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Nutrition, Agriculture and the Global Food System in Low and Middle Income Countries

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Abstract

The entire food value chain and diet of low and middle income countries (LMICs) are rapidly shifting. Many of the issues addressed by the nutrition community ignore some of the major underlying shifts in purchases of consumer packaged foods and beverages. At the same time, the drivers of the food system at the farm level might be changing. There is a need for the agriculture and nutrition communities to understand these changes and focus on some of their implications for health. This rapid growth of the retail sector will change the diets of the food insecure as much as that of the food secure across rural and urban LMIC's. This short commentary contents that current research, programs and policies are ignoring these rapid dynamic shifts.

Keywords

Low and middle income countries; nutrition; consumer packaged foods and beverages; food value chain

1. Introduction

We face major conflicting perceptions of the world of food, agriculture and nutrition. On the one hand there is an enormous need to focus on food insecurity and undernutrition and with it ensure adequate grain, pulse, oils and vegetable supplies and a critical focus on not only the first 1000 days of life but also key intergenerational issues of diets and adequate growth patterns of females. On the other hand overweight and all the related complications are rising rapidly in all Low and Middle Income Countries (LMIC's) and affecting all ages of the population and bringing with them a major new generation of health problems. Concurrent shifts are seen in two dimensions of the food system: the rapid growth of modern retailing and consumption of consumer packaged foods and beverages and the shift of the food value chain from traditional traders and retailers to one where supermarkets and food manufacturers directly source food from farmers and traders. From a public health perspective, the latter shift in food value chains and modern manufacture and retail will have profound effects on the diets of all LMIC's and subsequently affect both under- and over-nutrition. Coming to grips with these dynamics represents I feel a major global challenge for international agriculture and nutrition at a time great constraints are being placed on the system and funding.

This short commentary discusses some of the major conflicts in perspective, evaluates them and presents new evidence related to the advances in the modern food system and raises the challenge to agriculture and nutrition scholars that if we are to create an integrated sense of how food system dynamics in LMIC's are affecting diet and health among urban and rural poor, we must come to grips with the changes underway soon. Ultimately global agriculture is going to have to figure out how to redirect and regulate these emerging retail and processed food sectors or we may find that the poor's diet is transformed and our efforts to enhance food production and reduce overall food insecurity really have missed the major future targets which will improve the diets of the LMIC's poor urban and rural populations.

2. THE PERSPECTIVES WITHIN THE NUTRITION COMMUNITY

2.1 The first thousand days: should adolescence be included?

Much of the energy of global agencies and the agriculture and food system community as it links with the human nutrition community has focused on the first 1000 days theme. This is a critical component of food insecurity and malnutrition. At the same time, there are major intergenerational and other issues linked with undernutrition at other stages in the lifecycle that are critical but are ignored. This is important to note as the modern food system shifts I describe below affects quite differentially different stages of the life cycle of any person. The mantra of the first 1000 days is a bit naïve as we need to be focused not only on adequate maternal and child nutrition but also adequate growth for young females as we attempt to address intergenerational transmission of low birth weight and poor growth patterns. Getting adequate nutrition not only to women during pregnancy and lactation but also during adolescence plus proper infant feeding patterns are critical to prevent much of the malnutrition the globe faces in terms of both acute malnutrition and stunting. But the more complex issues of linking these same issues to an adequate growth profile that will address intergenerational transmission of undernutrition via low birth weight in South Asia and other areas of similar need represent a more complex array of issues. Even more complex is the huge gap in our understanding of the growth patterns that will be linked with the lowest risk of obesity and noncommunicable diseases (Popkin et al., 2012).

2.2 Do we just push traditional diets and consumption of real food or is it too late?

A major theme is the push for retaining traditional diets and food patterns in general. While they might always be healthful, there is a clear sense in the nutrition world that cooking real food rather than an excessive focus on processed or ultra-processed food is important. One question this paper poses is whether the push to preserve traditional cuisines and consume real food is naïve and is ignoring the massive growth of the modern consumer packaged food and beverages sector in LMIC's. This is true for debates around weaning foods as much as it is for debates about processed foods in general. There are environmental relationships also to be considered (Food and Agricultural Organization of the United Nations, 2007); however, the major battle about food vs processed food is not pursued further here (Ludwig and Nestle, 2008; Monteiro and Cannon, 2012; Monteiro et al., 2010; Monteiro et al., 2011; Monteiro et al., 2013; Nestle, 2007a, b; Pollan, 2006a; Pollan, 2006b, 2010; Woolf and Nestle, 2008) though elements of this affect weight gain, obesity and all other major noncommunicable diseases (Mozaffarian et al., 2011; Mozaffarian D, 2010;

Willett, 2001; Willett, 2006). This side battle focuses the food only push vs those who focus on improving the quality of what is already purchased (Rayner et al., 2013; Roodenburg et al., 2011; Sacks et al., 2011; Wartella et al., 2010). There are major critiques of this approach (Brownell and Koplan, 2011; Nestle and Ludwig, 2010).

In a later section we discuss the importance of processed food and question whether the push to retain traditional diets may not be feasible for many subpopulations and countries.

3. PERSPECTIVES IN THE AGRICULTURE COMMUNITY RELATED TO NUTRITION

While there is increasing awareness that we have a major global increase in obesity and obesity and undernutrition coexist throughout the low and middle income world, the bulk of the research and focus remains on food insecurity and hunger in terms of LMIC's. This could be highlighted by the IFPRI Addis Adaba conference '2020 Conference on "Building Resilience for Food and Nutrition Security'. While most national and international agencies and nonprofit groups focused on food and agriculture, provide lip service to the problem of obesity, when this is truly addressed it is mainly in higher income countries and ignores the issue in lower income countries (AGree, 2013). As we see a renewed focus on nutrition, health and agriculture much of it still focuses on traditional farming, particularly in Africa, with minimal effort to understand the rapid shifts and transformations going on globally in LMIC's agriculture. This is evident in the major research institutes in the food policy area such as IFPRI and newer ones such as the Leverhulme Centre for Integrative Research on Agriculture and Health (LCIRAH) and most research from the World Bank and regional banks. In contrast there are insightful new studies that show very rapid shifts in the food value chains underway in select countries (Gómez and Ricketts, 2013; Reardon, 2012).

What is not clear in this entire focus on food security is how much this focuses on the very narrow clear needs to the critical maternal and child health and adolescent female populations which link to long-term adequate growth and development. Much more targeted efforts have usually been needed to truly address these issues in most countries though there are others like China and Mexico where economic growth and income transfer programs seem to have led to major reductions in undernutrition and then these have had to be followed by targeting unique subpopulations still suffering from undernutrition. Furthermore the issues of adequate weaning food and an overall appropriate infant feeding pattern do not necessarily mesh with the global focus on overall agricultural production.

It is also not clear that this entire push is taking into consideration adequately the remarkable global transformation of agriculture and food production and processing. The urban and rural poor across the world are selectively purchasing from modern retailers increasing amounts of processed foods (Gómez and Ricketts, 2013). At the same time, there are in the agricultural sector on-going studies by Reardon and others that document the enormous growth of the modern retail sector. In a large number of earlier papers Reardon and many colleagues have documented the very rapid increase in modern retail markets in Latin America, Asia and Africa (Balsevich et al., 2003; Neven et al., 2009; Reardon and

Berdegue, 2002; Reardon and Timmer, 2012; Reardon et al., 2003; Reardon et al., 2012; Reardon et al., 2004).

The most insightful and provocative study is his recent publication with a team of scholars that examined the entire food chain in India, Bangladesh and China and looked at how the food value chain was being transformed within the context of this dynamic modern food system (Reardon, 2012). This poses major challenges for our traditional way of studying horizontally components of the food value chain when they suggest it may be driven increasingly by retailers and large consumer packaged food and beverage companies. Furthermore, there are two elements to consider in their work. If indeed the food value chains are being so transformed and if indeed modern retailing is growing this rapidly, the food consumed and available to both the urban and rural poor will be entirely different in the next decades and agriculture policy and food policy in general need to face this new reality in a much more thoughtful manner. We know already that in the US and many other higher and some LNIC's the retail sector plus agribusinesses already have created full vertical integration of the food value chain from farm to factory or retailer. Aside from the few countries studied, we do not know at this time how universal this transformation is (Reardon, 2012).

4. THE MODERN RETAIL SECTOR AND ITS REACH IN SELECTED COUNTRIES

We have few studies which have examined in low and middle income countries the scope of this sector. We have Reardon and many others who document its growth. We have one small cross-sectional study that suggests that processed food purchases are linked with increased BMI (Asfaw, 2011) and indirectly links this with the rapid shift toward a modern food retail sector in that country. In several recent national studies, we have used large nationally representative (Mexico) or nationwide (China) dietary intake surveys to collect data relevant to this issue. We will continue to collect these data and once longitudinal data are available, we will begin to be able to say something about those who purchase processed food and the impact of this food on various health parameters, understanding the complex endogeneity of all food consumption decisions when it comes to selection of shopping venues.

On the one hand agricultural economists such as Reardon and others have shown that produce and meat purchases and sales remain mainly controlled by traditional food retail sectors while packaged food is predominantly purchased in the modern retail chains. Figure 1, using data obtained from a recent Food Policy paper highlights that it still is the packaged food that is mainly purchased from modern retailers (Gómez and Ricketts, 2013).

Our research using direct measurement of dietary intake suggests quite remarkable transformations currently in Mexico (and potentially other rapidly growing Latin America countries) and future ones will be found in Asia in the consumption of consumer processed foods. In two recent national surveys in China and Mexico, we asked as part of 24-hour recalls the origin of each food they consumed in terms of whether it was processed and packaged or not (Gutiérrez et al., 2012; Popkin et al., 2010; Romero-Martínez et al., 2013; Zhai et al., 2014; Zhang et al., 2014). We do not know the origin of restaurant food in either

country. However for all food consumed in the homes, we could make this separation. In China we could go one step further in our collection and differentiate food consumed in the home that was home made from fresh bulk items (e.g., produce, fresh animal foods, rice purchased in bulk) from those processed and packaged as well as from away-from-home calories. In Mexico we could only separate out the processed home food from the total calories consumed but could not separate out away-from-home food.

For Mexico, we separate Mexico City from other urban areas from rural areas. What is surprising is that for Mexico, in rural areas and urban ones other than Mexico City there is a very small difference in the proportion of calories per capita that come from packaged processed foods (Figure 2A). Overall in Mexico 58% of all calories comes from consumer packaged foods and beverages. Elsewhere we have shown that this is rapidly growing in the beverage sector but have not explored trends in food (Stern D, In Press).

China is at an earlier stage of the retail sector growth and hence, a very early stage of consumption of consumer packaged foods and beverages; nevertheless already 29.6% of all calories come from consumer packaged foods and beverages (Figure 2B). Indeed we see that more than a third of calories come from this sector even in Beijing, Shanghai and Chongqing, the three Chinese cities that are autonomous. Big cities are those with 5-20 million people. The big cities in Figure 2B are those with 5 to 20 million and you see the progression of intake of CPG food and beverages increases with size of the urban area.

It is useful to understand what types of foods one of these countries residents consumed as processed consumer packaged foods and beverages. We present the data for Mexico to provide some sense of this component. In Table 1 we organize the foods and beverages into items predominant processed and packaged by the food industry versus those only partially processed and packaged. Section A presents the proportion of calories within each food groupings that are processed and packaged. Section B presents the proportion of each age group's calories that come from this food or beverage group. Section C provides the proportion of all processed and packaged foods and beverage calories that come from each food group. We present data for 3 age subgroups and the total sample ages 2+. As we see in Table 1 Columns A., less than a quarter of animal food products (excluding dairy) are processed and a tiny proportion of produce fits this category except for the processed items. In Table 1 Columns C we see about equal proportions of all processed beverage calories come from the very processed foods (collection of rows 2: 5.6% of all processed food kcal) vs 7.3% of kcal from the beverage categories with much less processing (section 4). In contrast much of the food processed kcal comes from the heavily processed foods (section 1). Overall major caloric contributors of processed and packaged food in Mexico come from dairy, tortilla, sugar-sweetened breads and desserts, salty snacks, meats, mixed dishes, and sugar-sweetened beverages. These groups represent about half of all processed and packaged food calories. Tortillas might seem like an unlikely processed food product; however about 98% of the masa flour used in tortillas is highly refined and comes from two major manufacturers in Mexico (Popkin, 2008).

We also have a separate indicator to highlight the trends purchase levels of packaged food expenditures per capita in higher and lower income countries. As can be seen the high

income countries are at much higher levels of expenditures and the high income Latin American countries are purchasing higher levels than are found in other LMIC's show in panel B. Also Figure 3B highlights the rapid growth of the sector in this one incomplete measure of the importance of the processed food sector.

From these two sets of figures (figures 2 and 3) we see that low level of processed packaged food that still exists in China and indeed in most Asian countries but we also see some of the growth we must expect in the future when we compare the large metropolitan megacities of China and Mexico with the rest of the country. And also when we note the growth shown both in Euromonitor and the studies of Reardon and others, my sense is that this is a train moving very rapidly forward. Mexico and Latin America show how deep the penetration of the retail sector and processed food is and I expect many Asian countries to move upwards though not necessarily to the level of Mexico.

Unfortunately to truly see the total growth of this sector, one needs volume and dollar values from a much more accurate retailer dataset that this author did not have access to (<http://www.planetretail.net/>). This is the retailer database Reardon uses. Euromonitor is useful for trends of sales but missed many component of the retail food sector. What we can say is that the penetration of the retail sector in China into almost all villages is complete. In our CHNS survey of 12 provinces and 240 communities every community now has at least one small grocery/convenience store. And in towns and cities of all sizes, some type of larger supermarket or megamarket is found. This happened just since 2000 that all villages reached this level of penetration, even a dozen in very poor isolated counties.

5. What does this mean for the agriculture sector?

In both high and lower income countries where we have obtained data on this emerging retail sector, we are finding the basic drivers in the food system are rapidly shifting. This enormous increase in the size and power of both the retail sector as noted by Reardon's many studies and others and the rapid increase in the CPG multinational and local food and beverage companies is driving a rapid transition of both the agriculture sector and the diet of rich and poor alike in LMIC's. The proportion of calories from this sector is poorly documented, little is understood yet about its nutritional impact; however at the same time we must realize that rich and poor alike in LMIC's are also changing their diets and purchasing increasing amounts of processed and even more ultra-processed foods and beverages. What this means for agriculture and its entire food value chain as well as health remains a major question that we must not neglect in future research and policy formulation. Yet we continue as a field to neglect this topic.

What is most interesting is the extent to which the donor community has completely ignored these shifts. They have funded studies such as the recent Reardon one but have not addressed ways these changes are affecting what is a prime concern—food insecurity. Moreover they ignoring how the consumer packaged food purchases of the poor are affecting their health, let alone how these affect the emerging noncommunicable disease problems of all LMIC's. Nor have they begun to monitor the shifts in the way the food

system operates from farm to factory or retailer across Africa and much of Asia and what this means for research and policy creation for the agricultural sector.

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Source: from Gomez et al Food Policy 2013.
Originally from Gorton et al 2001, Euromonitor 2012, and Goldman and Vanhonacker 2006
Mexico 2012 and China 2011 come from data collected by the Ensanut2012 and the
China Health and Nutrition Survey, 2011.

Figure 1.
The Proportion of Sales from Modern Consumer Packaged Foods

Figure 2.

The Proportion of calories from processed foods (food and beverages from consumer packaged goods)

Source: Ng and Dunford Obes Revi(2013).
Euromonitor Global Market Information Database.

Figure 3.
Food Sales per capita per year (2012 US \$)

Table 1

Proportion of kcal/day from processed foods, Mexico ENSANUT 2012

	A. Percent of kcal in each food group from processed food				B. Percent of total daily kcal from food group				C. Percent of total daily kcal from processed food			
	2-18	19-59	60+	2+	2-18	19-59	60+	2+	2-18	19-59	60+	2+
1. Food Group predominant processed by industry												
Dairy & soy	87.8	83.1	82.8	85.5	11.6	5.4	6.7	8.1	10.0	4.3	5.2	6.8
Tortillas	86.0	89.1	86.0	87.8	13.3	18.6	21.0	16.6	11.0	15.9	17.5	14.1
Pastries/pan dulces/desserts	94.8	94.0	96.4	94.6	13.1	10.4	10.0	11.3	12.2	9.6	9.4	10.5
Nuts, nut butters, seeds, & coconut	85.2	87.6	86.9	86.9	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.3
Breads and rolls, mostly unsweetened	97.1	98.8	99.5	98.5	1.2	1.6	2.3	1.5	1.1	1.6	2.3	1.5
Ready-to-eat cereals	66.6	76.2	74.0	71.2	0.8	0.4	0.3	0.5	0.5	0.3	0.2	0.4
Vegetable oils & animal fats	100.0	100.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salad dressing	100.0	100.0	98.1	99.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salty snacks from grain or starchy vegetables	98.0	98.3	99.9	98.3	3.8	1.3	0.4	2.1	3.7	1.2	0.4	2.1
Dips & spreads	64.8	52.9	75.6	63.4	0.0	0.1	0.2	0.1	0.0	0.0	0.1	0.0
Baby food, infant food, formula	93.0	100.0	100.0	91.0	0.2	0.0	0.2	0.8	0.2	0.0	0.2	0.7
Dietary supplements	100.0	100.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2. Food groups partially or fully home processed (% processed)												
Meat/poultry/fish/eggs	27.4	20.5	20.7	23.1	12.3	14.0	12.8	13.1	3.6	2.9	3.0	3.1
Legumes	14.0	15.8	15.0	15.0	3.7	4.4	5.7	4.2	0.8	1.0	0.9	0.9
Grain-based mixed dishes	26.5	23.2	30.3	25.0	15.7	16.3	13.7	15.5	4.8	4.2	4.7	4.4
Fruits & veggies	3.6	4.4	4.1	3.9	3.4	2.8	4.2	3.3	0.2	0.1	0.1	0.1
Processed veggies & potatoes	19.0	17.7	22.7	18.7	1.9	2.2	2.4	2.1	0.4	0.5	0.6	0.5
Sandwiches & filled rolls	42.0	36.7	51.8	39.9	4.0	3.4	1.8	3.3	1.8	1.4	1.0	1.4
Burgers	33.7	20.4	10.8	25.7	1.0	0.7	0.8	0.8	0.3	0.1	0.1	0.2
Sauces and condiments	17.8	10.4	9.1	12.0	0.3	0.4	0.7	0.4	0.0	0.0	0.0	0.0
Soups, stews, broths & creams	49.2	37.9	38.3	42.2	3.2	2.3	2.8	2.9	1.7	1.0	1.1	1.3
3. Beverages 99-100% processed by industry												
Sodas	99.9	100.0	99.7	100.0	2.9	4.8	2.5	3.8	2.9	4.8	2.4	3.8
Fruit/veg drinks	99.0	98.7	100.0	99.0	0.2	0.0	0.0	0.1	0.2	0.0	0.0	0.1

	A. Percent of kcal in each food group from processed food				B. Percent of total daily kcal from food group				C. Percent of total daily kcal from processed food			
	2-18	19-59	60+	2+	2-18	19-59	60+	2+	2-18	19-59	60+	2+
100% vegetable juice	100.0	100.0	100.0	100.0	1.4	0.6	0.5	0.9	1.4	0.6	0.5	0.9
Meal replacement beverages	99.7	100.0	99.2	99.9	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1
Sports drinks	95.3	87.9	69.4	83.8	0.0	0.1	0.3	0.1	0.0	0.1	0.2	0.1
Energy drinks	100.0	100.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beer/wine/liquor	100.0	95.4	99.8	95.3	0.1	1.2	0.4	0.7	0.1	1.1	0.4	0.6
4. Other beverages home or street processed (% processed by industry)												
Industrialized flavored water	68.7	66.9	86.1	68.1	0.4	0.4	0.2	0.4	0.3	0.3	0.1	0.2
Coffee/tea	72.9	72.8	74.0	72.8	2.1	4.2	5.6	3.6	1.5	3.2	4.2	2.7
Agua frescas and other sweet beverages	45.9	41.2	44.1	43.0	1.8	1.9	1.6	1.8	0.8	0.7	0.4	0.7
Horchata	36.1	70.1	89.8	62.4	0.3	0.5	0.6	0.4	0.2	0.3	0.5	0.3
Chocolate water	42.5	12.4	46.8	28.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
100% fruit juice	7.0	7.7	1.0	8.2	0.2	0.4	0.6	0.3	0.0	0.0	0.0	0.0
Mixed alcoholic beverages	7.2	65.6	94.8	69.0	0.0	0.3	0.1	0.2	0.0	0.1	0.1	0.1
Other beverages	12.0	0.7	66.0	11.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Atole Water-based	30.2	38.8	36.2	34.9	0.5	0.6	1.4	0.6	0.2	0.3	0.4	0.3
Total % all food and beverages processed	60.3	56.3	56.6	58.2	100.0	100.0	100.0	100.0	60.3	56.3	56.6	58.2
Total kcal/d					1867	2076	1713	1926				