



Food choice in low income populations – A review



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ABSTRACT

The vast majority of publications on food acceptability and behavior have considered middle- or high-income populations. However, there is research focused on low-income populations which deserves attention considering that many millions worldwide suffer undernutrition and/or food insecurity. The objective of this review is to highlight what the authors considered to be the most relevant research in the area to thus bring attention to this sensitive area which requires further research. Although there is a certain overlap, the review is classified in the following areas: fruits and vegetables, obesity, food choice, indigenous populations, development of specific food products and, finally, what we consider to be the most promising or necessary research in the field of food choice in low-income populations.

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Introduction

The Food and Agriculture Organization of the United Nations (<http://www.fao.org/hunger/en/>, accessed 04/10/2013) present basic definitions regarding nutrition status:

- *Undernutrition*: The outcome of undernourishment, and/or poor absorption and/or poor biological use of nutrients consumed as a result of repeated infectious disease. It includes being underweight for one's age, too short for one's age (stunted), dangerously thin for one's height (wasted) and deficient in vitamins and minerals (micronutrient malnutrition).

- *Malnutrition*: An abnormal physiological condition caused by inadequate, unbalanced or excessive consumption of macronutrients and/or micronutrients. Malnutrition includes undernutrition and overnutrition as well as micronutrient deficiencies.
- *Food security*: A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

Based on this last definition, four food security dimensions can be identified: food availability, economic and physical access to food, food utilization and stability over time. Also, it is interesting to note that food preferences are an important issue when addressing food security.

The title of this review refers to “low-income” (LI) populations as this term is easily understood. There is no universal definition of

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how a person is classified as belonging to a LI household. Some authors defined them as those that received public assistance and/or food aid (Kaufman & Karpati, 2007; Reicks et al., 2003; Sosa, Martínez, Márquez, & Hough, 2008), others according to their neighborhood (Antin & Hunt, 2012; Miewald, Ibanez-Carrasco, & Turner, 2010; Sosa, Flores, et al., 2008), and Hough and Ferraris (2010) according to the school they went to. In some cases actual income was considered; Cassady, Jetter, and Culp (2007) considered the income level which allowed families to receive food stamps and De Steur, Gellynch, Feng, Rutsaert, and Verbeke (2012) considered a yearly income below 40,000 Chinese Yuans. In the present review we have accepted each article's own criteria.

Worldwide, about 870 million people are estimated to have been undernourished (in terms of dietary energy supply) in the period 2010–2012 (FAO, 2012). This represents 12.5% of the global population, or one in eight people. The vast majority of these, 852 million, live in developing countries, where the prevalence of undernourishment is now estimated at 14.9% of the population. Additionally, the negative health consequences of micronutrient deficiencies continue to affect around 2 billion people worldwide; most of which live in developing countries. Although there are controversies on the methodology used to estimate food insecure populations (Weikard & Gabbert, 2010), there is no doubt that their numbers are high and that most of them live in developing countries.

Most of the scientists and research groups working on food acceptability and consumer studies work in developed countries and, quite naturally, focus their efforts on the populations of these countries which are mostly middle to high income. Thus, it is not surprising that the vast majority of publications in this area have considered middle- or high-income populations. However, there is research focused on LI populations which deserves attention. This was recognized by the organizers of the 10th Pangborn Sensory Science Symposium held Río de Janeiro, Brazil in August 2013 (<http://www.pangborn2013.com>, accessed 01/11/2013), who invited the first author of this article to present a plenary talk "What do we know (and do not know) about food acceptability in LI populations?". This talk was the basis of the present review.

The objective is to highlight what the authors considered to be the most relevant research in the area. To cover this objective we consulted papers published in 23 different journals. These journals covered research in nutrition, public health, preventive medicine, eating disorders, food choice and sociology and food science. Basically we looked at papers published after 2006; however references took us to include some papers published previously. To organize the review we classified it in the following areas: fruits and vegetables, obesity, food choice, indigenous populations and development of specific food products; there is a certain degree of overlap in the classification. We conclude the review with our suggestions for further research.

Fruits and vegetables

One of the suggestions of the FAO and WHO (2004) "Fruit and Vegetables for Health Workshop" was that one of the means of lowering the risk of diet-related chronic disease among LI consumers is through increased consumption of fruits and vegetables (F&V). However, in this same Workshop, when analyzing the barriers to F&V consumption, income level was considered a major barrier, either mentioned directly or indirectly, such as high prices, lack of preparation time or poor hygienic conditions. For this reason aspects related to F&V choice were considered as a specific section within this review.

Cassady et al. (2007) worked out the proportion of income spent by LI families on F&V, and how much they would have to spend to meet the Dietary Guidelines for Americans (US

Department of Health and Human Services and US Department of Agriculture, 2005). Cassady et al. (2007) conducted their study in the cities of Los Angeles and Sacramento, California, USA. A family of four shopping in a very LI neighborhood would have to pay on average \$1,688 annually to meet the Dietary Guidelines recommendations of F&V. A family of four using food stamps in California received on average \$3,888 each year to spend on food, and so to meet the Dietary Guidelines would have required $1688/3888 * 100 = 43\%$ of their food stamp budget. Households in the lowest two income quintiles spent an average of \$2,410 each year on food at home, which meant lowest income households would have had to allocate $1688/2410 * 100 = 70\%$ of their food-at-home budget to meet the Dietary Guidelines F&V market basket. At the time both groups were spending approximately 16% of their food budget on F&V. Both the 43% for food-stamp receivers or the 70% for the lowest income population were far beyond what could have been reasonably expected for them to spend on F&V. Our additional thought is that even if they were given the F&V or the money to buy them; would they abandon familiarity, convenience and pleasure to consume more F&V they are not accustomed to?

Drewnowski, Darmon, and Briend (2004) examined the association between diet quality and estimated diet costs in France. Freely chosen diets of 837 French adults were assessed by a dietary history method while mean national food prices for 57 foods were used to estimate diet costs. In their work it was observed that energy costs for oil, margarine, potatoes, sugar, or beans were substantially less than energy costs for lean meat, vegetables, lettuce, or fish. Differences in energy cost between fats and fresh produce were in excess of 1000. These authors also found that, depending on the level of energy intake, each 100g of fats and sweets was associated with a net reduction of €0.05–€0.40 in daily diet costs. In contrast, each additional 100g of F&V was associated with a net increase of €0.18–€0.29 per day in diet costs. We conclude that it is no surprise that LI populations prefer not to eat F&V. Jetter and Cassady (2006) worked out that in Sacramento and Los Angeles a standard market-basket cost was \$194, and the healthier market-basket cost was \$230. The average cost of the healthier market basket was more expensive by \$36 due to higher costs of whole grains, lean ground beef, and skinless poultry. The higher cost of the healthier basket was equal to about 35–40% of LI consumers' food budgets of \$2410 a year. Temple and Steyn (2009) endeavored to answer to what extent and in what way does the pattern of food costs pressure LI black people to consume an unhealthy diet. They priced 55 food items, including healthy options, in three different communities in Cape Town- South Africa. Their main finding was that, on average, the cost of following the healthier option (which included F&V) was 9–12% costlier. However, when comparisons were made in terms of energy cost (cost per 4.18 MJ), many healthier food items, such as brown rice, F&V, and low-fat meat, were as much as 50% more expensive than comparable less healthy items. As a result, these authors reflected that even carefully crafted health promotion messages are likely to achieve, at best, meager success because of the reality of food prices.

Reicks et al. (2003) described the development and implementation of the think aloud method in relation to F&V purchasing behaviors of LI African-American mothers. Women ($n = 70$) were audio taped as they thought aloud while selecting fruits and vegetables during a routine shopping trip. Data were analyzed using content analysis procedures. The method was found to be useful in its ability to provide verbalization data for the majority of the women in the sample that reflected a typical shopping experience. The participants were not excessively affected by the presence of the investigator. The most mentioned categories of verbalizations were: Need/want (for a recipe, meal, snack, on a list, for a child), Cost (considered price per quantity, sale, coupon, thought was

cheap or expensive, compared with usual price, fit within a budget) and Habit (usually or always buy).

Hough and Ferraris (2010) used the Free listing method to gain initial insight of a food category. They surveyed a total of 184 15–18 year-old secondary school students from the town of Nueve de Julio – Argentina. One hundred participants were from a private secondary school where the majority of students come from medium to high income families; and 84 were from a public school where the majority of students come from LI families. Respondents were asked to write a list of all fruits they had tasted, seen or heard about. There were differences in the fruit clusters originated from both income groups; and middle/high income students listed more fruits than those from LI students.

Summary:

- Income level is a major barrier to increasing F&V in the diet.
- LI populations would have to spend an unrealistic proportion of their food budget to meet proposed dietary guidelines regarding F&V.
- Relatively innovative methods like ‘thinking aloud’ and ‘free-listing’ have been applied to F&V choice among LI populations.

Obesity

Tanumihardjo et al. (2007) described what they called a newly appreciated paradox that links poverty, food insecurity, and malnutrition to obesity or the state of overnutrition. This paradoxical condition exists because many of the diets of people living in poverty have adequate kilocalories to meet or exceed their energy requirements, but lack the dietary quality needed to promote optimal health and prevent chronic disease. Fig. 1 illustrates how poverty can lead to two apparently contradictory situations: under- and over-nutrition. The dotted line between overnutrition and hidden hunger implies that one cannot assume that overweight or obese individuals are micronutrient replete and that hidden hunger does not coexist. These authors stated that globally, living in poverty predicts overweight and obesity more directly than race or ethnicity.

Levy, Riis, Sonnenberg, Barraclough, and Thorndike (2012) performed a 9-month longitudinal intervention study in a hospital cafeteria in Boston – USA. 4642 employees participated in the study. The first intervention was a traffic light-style color-coded labeling system encouraging patrons to purchase healthy items (labeled green) and avoid unhealthy items (labeled red). The

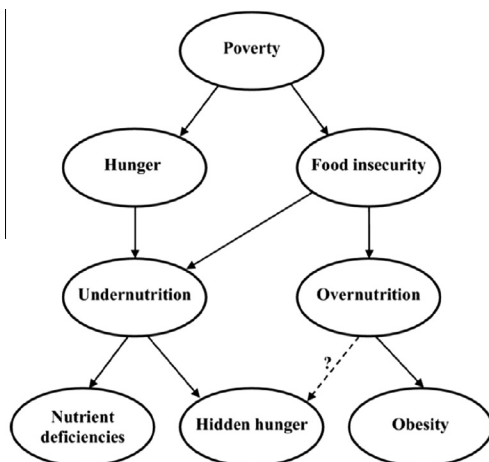


Fig. 1. Two contradictory paths of poverty: malnutrition and overnutrition. (Reprint with permission from: Tanumihardjo et al. (2007).)

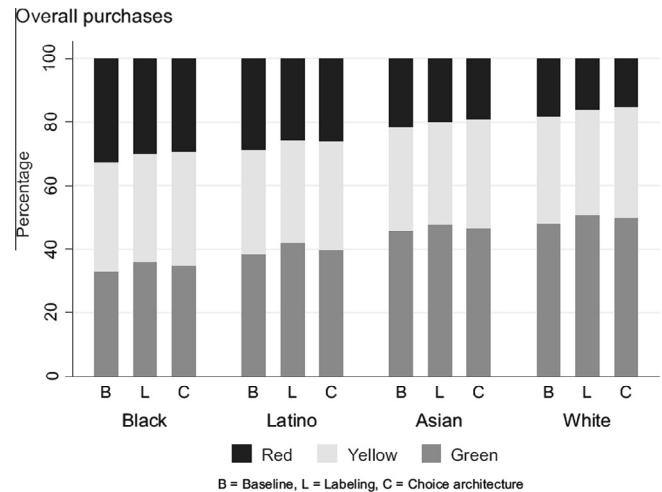


Fig. 2. Overall cafeteria purchases by race/ethnicity. In the labeling phase (“L”), foods were labeled green (healthy); yellow (intermediate); or red (unhealthy). In the choice architecture phase (“C”), selected items’ visibility and accessibility were increased if they were labeled green and decreased if they were labeled red. (Reprint with permission from: Levy et al. (2012).)

second intervention made green-labeled items more accessible and red-labeled items less accessible. Fig. 2 shows that interventions decreased consumption of red-labeled items and increased consumption of green-labeled items across all ethnic groups. However, ethnic effects were more important than the interventions (Fig. 2). Even after the second intervention, the lower-income black participants did not reach the higher-income white participants’ baseline. Thus, we observed that these cafeteria interventions can be helpful, but they do not replace the real issue of income-related differences in healthy diet choices.

Kaufman and Karpati (2007) presented an ethnographic study with the aim of understanding the sociocultural dimensions of childhood obesity in the district of Bushwick, Brooklyn, New York. In the introduction of their article, they presented numbers of obesity and poverty prevalence. The rate of childhood obesity was 15% nationwide while Latino children in New York suffered an obesity rate of 31%, compared with a rate of 23% for Black children and 15% for White and Asian children. In Bushwick, whose population is predominantly Latino, 47% of neighborhood children under the age of five lived in poverty. These authors justified their use of ethnographic methods by the fact that usually studies of childhood obesity are done with focus groups of mothers. They stated that this strategy limits its scope to mothers and children, while other kin and non-kin are often key actors in children’s everyday lives. Their ethnographic approach engaged people in their own environments to examine their everyday lives. Research techniques included individual and group interviews, life histories, and participant observation. As a result of their study three case studies are highlighted:

- (a) Yolanda (mother), Ramón (father) and María (daughter): Yolanda had an interview with a nutritionist who found María overweight and recommended less food and more physical activity. Yolanda stated that María was already active enough and that she could not ask her to eat less because she’s was only a child and loved her food. From Yolanda’s perspective, learning of her daughter’s “problem” through the nutritionist’s discussions of overfeeding, improper feeding, and inactivity served as indictments of her daughter and of her own ability as a mother. Disturbed after that meeting, Yolanda visited Maria’s pediatrician to clarify

her daughter's health status. The doctor recommended switching from whole to fat-free milk. It was not easy for Yolanda to find this milk in her neighborhood and towards the end of the month she had difficulty in paying for it. To aggravate the situation, Ramón gratified his daughter by adding sugary flavoring to the milk. The end result was that home politics prevailed and Maria's weight increased.

- (b) *Fatherhood and sharing food*: Lisette lived with 4 children: 3 of the children are from Juan, and 1 from Enrico. Juan came several times a week, always with food to share with the 4 children thus multiplying their eating opportunities. Enrico brought food only for his already obese daughter. Because of his troubled relationship with Lisette, sharing food inside her apartment was one of the only ways for him to participate in his daughter's life. What this case showed was that in many cases, the net effect of multiple fathers is to introduce opportunities for overeating, poor dietary choices, and strife around food. These authors concluded that feeding children, often in less than healthy ways, is a strategy by which LI adults please children. The heavier, gratified bodies of their children, in turn, gratify adults, who see those children as safe, satisfied, and aesthetically pleasing.
- (c) *Grandmother*: While Adela's children's father Mateo was in prison, she maintained a close relationship with his mother Maribel. During the researcher's visit, Maribel arrived with breakfast (ham, cheese, and egg sandwich) for her grandsons and Adela. She brought her grandsons to the table, ate with them, and then left for her job at a local factory. Every other day, Maribel brought bodega sandwiches and Honduran specialties. By visiting Adela's apartment, Maribel cared for her grandchildren, shared their lives, and cemented their relationship through food. Some food that Maribel shared with her grandchildren was less than healthy. Adela, who admitted that she enjoyed overfeeding her children, had been told by her pediatrician that her sons were overweight. Despite her awareness of the health consequences of certain foods, refusing meals from Maribel would have been socially unacceptable, and—given her family's lack of consistent resources—unrealistic. Periodic food scarcity patterns experienced by families and ensuing food sharing can lead to child overweight and obesity.

These three case studies clearly show how family and social environments can explain the high incidence of childhood obesity in LI households.

Most studies that have discussed the paradox of obesity prevalence in LI population have been performed in the USA. However, there are studies in other countries. For example, Pacheco Santos (2013) presented data on obesity by income level for men and women in Brazil. Fig. 3 shows a positive correlation between obesity incidence and income level for men; however, for women this correlation did not exist: the lowest income women had similar obesity prevalence as their highest income counterparts. Based on this data she concluded that hunger can probably coexist with obesity in Brazilian women, but not in men. This conclusion is supported by Kac et al. (2012) who found that Brazilian female adolescents who lived in severely food-insecure households were two times more likely to have excessive weight than their food-secure counterparts. Basile, Paniqui, Tarico, and Moratal Ibañez (2012) in a study among children living in slums in Buenos Aires – Argentina concluded that overweight appeared as their principal nutritional problem.

Aguirre (2010) published a book with the suggestive title: "Rich Slim, Poor Fat, Nutrition in Crisis", where she presents an anthropologists view on the issue of obesity among LI population. One

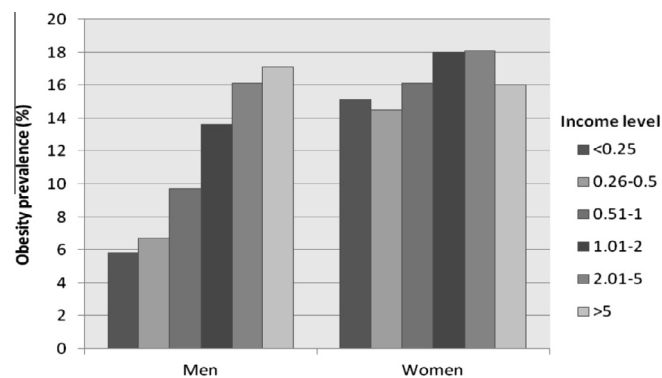


Fig. 3. Prevalence of obesity in Brazil's adult population (Body Mass Index ≥ 30) according to gender and range of per capita family income level (expressed in minimum wages). (Reprint with permission from: Pacheco Santos (2013).)

of the items she pointed out was that a LI strong-man's diet is basically cheap, energy-dense and acceptable. However, it is an illusion to consider this as the diet of a real "strong man", because in actual fact those that consume it have poor health and die younger. Another aspect discussed by Aguirre (2010) was how food aid programs respond to scarcity by generally repeating the same pattern of energy-dense food, serving up or providing the staple diet. One reason for this is that energy-dense foods are cheaper and thus food-aid budgets can be stretched. Another reason is that the staple diet usually guarantees acceptability and mainly for political reasons, food-aid programs cannot afford rejection. The net result is that food aid reinforces the poor diet which leads to stunting and obesity.

Wisman and Capehart (2010) presented a novel approach in their discussion on the increase of obesity. They stated that the percentage of Americans who are obese had doubled since 1980, yet the classical explanation of the "Big Two" (the increased availability of inexpensive food and the decline of physical exertion) alone did not explain the epidemic. They proposed that the obesity epidemic is substantially due to growing insecurity, stress, and a sense of powerlessness in modern society where high-sugar and high-fat foods are increasingly omnipresent. They cited experiments on animals where insecurity and stress had been found to increase the desire for high-fat and high-sugar foods. The claim of a link between insecurity-stress and obesity was strongly suggested by the fact that the incidence of obesity was greater among the least privileged in society, precisely those who were most exposed to insecurity and stress. Their hypothesis was grounded in the assumption that human behavior is significantly influenced by the social environment. Preferences are a consequence of both our genetic heritage and our cultural conditioning. They rejected the assumption that humans can usefully be assumed always to behave rationally. They hypothesized that socio-economic change is part of the explanation for the obesity epidemic.

Wisman and Capehart (2010) presented an experiment performed with mice by Kuo et al. (2007). When subjected to chronic stress—standing in a puddle of ice-cold water or exposed to an aggressive mouse for one hour a day for two weeks—and given a high-fat, high-sugar diet, mice gained about twice as much abdominal fat as unstressed mice fed the same diet. Neither chronic stress nor the high-fat, high-sugar diet by itself resulted in much weight gain. This study of mice suggested that weight gain from a high-fat, high-sugar diet was exacerbated by intense, chronic stress. For obvious reasons this type of experiments cannot be performed with humans. However, Wisman and Capehart (2010) cited a number of studies supporting the link between stress and obesity. For example, Thatcherism provided a natural experiment on the health

effects of job insecurity when a department of white-collar employees was privatized (Ferrie, Shipley, Marmot, Stansfeld, & Smith, 1998). Compared to other departments that remained within the government, these employees (both males and females) had a significant increase in mean BMI over a roughly five-year period, from before rumors of a sale until the transfer of ownership. The increase could not be explained by changes in exercise, smoking, or alcohol use.

Wisman and Capehart (2010) thus sustained that the obesity epidemic is traceable in part to increasing insecurity and stress in an environment in which there is ever-greater availability of fat and sugary foods. The social gradient of obesity is due to a social gradient of insecurity. They ended their article with a disturbing statement: “Alongside ecological destruction, obesity may be one of the canaries dying in the mine”.

Summary:

- There is an apparent paradox that links poverty, food insecurity, and malnutrition to obesity, or the state of overnutrition. This paradox is valid both in developed and in developing countries.
- Interventions to entice consumers to choose a healthier diet are helpful, but they do not overcome income-related differences in healthy diet choices.
- Ethnographic research showed how family and social environments can explain the high incidence of childhood obesity in LI households.
- A hypothesis sustained that the obesity epidemic is substantially due to growing insecurity, stress, and a sense of powerlessness in modern society where high-sugar and high-fat foods are increasingly omnipresent. LI population is the most vulnerable.

Food choice

Food choice is a multidimensional issue related to the product, the consumer and context. Literature covering these aspects in LI populations was considered a necessary section of this review.

Antin and Hunt (2012) indicated that the public health literature on obesity and dietary change draws very little from the food choice literature and, therefore, assumes that people prioritize health when making food choice decisions. As a result of this premise, public health interventions tend to focus on increasing people’s nutritional knowledge and making healthy choices easier by increasing availability or decreasing costs of healthy foods. They stated that these approaches ignore the multidimensional experience of food choice and do not correspond to the lived experiences of targeted populations. Köster (2009) also indicated that the forms of learning that lead to unconscious habit formation are the ones that are most resistant to change. They are almost inaccessible to cognitive arguments. Even though people know that their behavior is unhealthy, they are unable to mitigate the temptations of their habitual pleasures. He concludes that enticing people to change their habits by offering pleasant and at the same time healthy foods is a better method than providing information about dangers and risks or health advice.

With the support of these arguments Antin and Hunt (2012) held 2-h interviews with each of 20 LI African-American women, aged between 18 and 25 years. Their analyses focused on identifying social and cultural meanings and structural constraints and enablers that helped to elucidate additional factors of food choice not identified in the literature that were salient for these women. Participants were asked to bring 10–15 food-related photographs to the interview taken by themselves. The photographs, together with questions and free-listing of foods consumed in the last seven days, formed the basis of the interviews.

Examples of results from Antin and Hunt (2012) are:

- *Familiarity*: Marie explained an obsession she had with drinking whole milk as due to her mother giving her warm milk every morning and night during childhood. She was aware that she needed to cut down on calorie intake, yet the social meaning associated with consuming certain types of high calorie foods like whole milk trumped health considerations for Marie in certain situations.
- *Convenience*: For many women, the association of fast food with convenience sometimes took precedence over their perception of it as unhealthy when they made choices about what to eat. Most of the women in the study, who were busy with childcare, school, and/or work, saw the convenience of fast food as a time-saver. Even though “*That burrito just went straight to my thighs (Sani)*”.
- *Nutritional quality*: Most women in the study recognized a strong connection between health and the nutritional qualities of foods. However, in spite of this connection, they did not always prioritize nutritional quality when selecting foods.
- *Enjoyable experiences*: Sometimes in opposition to health, women reported selecting foods for reasons related to enjoyment. All women chose certain foods because they “tasted good”, but upon further discussion, it became clear that it was not the “taste” alone but the enjoyment women gained from eating foods that they considered “tasty”. The foods that women reported as enjoyable to consume were as varied as the explanations for why it was those foods brought them joy.
- *Satiation*: They pointed out that in spite of its importance, satiation as a distinct factor in food choice remains underdeveloped in the literature yet appears to play an important role in food choice for many of the women in their study. To support this statement made by Antin and Hunt (2012) we can say that Steptoe, Pollard, and Wardle (1995) Food Choice Questionnaire which consisted of 36 motives; had only one indirectly related to satiation: “nutritious”. Also, in a review article published by Bellisle (2009) on ingestive behaviors in humans where she discussed how different individuals decide they have reached satiation, stated that several psychological characteristics of humans, in addition to their particular social and economic circumstances, play a decisive role in their responses to foods. However, of the 55 references in her review, only one referred to socio-economic factors. And she closed the paragraph referred to this factor by stating that “one important problem of public health authorities is to deliver recommendations that people with low education and/or income will be able to understand and follow”. It is clear from other studies cited in this review that the reason LI populations often do not follow healthy dietary guidelines is not because they are not able to understand or follow public health recommendations. These last two references support our argument that satiation as a factor in food choice has received little attention in the literature.
- *Cost*: Two quotes taken from Antin and Hunt (2012) article are eloquent: “My kids really enjoy raviolis. And I buy cans and cans and cans of it. It’s so cheap. You know what I mean? It’s so cheap, and I know it’s not all that healthy, but it fills them up. And that’s the main thing. I want my kids to be full. (KeKe, age 25)”; and “I’m going to go towards whatever is on sale even if that’s the worst thing for me. I have to eat somehow and still be able to pay my phone bill, cable, all this other stuff. I feel like for the government to be putting bulletins and having health alerts and stuff, it’s just making people more depressed knowing they can’t afford that. (Meme, age 18)”. Some very LI women talked about how their food situation changed over the course of the month. They perceived their diets to be healthier at the beginning of the month, after pay days, when they had more money to spend on food. However, by the end of the month, tremendous changes needed to be made so that they could be sure

to have enough food to get through to the next pay day. We have recently analyzed food choices among LI women (unpublished data) and the motive “The money I have at the time of the month” was also highly relevant.

Libertino, Ferraris, López Osornio, and Hough (2012) used the free-listing method to gain insight in the menus listed by different income-level populations in Argentina. In the free-listing method, the importance or saliency of each item, in this case a menu, depends on the number of times the menu was mentioned and the average position in which it was mentioned. In Libertino et al. (2012) different saliency indexes were discussed. The menus mentioned were generally common to both income groups, although there were income-related differences in the saliency attached to the different menus. Pot roast and stew were significantly more salient for LI respondents than medium/high income respondents. These menus are relatively cheap. Barbecue, beef steak, fish, salads and pies showed a tendency to be more salient to the medium/high income level; these menus are relatively more expensive.

Miewald et al. (2010) presented a study on food choice of LI people living with HIV/AIDS (PLWHA); that is LI status aggravated by a severe health condition. To conduct their study they engaged in a 10-week community-based research, whose key elements are (1) a focus on applied research that is of relevance to the community; (2) equal involvement of researchers and community members in exchanging and producing knowledge; (3) research is used to create change or social action; and (4) entrenched power dynamics are challenged. Participants consisted of 10 HIV-positive men and women living in a LI district of Vancouver-Canada. There were 4 women, 2 male-to-female transgender people, and 4 men. The majority were Aboriginal, over half reported being involved in the sex trade and 9 were either current or former drug users. The majority lived in single-room-occupancy (SRO) hotels with limited cooking facilities, often infested with bugs, making food storage or preparation impossible.

For most participants in Miewald et al. (2010) study, lack of money to buy enough food and a lack of cooking facilities in the SROs meant that they relied on a network of free and low-cost meal providers in the neighborhood. How they chose their places to eat depended on:

- How they were treated.
- Whether the location had other services (e.g., showers, access to phones, information).
- Accessibility as some participants did not want to leave the neighborhood.
- To a lesser extent, the quality of food.
- If they could cook their own food, this increased acceptability.

Drug use had a significant effect on food intake. For many, food became unimportant when trying to access drugs and a multiday “binge” may mean that a person does not eat for several days. This, in turn, may have a significant effect on health, particularly for those with compromised immune systems. In other instances, addictions resulted in eating more sweets and junk food.

Long line-ups were common to access food, especially towards the end of the month where many more people resorted to food providers. Long line-ups could mean getting ill as PLWHA have weak immune systems; also fights break out, women get hassled and sometimes food runs out.

HIV status and the stigmatization that accompanies it play a role in where participants accessed food. Thus, PLWHA may continue to keep their HIV status hidden in an effort to avoid the stigma, which may affect their use of programs intended for them. This was particularly problematic in the case of programs that

operated in public space, where others could observe who was using the service. One woman, aged 30, said: “I hate waiting, I hate, hate, hate it, waiting at like an HIV + food program for groceries because everyone knows that everybody that goes in there is HIV+. And you’re standing there forever and ever on Hastings Street for everyone to see. I know a lot of people that have not disclosed to their families, never mind anyone else, and they avoid all these places “cause they have to disclose their status. So it’s a toss up! Do I want to be hungry or do I want to disclose my status?” Our additional thought is that once inside the locations, after going through the stressful waiting, will they worry about eating enough fruits and vegetables? And what about the link between stress and obesity (Wisman & Capehart, 2010)?

Sosa, Martínez, et al. (2008) researched the adequate scale and location to measure food acceptability among LI population. Two locations (home and central locations) and two scales (number and box scales) were tested. In the central location consumers were more critical than in the home location test. If sensory acceptability discrimination is of interest, the central location test would be more adequate for LI populations. Regarding the scales, both gave similar results; however, consumers found the number scale more familiar and easier to use.

Sosa and Hough (2006a) measured the influence of brand and price on the sensory acceptability of alfajores (an individual cake covered in chocolate) among children from different household incomes. A cheap and an expensive brand were tested. The children evaluated the alfajores in three conditions: blind, package-alone and package+ product. The LI children were not influenced by brand. For the medium-income children, an assimilation effect was observed; when presented blind, acceptability for both brands was similar, but when presented with the brand the more expensive one was scored higher. The findings highlighted the importance of socioeconomic factors in sensory expectation.

Sosa and Hough (2006b) measured sensory acceptability of menus and snacks forming part of a food-aid program in Argentina. It was hypothesized that subjects from LI households would have higher acceptability for institution-type menus than subjects from medium-income households, due to higher familiarity with these low-cost menus. This held true for adults but not for 11–13 year-old youths. Youths could have identified the menus served to them as “institutional” in nature and thus scored them lower than their older counterparts. LI youths consume these menus more often and their lower acceptability could have been due to boredom when faced with the same old dishes.

Summary:

- In-depth interviews allowed covering the multidimensional experience of food choice, showing the importance of factors such as familiarity, convenience, enjoyable experiences, satiation and the money left at the end of the month.
- Differences in menu choices between respondents from different income levels have been researched using a free-listing exercise and acceptability for institutional-type menus.
- Community-based research allowed analyzing food choice factors in a particularly vulnerable HIV positive and LI population.
- The influence type of scale, context and brand had on acceptability has also been studied.

Indigenous populations

The United Nations Committee on Economic, Social and Cultural Rights (CESCR, 1999) considered that the right to adequate food implies: “The availability of food in a quantity and quality sufficient to satisfy the dietary needs of individuals, free from adverse substances, and acceptable within a given culture”; and goes on to say: “Cultural or consumer acceptability [of food] implies the

need also to take into account, as far as possible, perceived non-nutrient-based values attached to food and food consumption and informed consumer concerns regarding the nature of accessible food supplies". Damman, Eide, and Kuhnlein (2008) stressed that the state not only has an obligation to respect and fulfill the right to cultural acceptability of food, but also an obligation to take positive steps to facilitate and promote traditional food cultures.

Damman et al. (2008) analyzed the nutritional transition of two indigenous populations: Kollas in the North-Western region of Jujuy in Argentina, and of the Inuits in the high North of Nunavut, Canada. Being from Argentina, we'll focus on the Kolla's, but conclusions were similar for the Inuits. The traditional Kolla diet consisted of lean and almost cholesterol-free llama meat, micronutrient-dense quinoa seeds, beans and potatoes. This diet has been abandoned by many to adopt a carbohydrate-rich and micronutrient poor 'modern' but cheap diet where pasta, rice, and white bread are the main sources of energy. Even though the federal and provincial governments make an effort to curb hunger and starvation, they at the same time fail to respect and protect the healthier traditional Kolla diet. Kolla's tended to consider traditional foods to be tastier and healthier than marketed foods, however, 'Kolla foods' have low status; even among Kolla's. Among children and teenagers, avoiding Kolla food seemed to be a way of avoiding stigma and portraying oneself as modern. The low status of Kolla foods should be understood in the context of society's negative attitudes towards Kolla culture in general.

Goldner, Lescano, and Armada (2013) studied the menus of a Kolla population in the Province of Salta, Argentina. They performed their study with twenty 11–14 year-old students from 11 households of a little rural village 3800 m above sea level. At their school the students were asked to draw and write the recipe of their preferred menu, the dish and dessert. As the authors pointed out, drawing requires little or no training for the students and also represents a natural activity that is spontaneous, with high participation and, usually enjoyable.

An adult assisted the students in writing down the recipes. The major observation obtained from the student's preferred menus was that the consumption of vegetables as a main course did not seem to be a problem as they liked to eat soups and mixed vegetables. Goldner et al. (2013) attributed this to the limited access to food shops in the region where the student's lived; sustaining this conclusion with an article published by Timperio et al., 2008 who found that children in Australia who lived close to food outlets consumed less F&V.

Summary:

- The United Nations considered that the right to adequate food includes it being acceptable within a given culture.
- Traditional diets of indigenous populations tend to be abandoned to adopt a carbohydrate-rich and micronutrient poor 'modern' but cheap diet where pasta, rice, and white bread are the main sources of energy.
- Indigenous populations tend to consider traditional foods to be tastier and healthier than marketed foods, however these traditional foods have low status; specially so among indigenous children and teenagers.
- Having children make drawings of their favorite menus was useful in investigating prevalent menus.

Development of specific food products for LI populations

Many research institutes or agencies have developed food products intended to cover the needs of LI populations. In some instances the effort has been to increase the nutritional value of a staple food, for example, maize which has had its vitamin A increased (Nuss et al., 2012). In other instances the focus has been

on replacing a standard food product by a cheaper alternative, usually using local plant materials as was the case of adding algarrobo flour as a protein and dietary fiber source in cookies (Escobar, Estévez, Funes, & Venegas, 2009). In many of these developments a lot of effort and sound scientific principles have been applied in the manufacturing processes, analyzing chemical compositions, determining physical properties and in calculating nutritional values. However, in many instances the acceptability of the developed products has been measured using inappropriate methodology. For example:

- Manaca, sweet potato and yam were used as substitutes of wheat in biscuits for two ethnic populations in the Venezuelan Amazon (Sangronis, Teixeira, Otero, Guerra, & Hidalgo, 2006). In the acceptability test no control all-wheat samples were included among the tested samples.
- Algarrobo flour was used as a protein and dietary fiber source in cookies and fried chips (Escobar et al., 2009). Acceptability was measured by 12 trained assessors and 12 non-trained assessors; none belonged to the target population.
- Vegetable milk was prepared from the seed of morro fruit (Figueroa Madrid & Bressani, 2000). Acceptability was measured with a 13-member trained panel.

Of course, not all product-development research has applied inappropriate acceptability methodology. Nuss et al. (2012) studied the acceptability of maize (*Zea mays*) biofortified with provitamin A carotenoids, often called "orange maize" because of its distinctive deep yellow–orange kernels. The color facilitates ready recognition but presents a cultural challenge to maize consuming populations who traditionally eat white varieties. They performed their study with 189 3–5 year old children in rural Zambia during a 3-month feeding trial. The children were fed a breakfast of maize porridge (sweet mush), a lunch of maize nshima (stiff mush) with various side dishes, and an afternoon snack based on a 6-day rotating menu. Menu items were served to the children in standardized serving quantities with tared dishes. The subjects were monitored by nutritionists for uneaten food, quantifying in grams the difference between the weight of food served and the weight of food waste. Thus acceptability was measured in relation to the quantity eaten by the target children over a relatively prolonged period, certainly a valid methodology. Fig. 4 shows how initially the porridge intake was greater for the white maize, but then leveled out. For the other maize dishes there was no intake difference between white and orange maize over the whole study period.

De Steur et al. (2012) measured willingness to pay for folate biofortified rice (FBR) using an auction procedure. Participants were LI women ($n = 132$) and university women students ($n = 120$), all regular rice eaters from the Shanxi Province of China. The study

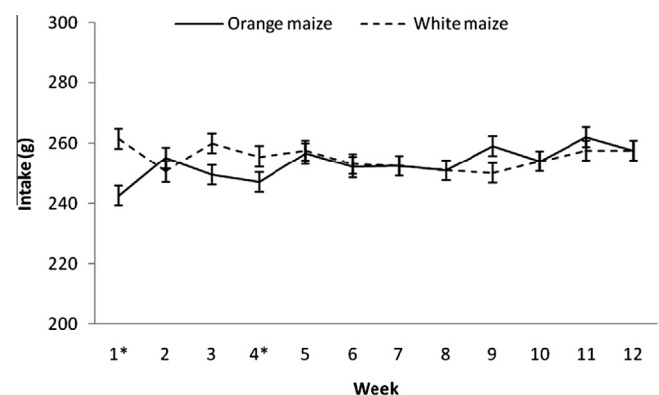


Fig. 4. Weekly intakes of porridge for each maize (orange and white) in rural Zambian children. (Reprint with permission from: Nuss et al. (2012).)

showed that on average consumers were prepared to pay a 34% premium for a genetically modified FBR. There was significant group effect: students were less likely to buy and pay more for FBR, mainly determined by their lower acceptance of genetically modified food. Their findings lend support for the large potential of biofortified staple crops in high-risk regions, even if these involve genetically modified technology.

In a wider project to develop bread with a reduced salt content, the first step was to measure the ideal salt level among middle- and low-income consumers. Sosa, Flores, et al. (2008) measured the ideal salt concentration in French-type bread among Argentine consumers in a home-usage-test (HUT) considering income status and salt content of daily bread consumption as covariables, and to compare the ideal salt concentrations measured in a HUT and a central-location test (CLT). For the HUT, 420 consumers each received a sample of bread with a single salt concentration, and for the CLT, 100 consumers each received 7 samples with different salt concentrations. For each sample, consumers responded if they found the bread “not-salty-enough,” “okay,” or “too-salty.” The authors expected that LI consumers, who generally have a lower education status, would be less aware of the dangers of high salt intakes and thus have their preferred salt levels shifted to higher concentrations than middle-income (MI) consumers; but this was not verified. Bread is a staple food consumed equally by low-, middle-, and high-income population in Argentina, thus this uniform behavior regarding its preferred salt content. Another issue presented by the authors was that unless a person has been put on a strict low-salt diet, he/she does not consider staple foods such as bread to be a potential menace regarding salt intake. A nutritionally educated consumer may restrict his/her consumption of foods, such as raw ham or salted snacks, but probably not worry about the salt content of bread.

Sosa, Libertino and Hough (personal communication) developed a new formulation for a sweet biscuit prepared from a mixture of wheat flour (WF) and amaranth flour (AF). AF was added to WF in 55, 70, 81, 89 and 95% proportions. Acceptability tests were conducted with 200 10–12 year-old children of different income households to select the optimum AF concentration. The influence of the brand, nutritional and sensory messages in packages was studied using conjoint analysis. 120 women between 25 and 60 years, half LI and half MI participated of this study. Cookies containing 81% AF and 19% WF were selected which presented a significant increase in protein and lysine content. The LI consumers preferred a local brand, while MI consumers chose the leading brand. Messages with amaranth information were selected by both income levels.

Summary:

- Food products have been developed with the aim of covering the needs of LI populations. In some instances the effort has been to increase the nutritional value of a staple food, in others the focus has been on replacing a standard food product by a cheaper alternative.
- In many of these developments the acceptability of the developed products has been measured using inappropriate methodology; however, there are exceptions where the methodology has been sound.
- LI populations tend to accept genetic modifications that increase nutritional value to their staple foods.

Conclusion: further research

We have presented a review of what we considered to be relevant articles on the issue of food acceptability in LI populations. These papers, and others not presented, have led us to believe that the most promising or necessary research in the field in order to

better understand and improve food security issues should be focused on the following:

- (a) Fig. 1 showed how poverty can lead to both under- and over-nutrition. People suffering hunger will eat basically whatever is available, while people with food insecurity can be obese through eating too many energy-dense foods, with some degree of choice involved in their diet. At what point do hunger and LI obesity interact? Do people come and go between these undesirable situations? This issue is related to the end-of-month crisis mentioned above (Kaufman & Karpati, 2007).
- (b) Wisman and Capehart (2010), as mentioned above, proposed the hypothesis that obesity, food insecurity and stress are closely related. Although they presented some evidence supporting this hypothesis, further studies are necessary to finally confirm it.
- (c) Central location tests generally measure acceptability by offering consumers a small portion of a food product. How representative of future purchase and consumption are these tests? For LI populations there have been some comparisons between home-use and central location tests (Sosa, Martínez, et al., 2008); however, further studies are needed to evaluate context and expectation errors in one-time acceptability measurements of products offered to LI populations.
- (d) In some of the articles referenced above there are promising methods which we believe deserve further research. Goldner et al. (2013) asked students to draw their preferred menus, using these drawings to gain insight into menus consumed by their families and community. Asking participants in interviews to bring food-related photographs taken by them can be an interesting approach to get the ball rolling (Antin & Hunt, 2012); however, in a focus-group setting LI participants could feel that showing images of their food environment would probably be stigmatizing. The think aloud method can be used to gain insight into food shopping behavior as shown by Reicks et al. (2003) in their study on fruit and vegetable shopping by LI women.
- (e) An issue we did not find any research on was how lack of food utensils, cooking facilities and insufficient storage space affect food choice in LI populations. For example, how does not having a freezer and/or microwave influence daily eating patterns? In very LI settings the lack of a big enough table or insufficient chairs could even have a bearing on what is eaten.
- (f) For diverse reasons some people suffer a lowering in their income which force them to restrain their consumption. The question of how dropping down the social ladder affects food choice has received limited attention. For example, what is abandoned first: good wine, dining out and/or fancy healthful yogurts? And during this transition what emotions prevail? Does moving down the social ladder generally mean a less healthy diet? Or does moving up generally mean a more healthy diet?

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