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**Title:** The Opacity of Reduction: Nutritional Black-Boxing and the Meanings of Nourishment

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**Abstract:**

This article explores the process of consolidating technical and historically contingent ideas about nourishment into seemingly straightforward terms such as vitamins and minerals. I study the adoption of scientific principles of abstraction and reduction as strategy of nutrition education in three Guatemalan highland sites: an elementary school classroom, a rural clinic, and the obesity outpatient center of Guatemala's third largest public hospital. I show that despite its pretense of simplicity, the reductionism of nutritional black-boxing produces confusion. Moreover, dietary education not dependent upon simplified and fixed rules and standards may be more intelligible to people seeking nourishment in their lives.

**Keywords:** Anthropology of Nutrition, Latin America, Obesity, Reductionism, Dietary

Education

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**Learning *Nutrición***

"I was so embarrassed when they referred me to a nutritionist. I thought they had it wrong. I thought nutrition was only for people who were starving, and, well, look at me."<sup>1</sup> Berta, a woman I had met at the obesity clinic of Guatemala's third largest public hospital, located in the western highland city of Xela, was sharing her confusion about *nutrición* with me over a cup of coffee during one of my visits to her home. She continued: "I thought: 'I am plump. How could I need a nutritionist?'"

By the time I was sitting at Berta's table several months into fieldwork, I had heard many stories recounting confusion about the meaning of *nutrición*.<sup>ii</sup> Like the people with whom I spoke, my own understandings had also shifted. When I arrived in Guatemala to study what scientists call "the nutrition transition" (Popkin 2001), I had conceptualized nutrition in broad terms. Geoffrey Cannon, secretary general of the World Health Policy Forum, writes that the word *diet* has origins in the Greek word *diaita*, which for centuries referred to a "way of life" or "way of being" (2005:701). The first definition given for nutrition in the *Oxford English Dictionary* also describes nutrition expansively: "The action or process of supplying, or of receiving, nourishment or food." "Diet" and "nutrition," as I had imagined them, encompassed the ability to care for oneself and others through the process of eating. Yet countless people I knew to be excellent cooks – including mothers who had raised several children – told me their knowledge of nutrition was murky at best.

I came to understand that in Xela *nutrición* referred not to a holistic conception of food, eating, and nourishment, but to a nutrient-based approach to health centered upon vitamins and minerals. As a result, women who were skilled cooks nonetheless claimed ignorance about nutritional matters. Culinary knowledge – an awareness of the pleasures and tastes of food, the skill necessary to transform a limited budget into an abundant meal, an ability to give and receive food – had nothing at all to do with *nutrición*; *nutrición* was technical, scientific, precise.

Bruno Latour has famously written that "[t]he word black box is used by cyberneticians whenever a piece of machinery or a set of commands is too complex. In its place they draw a little box about which they need to know nothing but its input and output" (1987:2). The controversies of its assembly, the complexities of its inner workings, and the commercial or academic networks that hold it in place do not matter: only the input and output count. We do not

see the black box – the conduit of scientific objectivity – as problematic; taking it for granted, we often do not even see it. Yet while the black box presents itself as “unproblematic and simple,” Latour suggests that it is always grappling with its Janus-faced twin: “science-in-the-making” – that is, the potentially fallible practices by which living complexity becomes reduced into theories, rules, and facts (1987:3). Moreover, Latour advises that by moving – in time and space – closer to places where black boxes are made we will encounter controversies illuminating their process of assembly and their underlying complexity, as well as the means through which they gain their appearance of authority and immutability.

Following Latour, this paper explores a process that I call nutritional black-boxing— the process of consolidating technical and historically contingent ideas about nourishment and the myriad relationships surrounding dietary practices into seemingly unproblematic terms: a vitamin, a nutrient. Although nutrition educators are busy closing the black boxes of nutrition with their emphasis on seemingly objective facts – *nutrients are good, fats and sugars are bad; with the input and output established, what more is there to know?* – I show that their “inner workings” remain parts of the systems in which they operate. Self-evident labels might obscure the complexity of nourishment, but hidden within these categories are powerful ontological changes in people’s relationships to their food, their environments, their bodies, and their selves.

My examination of nutritional black-boxing in this article begins by looking at the adoption of scientific principles of abstraction and reductionism as a strategy of nutrition education in three sites: an elementary school classroom, a rural clinic, and the obesity outpatient center of Guatemala’s third largest public hospital. Despite nutrition educators’ claims that the black boxes of nutritional terminology facilitate simplicity – allowing for the abstractions of nutritional science to most easily benefit people’s lives – I show how reductionism in nutritional

knowledge produces understandings of nutrition that can be, given the rising rates of metabolic illness in Guatemala, dangerously opaque. Black boxes are imagined as stable, their meanings secured within them in such a way that they appear universal and objectively “detached from the individuality of [their] makers” (Porter 1999:401). But, I will show in this paper that as they shift contexts the information that they seem to hold in place transforms. Despite its pretense of simplicity, the reductionism of nutritional black-boxing produces confusion. Meanwhile, education about nourishment that encompasses diverse, complex experiences of hunger, satiety, pleasure and satisfaction – which cannot be easily reduced, generalized, or standardized into the soundbites of pedagogy – may be more accessible to people seeking and needing nourishment in their lives. At its broadest, the encounters I describe highlight the value of complexity, thereby making a case for the importance of ethnographic knowledge well beyond the domain of anthropology.

### **The Simplified Model**

The Institute of Nutrition of Central American and Panama (INCAP) has operated out of Guatemala City since 1949.<sup>iii</sup> Founded as a scientific research center, its earliest work focused on examining biochemical properties of food, studying metabolism, and collecting epidemiological profiles of population health. INCAP is widely recognized for its important longitudinal study of physiological development. With data collected between 1969-1977, 1988-1989, and 2002-2004, this study “continues to be one of the richest sources of information about the importance of nutrition for growth, development, and human capital in developing countries” (Ramirez-Zea, et al. 2010:397).

While it began as a research center, shortly after its inception, INCAP researchers began to respond to political pressure to translate their research into public health programs and

policies. A newspaper article written at the conclusion of the first phase of the study paraphrases an INCAP scientist who stresses the need to define and execute national nutritional policies “at the country’s highest political levels” while bringing these policies to people “through direct and simplified models” (David Oliva 1977). In 1991, after decades of working to formulate an official policy on educational outreach, INCAP officials approved the “Policy of Information and Communication,” which formally recognized “the importance of facilitating access to information and communicating this information to the public as an core institutional function” (2000:31). In accordance with these goals, INCAP stresses that outreach programs and workshops should focus on “three *key components*” of nutrition: “a healthy home environment, basic health and nutrition with emphasis on school feeding, and health education with emphasis on developing life skills” (2000:21). It also emphasizes that to “strengthen knowledge” about food and nutrition in each of these arenas, the information to be communicated should be kept as “basic” as possible. In order to explore this strategy for nutrition educational further, I next trace three examples of what happens to basic, impersonal knowledge about dietary practice, as this knowledge circulates between persons.

### *Scene 1: The Classroom*

Nearly two decades after INCAP established its “Policy of Information and Communication,” I sat in a small rural schoolhouse in a village outside of Xela, observing a nutrition class for fifth grade students that was a result of continuing governmental efforts to transmit “basic” information about nutrition in a “direct and simplified model.” Alfonso, the teacher, had received a degree in education at the public university in Guatemala City, and the notes for his lesson came largely from a textbook for children he had acquired in his training. He told me that most

of the children and parents he worked with were *ignorantes sobre nutrición* [ignorant about nutrition]. Because of this, he said it was important to keep his material as simple as possible.

With eighteen children ages ten to thirteen sitting in a circle around him he began the lesson by asking the students to name foods that were *comidas malas* [bad foods]. Alfonso began the list: “Sugar is bad because it is sweet. Ice cream is bad because it is bad for your teeth.” He paused and then asked: “Why are these foods bad?” The audience silent, he answered his own question: “They are bad because they don’t have vitamins.” During the next half hour, while the children sat quietly around him, he used hand-made cards to explain the meaning of the terms vitamin and mineral. His introduction to the concept of a vitamin was short: “They are in our blood and they help to keep us healthy.” He then began to flip through the cards. He read from the front of the first card: “Vitamin A: A good source of nutrition.” He turned the card over, revealing a picture of eggs, carrots, and squash. “These are good for your eyes,” he said. “Do you understand?” Heads nodded, silently. He moved to the next card: “Vitamin B: It keeps the body healthy.” He had no examples of foods connected to vitamin B, so he moved to the next card, which was illustrated with pictures of lemon, orange, and pineapple: “Vitamin C.” Looking at notes he had written he explained: “It helps us be stronger. It helps our immunological system. It keeps us from catching a cold.” He had grouped vitamins D and E on the same card, where he had written: “For keeping our body healthy.”

He then turned to a discussion of minerals. “What is a mineral?” he asked the class. A few students, growing restless, tossed out suggestions in quiet voices: “A fruit?” “Water?” “No,” he corrected them, “A mineral is something like calcium. It is good for our bones. We can find it in milk. It makes us strong. It is also in fruits and almonds.” The next card read “Iron,” which Alfonso said was good for strengthening the body, and was found in beans, spinach, vegetables,

red meat, and cereal. He also explained, “Iron is good because iron gives you energy.” Next came “Protein,” a card that was illustrated with pictures of eggs, chicken, fish and red meat. He had the children recite the names for these images, a task they completed easily. The final card said carbohydrates. He asked where these came from; met with silence once again, he listed: “Wheat, rice, whole wheat bread, corn, potatoes, bread.”

With the initial material covered Alfonso quizzed the classroom: “What is a good food?” The students’ silence encouraged him to monologue: “Carrots, for example, are a good food. Fruits and vegetables are good. They are good, and we should eat these three times a day, every day of the week. Why is this especially important for you? Because your bodies are growing. What else should you eat? Dairy. Three to four times a week, you should eat dairy. Cereals, you should have three to four days a week. Meat you should eat two to three times a week. To strengthen your body you should eat red meat and you should have cereals. You can tell your parents that I’ve taught you this. But do you remember what the bad foods are? The bad foods are cake, sugar, fat, coca cola. You shouldn’t have any of these more than once a week. Why are they bad? They are bad because they don’t have iron. They are bad because they have sugar and fat. Remember that sugar and fat are bad for the body. The good foods though, they are good because they have lots of vitamins and minerals. The good foods you should eat often: fruit, vegetables, pure water, boiled water.”

Alfonso spent the last ten minutes of the class testing the students about the classifications of foods. The students didn’t miss a beat when asked how many drops of chlorine to add to a gallon of water to sterilize it (essential knowledge when washing produce), but there was considerable confusion about how to categorize food into various groups. It is important that while they spoke Spanish in school, most of the students were raised in K’iche’ speaking homes.

K'iche', as with other Mayan languages, has a word for plants (*k'yes*), but plants are not classified as “fruit” or “vegetables” as within public health nutrition programs. This classroom's classification of foods by vitamin and mineral content – intangible, invisible to the eye – was a similarly foreign form of knowledge, representing an unfamiliar way in which to understand, and to subsequently relate to the substance of food.

As a reward for sitting through the class, the students were each to receive half a banana, which Alfonso would only give them once they answered a final question. He paused for a minute before settling upon the question: “What is a good source of iron?” The shyness of the group had lessened and a few kids in unison shouted out an answer: “Sugar!” Alfonso, noticeably annoyed, promptly corrected them by listing beef, pork, beans and spinach as foods containing iron.

That night, while helping my home-stay family prepare coffee, I noticed the packaging on the sugar we used contained an image of a green cartoon triangle presenting the message: “Sugar with Iron.” Indeed, following legislation enacted in 1974 (that became law in 1989), Guatemala's national government requires sugar companies to fortify sugar with Vitamin A, and many have also added zinc, copper, and iron to the sugar they produce (Pineda 1998).<sup>iv</sup> On several occasions when I watched people spoon sugar into their drinks, they clarified to me: “It's for the vitamins.”

Although I have described a children's class here, it is representative of the nutritional education classes for adults that I also observed. The implicit assumption made by health educators was that a vitamin-centered approach to eating was correct and that information about vitamins would help people make “healthy” eating choices. In the lesson, Alfonso became frustrated when his students' knowledge about iron did not conform to his pedagogical model,



which categorized foods into simple binaries of good/bad and healthy/unhealthy. “Just Get The Facts Straight,” says the black box of ready-made-science (Latour 1987:7). Yet, straightening out “the facts” is not a straightforward task; the students were, after all, correct: their sugar did have iron. Here, the reductionist model of nutrition cannot handle the complexities of dietary practice, wherein the “health” of foods does not conform to fixed standards. In my next section I show that reductionism accompanying the classification of foods connects to other forms of nutritional reductionism; as food is divided into increasingly abstracted component parts, so are the relationships surrounding its production and consumption divided into discrete individuals. To illustrate this further, I turn to nutritional training at a rural health clinic.

### *Scene 2: The Rural Clinic*

Nutrition education is part of the Guatemalan government’s *extensión de cobertura* [health coverage extension], a program that sends doctors, *promotores* [health workers], medications, vaccines, and food fortification packets to communities too small and remote to have a health center of their own.<sup>v</sup> The *extensión* that I became affiliated with during my fieldwork rotated between ten villages, attending to one each day. In the early morning, when the line waiting for a consult with the doctor was the longest, Eva, the program’s certified health educator, would gather the group – almost exclusively women – together for a nutrition class. Eva told me when I began observing her lessons, “Since most of these women have never attended school, the information must be as simple as possible.” Here again— a focus on the need for simplicity. Yet, as I will show, the pretense of simplicity masks the complexity of *nutrición*. While the metabolic operations of nutrition may appear self-evident to those raised in a post-Cartesian era where mechanistic explanatory structures are commonplace (Coveney 2006), the logic of nutrition in

fact depends upon historically and culturally contingent understandings of food, bodies, and life itself.

In the nutrition class I next describe, a class representative of the many months of instruction I observed, Eva stood in front of a group of Mam women holding a poster of *la olla de la alimentación de Guatemala* [the Guatemalan food pot], which divided foods into seven categories (sugars and fats; meats; dairy; herbs and vegetables; fruits; and grains, cereals, and potatoes) to be consumed at various frequencies over the week (from once a week to every day).<sup>vi</sup> “This is very important to our body (*nuestro cuerpo*)” she began, pointing to the poster. I often heard people speak of “our body” in this way— conveying the sense of a shared body among women in the community. Yet in Eva’s teachings, this reference to a shared body, while common, countered her emphasis on an individual who must be responsible for her own diet. It is, I suggest, a momentary digression from the style of lesson-plan she is employing— an “epistemological survival” (Daston 2000:36) of another way of relating to food. Next, following a pattern that more closely reflected the tone of the lesson, she asked one woman from the group: “What do you eat every day? Do you eat herbs? Do you eat proteins?” The woman did not respond, and Eva turned to address the group: “It is very important that you eat from all these categories. Do you know why?” Without waiting for an answer she continued: “Because food gives us energy. And this food here,” she pointed to a section of the pot labeled herbs/vegetables, “this food helps us with our defenses against the flu. It also helps our skin heal from infections. Why? Because our skin is fragile, and we need vitamins to help it repair itself. This food has vitamins that help the skin repair itself. These vitamins help us have beautiful, strong hair. They help make our skin strong and beautiful. They help strengthen our fingernails.”

Eva next pointed to the area of the food bowl listing grains. “Some of your foods have what is called carbohydrates,” she explained. “Perhaps you aren’t familiar with this term, but carbohydrates are our source of energy. If you don’t eat them, you won’t be able to get up. You

won't be able to accomplish anything in the day. You won't be able to run. You won't be able to do your work. You won't be able to care for your children, even. So we need to eat these things" – she pointed to the illustration of carbohydrates – "in order to have energy. Our body needs vitamins to keep going. We must feed ourselves well. At least two eggs a week," she encouraged them. "It's very important for your children's health that they get a bit of fat in their meals. And they need lots of vitamins as well. *Tiene que tener mucho cuidado. Mucho, mucho cuidado.* [You must be very careful. Very, very careful]." With this message, her lesson ended.

It is important to note that discussions of food and health that focus on nutrients have only recently arrived to the region where I worked. Historically, communities throughout the Guatemalan highlands have followed a humoral logic of well-being, where dietary health was conceived through sensory properties of foods and bodies (Adams 1952; Cosminsky 1975; Logan 1973; Redfield and Villa-Rojas 1971). Whereas the idea of balance is crucial to both nutritive and humoral logics of food and health, the abstract guidelines and international standards of nutrition are anathema to humoral medicine, which depend on listening to, and making decisions around the state of the body and the immediate ecological context. What Foster calls "degrees of intensity" (1987:368) – non-absolute classifications – are important to the determination of humoral remedies. Many researchers referred to a hot-cold *continuum* of humoral epistemologies (c.f. Cosminsky 1975; Tedlock 1984: 1074-5). Redfield and Villas-Rojas, writing in the 1930s, argued that it would be a mistake to try to overlay categories onto humoral beliefs since the "categories are blurred and run into one another" (1971:160). Weller more recently describes the desire of health care professionals to create "rules" out of humoral medicine – i.e. orange juice is cool, measles is hot (1983:256). While they sought to establish these rules to simplify and expand the delivery of health care services, these attempts misunderstood the workings of

humoral medicines. From a humoral perspective, an individual food would never – could never – be understood as healthy or unhealthy on its own; rather, its health is determined through its relation to the different foods consumed and the state of the individual at the time of consumption. The *good* or *bad* character of foods would not be fixed but was “dependent upon the condition of the person who eats them” (Redfield and Villa-Rojas 1971:161)

In Eva’s lecture, however, she never mentioned sensory experiences or tastes. She focuses not on internal sensations of the body – which resist standardization – but reductive properties of food (vitamins, carbohydrates) and external properties of bodies (hair, eyes). Even though her discussion of diet and nourishment clearly touched upon many areas of kinship and social life, her lesson focuses on categories, particles, and individuals; the parts, and not the whole. Moreover, Eva, in warning the women to “be very careful” and to pay attention to their consumption of carbohydrates or vegetables, was involved in a project much more abstract than the microscopic vitamins about which she spoke. She was encouraging a new kind of moral subject— a woman responsible for her health and her appetites. Moreover, this was not someone who should focus on the feelings of hunger and satiety, the flavors of food, or the broader experiences of eating but someone who should learn to eat and to relate to food through abstract dietary guidelines.

### Scene 3: The City Hospital

The nutritionists at the obesity outpatient clinic of Guatemala’s third largest public hospital, where I carried out much of my fieldwork, gave every patient a sheet of dietary recommendations. While nutritionists worked to personalize the recommendations to accommodate different metabolic illnesses, they also used a standardized template that listed foods in two columns: permitted and prohibited. Permitted foods included skim milk, lowfat

yogurt, poultry without skin, whitefish, whole wheat cereals, whole wheat bread, boiled plantains, fresh fruits, fresh vegetables, olive or canola oil, diet or “fat free” (in English) mayonnaise, mineral water, tea and coffee (without sugar). Prohibited foods included whole milk, butter, cream, cheese, pork (or anything pork-based), hamburgers, lasagnas, any fried meats or fish, anything battered in egg, sweet cereals, fried potatoes, a long list of traditional foods cooked with lard, canned fruits, vegetables cooked in butter/margarine, most desserts, all oils (except olive and canola), hot chocolate, all alcoholic beverages, sodas, and a long list of snack foods. Nutritionists described permitted foods as *good*, emphasizing their vitamins or protein content. Prohibited foods – foods described as having fat and sugar – they described as *bad*.

After weighing the patient and then calculating his or her BMI, it was common for nutritionists to evaluate the patient’s typical day of eating. The aim of the consultation was to produce a *dieta* that would list all of the foods a patient should consume over a given day, for each day of the week, including portion size and suggested time of consumption. To create the *dieta*, nutritionists again categorized certain foods as “good/healthy” and others as “bad/unhealthy.” Sugar was bad. Fat was bad. By extension, foods associated with fats and sugars were also bad. Below, I present a substantial portion of one conversation between a nutritionist, a patient, and her grandson, so as to illustrate – as was also the case in the example with Eva above – that conversations about nourishment connect to broader themes of caregiving and kinship. Yet despite the diverse directions that interest in nutrition might travel, in this exchange foods ultimately become separated from the lived experiences in which they are consumed and treated as if they were solely functional and medicinal. As they are thus abstracted, they become endowed with fixed ontological properties— properties presumed to

move with the foods across time and context. Sweets *are* bad. Fats *are* bad. Herbs *are* good. Like the universal and generalizable properties associated with numbers, food takes on absolute identities; judgments that might be made through taste and texture, and in conversation with kin or one's body instead become compressed into seemingly universal rules and standards.

Hospital Exchange:

Nutritionist: Do you eat cakes, crackers?

Patient: Yes, Ma'am. Sometimes I eat chocolate. It's a need. I am bad, aren't I?

N: Ay! This isn't good Ma'am. Let's see. Well then, chocolate: no! Crackers: no! Jams: no! Honey neither. Cakes neither. Anything sweet: nope. Figs of whatever kind in honey: none of it. None of this can you eat. Only vegetables, fruits, meat and rice.

P: Okay, rice and beans.

Grandson: Bread?

N: But no. It's the same with bread. Not very much. Yes you can eat it, but only every now and then. Except sweet breads. You must help your grandmother, so that she doesn't eat it. When she eats it you have to tell her: "No grandmother, don't eat this." Okay? Yes?

G: (laughs)

N: You must tell your cousins too – to watch that she doesn't eat.

G: The young ones have all the responsibility.

N: Yes! You tell your cousins, your uncles and aunts: "She can't eat this." Okay? You'll help me with this?

G: Yes.

N: Good! Very good. (pause). Mazola oil or Canola oil. That's what you want – either of these is best. Okay? Herbs, whatever kind of herbs, you can eat. They're good.

P: Soup with herbs?

N: Yes, anything like that.

P: Herbs with egg?

N: We're going to avoid beets and carrots.

P: These I can't eat?

N: No because they're very sweet. No beets and carrots. They're bad.

P: Potato also?

N: No potato. No pasta either.

P: No pasta? What about mayonnaise?

N: No.

G: That is fat.

N: Excellent – that's right! He's got it! No hamburgers. No pizza. Nothing like that. No sausage. The worst is pork rind for all the fat it has. No cream. No cheese. Now you're thinking 'Jeez, they haven't left me with anything to eat!' But we are leaving you something.

P: No cheese either?

N: No, it has too much fat. Perhaps requesón (a ricotta-like cheese). It's better – that you can eat.

Okay?

Several of the hospital's nutritionists used colorful images of foods in the consultations. As they conversed with the patients about their dietary habits, they would assemble the images into three piles: healthy foods—to be eaten often; unhealthy foods—to be avoided; and middle foods – to be consumed in moderation. “These are confusing, complex diseases; income, family size, health history – this all matters ” one of the nutritionists told me when explaining why she



used the pictures. “They come in confused, and because we don’t want to confuse them further, we try to keep the lessons as simple as possible. You see, they might speak another language [not Spanish], but they will certainly recognize that this is a tomato and this is a carrot.”

Yet despite attempts made toward reductive categorization, many of the foods resisted easy placement into the piles by being low in fat (good) but high in sugar (bad), or high in some vitamins (good), but also high in simple carbohydrates (bad). The nutritionists often disagreed among themselves about where to place the pictures. Eventually they always chose a pile, which they then presented to the patient as an inflexible fact, but the root of the disagreement would not disappear: the “health” of a food can never be fixed into a category of good, bad since health is always dependent on the specificity of context. The apparently objective “view from nowhere,” (Nagel cited in Daston 1999:111) that seemed to materialize through the classification of foods into three piles, would always be a view from somewhere.

Indeed, when I visited patients at their homes the confusion that the nutritionists aimed to attenuate through their simple classificatory schema would resurface. Many patients were preoccupied with the details of the food rules they had learned, afraid they had confused healthy with unhealthy foods. They received messages about nutrition from a variety of sources: the hospital, friends and kin, radio, television, and newspapers. Each source employed reductive simplicity, labeling some foods as good and others as bad. Porter writes that people commonly view it as desirable “in cases of difficulty to have clear standards rather than to depend on judgment” (1995:35). Yet seemingly straightforward valuations of foods as healthy or unhealthy collided into one another when their reductive categorization spread out into the everyday experiences of eating. You see, avocados are high in fat (bad), but also high in vitamins (good); carrots are high in vitamins (good), but also high in sugar (bad); potatoes are low in fat (good),

but high in simple carbohydrates (bad)... and so on. “Clear standards” are, after all, still made of judgments.

### **Nutritional Reductionism**

Although my research focused on Guatemala it is not my desire to here emphasize a distinction between “Guatemalan” and so-called “Western” nutrition education strategies. Instead I aim to show how nutrients are black-boxed through a recursive logic that cares not for location or context—a logic that expands the significance of terms like vitamins and minerals while also making it difficult to pinpoint what they are, and how they operate. The nutrients I encountered in my fieldwork – though small and invisible under most circumstances – both presume and produce calculative, quantitative, and reductive forms of value. As is the case with historian Mary Poovey’s numerical “modern fact,” they reflect and circle back upon understandings of material reality, thereby contributing to systematic knowledge about the world. They entail information about the self through which we learn to manage our relationships with others; they act as a mode of representation that embodies “available ways of organizing and making sense of the world;” and they do all of this while appearing to be disinterested free-floating signifiers without an interpretive dimension (Poovey 1998:xv).

A nutrient-based understanding of human energy has been traced to Descartes’ efforts to explain bodily movements in mechanical terms. According to Cartesian explanations, digestion entailed a heat-induced separation of food-particles, “the coarsest descending, ultimately to be expelled through the rectum, and the finest particles flowing through appropriately sized pores to the brain and organs of reproduction” (Shapin 1996:48). Central to this belief was the idea that bodies, like machines, were composed of smaller and smaller parts. The interaction of these parts produced the qualities of the whole – its tastes, colors, and smells (Jardine 1999:94-6). Yet

though Descartes' mechanistic theories laid a foundation for a nutrient-based vision of food and bodies, a view of nutrients as elements in food required in a "balanced ration for life" (OED) would still be centuries in the making.

Nutrition scientist Kenneth Carpenter describes the laborious processes by which the mysterious workings of nutrition became a reputable science. He provides the memorable example of U.S. Director of Public Health Joseph Goldberger, who in 1916 used his own body to test whether pellagra – which was causing epidemic rates of death in the American south – was infectious: "He received subcutaneous injections of blood from patients [with pellagra], then had skin eruptions rubbed into his nasal mucosa, and finally ate some of their excreta" (Carpenter 2003:3027). Goldberger did not become ill, giving credibility to the idea that pellagra was not caused by the spread of microbes but by deficiencies of a small, invisible substance— what would later be known as niacin or vitamin B3.<sup>vii</sup> In the 1930s niacin – today called nicotinic acid – became mapped alongside other vitamins, which scientists began to understand to be organic compounds (defined as the substance arising from the combination of two or more atoms from different elements) necessary for life. Between 1913 (with vitamin A) and 1941 (with Folic Acid), vitamins were dissected into chemical parts and then labeled and arranged by the activity of their compounds. Regardless of how foods are enacted in dietary practices, "they all end up at such scale that a few men or women can dominate them by sight; at one point or another, they all take the shape of a flat surface of paper that can be archived, pinned on a wall and combined with others" (Latour 1987:227). Metabolic research on nutrients would soon translate into the charts, graphs, and labels of Recommended Daily Allowances (RDAs), which in turn began to accompany processed foods (Mudry 2009). Sociologists Espeland and Stevens suggest that commensurate systems – one of which, I suggest is the RDA – unite objects through a "shared

cognitive system” where qualitative differences and similarities are transformed into quantities that can be expressed in magnitudes of more or less (2008:408). That which is continuous and interpersonal comes to appear as impersonal, discrete, and hierarchical. Nourishment becomes equated with elements; health begins to appear as the sum of elemental parts.

This method for valuing food was largely unfamiliar for the women with whom I lived and spent time. They had been raised to consider tastes and textures, a process that required engagement and adjustment. Their knowledge about food was not knowledge that could exist outside of the activities of cooking; they did not (and could not) answer my question of “what is good food” with words, but would invite me to sit next to them while they crafted their meals. They gave me tastes of what they prepared so I could develop awareness of their skill within me, as this was how their own culinary knowledge had been formed.

Historian Gyorgy Scrinis argues that increasingly complex nutritional technologies that have emerged since the late 19<sup>th</sup> century have led to a “biomarker reductionism” (2008:42). In a process he calls *nutritionism*:

Particular nutrients, food components, or biomarkers—such as saturated fats, kilojoules, the glycemic index (gi), and the body mass index (bmi)—are abstracted out of the context of foods, diets, and bodily processes. Removed from their broader cultural and ecological ambits, they come to represent the definitive truth about the relationship between food and bodily health. Within the nutritionism paradigm, this nutri-biochemical level of knowledge is not used merely to inform and complement but instead tends to displace and undermine food-level knowledge, as well as other ways of understanding the relationship between food and the body. (2008:40).

The argument I have been advancing about nutritional education in Guatemala is that nutritional reductionism obscures foods' intricate social histories and complicated physical interactions. Absent from the classificatory categories of nutrition is attention to taste, pleasure, and awareness of all of the social relations inherent in the production and consumption of any meal. What remains is a focus on biological functionality— “a way of looking at and encountering food as being composed of nutrients, which overwhelms other ways of encountering and sensually experiencing food” (Scrinis 2008:46). It is not that social context itself becomes irrelevant; rather it becomes obscured by the abstraction of a meal's value into its biochemical parts, parts that themselves come to appear as the whole source of a meal's value to the body. Though reductive language camouflages the complexity that underpins the “epistemological units” (Poovey 1998) of nutrients, this complexity remains— resurfacing in the confusion that arises when people attempt to incorporate universalized food rules into the unpredictable and often-contradicting demands of everyday life. This confusion about eating does not result *in spite of* an effort to present food in a simplistic form, but *because of* this presentation.

### **Everything Good is Harmful: Misunderstandings in Nutrition Communication**

In my fieldwork I encountered numerous situations where an idea of value, presumed by health educators to be stable, transformed from one context to another. For example, I saw that patients at the obesity outpatient clinic of Xela's hospital often expressed confusion about vitamins. In nearly every consultation, nutritionists advised patients suffering from metabolic illness to eat more vegetables. *Vegetables have a lot of vitamins and are healthy* the nutritionists would say. The advice sounds simple; who could become confused? Yet when I spent an afternoon with a patient, Gloria, in her home, I noticed that she avoided eating the vegetables she served for

lunch. When I later asked her about this, she told me that vegetables had too many vitamins. Asking further, I learned that at a health training that she had attended at her children's grade school, the teacher advised her to feed them lots of vegetables. "Vegetables have vitamins," Gloria had learned from the teacher, whose knowledge mirrored that of the nutritionists. Yet, in this context the teacher had encouraged Gloria to feed her children vitamins because vitamins would help them to gain weight. Many children in Xela remain malnourished, and although concern about childhood obesity is increasing (Groeneveld, et al. 2007), childhood weight gain is still tightly linked with well-being. Gloria, however, had been treated for hypertension and was trying to lose weight. Associating vegetables with vitamins, and vitamins with weight gain, she was consequently avoiding their consumption.

The following exchange between a hospital nutritionist and a patient with diabetes illustrates another example of the potentially harmful effects of nutritional reductionism. Here, fears about food have caused the patient to avoid drinking atoles/cereals entirely; instead she drinks only purified water. The nutritionists told me that one of the largest obstacles they encountered was that patients attempted to diet by skipping meals or not eating enough. Nutritionists almost always advised patients to eat a snack between meals to stave off hunger, and they found unsweetened atole to be a popular, convenient, and inexpensive snack. Yet the patient here, uncertain and scared about what to eat, finds safety only in total avoidance.

Hospital Exchange:

Nutritionist: Cereal? Do you drink any kind of cereal? (In Guatemala, cereal is consumed as a beverage).

Patient: No, I only drink purified water, that's all I drink, doctor.

N: Just purified water? You don't drink atole anymore?

P: I don't drink atole anymore.

N: Not at all?

P: No

N: Why? Do you not like it?

P: Well I like it, but it scares me.

N: No, atole is okay.

P: Ah, that's good, doctor.

N: So, what we are going to want to drink, we're going to have two tablespoons of *mosh* (dry oatmeal).

P: That's how I make it.

N: That's how you make it? When?

P: Before breakfast.

N: Okay. And how much... how much mosh do you add?

P: I add three teaspoons.

N: I see. And in how much water? In one cup?

P: In my cup of water, I add about three teaspoons of mosh, and I drink it before breakfast.

N: Okay, that's very good. Don't stop doing that.

P: Very well.

N: Because that's very good, and it will take away all the fat you have in your body.

P: Very well doctor.

Although nutritionists commonly bemoaned the tendency of patients to think in “all or nothing” terms, I suggest that the pedagogical framework they employed contributed to this tendency. In the example above, the nutritionist might have taken this opportunity to direct the patient toward an awareness of the specificity of taste (i.e. if it is sweet, do not drink it); or she might have talked about the circumstances surrounding its consumption. Yet instead of discussing the context of the meal, the nutritionist circumscribed the patient’s diet into a carefully measured prescription: two teaspoons of dry oatmeal with one cup of water. Removing the context from mealtime experiences, she leaves the patient with other absolutes: “it’s very good,” and “it will take away all the fat you have in your body”— the obvious implication being that fat is very bad.

A reductive valuation of foods as good or bad has the additional effect of assigning to individuals the personal responsibility of following these ostensibly self-evident rules. Eva’s warning in the nutrition class above – “you must be very careful” – locates responsibility for health within the individual. Similarly, I often heard health educators scold their students when the students admitted to eating “bad” foods. Viewing nutritional advice as simple and therefore easy to follow, health educators described their students’ decisions to eat fats and sweets to me as willfully “non-compliant.” Patients and students, on the other hand, spoke to me about conflicting pressures they faced when eating. Eating fat might be “bad” from the vantage of a nutrition class, but it was also “bad” socially to forego eating what a friend or family member had prepared. However, since food rules were presented through simplistic and individualized frameworks, educators were often ill-equipped to help their students negotiate the complicated interstices of lived dietary experiences where “goods” and “bads” exist as continuums-in-conversations and not as absolutes. Moreover, a reductive understanding of foods as good or bad



has the effect of situating illnesses as the result of “simple” food choices, with the expectation that treatment lies in equally “simple” changes in dietary behaviors. In the following exchange we see a patient who, despite desiring foods she believes to be fattening, is following a recommended diet. Unable to map the patient’s illness to an obvious dietary failing, the nutritionist can offer no further assistance:

Hospital Exchange:

Patient: I have to tell you that I love fried plantains with refried beans. And cream.

Nutritionist: And cream?

P: But from a distance, because I know they’re harmful, right? Everything good is harmful.

N: Yes, that’s right.

P: I also don’t make fried chicken.

N: No, absolutely not. That’s forbidden.

P: No. I told you I never ever have it. Only boiled or stewed. But most importantly, with no fat.

N: Exactly.

P: Now, it’s me with my problems.

N: ... .. Pause, turns to chart. Picks up again 30 seconds later to ask about a typical day of food.

Underlying many nutritional miscommunications is the polysemic character of the commonly invoked notion of “health.” *¡Vamos a Comer Sano!* [We’re Going to Eat Healthy!] was a slogan for many governmental health classes, which educators reiterated in their lessons

by identifying specific foods as *sano* or *saludable* [Spanish synonyms for health]. Yet as I have been showing, “health” is not a property that can be fixed within a food; existing instead in the specificities of dietary practices, it is a process to be enacted, not an object to hold.

Within my field notebook I carried a picture of a local fruit stand. The photograph showed sliced pineapples, papaya, and melon, to be served with lime, salt, and chile powder for 13 cents a bag. In the background was a *comida chatarra* [junk food] stand, where for the same price, vendors sold bags of chips packaged in colorful plastic wrapping. During an afternoon conversation with Brenda, one of the first women with whom I lived, who became a friend I visited often, the picture slipped out of my notebook. Brenda, who was familiar with my project, picked it up and as she handed it back to me, smiled cleverly. She pointed to the fruit and then the chips and then asked me: *Which of these do you think is healthier?*

I had observed enough health education classes by that point to know that the “correct,” answer was the fruit. “Fruit is good and healthy” – I had heard this mantra hundreds of times. Yet despite a rubric of standardizable, reductive guidelines, there was no clear answer to Brenda’s question. The fruit might have been sitting on the street for hours absorbing the exhaust of traffic, the knife used to cut it might not have been clean, it might have been grown in polluted water. These were all possibilities that Brenda, who had two young children, pointed out as she told me that she didn’t allow her children to eat fruit from the street because it could give them diarrhea. She said that when she was away from home, she thought chips were a healthier snack for her family than fruit because they would not make them sick. *Not in the short term, anyway,* she laughed.

Not all potential misrecognitions were humorous. Many of the people I worked among were terrified by the changes happening within their bodies: the pain or numbness in their limbs,

the violent and unfamiliar urges of appetite or thirst, the repetitive need for urination even when they had not been drinking, the unusual palpitations of their hearts, or heat felt in their chests. While metabolic illnesses such as diabetes and heart disease have existed in small numbers in Guatemala for some time, the rates at which they are now occurring are unprecedented (Mendoza Montano, et al. 2008). People could not turn to their parents or relatives for stories that place the illnesses in a historical or social context. Scared, they listened carefully to the ideas of nourishment that came from nutrition educators. That people easily reinterpreted nutritional guidelines – adding extra sugar to drinks because it was fortified with iron, avoiding broccoli because they associated its vitamins with weight gain, eating chips because they were safe from microbes – was not the result of their lack of interest or attention. It was instead a result of the sheer impossibility of translating the sensations, emotions, and relationships of eating into abstract food groups and eating guidelines.

## **Conclusion**

Latour writes that knowledge is understood to be “familiarity with events, places and people seen many times over” (1987:220). Yet knowledge, he clarifies, must also account for the “whole cycle of accumulation” (1987:220). Most health educators I worked among would be judged as knowledgeable given the first part of this definition: they can match certain foods to certain vitamins; they can arrange foods into piles according to their quantities of fats and carbohydrates; they can explain a carbohydrate in the terms in which they have learned it (*if you do not eat them, you will not have energy*). And yet, their knowledge of nutrition is cut off from the accumulation of nutritional knowledge. They are like the scientists Latour describes who hold a piece of information, having “the form of something without the thing itself” (1987:243).

As a result, nutritional black boxes eventually lead to the tautologies of recursive definitions: *a vitamin is a vitamin*.

Nutritional black boxes give an appearance of stability to the otherwise processual experiences of nourishment; this stability allows them to travel around the world, so that even in the remote highlands of Guatemala people are learning to value food and eating on the basis of nutrients. Nutritional black boxes also make formerly separate objects – take the classically incommensurate apple and orange – appear in like terms. We no longer consider: *How do they taste?* We instead ask: *How many vitamins do they have?* We presume that the sum of the parts will equal the whole, and we consequently count the nutrients in apples and oranges to know their value. Yet when we relate the apparently “immutable and combinable mobiles” (Latour 1987:227) of nutrients to one another through equations derived from dissected parts, we lose sight of the *relationships* formed in eating, which can never be accurately fixed and measured. Nourishment will never simply be nutrients.

Humoral beliefs about health are no longer present in Xela, and I want to be clear that I am not advocating for their reintroduction. I draw attention to them because they help us to imagine other ways in which to communicate dietary health, and they provide a window into the existence of other – potentially many other – ways in which people might come to *know* their food and their bodies. It is relevant that in K’iche’, the experiences of desire and pleasure (*utz*) must be expressed through three other sensory experiences— sight, feeling (which encompasses touch, taste and smell) and sound. Instead of simply saying “I like,” as we do in English (in Spanish, *gustarse*), K’iche’ speakers linguistically conjugate the experience of pleasure with reference to these three different sensory experiences, identifying whether something pleases their sense of sight (*ilo*), their sense of feeling (*na’*), or their sense of sound (*ta*). I do not intend

to create a false sense of difference between K'iche' cosmologies of pleasure and the beliefs of those who speak only Spanish or English. We also experience pleasure through sight, touch, taste, smell, and sound. But, I suggest that the pedagogical and discursive models that surround *nutrición* minimize awareness of varied forms of pleasure in eating. In a complex world, these models present rigid grids and reductive language. It is from these reductions that people begin to say: this food is bad/unhealthy; this food is good/healthy. Such ideas appear simple, and at first glance they may even appear to be more intelligible. But this reduction obfuscates our diverse experiences of food, bodies, communities, and ourselves.

It is important to my argument that in most nutritional education classes I observed, those who were being “educated” remained quiet. Whether classes were directed toward children or adults, the assumption built into the pedagogical approach of the courses was that the audience had no nutritional knowledge of its own. Rarely did instructors ask about – or by extension value – the understandings of nourishment held by their audience. Porter argues that in democratic societies, institutional classroom instruction has supplanted the “kind of wisdom that comes from long experience, which is often passed on from parent to child or master to disciple” (1995:7). Formal instruction, he suggests, appears “more open and less personal,” (1995:7) thereby appearing more objective. In a similar vein, Daston has argued that aperspectival objectivity – the removal of individual idiosyncrasies central to nutritional black-boxing – became a scientific value when scientific knowledge had to be communicated across boundaries of nationality, training, and skill (1999:112). She writes:

Indeed, the essence of aperspectival objectivity was its communicability, narrowing the range of genuine knowledge to coincide with that of public knowledge... aperspectival

objectivity may even sacrifice deeper or more accurate knowledge to the demands of communicability (1999:112).

As I have argued, within nutritional education in the Guatemalan highlands, a “deeper” form of knowledge is sacrificed to an ostensible demand of communicability— with the unfortunate consequence of infelicitous communication. As is the case with nutritional knowledge – and potentially many other forms of knowledge – nourishment must necessarily be *personal* (and familial, and communal).

The example of research on pellagra I described in my earlier discussion of the history of nutritional science connects to my argument in a revealing way. “Outbreaks” of pellagra often occurred in communities around the world where corn was a staple food, yet the illness of pellagra was mostly absent in Mesoamerica, the ancestral homeland of corn. Nonetheless, it took scientists nearly two centuries to move from this observation to the knowledge of pellagra as a deficiency in niacin. Meanwhile, Maya peasants with no knowledge of *nutrición* continued to mix their corn with lye-filled *cal*, the lye helping to transform the niacin in corn to an unbound form that could be utilized by the body, thereby preventing the illness. Lacking a periodic table of elements – indeed lacking the concept of vitamins – they nonetheless followed careful culturally regulated tortilla-making practices that staved off sickness and subsequent death.

My research suggests that nutrition educational strategies have much to learn from listening to and valuing the knowledge that people already possess, even when this knowledge takes the inconvenient, ineffable form of practices, engagements, and diverse sensory experiences; even when this knowledge resists reductive simplicity. As difficult as it might be, public health nutrition might work to develop knowledge of and communication about nutrition that is deeply connected to the “cycle[s] of accumulation” through which this knowledge is

produced. It might also find a way to value the tastes, pleasures, relationships, and ways of knowing oneself and others that emerge through eating and feeding. This approach will be more complex than the educational strategy currently employed, with its black boxes of vitamins and nutrients. But this complexity may resonate with people in a way that is less confusing and more intelligible than contemporary models of nutritional reductionism. Nourishment is not cybernetics; it is not mathematics; it will never be “a modern fact.” No matter how hard educators work to distill the flesh of experience from the black boxes of nutrition, nourishment will remain the domain of bodies and lives.

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<sup>i</sup> The use of quotes indicates that I recorded, transcribed, and translated the conversation cited. When I refer to what people say in italics and without quotes this indicates I recorded the conversation in field-notes shortly after it took place. I recorded all hospital interactions, with consent from the nutritionists and patients following my university's protocol for research with human subjects.

<sup>ii</sup> During the 16 months of the fieldwork upon which this article is based (January 2008-April 2009), I conducted participant observation ethnography two days a week in the obesity outpatient clinic of the Xela's public hospital, traveled with health educators to rural communities two to three days a week, and lived in the homes of twelve local families.

<sup>iii</sup> INCAP was established following the *Universal Declaration of Human Rights* (1948), which identifies access to adequate food as both an individual right and a collective responsibility. Since its founding, the institute has been connected to the Pan American Health Organization (PAHO) – an offshoot of the United Nation's World Health Organization (WHO) – as well as the national Ministries of Health from the countries it represents.

<sup>iv</sup> Sugar meets the important international health criteria of being a processed food that is widely consumed and whose production is relatively centralized in just a few refineries (corn, while widely consumed, is processed in hundreds – if not thousands – of sites) (Dary, et al. 2005).

<sup>v</sup> Like many health services in Guatemala, these programs are funded by the government but coordinated by non-governmental organizations, making them both governmental and non-governmental.

<sup>vi</sup> INCAP designed this graphic in 1998, and it has since been incorporated into health and hygiene classes throughout Guatemala.

<sup>vii</sup> The medical physiologist Albert Szent-Györgi, widely credited with the discovery of Vitamin C in the 1930s, defined vitamins saying: "A vitamin is a substance you get sick from if you don't eat it" (2005:163). While this may today appear to be obvious, the idea that illness could be born of lack (and not the presence of a pathogen or toxic agent) countered the scientific paradigm of the 19<sup>th</sup> century.

#### **References:**

- ADAMS, RICHARD.** 1952. "An Analysis of Medical Beliefs and Practices in a Guatemalan Indian Town." Guatemala: Instituto Indigenista Nacional De Guatemala.
- CANNON, GEOFFREY.** 2005. "The Rise and Fall of Dietetics and of Nutrition Science, 4000 Bce-2000 Ce." *Public Health Nutrition* 8, no. 6a: 701.
- CARPENTER, KENNETH J.** 2003. "A Short History of Nutritional Science: Part 3 (1912-1944)." *J. Nutr.* 133, no. 10: 3023-32.
- COSMINSKY, SHEILA.** 1975. "Changing Food and Medical Beliefs and Practices in a Guatemalan Community." *Ecology of Food and Nutrition* 4: 183-91.

- 
- COVENEY, JOHN.** 2006. *Food, Morals and Meaning : The Pleasure and Anxiety of Eating.* 2nd ed. London ; New York: Routledge.
- DARY, OMAR, CAROLINA MARTÍNEZ, AND MÓNICA GUAMUCH.** 2005. "Sugar Fortification with Vitamin a in Guatemala: The Program's Successes and Pitfalls." In *Nutrition and an Active Life: From Knowledge and Action*, edited by Wilma B. Freire, 43-59: Pan American Health Organization.
- DASTON, LORRAINE.** 2000. *Biographies of Scientific Objects.* Chicago: University of Chicago Press.
- 1999. "Objectivity and the Escape from Perspective." In *The Science Studies Reader*, edited by Mario Biagioli, xviii, 590 p. New York: Routledge.
- DAVID OLIVA, SAUL.** 1977. "900,640 Niños Desnutridos." *Diario de Centro America*, August 23.
- ESPELAND, WENDY NELSON, AND MITCHELL L. STEVENS.** 2008. "A Sociology of Quantification." *European Journal of Sociology* 49, no. 03: 401-36.
- FOSTER, GEORGE M.** 1987. "On the Origin of Humoral Medicine in Latin America." *Medical Anthropology Quarterly* 1, no. 4: 355-93.
- GRATZER, W. B.** 2005. *Terrors of the Table : The Curious History of Nutrition.* Oxford ; New York: Oxford University Press.
- GROENEVELD, IRIS F., NOEL W. SOLOMONS, AND COLLEEN M. DOAK.** 2007. "Nutritional Status of Urban Schoolchildren of High and Low Socioeconomic Status in Quetzaltenango, Guatemala " *Pan American Journal of Public Health* 22, no. 3: 169-77.
- INCAP.** 2000. "Informe Anual." edited by INCAP. Guatemala City: Instituto de Nutrición de Centro América y Panamá (INCAP/OPS).
- JARDINE, LISA.** 1999. *Ingenious Pursuits : Building the Scientific Revolution.* New York: Random House.
- LATOUR, BRUNO.** 1987. *Science in Action : How to Follow Scientists and Engineers through Society.* Cambridge, Mass.: Harvard University Press.
- LOGAN, MICHAEL H.** 1973. "Humoral Medicine in Guatemala and Peasant Acceptance of Modern Medicine." *Human Organization* 32, no. 4: 385-96.
- MENDOZA MONTANO, CARLOS , KARIN ESTRADA, ANDREA CHÁVEZ, AND MANUEL RAMÍREZ-ZEA.** 2008. "Perceptions, Knowledge and Beliefs About Prevention of Cardiovascular Diseases in Villa Nueva." *Prevention and Control* 3: 1-9.
- MUDRY, JESSICA.** 2009. *Measured Meals: Nutrition in America.* Albany: SUNY Press.
- PINEDA, OSCAR.** 1998. "Fortification of Sugar with Vitamin A." *Food and Nutrition Bulletin* 19, no. 2.
- POOVEY, MARY.** 1998. *A History of the Modern Fact : Problems of Knowledge in the Sciences of Wealth and Society.* Chicago: University of Chicago Press.
- POPKIN, BARRY M.** 2001. "The Nutrition Transition and Obesity in the Developing World." *J. Nutr.* 131, no. 3: 871S-73.
- PORTER, THEODORE.** 1999. "Quantification and the Accounting Ideal in Science." In *The Science Studies Reader*, edited by Mario Biagioli, xviii, 590 p. New York: Routledge.
- 1995. "Trust in Numbers the Pursuit of Objectivity in Science and Public Life." Princeton, N.J.: Princeton University Press.

- 
- RAMIREZ-ZEA, MANUEL, PAUL MELGAR, AND JUAN A. RIVERA.** 2010. "Incap Oriente Longitudinal Study: 40 Years of History and Legacy." *Journal of Nutrition* 140, no. 2: 397-401.
- REDFIELD, ROBERT, AND ALFONSO VILLA-ROJAS.** 1971. *Chan Kom, a Maya Village*. Chicago: University of Chicago Press.
- SCRINIS, GYORGY.** 2008. "On the Ideology of Nutritionism." *Gastronomica* 8, no. 1: 39-48.
- SHAPIN, STEVEN.** 1996. *The Scientific Revolution*: University of Chicago Press.
- TEDLOCK, B.** 1984. "An Interpretive Solution to the Problem of Humoral Medicine in Latin America." *Soc Sci Med* 24, no. 12: 1069-83.
- WELLER, SUSAN C.** 1983. "New Data on Intracultural Variability: The Hot-Cold Concept of Medicine and Illness." *Human Organization* 42, no. 3: 249-57.