

Guatemalan school food environment: impact on schoolchildren's risk of both undernutrition and overweight/obesity

Elisa L. Pehlke^{1,2,*}, Paola Letona¹, Kristen Hurley², and Joel Gittelsohn²

¹INCAP Research Center for the Prevention of Chronic Diseases (CIIPEC), Institute of Nutrition of Central America and Panama (INCAP), Calzada Roosevelt 6-25 Zona 11, Apartado Postal 1188, Guatemala 01011, Guatemala, and ²Department of International Health, Human Nutrition Division, Johns Hopkins Bloomberg School of Public Health, 615 N. Wolfe St., Baltimore, MD, USA

*Corresponding author. E-mail: elisa.l.pehlke@gmail.com

Summary

Guatemala suffers the double burden of malnutrition with high rates of stunting alongside increasing childhood overweight/obesity. This study examines the school food environment (SFE) at low-income Guatemalan elementary schools and discusses its potential impact on undernutrition and overweight/obesity. From July through October 2013, direct observations, in-depth interviews with school principals ($n=4$) and food kiosk vendors ($n=4$, 2 interviews each) and also focus groups (FGs) with children ($n=48$, 8 FGs) were conducted. The SFE comprises food from school food kiosks (casetas); food from home or purchased in the street; and food provided by the school (refacción). School casetas, street vendors and children's parents largely provide sandwiches, calorie-rich snacks and sugar-sweetened beverages. Refacción typically serves energy dense atol, a traditional beverage. The current school food program (refacción), the overall SFE and the roles/opinions of vendors and principals reveal persistent anxiety concerning undernutrition and insufficient concern for overweight/obesity. Predominant concern for elementary schoolchildren remains focused on undernutrition. However, by the time children reach elementary school (ages 6–12+), food environments should encourage dietary behaviors to prevent childhood overweight/obesity.

Key words: Latin America, nutrition, primary schools, qualitative methods

BACKGROUND

A growing number of low- and middle-income countries (LMICs) are facing the double burden of malnutrition: the persistence of undernutrition along with rapid increases in overweight and obesity. This double burden affects individuals across life stages as undernutrition during childhood leads to increased risk of overweight/obesity in adulthood (Shrimpton and Rokx, 2012). Guatemala has

been identified as one of these countries, with stunting in over 40% of children under 5 years of age alongside overweight and obesity in around 23 and 29% of adult men and women, respectively (Black *et al.*, 2008; World Health Organization (WHO), 2013). Stunted growth has become the main indicator of chronic child undernutrition, and has been linked to compromised cognitive development and physical capabilities (Black *et al.*, 2013). Fortunately, trends

demonstrate that stunting is on the decline in LMICs and is estimated to decrease to 127 million globally by 2025, a 25% reduction (Black *et al.*, 2013). Meanwhile, prevalence of childhood overweight/obesity continues to increase in LMICs. Although the prevalence of overweight in high-income countries is far greater than that in LMICs, most affected children (over 75% of the total number), live in LMICs, especially Latin America and the Caribbean (Onis and Blössner, 2000; Black *et al.*, 2013; WHO, 2014).

This rise in childhood overweight/obesity is likely a consequence of altered dietary and physical activity patterns driven by globalization, urbanization and also economic and technological developments. These transitions are illustrated in the recent history of the Guatemalan urban food environment. Since the 1970s neo-liberal policies have expanded the informal sector and led to a rapid increase in *casetas* (food kiosks) (Green, 2003; Way, 2012). *Casetas* predominantly offer products influenced by companies of the USA which appeal to the urban idea of a new, global and developed Guatemala (Artiga, 2008; Way, 2012). Urban residents have moved from traditional foods toward western fare like fried chicken, hot dogs, chips and soda (Green, 2003; Way, 2012). It is still common to see traditional foods in the home, but in public and at schools people often eat fast food from *casetas* (Artiga, 2008). School *casetas* (located within school grounds) are one of the four principal sources of food for children at Guatemalan public elementary schools (Pehlke *et al.*, Submitted).

It is important to explore what other dietary sources children are exposed to at school and whether these are appropriate given Guatemala's 'double burden'. Another source is the school food program, called *refacción* or snack, which provides food to children free of cost. The program began in 1959, providing 20 000 students with rations of powdered milk and wheat (Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO), 2013). By 1986, it grew to distribute a fortified cookie to 100% of urban and rural public schools in the country (FAO, 2013). The program was modified in the 1990s to include cereals, sweets and *atol* (hot traditional beverage) as well as meals with chicken, beef, beans and pasta (FAO, 2013). The program was once again universalized in the 2000s to provide one cookie and one glass of *Incaparina* (fortified beverage) (FAO, 2013). Since then, the Ministry of Education (MINEDUC) has worked in cooperation with other institutions experimenting with school food programs. Today MINEDUC provides a budget of 1.11 Quetzales (Q) per student per day at urban schools and Q1.58 for those at rural schools (1.11Q = \$0.14, Q1.58 = \$0.20) which is used to provide children a daily snack from a list of permitted products (FAO, 2013; Rodríguez, 2014).

The third and fourth dietary sources come from outside school grounds. These are foods brought from home and food purchased on the street. Mothers will often pack school snacks for children, especially if they have not eaten breakfast. Unfortunately, time constraints and other priorities often conflict with parents' ability to prepare snacks for their children. Sometimes this leads parents to give their kids money to spend at *casetas* or to purchase items in the street (Pehlke *et al.*, 2014).

Although schools have been identified as effective settings to intervene for prevention of childhood overweight/obesity, relatively few school-based interventions have been implemented in LMICs (Sharma, 2007; Wang *et al.*, 2013). A review by Verstraeten (2012) identified 25 school-based interventions in LMICs, 12 of which were conducted in Latin America. These show promising evidence of positive impact on overweight/obesity in schoolchildren (Verstraeten *et al.*, 2012). To our knowledge, no research has been done to explore school food environments (SFEs) in Guatemala. The only literature concerning SFEs in Central America are reports, action plans and educational materials encouraging improvement (Medrano *et al.*, 2009; Paz *et al.*, 2009; Abonce *et al.*, 2010; Fonseca, 2013). However, few of these are being put into action. This literature illustrates similar SFEs throughout Central America; however, with no research on this topic it is difficult to make comparisons. Therefore, more research is needed to understand SFEs in Guatemala and similar LMICs, and how they are impacting one or both sides of this 'double burden'.

The purpose of this study was to examine the SFE at low-income Guatemalan elementary schools and to discuss its potential impact on both undernutrition and overweight/obesity. The research questions included (1) What opinions and concerns exist about school children's nutrition in this setting? (2) What is the role of *casetas* vendors? (3) What foods are available at school *casetas*? (4) What is the role of parents in this setting? (5) What do children bring to school to eat/drink? (6) What role does the school food program play in children's nutrition? (7) What do school kitchens usually serve for *refacción*? This study aims to gain a greater understanding of the SFE in urban, low-income Guatemalan public elementary schools and to discuss whether this environment is appropriate given Guatemalan children's risk of both undernutrition and overweight/obesity.

METHODS

Research setting

From July to October 2013, qualitative research was conducted in Villa Nueva and Mixco, two low-income,

peri-urban municipalities in the outlying areas of Guatemala City. A purposive sample of two low-income public elementary schools in Mixco (VN, B) and in Villa Nueva (F, TUB) was chosen based on the following criteria: (1) having at least one *caseta*; (2) provided daily *refacción* and (3) the principals and vendors were willing to participate.

Participants and recruitment

The study sample consisted of school *caseta* vendors ($n = 4$), school principals ($n = 4$) and children 7–12 years of age in 1st–6th grades ($n = 48$). Principals and vendors were recruited individually. One in-depth interview (IDI) was done with each principal and two IDIs were completed with each vendor. From official student lists, children were randomly selected for focus groups (FG). The selected children's parents were invited to a meeting that explained the study and FG where they were asked to give their written informed consent. Before the start of the FG, an individual oral assent was done with each child at which point they could decline participation ($n = 1$).

Approval and consent

The Johns Hopkins School of Public Health Institutional Review Board and the Institutional Ethics Committee of the Institute of Nutrition of Central America and Panama (INCAP) in Guatemala granted approval for the study. Vendors and principals were required to give oral consent while children's participation required written informed consent from parent(s) as well as oral assent of the child.

Study procedures

Data collection and analysis was approached using emergent design and conducted simultaneously allowing for an iterative process, flexibility and modification of research tools to gather the richest data (Maxwell, 2005).

Researchers completed three study phases (Table 1). All IDIs and FGs were conducted in Spanish, audio recorded and hand written notes were taken. Direct observations were also conducted to attain methodological triangulation. At schools with multiple vendors, principals

were asked to identify the 'primary' *caseta* (most frequented by students) for recruitment and participation in the study.

In-depth interviews

Initial IDIs began with a script and proceeded with outlined questions agreed upon amongst the research team prior to data collection. The questions for follow-up IDIs with vendors were developed by head researchers during data collection as part of the iterative research process.

One IDI was conducted with each school principal ($n = 4$), one male and three females. Principals were asked about their experience with *casetas*, the school food program, what types of food and beverages they see children bring to school from home or the street as well as opinions concerning the SFE and children's nutrition.

Two IDIs were conducted with each vendor ($n = 4$), all female. The IDIs covered the following topics: store contents; purchasing practices; rules and regulations put forth by the school and Ministry of Education; how often and how much children spend at *casetas*; perceptions of children's food preferences; other products vendors observed children eating; and opinions about children's nutrition.

Focus groups

FGs began with a script and proceeded with questions and activities which were agreed upon amongst the research team prior to data collection.

Eight FGs were conducted ($n = 8$), two at each of the four schools. The first FG was conducted with 1st–3rd graders (27 total participants, 6–8 from each school), and the second with 4th–6th graders (21 total participants, 4–7 from each school), a total of 48 student participants, 24 males and 24 females. Children were asked what foods and drinks they like, what types of food and beverages they bring from home or purchase in the street, what they are given for *refacción* at the school and if they enjoy it, and what they usually purchase at *casetas* along with their opinions about available products.

Table 1: Information on study phases, activities and participants

Study Phase	Activity	Number conducted	Study group	Number of participants	Duration (min)	Location
1	IDIs	4	School principals	4	35–50	Private office
	Initial IDIs	4	Food vendors	4	30–80	<i>Caseta</i>
2	FGs	8	Children	48	35–60	Private classroom
3	Follow up IDIs	4	Food vendors	4	30–60	<i>Caseta</i>

Direct observation

Eight direct observations were conducted ($n = 8$), two at each of the four schools. These were completed during recess from August to October to observe what types of food and beverages children brought from home and/or the street, purchased at *casetas*, as well as how much they spent at *casetas*. Due to the significant amount of time the head researcher spent over several days at each of the sample schools, no observer effect was evident. Permission to take pictures of the *casetas* was received from all vendors and used to document available products. Permission was also given to enter each school's kitchen to observe and take pictures of the daily *refacción* as well as where it is prepared and served.

Data analysis

IDIs and FGs were transcribed verbatim. These transcripts were closely reviewed during and post data collection to create a detailed codebook using elements of grounded theory (Maxwell, 2005). Axial codes were created to identify key categories and connections. A finalized coding scheme was reviewed by research advisors to ensure comprehensiveness. For validity, each Spanish transcript was reviewed 3–4 times and coded using Atlas.ti Version 7 where queries of main themes were conducted. During further analysis select quotes that were most representative and contextually rich were translated to English by the first author. Photographs were revisited during data analysis as documentation of what products were available and what was being prepared for *refacción*.

RESULTS

Principals' and vendors' opinions of health and nutrition of schoolchildren

Principals and vendors agreed that the general state of children's nutrition at their schools was fairly poor. Their consistent opinion was that it was important to improve children's diets for them to be able to reach their potential in school. Two informants mentioned the small stature of Guatemalan children and blamed it on undernutrition that they attributed to parental negligence, the bad economy, unemployment, limited resources, lack of time or a combination of these (Table 2). Principals and vendors acknowledged the lack of healthy food options but only one vendor mentioned the issue of excess weight in relation to children's overindulgence in snacks, candies and sugary beverages.

School *casetas*, food from outside school grounds, and school provided *refacción*

Guatemalan children had four sources of food that made up their SFE: (1) food from *casetas*; food brought from outside school grounds, including (2) food brought from home and (3) food purchased in the street; and (4) food provided by the school (*refacción*) (Table 3). Our participant schools had from 1 to 5 *casetas* (VN = 2, B = 1, F = 5, TUB = 5). About 75% of students reported purchasing at least 1 product daily from *casetas* spending around 1–3 Quetzales per day (1Q = \$0.13). This figure was

Table 2: Select quotes from school principals and vendors

Participant	Context	Quote
Principal, TUB school	Principal's opinion of health and nutrition of schoolchildren.	'About 50% of parents worry about their children's nutrition, because we have a large number of students who are lacking in school performance because of their poor diet and the parents do not care about giving them something healthier. . . I believe that the people of my community are not very concerned about their children's nutrition.'
Principal, F school	Instead of providing something nutritious, some parents give their children money or unhealthy snacks.	'(The children's) diet is not good, sometimes because of lack of money, other times because of time. Working parents are exploited at work and do not have time for anything. And some mothers are negligent and do not do their part to feed their children. Instead of giving them <i>panes con frijoles</i> , they know we don't sell junk food here, so they go to buy their kids <i>Tortrix</i> , potato chips or things like that.'
Vendor, VN school	Speaking of the importance of children eating breakfast before arriving at school.	'The kids that arrive without breakfast, without anything, are those who repeat and repeat grades for that reason. When a child is well nourished and everything, they think well, and have better outcomes from their studies.'

Table 3: Sources and types of food that make up SFEs at Guatemalan elementary schools ($n = 4$)

Source 1 <i>Casetas</i>	Source 2 From outside school grounds	Source 3	Source 43 <i>Refacción</i>
	Purchased in street	Brought from home	
- sandwiches with ham, chicken, beans	<u>Purchased in street:</u>	<u>Brought from home:</u>	<u>Common:</u>
- tostadas with beans and guacamole	- <i>ricitos</i>	- <i>panes</i> (sandwiches)	- <i>atol</i>
- fruit	(processed snacks)	- <i>frescos</i>	(traditional drink)
- <i>tacos</i>	- sugar sweetened beverages	- pure water	- cereal with milk
(fried tortilla with chopped meat)	<u>Brought from home:</u>	- fruit	- fruit
- soda	- <i>panes</i> (sandwiches)		<u>Rarely:</u>
- cake	- <i>frescos</i>		- <i>panes</i>
- cookies	- pure water		- hard boiled eggs
- <i>mixtas</i>	- fruit		- refried black beans
(hot dog with tortilla)			
- candy			
- water			
- <i>frescos</i>			
(sugar sweetened fruit beverage)			
- <i>elotitos</i> (fried corn kernels)			

reached by taking the average of 60 observed and recorded transactions (15 at each school) and then verifying the information with vendors and children. About 50% of children reported bringing food from home or outside school grounds—half of these students said they also brought money to spend at *casetas*. Additionally, all children were provided a *refacción* by the school at no cost. *Refacción* was distributed sometime between the start of school (8 am) and recess (10 am). During recess children were allowed to purchase snacks from *casetas*; however, through observations it was evident that children purchased items throughout the school day and would consume throughout the day, including during class. Schoolchildren finished classes at 12 pm when children returned home where their families would most often provide them lunch. Recreation was limited to paved areas around school grounds that ranged in size from 3000 to 50 000 ft².

Vendors' role and products sold in school *casetas*

Vendors realized their role as a source of children's nutrition. Most principals and vendors were aware that the popularity of processed snacks was an aspect of poor nutrition among children. One vendor explained that kids in Guatemala were not getting fat because of an abundance of nutritious foods but rather by the overindulgence in unhealthy snacks and sugary *frescos* (sugar sweetened fruit beverage). Most vendors were also aware that sugary beverages, especially sodas, are unhealthy and harmful if consumed in excess. Yet no true effort was being made to minimize children's consumption of these products.

Foods that vendors perceived to be nutritious were prepared foods with beans, meat and corn 'for protein', as well as fruit for 'vitamins'. However, vendors expressed no concern about food preparation in relation to nutrition (i.e. fried as opposed to steamed)—all items provided healthy energy to children in their perspective.

Most commonly sold at *casetas* were *panes* (sandwiches) filled with ham, chicken (chicken salad with mayonnaise), *frijoles volteados* (refried black beans) and sometimes egg or cheese. These were prepared with white bread, mayonnaise and sweet tomato sauce. Fruits and vegetables (e.g. cucumber salad) were available at *casetas* which vendors perceived to be the most nutritious options along with *panes*. Regulations put forth by MINEDUC prohibited the sale of processed snacks (*ricitos*) and soda pop, however some *casetas* abode more closely than others as enforcement was lacking. In our sample, two of four *casetas* sold *ricitos*, such as corn chips, potato chips and Cheetos, while others offered snacks like *plataninas* (fried plantains), *elotitos* (fried corn kernels) and peanuts which were perceived as more natural and therefore healthier. One principal explained, 'Yes, they process them (peanuts and *elotitos*), but the peanuts and corn are natural products' (Principal, School F). *Caseta* vendors reported offering *tostadas* (fried tortilla) with *frijoles volteados* or guacamole, as well as *mixtas* (tortilla with hot dog), *chuchitos* (Guatemalan tamales), candy, *granizadas* (shaved ice), *frescos* and pure water. Some sold *tacos* and *dobladas* (fried tortilla with chopped meat), cookies, sodas and cakes/pies. All *caseta* vendors said they offered 1–3 types

of fruit and/or salad per day; however, one store was never observed offering fruit during data collection. Other items available at *casetas* included hamburgers, pizza, cereal, hot dogs and fruit cocktail. Children reported enjoying the foods sold at *casetas* which was demonstrated by the frequency in which they purchased products. Additional information from the children's perspective is presented in another manuscript currently under review (Pehlke *et al.*, 2014).

Parent's role and food brought from outside school grounds

All principals and vendors emphasized the responsibility of parents in preparing healthy snacks for their children as well as the importance of children eating breakfast before arriving at school. Informants consistently described that many parents fail to do this due to long working hours leaving them little time to prepare their children breakfast and/or a snack. For this reason, it was common that parents gave money to their kids to spend at *casetas* or purchase snacks in the street. Often this money was spent on products sold in the street that were not always available within school grounds such as *Tortrix* (corn chips), Doritos and sugary beverages according to principals, vendors and self-reports from children. School principals reported speaking to parents about the importance of breakfast and healthy snacks, but parents continued to give their children money or unhealthy snacks due to lack of time and/or negligence, according to informants (Table 2).

Parents who did provide snacks most often prepared *panes* filled with hot dog, black beans, ham or egg according to children. Some children also reported bringing fruit to school. To drink, parents gave juice boxes or water bottles filled with pure water or *fresco*. The pressure on parents from school staff to provide their children breakfast and snacks demonstrated concern for the perceived poor or inadequate nutrition of schoolchildren.

School's role and *refacción*

All public elementary schools in Guatemala at this time offer *refacción*, a daily snack for children funded by government money dispersed through MINEDUC. Each principal was responsible for providing a count of students for which the ministry provided a budget of just over 1Q per student per day. Each of our sample schools organized a committee of teachers, parents or both in charge of food coordination and preparation. In most cases, this budget was only enough to cover the cost of *atol* (hot traditional beverage), cereals and rarely fruit.

All vendors and principals spoke about the nutritious qualities of *atol*. They believed that *atoles*, cereals and milk

were extremely important as part of a child's diet. Schools offered calorie-rich *atoles* made with milk, oats, wheat germ, fava beans and enriched flours such as *Incaparina*. Foods provided by the school were limited to a list of permitted foods outlined by MINEDUC (i.e. *atol*, cereal, milk, beans, eggs, fruit etc.). This list, as well as the opinions of informants, demonstrated the persisting concern of undernutrition and the importance placed on feeding children *atoles*, milk and cereal-based products.

Refacción was prepared daily in the school kitchen by cooks or students' mothers and was distributed before the hour of recess. It was the responsibility of children to bring bottles or cups to receive the *atol*. If they forgot, they forfeited their snack or paid the school *casetas* for a cup or plastic bag to fill. Principals, vendors and children reported that most kids enjoy *refacción* and sometimes asked for second servings. This was the case at every school except for where the *atol* was prepared by mothers rather than a cook.

DISCUSSION

This study explores the SFE at low-income elementary schools in Guatemala City. Currently this is made up of food from kiosks (*casetas*), food brought from outside school grounds and food provided by the school (*refacción*) (Table 3). The nutritional roles of vendors, parents and the school food program within this environment and the types of foods they provide (i.e. calorie-rich products) suggest that the predominant health concern for elementary schoolchildren remains undernutrition, despite the increasing risk for overweight and obesity in Guatemala. Therefore, the current SFE seems to be lending itself to shift the nutritional burdens of children from one extreme (undernutrition) to the other (overweight/obesity) without real positive impact.

The current SFEs in Guatemalan elementary schools that offer a wide range of energy dense snacks and sugar sweetened beverages and limited fruit/vegetable options are detrimental to children considering the trends of childhood overweight/obesity. Research has shown that the availability of energy dense snacks and sugar-sweetened beverages increases consumption of these products and decreases the consumption of healthier alternatives such as fruits and vegetables (Bauer *et al.*, 2004). This holds true in Guatemala City where research demonstrates that children show preference for energy dense snack foods because they enjoy their flavor and are accustomed to eating them (Letona *et al.*, 2014). This is important to address as the majority of school age children are not meeting the recommended daily intake of fruits of vegetables in the USA and other countries (Evans *et al.*, 2012; United States

Department of Agriculture Economic Research Service, 2014). In Guatemala, more than 55% of school children in the Quetzaltenango region fell below the daily recommended intake of fruits and vegetables (Montenegro-Bethancourt *et al.*, 2009). These dietary, environmental and behavioral factors have negative implications on children's health. A study in Colombia found that snacking among school age children is related to increased adiposity and prevalence of overweight. Children who snacked often and consumed sugar-sweetened beverages had increased measures of BMI, skinfold thickness and waist circumference (Shroff *et al.*, 2013). This snacking behavior is similar to what this study found to be the case in Guatemala; therefore, more research about health outcomes is needed.

Snacking and other dietary behaviors can be more easily influenced during childhood; therefore school-based interventions are paramount. Those who have altered SFEs have shown positive impact in the USA and in LMICs (Caballero *et al.*, 2003; Verstraeten *et al.*, 2012). It is important that SFEs be improved to provide healthy choices to curb the prevalence of overweight/obesity while also addressing the persistent issue of hunger. The USA recently approached these issues with the passing of the Healthy Hunger-Free Kids Act (HHFKA) in 2010. The HHFKA aims to improve child nutrition by expanding food access to children in need of school provided nutrition aid by changing guidelines for eligibility for programs such as the School Lunch Program (National Conference of State legislatures, 2011). It also strengthens the Local School Wellness Policy Requirement that calls for schools to address the growing problem of childhood obesity by adhering to nutrition standards of school meals as well as foods and beverages for purchase on school campus (Federal Register, 2014). The Fourth School Nutrition Dietary Assessment Study has found that schools have made substantial improvement since being required to adopt a Local Wellness Policy (Fox and Condon, 2012). With similar goals of preventing hunger and obesity, programs and legislation such as the HHFKA should serve as a base for effective policy change in Guatemalan schools and in similar LMICs.

But what should be done about the persistent double burden of undernutrition in LMIC school settings? While schools may serve as effective arenas to intervene for overweight/obesity, by the time children enter elementary school, at 6 or 7 years of age, the most effective window to intervene for the prevention of undernutrition has already passed. A child who suffers from undernutrition in the first 2 years of life, during which linear growth and cognitive development are most vulnerable, can demonstrate poor cognitive function and lower academic

performance into their school age years (Mendez and Adair, 1999; Berkman *et al.*, 2002; Black, 2003; Black *et al.*, 2013). In response, research on early infant supplementation conducted in Mexico and Guatemala has demonstrated positive nutritional impact on growth and development (Rivera *et al.*, 1998, 2001, 2004; Neufeld *et al.*, 2006). Currently in Guatemala, Project MIEL is being implemented with mothers and young children (6–48 months) to study the effects of responsive feeding and exposure to a comprehensive micronutrient mix on child development and nutritional status. More programs like this are needed to target children in infancy to prevent stunting and its long-term consequences on growth, academics and earning potential, while interventions at elementary schools should aim for the provision of healthy food (micronutrient dense) to prevent both over- and undernutrition in later childhood (Black *et al.*, 2008).

The findings of this study and a review of current literature demonstrate further research and progression of child development programs are needed to target undernourished children during their most vulnerable, and therefore, most responsive years developmentally. By the time children reach elementary school (at age 6 or 7), SFEs in Guatemala and similar LMICs should shift focus to prevention of childhood overweight/obesity as this problem continues to increase in prevalence, even in low-income areas. Recommendations outlined to target improvement of school *casetas* include healthy food preparation, promotional materials and activities, price manipulation and stronger government legislation and enforcement (Pehlke *et al.*, 2014). Shifts in the school food program and education for parents require further research and intervention.

Strengths of this study include the use of methodological and data triangulation (Guion *et al.*, 2002). This increased credibility and allowed researchers to explore multiple perspectives and check data for consistency and patterns. An emergent design approach allowed for flexibility to modify FG and IDI guides for richer data collection (Maxwell, 2005). Additionally, the lead author conducted all IDIs which created significant rapport with informants. Finally, the sampling of schools from two differing municipalities provided diversity of setting.

The greatest limitation of this study was the inability to include parents as participants due to budget and timeline constraints. However, parental influences (money and food given to children) were explored through IDIs and FGs with vendors, principals and children themselves. Children, however, were not asked about whether they ate breakfast before arriving at school as this does not directly have to do with the SFE. Ultimately, these data would have been valuable to collect. Another limitation was the

lack of reliability of code determined. Although multiple researchers approved the final coding scheme only one investigator applied codes. The scope of this study did not allow for estimates to be made for calories consumed from each food source, or for data to be collected on the total calories consumed per day by each student. These lacking data limit our ability to conclude that these sources contribute to overconsumption or calorie excess in these children's diets. However, it remains arguable that the availability of healthier choices at schools and a greater understanding amongst schools and policy-makers of how and when to intervene against undernutrition and overweight/obesity would reduce children's risk of these and improve their nutrition and health whether or not they are consuming in excess.

CONCLUSION

Results explore the four dietary sources that make up the daily SFE at low-income public elementary schools in Guatemala: food bought from school *casetas*, food brought from home, food purchased in the street and food provided by the school (*refacción*). Available products and foods provided to children, along with opinions of principals and vendors, clearly demonstrate the persistent concern of undernutrition in low-income schools. However, as undernutrition prevalence in LMICs are on the decline and childhood overweight/obesity continues to increase, we argue that elementary schools with children from ages 6–12+ should focus on the rising burden of overweight/obesity. To more effectively combat undernutrition, programs must be implemented during infancy and early childhood, when nutrition requirements for physical growth and cognitive development are greatest. To prevent overweight/obesity in elementary schools, policy focused on nutrition standards of the school food programs as well as products being sold on school grounds is recommended. Also, parent and student nutrition education is useful in these settings.

ACKNOWLEDGEMENTS

The research project described in this paper was carried out with financial support of the National Heart, Lung and Blood Institute (NHLBI, HHSN268200900028C). It was also supported by the INCAP Research Center for the Prevention of Chronic Diseases (CIPEC) at the Institute of Nutrition of Central America and Panama (INCAP), Lilian Navas, Larry Cheskin MD and the Johns Hopkins Weight Management Center, Benjamin Caballero MD, PhD, the Georgeda Buchbinder Fund, and a Harry D. Kruse Publication Award in Human Nutrition.

FUNDING

Funding to pay the Open Access publication charges for this article was provided by INCAP Research Center for the Prevention of Chronic Disease.

REFERENCES

- Abonce A., Burak F., Benítez M. V., González M. R., Castillo N. (2010) Cómo preparar el refrigerio escolar y tener una alimentación correcta : Manual para madres y padres y toda la familia. In García C. A. P., Padilla G. V. (eds), *Acuerdo Nacional Para la Salud Alimentaria: Estrategia Contra el Sobrepeso Y la Obesidad. Programa de Acción en el Contexto Escolar*. Gobierno Federal: Secretaria de Educación Pública y la Secretaria de Salud, México, pp. 1–20.
- Artiga L. M. (2008) *Mixtas, Hot Dogs Y Shuchos: Aproximacion A las Transformaciones de la Comida Popular de la Ciudad de Guatemala*. *Anthropology*. University of San Carlos, Guatemala, CA.
- Bauer K., Yang Y., Austin S. (2004) “How Can We Stay Healthy When You’re Throwing All of This in Front of Us?” Findings From Focus Groups and Interviews in Middle Schools on Environmental Influences on Nutrition and Physical Activity. *Health Education and Behavior*, 31, 34–46.
- Berkman D., Lescano A., Gilman R., Lopez S., Black M. (2002) Effects of stunting, diarrhoeal disease, and parasitic infection during infancy on cognition in late childhood: a follow-up study. *The Lancet*, 359, 564–571.
- Black M. (2003) Micronutrient deficiencies and cognitive functioning. *The Journal of Nutrition*, 133, 3927S–3931S.
- Black R., Allen L., Bhutta Z., Caulfield L., Onis M., Ezzati M., et al. (2008) Maternal and child undernutrition: global and regional exposures and health consequences. *The Lancet*, 371, 243–260.
- Black R., Alderman H., Bhutta Z., Gillespie S., Haddad L., Horton S., et al. (2013) Executive Summary of The Lancet Maternal and Child Nutrition Series. In Maternal and Child Nutrition Study Group (eds), *Maternal and Child Nutrition*, pp. 1–12.
- Black R., Victoria C., Walker S., Maternal and Child Nutrition Study Group. (2013) Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*, 382, 427–451.
- Caballero B., Clay T., Davis S., Ethelbah B., Rock B. H., Lohman T., et al. (2003) Pathways: a school-based, randomized controlled trial for the prevention of obesity in American Indian schoolchildren. *American Journal of Clinical Nutrition*, 78, 1030–1038.
- Evans C., Christian M., Cleghorn C., Greenwood D., Cade J. (2012) Systematic review and meta-analysis of school-based intervention to improve daily fruit and vegetable intake in children 5–12 y. *The American Journal of Clinical Nutrition*, 96, 889–901.
- Federal Register, Department of Agriculture Food and Nutrition Service. (2014) *Proposed Rules. Local School Wellness Policy Implementation under the Healthy, Hunger-Free Kids Act of 2010*. *Authenticated U.S. Government Information*, 79, 10693–10706.

- Fonseca K. (2013) *Alimentación Escolar Y las Posibilidades de Compra Directa de la Agricultura: Estudio Nacional de Costa Rica*. Organización de las Naciones Unidas para la Alimentación Y la Agricultura (FAO), Costa Rica, pp. 1–138.
- Fox M. K., Condon E. (2012) *School Nutrition Dietary Assessment Study-IV: Summary of Findings* (No. 7605). *Mathematica Policy Research*. No. 77c485889fac4708a16759458eeaf9ff.
- Green L. (2003) Notes on Mayan Youth and Rural Industrialization in Guatemala. *Critique of Anthropology*, 23, 51–73.
- Guion L. A., Diehl D. C., McDonald D. (2002) *Triangulation: Establishing the Validity of Qualitative Studies*. Department of Family, Youth and Community Sciences, Florida Cooperative Extension Service: Institute of Food and Agricultural Sciences (IFAS), University of Florida, Gainesville, Florida.
- Letona P., Ramirez-Zea M., Caballero B., Gittelsohn J. (2014) Formative research to develop a community-based intervention for chronic disease prevention in Guatemalan school-age children. *BMC Public Health*, 14, 101.
- Maxwell J. (2005) *Qualitative Research Design: An Interactive Approach*, 2nd edn. Sage Publications, Thousand Oaks, CA.
- Medrano N., Álvarez I., Maldonado M., Trejo E. (2009) Alimentos Saludables en las Escuelas. In Morales D. (ed.), *Consumidores en Acción de Centroamérica Y el Caribe*. San Salvador.
- Mendez M., Adair L. (1999) Severity and timing of stunting in the first two years of life affect performance on cognitive tests in late childhood. *Journal of Nutrition*, 129, 1555–1562.
- Montenegro-Bethancourt G., Doak C., Solomons N. (2009) Fruit and vegetable intake of schoolchildren in Quetzaltenango, Guatemala. *Revista Panamericana de Salud Pública*, 25, 146–156.
- National Conference of State Legislatures. (2011) Healthy, Hunger-Free Kids Act of 2010 (P.L. 111-296) Summary. Retrieved 19 September 2014. <http://www.ncsl.org/research/human-services/healthy-hunger-free-kids-act-of-2010-summary.aspx> (23 March 2015, date last accessed).
- Neufeld L., García-Guerra A., Leroy J., López M. F., Gaxiola A. F., Rivera-Donmarco J. (2006) Impacto del programa Oportunidades en nutrición y alimentación en zonas urbanas de México. *Evaluación Externa de Impacto del Programa Oportunidades*, 2, 136–2006.
- Onis M. d., Blössner M. (2000) Prevalence and trends of overweight among preschool children in developing countries. *The American Journal of Clinical Nutrition*, 72, 1032–1039.
- Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO). (2013) *Alimentación Escolar Y las Posibilidades de Compra Directa de la Agricultura Familiar: Estudio Nacional de Guatemala*. Ministerio de Relaciones Exteriores de Brasil, Ministerio de Educación de Brasil, Fondo Nacional de Desarrollo de la Educación, Oficina Regional de la FAO para América Latina y el Caribe (eds), Estudio Nacional de Guatemala: Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO), pp. 1–155.
- Paz A., Goitia A., Soto B. (2009) *Comida Chatarra en los Centros Escolares*. In Boulogne M., Trejo E., Álvarez I. (eds), *Consumidores en Acción de Centroamérica y el Caribe*, San Salvador, pp. 1–57.
- Rivera J., Ruel M., Santizo M. C., Lönnnerdal B., Brown K. (1998) Zinc supplementation improves the growth of stunted rural Guatemalan infants. *Journal of Nutrition*, 128, 556–562.
- Rivera J., González-Cossío T., Flores M., Romero M., Rivera M., Téllez-Rojo M., et al. (2001) Multiple micronutrient supplementation increases the growth of Mexican infants. *American Journal of Clinical Nutrition*, 74, 657–663.
- Rivera J., Sotres-Alvarez D., Habicht J., Shamah T., Villalpando S. (2004) Impact of the Mexican Program for Education, Health and Nutrition (Progresá) on Rates of Growth and Anemia in Infants and Young Children. *The Journal of the American Medical Association*, 291, 2563–2570.
- Rodríguez M. (2014, Friday, February 21). Destinan Q1.11 por alumno en refacción escolar urbana, *La Hora*.
- Sharma M. (2007) International school-based interventions for preventing obesity in children. *Obesity Reviews*, 8, 155–167.
- Shrimpton R., Rokx C. (2012) The double burden of malnutrition: a review of global evidence. In Bank T. W. (ed), *HNP Discussion Paper*. The International Bank for Reconstruction and Development, Washington, DC.
- Shroff M., Perng W., Baylin A., Mora-Plazas M., Marin C., Villamor E. (2013) Adherence to a snacking dietary pattern and soda intake are related to the development of adiposity: a prospective study in school-age children. *Public Health Nutrition*, 17, 1507–1513.
- United States Department of Agriculture Economic Research Service. (2014, 10 March 2014). USDA Fruit and Vegetable Program Retrieved September 19 2014.
- Verstraeten R., Roberfroid D., Lachat C., Leroy J., Holdsworth M., Maes L., Kolsteren P. (2012) Effectiveness of preventive school-based obesity interventions in low- and middle-income countries: a systematic review. *The American Journal of Clinical Nutrition*, 96, 415–438.
- Wang Y., Wu Y., Wilson R., Bleich S., Cheskin L., Weston C., et al. (2013) *Childhood Obesity Prevention Programs: Comparative Effectiveness Review and Meta-Analysis*. Johns Hopkins University Evidence-based Practice Center, Rockville, MD.
- Way J. (2012) *The Mayan in the Mall: Globalization, Development and the Making of Modern Guatemala*. Duke University Press, Durham, NC.
- World Health Organization (WHO). (2013) Countries: Guatemala: Health Profile. Retrieved 13 April 2014, from www.who.int/gho/countries/gtm.pdf (23 March 2015, date last accessed).
- World Health Organization (WHO). (2014, March 2013). Obesity and Overweight. Media Centre Retrieved 1 April 2014, from www.who.int/mediacentre/factsheets/fs311/en/ (23 March 2015, date last accessed).