, 1.63]
Electricity (ref: no electricity)	0.44 [0.22, 0.89]*	0.39 [0.19, 0.81]*	0.44 [0.21, 0.89]*
Household size (ref: 3 members)			
4 members	1.33 [0.55, 3.21]	1.39 [0.56, 3.48]	1.29 [0.52, 3.19]
5 members	2.09 [0.88, 4.97]^{T}	2.43 [0.98, 6.06]^{T}	2.00 [0.82, 4.89]
6 or more members	1.48 [0.63, 3.47]	1.67 [0.68, 4.07]	1.42 [0.59, 3.42]
White spots on child's teeth observed by caregiver		1.87 [1.07, 3.24]*	
Likelihood that child will have toothache according to caregiver (ref: Very likely)			
Likely		1.66 [0.76, 3.59]	
Normal		0.53 [0.21, 1.34]	
Unlikely		1.97 [0.65, 5.99]	
Very Unlikely		0.69 [0.28, 1.72]	
Reported food consumption on previous day			
Breastfed			1.38 [0.77, 2.48]
Bottled milk formula			0.77 [0.37, 1.61]
Bottled soy milk			0.97 [0.47, 1.99]
Bottled water			1.32 [0.53, 3.29]
Rice			0.95 [0.24, 3.84]
Constant	0.79 [0.18, 3.53]	0.63 [0.13, 3.06]	0.56 [0.07, 4.52]
Observations	335	328	330

** p<0.01, * p<0.05, ^{T} p<0.1

Table A12. Association of consumption of number of FLNV on previous day with being underweight at 24 months of age

	Model 1: Adjusted for sociodemographic covariates	Model 2: Adjusted for sociodemographic and health covariates	Model 3: Adjusted for sociodemographic and food covariates
VARIABLES	**OR [95% CI]**	**OR [95% CI]**	**OR [95% CI]**
Number of FLNV			
1	0.60 [0.30, 1.21]	0.64 [0.31, 1.35]	0.65 [0.31, 1.33]
2	1.10 [0.53, 2.26]	1.10 [0.51, 2.37]	1.12 [0.53, 2.34]
3 or more	0.64 [0.30, 1.35]	0.71 [0.32, 1.56]	0.71 [0.33, 1.54]
Intervention	1.57 [0.87, 2.84]	1.19 [0.57, 2.52]	1.68 [0.90, 3.11]
Child sex (ref: male)	1.08 [0.65, 1.81]	1.09 [0.64, 1.87]	1.12 [0.66, 1.90]
Income (ref: $0-50)			
$51-150	0.93 [0.36, 2.37]	0.90 [0.34, 2.36]	0.92 [0.36, 2.36]
$151-250	0.51 [0.20, 1.31]	0.47 [0.18, 1.24]	0.45 [0.17, 1.17]
>$250	0.55 [0.21, 1.46]	0.50 [0.19, 1.36]	0.56 [0.21, 1.48]
Mother's occupation (ref: Stay at home)			
Seller	0.70 [0.21, 2.31]	0.63 [0.18, 2.20]	0.68 [0.20, 2.28]
Farmer	0.92 [0.29, 2.87]	0.91 [0.28, 2.92]	0.72 [0.21, 2.41]
Government worker	-	-	-
Other	0.85 [0.47, 1.54]	0.83 [0.44, 1.54]	0.88 [0.47, 1.63]
Electricity (ref: no electricity)	0.46 [0.23, 0.94]*	0.40 [0.19, 0.85]*	0.45 [0.22, 0.92]*
Household size (ref: 3 members)			
4 members	1.29 [0.53, 3.13]	1.36 [0.54, 3.43]	1.27 [0.51, 3.16]
5 members	2.13 [0.89, 5.10]^{T}	2.52 [1.01, 6.33]*	2.07 [0.84, 5.10]
6 or more members	1.55 [0.65, 3.65]	1.72 [0.70, 4.23]	1.50 [0.62, 3.62]
White spots on child's teeth observed by caregiver		1.87 [1.08, 3.26]*	
Likelihood that child will have toothache according to caregiver (ref: Very likely)			
Likely		1.72 [0.78, 3.78]	
Normal		0.57 [0.22, 1.44]	
Unlikely		2.06 [0.67, 6.27]	
Very Unlikely		0.71 [0.29, 1.78]	
Reported food consumption on previous day			
Breastfed			1.39 [0.77, 2.49]
Bottled milk formula			0.82 [0.39, 1.72]
Bottled soy milk			1.04 [0.50, 2.15]
Bottled water			1.34 [0.53, 3.37]
Rice			0.93 [0.23, 3.74]
Constant	0.70 [0.15, 3.21]	0.54 [0.11, 2.69]	0.50 [0.06, 4.16]
Observations	333	327	328

** p<0.01, * p<0.05, ^{T} p<0.1

Table A13. Association of consumption of packaged snack on previous day with being underweight at 24 months of age

	Model 1: Adjusted for sociodemographic covariates	Model 2: Adjusted for sociodemographic and health covariates	Model 3: Adjusted for sociodemographic and food covariates
VARIABLES	**OR [95% CI]**	**OR [95% CI]**	**OR [95% CI]**
Packaged snack on previous day	0.60 [0.36, 1.01]^{T}	0.54 [0.31, 0.93]*	0.65 [0.39, 1.10]
Intervention	1.54 [0.86, 2.74]	1.25 [0.59, 2.62]	1.61 [0.88, 2.94]
Child sex (ref: male)	1.10 [0.66, 1.84]	1.13 [0.66, 1.94]	1.14 [0.67, 1.93]
Income (ref: $0-50)			
$51-150	0.99 [0.39, 2.49]	0.92 [0.35, 2.41]	0.97 [0.38, 2.47]
$151-250	0.51 [0.20, 1.29]	0.45 [0.17, 1.19]	0.44 [0.17, 1.16]^{T}
>$250	0.56 [0.21, 1.48]	0.49 [0.18, 1.34]	0.57 [0.21, 1.51]
Mother's occupation (ref: Stay at home)			
Seller	0.67 [0.20, 2.21]	0.62 [0.17, 2.21]	0.68 [0.20, 2.29]
Farmer	0.95 [0.30, 2.96]	0.96 [0.30, 3.09]	0.74 [0.22, 2.48]
Government worker	-	-	-
Other	0.84 [0.47, 1.53]	0.83 [0.44, 1.55]	0.89 [0.48, 1.65]
Electricity (ref: no electricity)	0.43 [0.21, 0.87]*	0.37 [0.18, 0.79]**	0.43 [0.21, 0.87]*
Household size (ref: 3 members)			
4 members	1.35 [0.56, 3.27]	1.50 [0.60, 3.77]	1.31 [0.53, 3.23]
5 members	2.07 [0.88, 4.91]^{T}	2.57 [1.03, 6.44]*	1.99 [0.82, 4.82]
6 or more members	1.56 [0.66, 3.68]	1.85 [0.75, 4.56]	1.49 [0.62, 3.60]
White spots on child's teeth observed by caregiver		1.94 [1.11, 3.40]*	
Likelihood that child will have toothache according to caregiver (ref: Very likely)			
Likely		1.51 [0.69, 3.30]	
Normal		0.45 [0.18, 1.17]	
Unlikely		1.77 [0.58, 5.37]	
Very Unlikely		0.65 [0.26, 1.63]	
Reported food consumption on previous day			
Breastfed			1.37 [0.76, 2.45]
Bottled milk formula			0.76 [0.37, 1.58]
Bottled soy milk			0.97 [0.47, 1.98]
Bottled water			1.30 [0.52, 3.26]
Rice			0.98 [0.24, 4.00]
Constant	0.76 [0.18, 3.26]	0.66 [0.14, 3.08]	0.54 [0.07, 4.35]
Observations	335	328	330

** p<0.01, * p<0.05, ^{T} p<0.1

Table A14. Association of consumption of numbers of packaged snack on previous day with being underweight at 24 months of age

	Model 1: Adjusted for sociodemographic covariates	Model 2: Adjusted for sociodemographic and health covariates	Model 3: Adjusted for sociodemographic and food covariates
VARIABLES	**OR [95% CI]**	**OR [95% CI]**	**OR [95% CI]**
Number of packaged snacks			
1	0.54 [0.31, 0.96]*	0.47 [0.26, 0.87]*	0.58 [0.32, 1.04]^{T}
2 or more	0.75 [0.37, 1.52]	0.69 [0.33, 1.45]	0.83 [0.41, 1.71]
Intervention	1.53 [0.86, 2.73]	1.28 [0.61, 2.70]	1.60 [0.88, 2.92]
Child sex (ref: male)	1.09 [0.65, 1.83]	1.12 [0.65, 1.92]	1.13 [0.67, 1.91]
Income (ref: $0-50)			
$51-150	0.98 [0.39, 2.49]	0.90 [0.34, 2.38]	0.97 [0.38, 2.47]
$151-250	0.52 [0.20, 1.34]	0.46 [0.17, 1.23]	0.46 [0.17, 1.20]
>$250	0.57 [0.22, 1.50]	0.50 [0.18, 1.35]	0.58 [0.22, 1.54]
Mother's occupation (ref: Stay at home)			
Seller	0.65 [0.20, 2.16]	0.62 [0.17, 2.20]	0.66 [0.20, 2.23]
Farmer	0.95 [0.30, 2.97]	0.96 [0.30, 3.12]	0.75 [0.22, 2.51]
Government worker	-	-	-
Other	0.81 [0.45, 1.49]	0.80 [0.43, 1.51]	0.86 [0.46, 1.61]
Electricity (ref: no electricity)	0.41 [0.20, 0.85]*	0.36 [0.17, 0.76]**	0.41 [0.20, 0.84]*
Household size (ref: 3 members)			
4 members	1.36 [0.56, 3.28]	1.50 [0.60, 3.78]	1.31 [0.53, 3.23]
5 members	2.07 [0.87, 4.91]^{T}	2.60 [1.03, 6.53]*	1.97 [0.81, 4.80]
6 or more members	1.53 [0.64, 3.61]	1.79 [0.72, 4.45]	1.46 [0.60, 3.52]
White spots on child's teeth observed by caregiver		1.98 [1.13, 3.46]*	
Likelihood that child will have toothache according to caregiver (ref: Very likely)			
Likely		1.44 [0.65, 3.17]	
Normal		0.43 [0.16, 1.11]^{T}	
Unlikely		1.72 [0.56, 5.24]	
Very Unlikely		0.63 [0.25, 1.58]	
Reported food consumption on previous day			
Breastfed			1.41 [0.78, 2.54]
Bottled milk formula			0.76 [0.37, 1.58]
Bottled soy milk			0.96 [0.46, 1.96]
Bottled water			1.30 [0.52, 3.26]
Rice			1.04 [0.25, 4.24]
Constant	0.81 [0.19, 3.54]	0.71 [0.15, 3.38]	0.55 [0.07, 4.41]
Observations	335	328	330

** p<0.01, * p<0.05, ^{T} p<0.1

Table A15. Association of consumption of packaged sweet on previous day with being underweight at 24 months of age

	Model 1: Adjusted for sociodemographic covariates	Model 2: Adjusted for sociodemographic and health covariates	Model 3: Adjusted for sociodemographic and food covariates
VARIABLES	**OR [95% CI]**	**OR [95% CI]**	**OR [95% CI]**
Packaged sweet on previous day	0.95 [0.55, 1.64]	1.11 [0.63, 1.96]	0.89 [0.51, 1.57]
Intervention	1.55 [0.87, 2.76]	1.18 [0.57, 2.45]	1.62 [0.89, 2.96]
Child sex (ref: male)	1.03 [0.62, 1.72]	1.05 [0.62, 1.78]	1.08 [0.65, 1.82]
Income (ref: $0-50)			
$51-150	0.98 [0.39, 2.46]	0.92 [0.35, 2.41]	0.96 [0.38, 2.45]
$151-250	0.52 [0.21, 1.33]	0.47 [0.18, 1.24]	0.46 [0.18, 1.19]
>$250	0.55 [0.21, 1.42]	0.48 [0.18, 1.30]	0.56 [0.21, 1.47]
Mother's occupation (ref: Stay at home)			
Seller	0.62 [0.19, 2.02]	0.56 [0.16, 1.92]	0.64 [0.19, 2.12]
Farmer	0.91 [0.30, 2.80]	0.94 [0.29, 2.98]	0.71 [0.22, 2.34]
Government worker	-	-	-
Other	0.83 [0.46, 1.51]	0.82 [0.44, 1.53]	0.88 [0.47, 1.62]
Electricity (ref: no electricity)	0.45 [0.22, 0.90]*	0.39 [0.19, 0.82]*	0.44 [0.22, 0.89]*
Household size (ref: 3 members)			
4 members	1.26 [0.53, 3.02]	1.33 [0.54, 3.29]	1.25 [0.51, 3.05]
5 members	1.97 [0.84, 4.62]	2.30 [0.94, 5.66]^{T}	1.92 [0.80, 4.64]
6 or more members	1.44 [0.62, 3.35]	1.61 [0.67, 3.90]	1.41 [0.59, 3.36]
White spots on child's teeth observed by caregiver		1.84 [1.06, 3.19]*	
Likelihood that child will have toothache according to caregiver (ref: Very likely)			
Likely		1.75 [0.81, 3.77]	
Normal		0.53 [0.21, 1.34]	
Unlikely		2.06 [0.68, 6.26]	
Very Unlikely		0.69 [0.28, 1.71]	
Reported food consumption on previous day			
Breastfed			1.43 [0.79, 2.57]
Bottled milk formula			0.77 [0.37, 1.60]
Bottled soy milk			0.95 [0.46, 1.93]
Bottled water			1.33 [0.53, 3.34]
Rice			0.93 [0.23, 3.73]
Constant	0.66 [0.15, 2.82]	0.53 [0.11, 2.42]	0.50 [0.06, 3.94]
Observations	334	328	329

** p<0.01, * p<0.05, ^{T} p<0.1

Table A16. Association of consumption of number of packaged sweet on previous day with being underweight at 24 months of age

	Model 1: Adjusted for sociodemographic covariates	Model 2: Adjusted for sociodemographic and health covariates	Model 3: Adjusted for sociodemographic and food covariates
VARIABLES	**OR [95% CI]**	**OR [95% CI]**	**OR [95% CI]**
Number of packaged sweets			
1	1.31 [0.68, 2.54]	1.50 [0.75, 3.02]	1.16 [0.58, 2.31]
2 or more	0.61 [0.27, 1.38]	0.74 [0.32, 1.71]	0.63 [0.28, 1.43]
Intervention	1.55 [0.87, 2.76]	1.12 [0.53, 2.34]	1.60 [0.88, 2.93]
Child sex (ref: male)	1.04 [0.63, 1.74]	1.06 [0.62, 1.80]	1.09 [0.65, 1.83]
Income (ref: $0-50)			
$51-150	1.01 [0.40, 2.54]	0.97 [0.37, 2.55]	0.99 [0.39, 2.53]
$151-250	0.55 [0.22, 1.41]	0.50 [0.19, 1.32]	0.48 [0.18, 1.26]
>$250	0.58 [0.22, 1.52]	0.52 [0.19, 1.40]	0.59 [0.22, 1.57]
Mother's occupation (ref: Stay at home)			
Seller	0.70 [0.21, 2.33]	0.62 [0.18, 2.13]	0.70 [0.21, 2.36]
Farmer	1.02 [0.33, 3.17]	1.03 [0.32, 3.34]	0.78 [0.23, 2.60]
Government worker	-	-	-
Other	0.87 [0.48, 1.58]	0.85 [0.45, 1.58]	0.90 [0.49, 1.68]
Electricity (ref: no electricity)	0.45 [0.22, 0.90]*	0.39 [0.18, 0.81]*	0.44 [0.21, 0.89]*
Household size (ref: 3 members)			
4 members	1.28 [0.53, 3.06]	1.34 [0.54, 3.32]	1.25 [0.51, 3.06]
5 members	1.96 [0.83, 4.60]	2.24 [0.91, 5.54]^{T}	1.90 [0.79, 4.58]
6 or more members	1.43 [0.61, 3.32]	1.58 [0.65, 3.83]	1.39 [0.58, 3.31]
White spots on child's teeth observed by caregiver		1.83 [1.05, 3.17]*	
Likelihood that child will have toothache according to caregiver (ref: Very likely)			
Likely		1.90 [0.87, 4.13]	
Normal		0.60 [0.24, 1.53]	
Unlikely		2.16 [0.70, 6.61]	
Very Unlikely		0.69 [0.28, 1.71]	
Reported food consumption on previous day			
Breastfed			1.40 [0.78, 2.53]
Bottled milk formula			0.77 [0.37, 1.60]
Bottled soy milk			0.96 [0.47, 1.97]
Bottled water			1.24 [0.49, 3.12]
Rice			0.96 [0.24, 3.85]
Constant	0.61 [0.14, 2.60]	0.48 [0.10, 2.24]	0.49 [0.06, 3.91]
Observations	334	328	329

** p<0.01, * p<0.05, ^{T} p<0.1

Table A17. Association of consumption of bottled fruit juice or other sweetened beverage on previous day with being wasted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		**Model 2: Adjusted for sociodemographic and health covariates**		**Model 3: Adjusted for sociodemographic and food covariates**		Model 0: Sociodemographic covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**	OR	[95% CI]
Fruit juice or other sweetened beverage on previous day	2.52	[1.31, 4.85]**	2.43	[1.24, 4.78]*	2.61	[1.33, 5.11]**		
Intervention	3.46	[1.72, 6.95]**	4.56	[1.88, 11.06]**	3.88	[1.85, 8.13]**	3.35	[1.69, 6.67]**
Child sex (ref: male)	0.82	[0.45, 1.53]	0.85	[0.45, 1.61]	0.82	[0.44, 1.55]	0.82	[0.45, 1.51]
Income (ref: $0-50)								
$51-150	2.60	[0.68, 9.98]	2.34	[0.59, 9.33]	2.68	[0.69, 10.34]	2.87	[0.75, 10.96]
$151-250	1.44	[0.37, 5.64]	1.35	[0.34, 5.40]	1.26	[0.31, 5.04]	1.64	[0.42, 6.36]
>$250	1.45	[0.36, 5.80]	1.32	[0.32, 5.45]	1.46	[0.36, 5.91]	1.56	[0.39, 6.20]
Mother's occupation (ref: Stay at home)								
Seller	1.14	[0.30, 4.30]	0.88	[0.20, 3.84]	1.18	[0.31, 4.50]	1.26	[0.34, 4.72]
Farmer	0.50	[0.10, 2.62]	0.32	[0.05, 1.90]	0.53	[0.10, 2.81]	0.52	[0.10, 2.71]
Government worker	-		-		-		-	
Other	1.02	[0.49, 2.13]	0.96	[0.44, 2.07]	1.10	[0.51, 2.36]	1.04	[0.51, 2.16]
Household size (ref: 3 members)								
4 members	1.35	[0.47, 3.88]	1.91	[0.61, 5.94]	1.32	[0.45, 3.88]	1.28	[0.45, 3.60]
5 members	2.15	[0.74, 6.23]	2.75	[0.88, 8.56]^{T}	2.18	[0.73, 6.45]	1.91	[0.68, 5.39]
6 or more members	0.88	[0.30, 2.65]	1.17	[0.36, 3.76]	0.79	[0.26, 2.45]	0.91	[0.31, 2.67]
Took antibiotic last month			2.39	[1.11, 5.16]*				
Likelihood that child will have toothache according to caregiver (ref: Very likely)								
Likely			0.61	[0.24, 1.56]				
Normal			0.43	[0.15, 1.27]				
Unlikely			0.50	[0.12, 2.02]				
Very Unlikely			0.44	[0.13, 1.44]				
White spots noted by caregiver on child's teeth			1.36	[0.88, 2.09]				
Reported food consumption on previous day								
Breastfed					1.86	[0.94, 3.67]^{T}		
Bottled milk formula					0.87	[0.34, 2.22]		
Constant	0.04	[0.01, 0.26]**	0.03	[0.00, 0.20]**	0.03	[0.00, 0.21]**	0.05	[0.01, 0.31]**
Observations	341		330		337		342	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A18. Association of consumption of number of packaged foods on previous day with being wasted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Number of packaged foods						
1	1.47	[0.69, 3.11]	1.45	[0.67, 3.17]	1.41	[0.65, 3.04]
2	1.75	[0.73, 4.18]	1.71	[0.70, 4.20]	1.73	[0.71, 4.19]
3 or more	0.44	[0.13, 1.43]	0.49	[0.15, 1.63]	0.44	[0.13, 1.48]
Intervention	3.27	[1.63, 6.57]**	4.12	[1.74, 9.77]**	3.56	[1.70, 7.46]**
Child sex (ref: male)	0.85	[0.46, 1.58]	0.88	[0.46, 1.68]	0.85	[0.45, 1.61]
Income (ref: $0-50)						
$51-150	2.75	[0.71, 10.69]	2.43	[0.61, 9.73]	2.79	[0.71, 10.93]
$151-250	1.68	[0.43, 6.55]	1.54	[0.39, 6.10]	1.47	[0.37, 5.88]
>$250	1.66	[0.41, 6.63]	1.52	[0.37, 6.25]	1.74	[0.43, 7.10]
Mother's occupation (ref: Stay at home)						
Seller	1.47	[0.37, 5.77]	1.16	[0.26, 5.27]	1.52	[0.38, 6.09]
Farmer	0.54	[0.10, 2.83]	0.37	[0.06, 2.19]	0.56	[0.11, 2.98]
Government worker	-		-		-	
Other	1.12	[0.54, 2.33]	1.06	[0.49, 2.30]	1.22	[0.57, 2.61]
Household size (ref: 3 members)						
4 members	1.30	[0.45, 3.75]	2.06	[0.66, 6.45]	1.31	[0.45, 3.81]
5 members	1.88	[0.66, 5.42]	2.67	[0.85, 8.34]^{T}	1.89	[0.64, 5.54]
6 or more members	1.00	[0.34, 2.94]	1.44	[0.45, 4.59]	0.89	[0.29, 2.72]
Took antibiotic last month			2.61	[1.22, 5.59]*		
Likelihood that child will have toothache according to caregiver (ref: Very likely)						
Likely			0.67	[0.27, 1.70]		
Normal			0.47	[0.16, 1.38]		
Unlikely			0.55	[0.14, 2.22]		
Very Unlikely			0.49	[0.15, 1.60]		
White spots noted by caregiver on child's teeth			1.37	[0.88, 2.13]		
Reported food consumption on previous day						
Breastfed					1.94	[0.98, 3.83]^{T}
Bottled milk formula					0.79	[0.31, 1.99]
Constant	0.04	[0.01, 0.26]**	0.02	[0.00, 0.17]**	0.03	[0.00, 0.21]**
Observations	341		331		337	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A19. Association of consumption of FLNV on previous day with being wasted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
FLNV on previous day	1.31	[0.62, 2.78]	1.34	[0.61, 2.95]	1.34	[0.62, 2.88]
Intervention	3.47	[1.73, 6.94]**	4.62	[1.96, 10.91]**	3.79	[1.82, 7.88]**
Child sex (ref: male)	0.82	[0.45, 1.51]	0.86	[0.46, 1.62]	0.82	[0.44, 1.53]
Income (ref: $0-50)						
$51-150	2.80	[0.73, 10.69]	2.52	[0.64, 9.95]	2.85	[0.74, 10.96]
$151-250	1.64	[0.42, 6.34]	1.56	[0.40, 6.12]	1.45	[0.37, 5.74]
>$250	1.54	[0.39, 6.10]	1.42	[0.35, 5.80]	1.57	[0.39, 6.35]
Mother's occupation (ref: Stay at home)						
Seller	1.25	[0.33, 4.66]	0.97	[0.22, 4.18]	1.31	[0.35, 4.98]
Farmer	0.52	[0.10, 2.70]	0.35	[0.06, 2.05]	0.55	[0.11, 2.86]
Government worker	-		-		-	
Other	1.06	[0.51, 2.19]	1.04	[0.48, 2.23]	1.16	[0.54, 2.46]
Household size (ref: 3 members)						
4 members	1.24	[0.44, 3.52]	1.88	[0.61, 5.78]	1.24	[0.43, 3.57]
5 members	1.82	[0.64, 5.19]	2.56	[0.83, 7.86]	1.84	[0.63, 5.34]
6 or more members	0.90	[0.31, 2.63]	1.27	[0.41, 3.99]	0.81	[0.27, 2.45]
Took antibiotic last month			2.52	[1.19, 5.33]*		
Likelihood that child will have toothache according to caregiver (ref: Very likely)						
Likely			0.67	[0.27, 1.67]		
Normal			0.42	[0.15, 1.21]		
Unlikely			0.48	[0.12, 1.86]		
Very Unlikely			0.46	[0.14, 1.50]		
White spots noted by caregiver on child's teeth			1.32	[0.86, 2.01]		
Reported food consumption on previous day						
Breastfed					1.94	[0.99, 3.80]^{T}
Bottled milk formula					0.78	[0.31, 1.95]
Constant	0.04	[0.01, 0.28]**	0.02	[0.00, 0.19]**	0.03	[0.00, 0.23]**
Observations	342		331		338	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A20. Association of consumption of number of FLNV on previous day with being wasted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Number of FLNV on previous day						
1	1.26	[0.53, 2.97]	1.27	[0.51, 3.13]	1.31	[0.55, 3.14]
2	1.99	[0.81, 4.86]	1.98	[0.78, 5.03]	1.88	[0.75, 4.73]
3 or more	0.88	[0.33, 2.36]	0.95	[0.35, 2.61]	0.95	[0.35, 2.58]
Intervention	3.54	[1.74, 7.18]**	4.57	[1.92, 10.90]**	3.89	[1.84, 8.23]**
Child sex (ref: male)	0.87	[0.47, 1.61]	0.92	[0.48, 1.75]	0.86	[0.46, 1.62]
Income (ref: $0-50)						
$51-150	2.52	[0.65, 9.75]	2.27	[0.57, 9.05]	2.62	[0.67, 10.21]
$151-250	1.54	[0.39, 6.03]	1.45	[0.36, 5.72]	1.38	[0.34, 5.50]
>$250	1.54	[0.38, 6.17]	1.40	[0.34, 5.78]	1.58	[0.39, 6.42]
Mother's occupation (ref: Stay at home)						
Seller	1.38	[0.36, 5.25]	1.05	[0.24, 4.65]	1.41	[0.36, 5.45]
Farmer	0.51	[0.10, 2.64]	0.36	[0.06, 2.08]	0.54	[0.10, 2.84]
Government worker	-		-		-	
Other	1.10	[0.53, 2.28]	1.08	[0.50, 2.35]	1.19	[0.56, 2.55]
Household size (ref: 3 members)						
4 members	1.22	[0.42, 3.49]	1.88	[0.60, 5.89]	1.23	[0.42, 3.58]
5 members	1.83	[0.64, 5.26]	2.61	[0.83, 8.16]^{T}	1.84	[0.63, 5.39]
6 or more members	0.99	[0.34, 2.93]	1.40	[0.44, 4.47]	0.89	[0.29, 2.71]
Took antibiotic last month			2.61	[1.22, 5.58]*		
Likelihood that child will have toothache according to caregiver (ref: Very likely)						
Likely			0.70	[0.28, 1.77]		
Normal			0.44	[0.15, 1.28]		
Unlikely			0.51	[0.13, 1.99]		
Very Unlikely			0.48	[0.15, 1.56]		
White spots noted by caregiver on child's teeth			1.30	[0.85, 2.01]		
Reported food consumption on previous day						
Breastfed					1.95	[0.99, 3.84]^{T}
Bottled milk formula					0.83	[0.33, 2.09]
Constant	0.04	[0.01, 0.26]**	0.02	[0.00, 0.17]**	0.03	[0.00, 0.21]**
Observations	340		330		336	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A21. Association of consumption of packaged snack on previous day with being wasted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Packaged snack on previous day	1.30	[0.69, 2.45]	1.27	[0.65, 2.46]	1.44	[0.75, 2.79]
Intervention	3.35	[1.68, 6.67]**	4.39	[1.86, 10.39]**	3.66	[1.77, 7.58]**
Child sex (ref: male)	0.81	[0.44, 1.49]	0.84	[0.45, 1.59]	0.80	[0.43, 1.50]
Income (ref: $0-50)						
$51-150	2.82	[0.74, 10.75]	2.55	[0.65, 10.03]	2.82	[0.74, 10.83]
$151-250	1.66	[0.43, 6.40]	1.56	[0.40, 6.11]	1.46	[0.37, 5.74]
>$250	1.52	[0.38, 6.02]	1.40	[0.34, 5.73]	1.51	[0.37, 6.12]
Mother's occupation (ref: Stay at home)						
Seller	1.22	[0.32, 4.57]	0.94	[0.22, 4.08]	1.25	[0.33, 4.79]
Farmer	0.54	[0.11, 2.77]	0.36	[0.06, 2.07]	0.57	[0.11, 2.95]
Government worker	-		-		-	
Other	1.05	[0.51, 2.17]	1.02	[0.47, 2.20]	1.14	[0.54, 2.43]
Household size (ref: 3 members)						
4 members	1.25	[0.44, 3.55]	1.93	[0.63, 5.93]	1.25	[0.43, 3.60]
5 members	1.88	[0.67, 5.34]	2.64	[0.86, 8.12]^{T}	1.91	[0.66, 5.52]
6 or more members	0.89	[0.30, 2.62]	1.28	[0.41, 4.02]	0.80	[0.26, 2.42]
Took antibiotic last month			2.58	[1.21, 5.48]*		
Likelihood that child will have toothache according to caregiver (ref: Very likely)						
Likely			0.67	[0.26, 1.68]		
Normal			0.45	[0.15, 1.30]		
Unlikely			0.49	[0.12, 1.91]		
Very Unlikely			0.48	[0.15, 1.54]		
White spots noted by caregiver on child's teeth			1.32	[0.87, 2.01]		
Reported food consumption on previous day						
Breastfed					1.96	[1.00, 3.84]*
Bottled milk formula					0.80	[0.32, 2.01]
Constant	0.05	[0.01, 0.29]**	0.03	[0.00, 0.20]**	0.03	[0.01, 0.23]**
Observations	342		331		338	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A22. Association of consumption of numbers of packaged snack on previous day with being wasted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Number of packaged snacks						
1	1.50	[0.76, 2.92]	1.44	[0.71, 2.91]	1.62	[0.81, 3.24]
2 or more	0.88	[0.35, 2.22]	0.93	[0.36, 2.41]	1.04	[0.40, 2.70]
Intervention	3.30	[1.66, 6.58]**	4.23	[1.79, 10.01]**	3.62	[1.75, 7.51]**
Child sex (ref: male)	0.81	[0.44, 1.49]	0.84	[0.45, 1.58]	0.80	[0.43, 1.50]
Income (ref: $0-50)						
$51-150	2.79	[0.73, 10.67]	2.51	[0.64, 9.89]	2.81	[0.73, 10.81]
$151-250	1.58	[0.41, 6.13]	1.48	[0.38, 5.83]	1.41	[0.36, 5.56]
>$250	1.48	[0.37, 5.90]	1.37	[0.34, 5.61]	1.50	[0.37, 6.08]
Mother's occupation (ref: Stay at home)						
Seller	1.28	[0.34, 4.81]	0.99	[0.23, 4.34]	1.29	[0.33, 5.00]
Farmer	0.54	[0.11, 2.78]	0.36	[0.06, 2.05]	0.58	[0.11, 2.97]
Government worker	-		-		-	
Other	1.11	[0.53, 2.30]	1.05	[0.49, 2.27]	1.19	[0.56, 2.54]
Household size (ref: 3 members)						
4 members	1.31	[0.46, 3.74]	2.02	[0.65, 6.26]	1.30	[0.45, 3.77]
5 members	1.93	[0.68, 5.51]	2.69	[0.87, 8.31]^{T}	1.94	[0.67, 5.65]
6 or more members	0.95	[0.32, 2.81]	1.36	[0.43, 4.31]	0.84	[0.28, 2.56]
Took antibiotic last month			2.60	[1.22, 5.54]*		
Likelihood that child will have toothache according to caregiver (ref: Very likely)						
Likely			0.69	[0.27, 1.74]		
Normal			0.46	[0.16, 1.34]		
Unlikely			0.50	[0.13, 1.97]		
Very Unlikely			0.49	[0.15, 1.60]		
White spots noted by caregiver on child's teeth			1.36	[0.88, 2.09]		
Reported food consumption on previous day						
Breastfed					1.90	[0.97, 3.74]^{T}
Bottled milk formula					0.81	[0.32, 2.03]
Constant	0.04	[0.01, 0.28]**	0.03	[0.00, 0.19]**	0.03	[0.01, 0.22]**
Observations	342		331		338	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A23. Association of consumption of packaged sweet on previous day with being wasted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates			Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Packaged sweet on previous day	0.97	[0.50, 1.88]	0.96	1.08	[0.55, 2.13]	0.84	[0.43, 1.67]
Intervention	3.34	[1.68, 6.64]**	3.35	4.52	[1.92, 10.64]**	3.62	[1.76, 7.47]**
Child sex (ref: male)	0.82	[0.45, 1.51]	0.86	0.86	[0.46, 1.61]	0.83	[0.44, 1.55]
Income (ref: $0-50)							
$51-150	2.88	[0.75, 10.98]	2.72	2.56	[0.65, 10.07]	2.97	[0.77, 11.41]
$151-250	1.65	[0.43, 6.41]	1.57	1.54	[0.39, 6.06]	1.47	[0.37, 5.82]
>$250	1.57	[0.40, 6.23]	1.47	1.42	[0.35, 5.79]	1.64	[0.41, 6.63]
Mother's occupation (ref: Stay at home)							
Seller	1.25	[0.33, 4.70]	1.19	0.99	[0.23, 4.29]	1.29	[0.34, 4.93]
Farmer	0.52	[0.10, 2.69]	0.42	0.34	[0.06, 2.02]	0.54	[0.10, 2.79]
Government worker	-		-	-		-	
Other	1.04	[0.50, 2.15]	1.07	1.03	[0.48, 2.21]	1.11	[0.52, 2.37]
Household size (ref: 3 members)							
4 members	1.28	[0.45, 3.61]	1.57	1.94	[0.63, 5.93]	1.29	[0.45, 3.69]
5 members	1.92	[0.68, 5.45]	2.15	2.65	[0.87, 8.13]^{T}	2.00	[0.69, 5.77]
6 or more members	0.92	[0.31, 2.69]	1.10	1.29	[0.41, 4.04]	0.84	[0.28, 2.53]
Took antibiotic last month			2.08	2.51	[1.19, 5.31]*		
Likelihood that child will have toothache according to caregiver (ref: Very likely)							
Likely				0.63	[0.26, 1.57]		
Normal				0.42	[0.15, 1.21]		
Unlikely				0.47	[0.12, 1.82]		
Very Unlikely				0.47	[0.15, 1.51]		
White spots noted by caregiver on child's teeth				1.32	[0.86, 2.02]		
Reported food consumption on previous day							
Breastfed						1.94	[0.99, 3.81]^{T}
Bottled milk formula						0.77	[0.31, 1.92]
Constant	0.05	[0.01, 0.32]**	0.04	0.03	[0.00, 0.22]**	0.04	[0.01, 0.27]**
Observations	341		341	331		337	

** p<0.01, * p<0.05, ^{T} p<0.1

Table A24. Association of consumption of number of packaged sweet on previous day with being wasted at 24 months of age

	Model 1: Adjusted for sociodemographic covariates		Model 2: Adjusted for sociodemographic and health covariates		Model 3: Adjusted for sociodemographic and food covariates	
VARIABLES	**OR**	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
Number of packaged sweets						
1	1.80	[0.85, 3.81]	1.83	[0.84, 3.99]	1.51	[0.69, 3.28]
2 or more	0.31	[0.09, 1.07]^{T}	0.39	[0.11, 1.38]	0.29	[0.08, 1.02]^{T}
Intervention	3.42	[1.70, 6.89]**	4.23	[1.77, 10.11]**	3.67	[1.76, 7.64]**
Child sex (ref: male)	0.80	[0.43, 1.48]	0.83	[0.44, 1.58]	0.80	[0.42, 1.51]
Income (ref: $0-50)						
$51-150	3.06	[0.79, 11.81]	2.81	[0.70, 11.25]	3.14	[0.81, 12.19]^{T}
$151-250	1.84	[0.47, 7.22]	1.74	[0.43, 6.94]	1.60	[0.40, 6.44]
>$250	1.86	[0.46, 7.49]	1.74	[0.42, 7.25]	1.96	[0.48, 8.02]
Mother's occupation (ref: Stay at home)						
Seller	1.60	[0.41, 6.22]	1.21	[0.27, 5.36]	1.57	[0.39, 6.22]
Farmer	0.65	[0.12, 3.50]	0.42	[0.07, 2.70]	0.64	[0.12, 3.47]
Government worker	-		-		-	
Other	1.14	[0.54, 2.39]	1.07	[0.49, 2.36]	1.21	[0.56, 2.61]
Household size (ref: 3 members)						
4 members	1.31	[0.46, 3.75]	1.99	[0.64, 6.17]	1.32	[0.45, 3.83]
5 members	1.96	[0.68, 5.65]	2.63	[0.85, 8.17]^{T}	2.04	[0.69, 5.98]
6 or more members	0.93	[0.32, 2.75]	1.30	[0.41, 4.12]	0.85	[0.28, 2.59]
Took antibiotic last month			2.40	[1.12, 5.11]*		
Likelihood that child will have toothache according to caregiver (ref: Very likely)						
Likely			0.70	[0.28, 1.78]		
Normal			0.51	[0.17, 1.49]		
Unlikely			0.52	[0.13, 2.05]		
Very Unlikely			0.47	[0.15, 1.53]		
White spots noted by caregiver on child's teeth			1.35	[0.87, 2.09]		
Reported food consumption on previous day					1.93	[0.97, 3.82]^{T}
Breastfed					0.75	[0.30, 1.88]
Bottled milk formula	0.04	[0.01, 0.27]**	0.02	[0.00, 0.19]**	0.04	[0.01, 0.23]**
Constant						
Observations	341		331		337	

** p<0.01, * p<0.05, ^{T} p<0.1