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Food consumption versus income in the city of Cali, Colombia: the poor are not necessarily the worst off

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Summary

The rapid epidemiological transition occurring in urban areas is a very high burden for emerging countries. While it is admitted that poor households are more vulnerable than richer to overweight & obesity, the link between overweight & obesity and food consumption is still controversial. Data from a sub sample of the national sample of the 2006 Colombian LSMS (Living Standards Measurement Study) survey was analyzed: it consists in 1300 households representative of the city of Cal. We compared food consumption according to the level of poverty of the households. Unsurprisingly the richer households consume more of almost all products than the poorer households. They consumed also much more of the "un-healthy" food products such as industrial processed food, or meat, and more alcoholic beverages. On the contrary, poor households ate as often fruit and vegetables as the richest. The analysis has to be fine-tuned but these first insights show that the common idea that "poor" eat a poor quality diet compared to the better off, might not be true.

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D12 Consumer Economics: Empirical Analysis

P46 Consumer Economics • Health • Education and Training • Welfare, Income, Wealth, and Poverty

Q18 Agricultural Policy • Food Policy

Introduction

The economy of Colombia, similar to most Latin America countries, has been growing during the two last decades, in spite of the ongoing armed conflict. In 2008, the World Bank changed the country from the Lower to the Upper middle group of income. This economic growth is however hampered by the very high level of inequalities which only reduces very slowly (The Gini index – 53% - was still one of the worst in the world in 2013). Like in all emerging economies, the country became increasingly urban and the agricultural and food sectors have adapted and are being transformed. Food chains, from the producers to the final consumers, have become more complex. Some remain "traditional" with low processing and mainly sourced from the local food basin, short distance transportation and usually few intermediaries. On the opposite, some are based on industrial transformation of the farm products, the standardization of the products and processes, and the multiplication of both technical and economic intermediaries. Many food industries and food retailers and supermarket chains have emerged. During the same period, a radical epidemiological transition has been observed in Colombia, just like in other emerging countries such as in Asia, in the Middle East, Northern Africa or other central and southern American countries. It consists of a simultaneous sharp decrease of communicable diseases and the rise of non-communicable diseases - NCD (cancer, cardio vascular pathologies, depressions, etc.). The human and economic costs of these new pathologies are very high and even more binding in emerging countries. The different causes of the NCD epidemic are usually linked to the rise of overweight and obesity which in turn is caused, at the individual or household level, by changes in living habit, less physical activity and changes in food consumption patterns. The latter is sometimes called "food transition" and is characterized by an increase in oil and fat, sugar, meat consumption, and a decrease in pulses, fruits and vegetables consumption (Popkin & Ng, 2007)

Apart from this conventional claim, a group of public health scholars and practitioners lead by Carlos Monteiro from Brazil argues that the links between the observed changes in diets and the epidemic of obesity is related to the nature and the level of processing of the food products that are purchased and consumed. They propose a classification of products (NOVA) based on the nature and the level of processing of the food that is bought by the households or persons. The NOVA classification consists of (1) unprocessed of minimally processed food products, (2) processed culinary ingredients that are combined with group 1 products in order to prepare meal in homes or restaurants, (3) Processed foods, relatively simple products and (4) ultra-processed food and drink products, i.e. Industrial formulation (Monteiro *et al.*, 2016). In several different countries, they established correlations between the level of consumption of ultra-processed food of the food group number 4 and the prevalence of NCD.

The question of designing specific policies for urban sustainable food systems has emerged as a priority in many international development agendas. It is supported by different high level

and global initiatives such as the Milan Urban Food Policy Pact. In Cali Colombia, a medium to large sized city (with about 2.3 million inhabitants), the issue is the subject of interest linked to addressing inequalities between different urban dwellers in an applied-research project entitled Cali Better Food (Ford Foundation/CIAT, 2015-17). During 2015, the scientific and grey literature about food in Cali was explored. Different actors from public services in charge of nutrition, food security and agriculture, from companies of the food sector (traders, caterers, supermarkets leaders, small shop keepers) or involved in social (religious) aid associations for the poor were interviewed. Evidence was found that policies and interventions were not based on strong and shared data and/or knowledge concerning the definition of the food problems of the poor the policies aim to address. In a roundtable (December 2015) with the main stakeholders of the food system, the preliminary findings were discussed and one recommendation was to develop additional lines of research to better describe and understand food consumption of urban populations, in light of differences between the "poor" and the "rich" in order to address different specific research questions. This paper is one contribution to this research, using a statistical analysis of existing consumption data.

What is known and what is obscure

Mal-nutrition in Cali compared to other cities: good and bad news

For Cali, the existing literature concerning the food or nutrition transition describes the same trends in malnutrition than in all of Colombia: a simultaneous large decrease in undernutrition and a rapid increase in overweight and obesity. In 2010, children under 5 years old in Cali were less affected by undernutrition (less stunted, wasted or underweighted) than children in other Colombian regions. In the same strand, women in Cali were less often underweighted. Instead, children and women in Cali and the Valle region[1] were more affected by overweight and obesity.

More precisely, in Colombia, malnutrition of children under 5 years mainly consisted in chronic malnutrition that translates into a low height for age (stunting). The results of the national survey on demography and health "ENDS-2010" showed that in 2010, 13.2% of children were stunted (Ojeda et al, 2011). Even if this rate was still high, it has been divided by two between 1990 and 2010 (ENDS-2010 quoted by Neufeld *et al*. (2012)). In 2010, the prevalence of low weight for height (wasting) was very low (with 0.9%) and the prevalence of low weight for age (underweight) was also low (3.4%). On the other hand, 4.8% of the Colombian children were considered too heavy for their size regarding international standards in 2010.

According to the ENDS-2010 survey, there were large differences between sociodemographic levels, regions or areas of life among others: all indicators improved significantly with the level of education of the mother ; in rural areas stunting prevalence was much more important (17%) than in urban areas (11.6%) ; on the contrary, excess weight was

[1] Valle del Cauca is the department of which Cali is the capital (also referred to as Valle).

more important in urban areas (5%) than in rural areas (4.1%) (Ojeda *et al*, 2011, pp 296-297).

Less undernutrition than in other Colombian regions / cities

Regions also showed large differences. Children under 5 years of Cali had a very low prevalence of stunting with only 5.3% of children under five affected (against 11.6% all in urban areas, 16.3% in Bogotá). Similarly, in the rural periphery of Cali, the sub-region "without Cali, Valle or Littoral" had a low prevalence of stunting (7.2%) compared to the other rural sub-regions (average 17.0%) (Ojeda *et al*. (2011), p. 297).

Undernutrition indicators were, in 2010, also for women, better in Cali than in the total Colombian population. The women of Cali and the Valle were higher (taller) than women in the other sub-regions (156.9 cm and 156.2 cm respectively against a national average of 155.9 cm); the prevalence of underweight (index of mass body < 18.5) was lower in comparison to the national average. Underweight affected 4.5% of women in Cali, 4.6% of the women of the Valle without Cali, while at the national level, it affected 4.8% of all women.

To our knowledge, there are no known explanations for these relative "good" performances. Are they linked to the rich "natural" environment[2] which is a source of food diversity, to specific, political, economic or cultural causes (a mix of different origins and complex food traditions)? Are they related to food or to healthy specific practices? This is not clear.

More overweight and obesity

On the other hand, the level of overweight and obesity was worst in Cali than in other parts of Colombia, both for children and adults.

The nutritional situation of Colombian women was characterized by a high prevalence of overweight and obesity that constitute therefore a greater risks in terms of health and well-being. 45.3% of Colombian women from 15 to 49 years were so affected in 2010. For children the prevalence of overweight reached 46.6% in rural areas and 44.9% in urban areas in Colombia in 2010.

Both the the city of Cali (46.7%) and the Valle-without-Cali-or-littoral sub-region (46.4%) had rates above these national estimates. Parra *et al*. (2015) show that the prevalence of obesity has increased more quickly in poor households between 2000 and 2010 than in other households. Olszowy *et al*. (2012) who studied poor women in Cali also showed that body

[2] Indeed, Cali is ideally located in altitude and almost under the equator. The soils in that region are amongst the richest in the world and any crop, tree or herb can grow, and, thanks to the altitude, any animal can live. Not far, to the west of Cali, the ocean coast provides another natural environment with access to other plants and animals, fish and see products. On the south, there is the tropical lowland forest. Thus, the diversity of food products in Cali is good, even if the best soils are dedicated almost exclusively to sugarcane.

mass index increased in low socio-economic groups while in higher socio-economic groups, it remained constant. [3]

The controversial food – nutrition linkages

In the specific context of urban Colombia, and Cali, we looked at the literature concerning food consumption practices to assess if this could be an explanation of the different performance in nutrition outcomes, and especially for the rise of overweight and obesity.

The report of the 2010 National Nutrition Survey (Fonseca Centeno *et al*., 2011) gives very precise information about food practices and in particular frequency of consumption of difference food groups. It shows that the population of the city of Cali consumed fruit more often that the other Colombian people: 79.6% of the dwellers in Cali ate fruits between 1 and 3 times or more per day (pp. 337-338) while this figure reached "only" 66.8% in the whole Colombian population. The Cali population consumed also more vegetables: 34.9% had eaten vegetable 1 to 3 times per day (or more) compared to 28.1% in the whole Colombian population.

These results are perhaps related to the lower prevalence of stunting compared to other cities but one should be cautious of such interpretations. A very specific study on the relationship between food consumption and malnutrition would be necessary because there are many links between food consumption and malnutrition.

For Dufour *et al*. (2015)the very fast growth of overweight and obesity of poor women of Cali between 1990-95 and 2008 was not entirely due to a change in food consumption habits. They suggested that some non-food causes would also explain the rapid increase in the rate of obesity in urban poor women. They compared the consumption of 85 women of age group 18-43 years in 1990-1995 and of 88 women in 2008. The consumption of total energy and of protein had not changed but in 2008 the women consumed proportionately more fatty food items (23,0% against 19.1% of calories) than in 1990-1995. They also showed that the frequency of consumption of roots, tubers and plantains has declined. These two characteristics are in accordance with the national supply trends and expectations of the nutritional transition. On the other hand, the consumption of added sugars and proteins of animal origin has not changed, which is contrary to the expectations of the nutritional transition.

On the other hand, Ocampo Téllez *et al*. (2014) analyzed a national sample of 10,187 Colombian children from 5 to 17 years. They showed that excess weight is more prevalent than stunting and that the food transition experienced by Colombia, has negative effects on nutritional status. Based on factor analysis, they established three patterns of consumption, (a) Protein / fiber, (b) sandwich or Snack and (c) traditional / starch. The patterns (a) and (c) are

[3] " *Stature increased in all SES groups and remained positively associated with SES. BMI increased only in the lower SES group, from 24.4 to 25.9 kg/m2 and remained negatively associated with SES. "The age-standardized prevalence of obesity increased from 7.9 to 17.0% in the lower SES group, but only from 4.5 to 8.2% in the middle SES group, and was unchanged in the upper SES group*"

associated to the excess of weight. Contrary to expectations, they found that the pattern (b) is not associated with overweight.

Finally, if we consider the different publications of aforementioned Carlos Monteiro, and several other scholars and practitioners, related to the World Public Health Nutrition Association, there is significant evidence of a strong association between level of food processing and increase in non-communicable diseases (many added sugar and salt etc.).

The results discussed here are quite controversial since for some authors, the food pattern is deemed to cause overweight and obesity, while for others, this is not the case. One scientific issue we identified is the complexity of food classification and analysis. The other is to identify if the food consumption practices are favorable or unfavorable to health and if this changes according to income level.

In this contribution, we compare food consumption of different income groups in Cali, Colombia, using secondary data from a food expenditure survey, applying two different systems of food classification.

Methodology

The national survey on income and expenditure (ENIG 2006-2007, Dane-Dimpe (2014))

This survey on expenditure and incomes has very detailed information on food consumption, and a 1400 household representativeness of the city of Cali[4]. We extracted the relevant data, checked their quality, and analyzed them at different levels of aggregation. For each of the 238 food products, we calculated the average individual food consumption (in Colombian Pesos, COP per month and per household member) by dividing the household consumption by the number of household members. We decided that outliers were the values superior to the median + 30 times the interquartile value. We replaced them by the value of the 95th percentile of the average individual consumption distribution of those households that consumed the product (exclusion of the 0 values). For each of the products, and for different groups we estimated distributional statistics for the sample and by quintile of income.

Questions of vocabulary: expenditure or consumption?

It is very important to precise what is exactly in the database since sometimes the vocabulary can be tricky. The process of data collection is based on a recall of what was earned (incomes) and consumed (various products) by the household (a group of people usually living together). Many food and beverages items are consumed on a daily basis, but not all, and that is the reason why there are several questionnaires: one (questionnaire 2) for daily

[4] For the city of Cali, this survey only collected information for houses located in the Cali metropolitan area, excluding people living in its rural area.

consumption and one for less frequent expenses (questionnaire 3). They were filled out by one person (referee) in the household. But as other persons (of the same household) might have incurred other expenses, not known by this referee, a third questionnaire (number 4) was also filled out by other persons for their consumption outside the house. What is complex is the terminology of all the documents, at least in English, but also in Spanish and French. When we read the Spanish version of the questionnaires, it is quite clear that the values do not encompass only the expenditures (cash expenses) but also the value of the food and beverages that were received as gift, or produced (self-consumption) by the household. In a city such as Cali, this will not be a real difference since most purchasing is from the market. However, there is a section in the questionnaire where we can find the origin (market, gift) of the product that was consumed (eaten, drank). The value of the products that were not bought is estimated. Should we then use "consumption" instead of "expenditures" or "expenses"? This is not straightforward since consumption has several meanings according to different points of view. Food consumption usually refers to what is eaten by a person. In nutritional surveys, it is usually estimated by weighting the food really eaten all day long by a person. It requires to know the receipts, the composition of the different dishes that people prepare and eat or just buy and eat. On the contrary, here, we have an estimation of the value of the products that are used to prepare (at home) the food which will be eaten by a quite theoretical group of persons (the household). The consumption of the food that is eaten outside is poorly registered[5]. In the end, we have an estimation of the value of the products that are used to prepare the meals, plus the ready-to-eat products that are eaten at home by the members of the household. If we divided this amount by the number of people inside the house, we have a rough estimation of the value of the consumption of the individuals, usually the biggest part, but not always, since people can eat outside (and we are not considering the intra-household distribution that is another methodologic problem). These kinds of figures (data from the LSMS surveys) are usually called by economists "*expenditure*" (Deaton (1997) in the « per capita expenditure » definition for example) or "*food consumption at the household level*" more recently (Sibhatu *et al*., 2015). So, the "monetary value of consumption at the household level", would be the better term, in our understanding, but it is long and not practical.

The two systems of classifications of different food items

Altogether 238 food and beverages items were identified in the "ENIG" database. So many products are difficult to analyze and a system of classification is required. Depending on the purpose, there are many different ways to classify the food products. In this study, we have chosen two different systems of classifications:

a) The standard United Nation system of "Classification of Individual Consumption according to Purpose" (COICOP) adapted to the Colombian food supply is used in the ENIG survey and more generally in all surveys lead by the National Department of statistics (DANE). Since it

[5] This is a problem that mainly affects data on high income households, as some of them reported small values of consumption of products to prepare food at home, but a high expenditure in catering services.

is an international standard, it is interesting to establish comparisons and therefore we chose to use it[6]

b) The latest version of the NOVA system, of classification of food products and beverages takes into account both the extent and purpose of food processing of these products. There are several different versions of the "NOVA" classification system and the latest and simplest one consists of 4 groups: (i) unprocessed or minimally processed foods, (ii) processed culinary ingredients, (iii) processed foods (ex: cheese, smoked meat, canned fish, fruits in syrup, unpackaged freshly made bread, …. and wine, beer or cider), and (iv) ultra-processed foods and drinks. We did not find a Colombian version of this classification. So, we decided by ourselves in which category each of the products should go, using the guidelines given in Monteiro et al (2016). Table 1 gives the summary of the classification we established and are using.

Table 1: Number of products by groups in both the Nova & the Coicop-Dane systems of classification

	NOVA 2016 Group' code					
Class name	0	1	2	3	4	Total
111_Bread and cereals	0	18	2	3	11	34
112_Meat	0	17	0	0	10	27
113_Fish and seafood	0	4	0	2	0	6
114_Milk, cheese an..	0	3	4	4	7	18
115_Oils and fats	0	0	7	0	0	7
116_Fruit	0	36	0	0	0	36
117_Vegetables	0	52	0	0	0	52
118_Sugar…	0	1	3	1	9	14
119_Food products n..	2	0	9	1	8	20
121_Coffee, tea or ..	0	5	1	0	3	9
122_Mineral waters,..	0	2	0	0	5	7
211_Spirits	0	0	0	0	5	5
212_Wine	0	0	0	1	0	1
213_Beer	0	0	0	2	0	2
Total	2	138	26	14	58	238

Source: Authors' classification of the items found in the ENIG survey, for the city Cali. NOVA 2016: 1: Unprocessed or minimally processed foods; 2: Processed culinary ingredients; 3: Processed foods; 4: Ultra processed foods and drink products.

We included all fruits and vegetables of the Coicop-DANE classes 116 and 117 in the first NOVA group, the oils and fats products (class 115) in the second NOVA group. All spirits and distilled alcohols (class 221) are in the fourth Nova Group. All beers (class 213) and wines (212) are in the third Nova Group as recommended[7]

All other Coicop-Dane classes are divided into several Nova groups. For example; the bread and cereals (111) products and the milk and dairy (114) products are split in all four Nova groups. One can see that the Group 1 in NOVA classification is the most important in number of products with 60% of the 238 products, The list of items in the group 4 represents 25% of

[6] * Altogether there are 14 classes or groups of food and beverages, i.e. nine groups of food products (111. bread and cereals; 112. meat; 113. fish and seafood; 114. Milk, cheese and eggs; 115. Oils and fats, 116. Fruits; 117. Vegetables; 118. Sugar; 119. Others), two classes of non-alcoholic beverages (121. coffee; tea and cocoa and 122 mineral water& fruit juices and soda) & three classes of alcoholic beverages (211. distilled beverages; 212. wine; 213. beer). The general meaning and content of these groups is given in annex. In the text, their names are simplified in different forms such as "111: "cereals"; 112: "meat", 113: "fish", 114 : "milk"; 115:"oil" ; etc…

[7] since "*they are produced by fermentation of products of group 1 foods*" (p.32, Monteiro et al, 2016).

all items. It is interesting to note that only 14% of the products are "traditionally processed" (Group 3). One has to confirm this figures with the analysis of the monetary values and the quantities of the consumed products.

Quantitative and qualitative analysis of food consumption

We used two strands of analysis, the level of consumption expressed in per capita monetary value (quantitative approach) and the fact that a household has or has not consumed a product (qualitative approach). This latter approach is justified in a context of high level of overweight and obesity and renewed interest specific group consumption. If we consider that prices were not very different within the same "product" (ie. not much quality segmentation) this value can be considered as a very rough proxy of the average per capita consumption in terms of quantity. In this first analysis, we mainly focused on data quality and communication with non-specialists, and thus conducted analysis by income groups (quintiles).

In order to estimate income elasticities, we conducted the following "log log" regressions for each food or beverage group: $Log(PCE)= \alpha \log(PCI)+c+\varepsilon$
Where PCE is the "Per capita expenditure" ; PCI the "Per capita income", α represents the income elasticity of consumption; c is a constant, and ε the error term. The results are given in

Results

Value of the food and beverages consumption in the households.

The value of all food and beverages consumption at the level of the households in Cali was 300 million Colombian Pesos (COP)[8] per month [9] for the "clean" sample of 1253 households (Table 2); in other words it represented around 74,000 COP (or 65 US$) /month/capita. Ninety percent (90%) of this value consisted of food, while nonalcoholic beverages and alcoholic beverages waged respectively about 4% and 6%. Meat expenditure was number one in the food budget, with 25% of all food and beverage value (fig.1)

The three groups of "cereals and cereal based products" group, "milk and dairy products", "vegetables, bananas, roots and tubers" had all the second largest budget share with about 12%-13% of the value of all food and beverages consumed by the households in Cali. However, one should note the group "vegetables, bananas, roots and tubers", is very heterogeneous in nutritional terms. In this group, the most important products in terms of value were for example tomatoes (1.6%); potatoes (1.8%) or banana plantain (1.1%) or dry beans (2.2%).

Table 2 : Food and beverages total of the sample in COP/ month

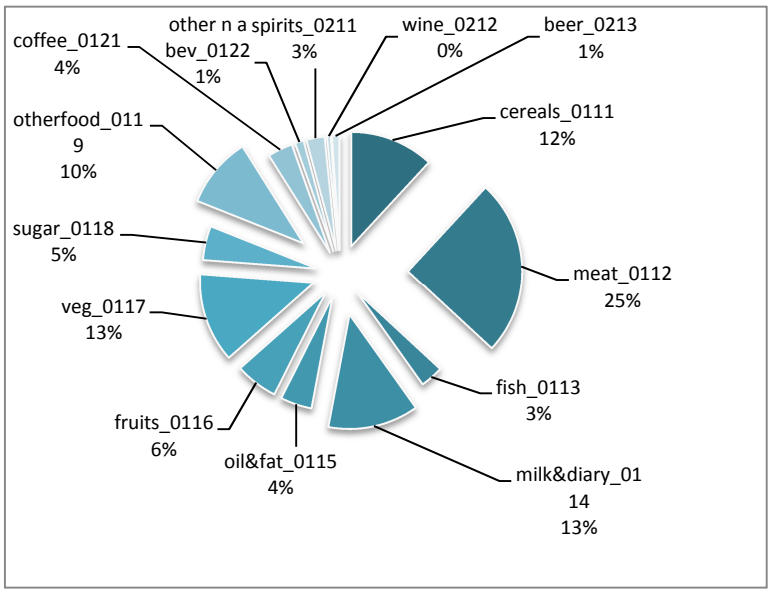
[8] By 2006, 1 USD in PPP was equal to 1,130 COP
[9] with a rather « good » 95% confidence interval [286-313] million COP per month.

Total estimation Number of obs = 1,253

	Total	Std. Err.	[95% Conf.	Interval]
food	273050738	6523513	260252515	285848961
non_alc_bev	14274974	539923	13215721	15334227
alcohol	12568401	1148585	10315037	14821765
tot	299894113	6919613	286318797	313469429

Source: Authors' calculations based on data from the DANE

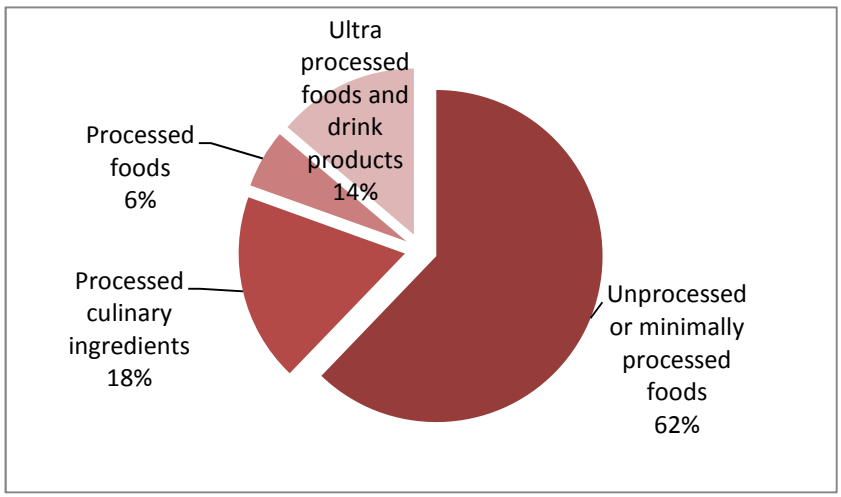
Figure 1: Shares of the different food and beverages groups (COICOP classification)



Source: Authors' calculations based on data from the DANE

If we consider the NOVA grouping (Figure 2), one can see that group 1 of simple, unprocessed and minimally processed food was the most important with almost two thirds of the budget. This is important to note that "traditional" processed food products' group had the smallest percentage (6%), which represented a bit more than half the ultra-processed - ready to eat-industrial food and beverages' group (about 14% of the budget).

Figure 2: Shares of the different food and beverages groups (NOVA classification)



This could be good news in terms of nutrition: most products purchased by the households are simple, raw and not processed, and the products "to be avoided" (group 4) represent "only" 14% of the value of the food and beverages consumed by the households. It could also be interpreted as an image of a "not yet" industrial society where most products are purchased raw by the households and where most of the processing is done "at home". Both interpretations are not exclusive, but have different implications in terms of vision. In one sense, one can be happy with these results (nutritionally "not two bad"), while on the other hand, one can regret the fact that it is an image of lagging behind society.

The correlation between food and beverages consumption and per capita income

They are large variations between households. As expected, the total value of the food and beverages consumption in the households is correlated with the per capita income (correlation coefficient=0.4) (Table 3). At a lower level, the per capita consumption of the alcoholic beverages and of the nova3 ("traditional" processed products) and nova4 (ultra processed products) groups were highly correlated with the per capita income: the correlation coefficients were respectively 0.37, 0.37 & 0.43 (Table 3).

Table 3: Matrix of correlation between food and beverages groups and income

	food_c	alcoho~c	nab_c	tot_c	income_c
food_c	1.0000				
alcohol_c	0.0594	1.0000			
nab_c	0.3795	0.1088	1.0000		
tot_c	0.9666	0.2995	0.4643	1.0000	
income_c	0.3198	0.3721	0.1964	0.3989	1.0000

	cer_cap	meat_c	fish_c	milk_c	oil_c	fruit_c	veg_c	sugar_c	other_c	income_c
cer_cap	1.0000									
meat_c	0.2935	1.0000								
fish_c	0.2746	0.2497	1.0000							
milk_c	0.2929	0.2937	0.2931	1.0000						
oil_c	0.4173	0.3105	0.2925	0.2750	1.0000					
fruit_c	0.2752	0.2691	0.3289	0.3700	0.2668	1.0000				
veg_c	0.3999	0.4378	0.3569	0.3232	0.4413	0.5712	1.0000			
sugar_c	0.4308	0.3295	0.2451	0.2741	0.4498	0.2832	0.4252	1.0000		
other_c	-0.0151	0.0034	0.0400	-0.0021	-0.0192	-0.0432	-0.0379	-0.0365	1.0000	
income_c	0.0864	0.2355	0.1691	0.2595	0.1378	0.2368	0.1486	0.1477	0.1312	1.0000

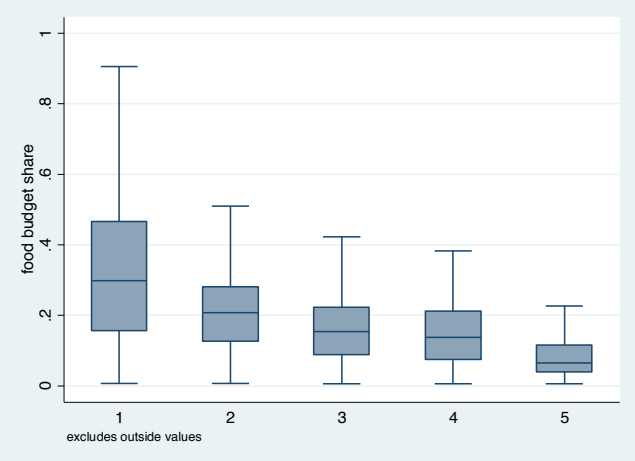
	nova1	nova2	nova3	nova4	income_c
nova1	1.0000				
nova2	0.5661	1.0000			
nova3	0.2171	0.2150	1.0000		
nova4	0.2649	0.3074	0.4252	1.0000	
income_c	0.2297	0.1920	0.3747	0.4252	1.0000

Food and beverages budget shares

On average the food budget share of this sample of the Cali population was 20% (median value 15%). As shown in Figure 3, the households of the poorest quintile (number 1) had an average income of 135,000 COP (standard deviation= 46000) per month per capita. Their

average food expenditure was 42,425 COP/month/cap, and their average budget share was 0.34 (median value 0.3.) On the opposite, the households of the richest quintile (no 5) had an average income of 1,466,000 COP/month/cap) and their average food and beverages budget was 108 000 COP/month/capita and budget share was 9% (median value 7%)

Figure 3: food and beverages budget shares by quintile of income



To our knowledge, these values are appropriate and in line with other statistics on income or food budgets. On average, in terms of value per capita, the poorest quintiles consume less than the richest households for each group and class of products.

However, there are differences according to the various groups and class. For food expenditures, the mean value per capita in quintile 5 is 2.4 times the mean value of quintile 1, while for alcoholic beverages the mean value in quintile 5 is more than six times the mean value of Quintile 1. For non-alcoholic beverages, the ratio is in between (2.9).

Engel curves : estimation of income elasticities

In addition to the log-log regressions, we tested for normality of each distribution of the different variables[10], the results are given in Table 4. Fish, oil, fruit, non alcoholic beverages and alcoholic beverages, plus "nova3", are the only groups where the log of the expenditure is "normally distributed"[11]. The other groups are not following normal distribution, and thus it is better to use non parametric statistics. That is why we conducted non parametric Kruskal Wallis rank test to compare the distribution of the per capita expenditure for each food or beverage group in between the different per capita income quintiles[12]. The results of these tests showed that the distribution of the per capita consumption of all Coicop groups (except the cereal's one) and of all nova groups are different between income quintiles.

[10] Using the sktest command in stata14
[11] Said in statistical terms, «we can not reject normality »
[12] Each income quintile have an equal number of 250 or 251 observations

These statistical- parametric and non parametric- analysis showed that the richest consumed "more"[13] products than the other households (except for cereal products). Because distributions of many groups are not normally distributed it is difficult to give credit to the estimated elasticities. For those groups where normality is accepted the estimated income elasticities were 0.4 for the "fish" group , 0.35 for the "oil" group, 0.57 for the "fruit" group, 0.40 for the "non alcoholic beverage" group, 0.57 for the "alcohol" group and 0.51 for the "nova3" group. Note that this elasticities are estimated only on households with a positive values for consumption of each group.

Table 4: results of regressions; values of income elasticities.

	PCE	food_all	cereal_	meat_	fish	dairy_
PCI	0.439	0.386	0.218	0.496	0.401	0.459
	(17.11)**	(13.53)**	(6.57)**	(14.89)**	(7.97)**	(14.15)**
Constant	5.260	5.807	6.068	3.269	3.228	2.992
	(15.91)**	(15.80)**	(14.24)**	(7.63)**	(4.95)**	(7.16)**
Obs.	1253	1253	1031	1018	457	1115
R-squared	0.19	0.13	0.04	0.18	0.12	0.15
Normality					(N)	

	oil_	fruit_	veg_	sugar_	non_alc_bev_	alcohol_
PCI	0.347	0.567	0.331	0.386	0.404	0.574
	(10.49)**	(12.81)**	(9.19)**	(11.43)**	(11.51)**	(7.19)**
Constant	3.783	1.001	4.662	3.254	2.986	1.572
	(8.88)**	(1.75)	(10.07)**	(7.49)**	(6.60)**	(1.49)
Obs.	785	816	1050	853	873	262
R-squared	0.12	0.17	0.07	0.13	0.13	0.17
Normality	(N)	(N)			(N)	(N)

	nova1	nova2	nova3	nova4
PCI	0.321	0.391	0.511	0.665
	(10.17)**	(11.72)**	(10.43)**	(14.83)**
Constant	6.219	4.136	1.630	0.021
	(15.31)**	(9.63)**	(2.55)*	(0.04)
Obs.	1200	1164	729	1059
R-squared	0.08	0.11	0.13	0.17
Normality			(N)	

Absolute value of t-statistics in parentheses
* significant at 5% level; ** significant at 1% level
(N) means that the test for non-normality is negative

[13] in value terms, but since it seems that the "quality effect" was not important at this time in Cali, there was very few quality segmentation, one can imagine that this "more" would also concern quantities.

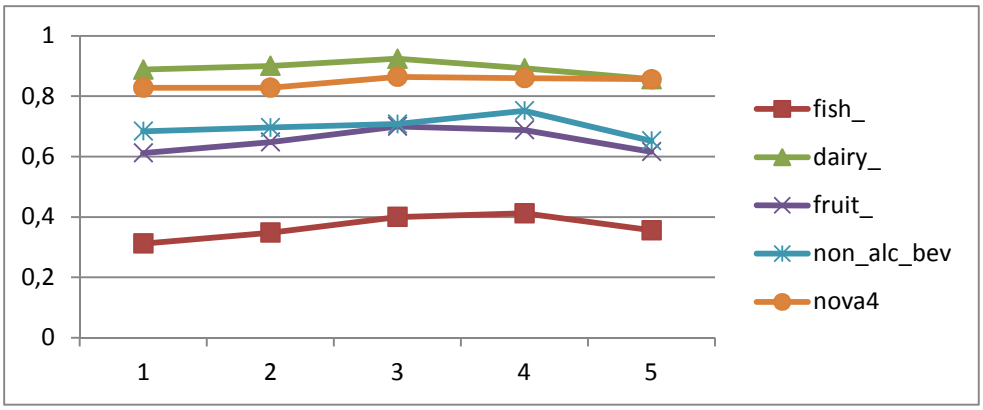
Prevalence of consumption

Food items were sorted in terms of prevalence of consumption. The most popular products were eggs and rice (65% of the households had consumed these items), oil (sunflower or maize or soya or palm), common potatoes, tomatoes, beef, chicken meat, coffee (55 to 49 % respectively of the households have consumed these items).[14] The analysis of the difference between "poor" and "rich" households gave some expected results: the value of food consumed by the richer households are most of the time higher than those of the poorer, almost for each products and groups of products (cereal group excepted).

The differences are not the same when considering the prevalence of consumption. For example, for very healthy "fresh fruit group", the richer quintile of household has a median value of 6100 COP/month/cap almost twice higher the median value observed in the poorer quintile (3550 COP/m/cap). However, in terms of prevalence, there is almost no differences between quintiles, between 59 to 66% of the households had consumed fresh fruits during the survey (with the maximum being the medium quintile). The value of the dairy consumption, is highly correlated with the per capita income (income elasticity = 0.46. However, the prevalence of consumption is almost the same and very high in all income groups (deciles here, see Figure 4). Almost all households (90%) did consume diary products (mainly milk)[15].

We conducted tests of independence and the results are presented in the following table 4. The prevalence of consumption of the groups "fish", "diary", "fruit", "non alcoholic beverage" and "nova4" was independent of the income class of the household (Figure 4). The number of households who consumed alcoholic beverages, oil products and nova3'group products was positively correlated with the income quintile(figure 5). Finally, the "decreasing" groups were "cereal", "meat", "vegetable", "sugar", nova1 and nova2 (Figure 6).

Figure 4: Prevalence of food consumption by income class: groups with a "flat" profile



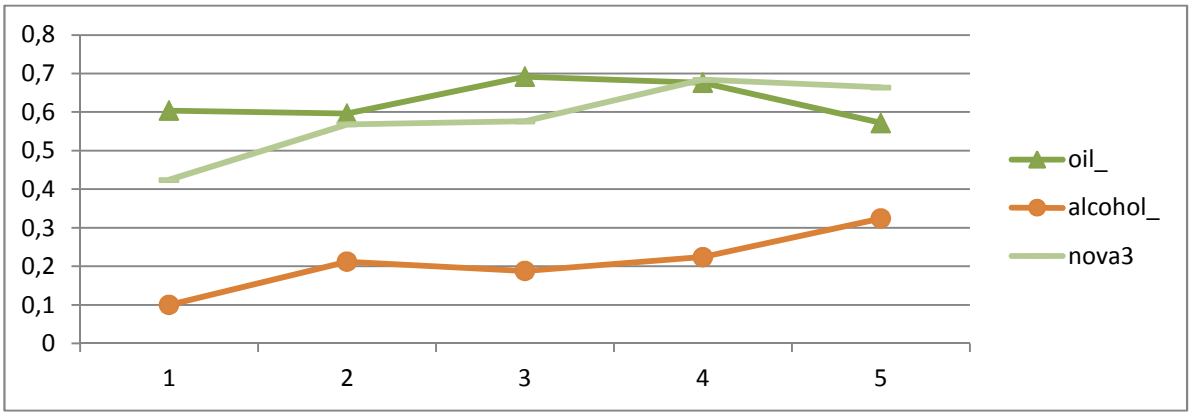
[14] These products were also important in terms of value and "budget share" even if the order was not the same. Beef was first in term of value and total "budget share" (10.6%), chicken meat came second (7.6%) and rice third (7%).

[15] Surprisingly, the prevalence of consumption of the "oil" group was quite low (60-70% of the households) if we consider that people use these products to cook food. It might be underestimated / reported since it is an ingredient (group 2 in nova classification) that is added to the main food products (cereals, tubers, meat, fish…).

Table 5: prevalence of consumption per income quintile

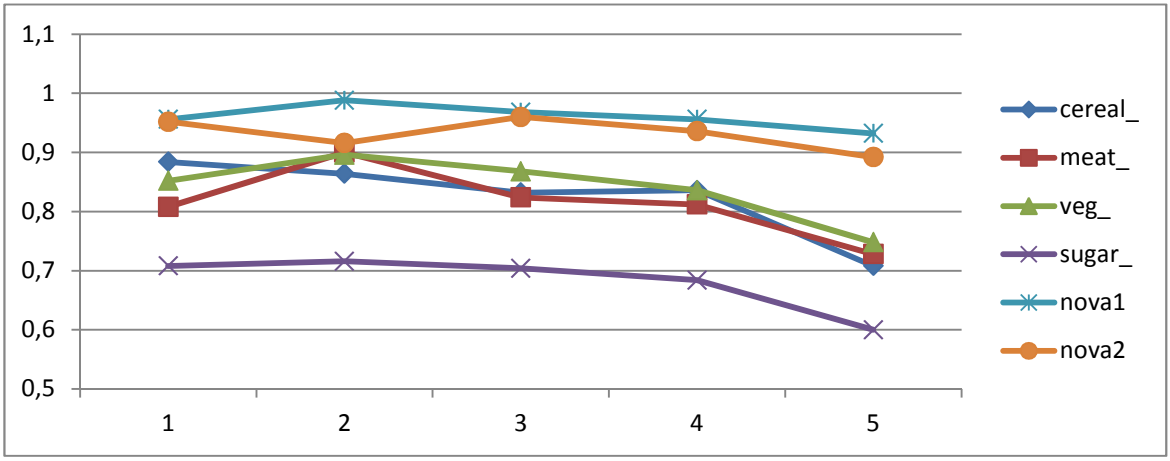
qic	cereal***	meat***	Fish	dairy	oil**	fruit	veg***	sugar**
1	88%	81%	31%	89%	60%	61%	85%	71%
2	86%	90%	35%	90%	60%	65%	90%	72%
3	83%	82%	40%	92%	69%	70%	87%	70%
4	84%	81%	41%	89%	68%	69%	84%	68%
5	71%	73%	36%	86%	57%	62%	75%	60%
all	82%	81%	36%	89%	63%	65%	84%	68%
Chi2 Pearson	31.10	23.65	7.19	6.09	11.93	7.22	22.31	10.02
Pr	0.000	0.000	0.126	0.19	0.018	0.12	0.000	0.04
qic	Non alc. beverage	alcohol***	Nova1*	Nova2**	Nova3***	Nova4		
1	68%	10%	96%	95%	42%	83%		
2	70%	21%	99%	92%	57%	83%		
3	71%	19%	97%	96%	58%	86%		
4	75%	22%	96%	94%	68%	86%		
5	65%	32%	93%	89%	66%	86%		
all	70%	21%	96%	93%	58%	85%		
Chi2 Pearson	6.09	39.13	9.41	11.3	43.7	2.76		
Pr	0.19	0.000	0.052	0.023	0.000	0.599		

Figure 5: Prevalence of food consumption by income class: Groups with an "increasing" profile



Note: X axis represents the quintile of per capita income

Figure 6: Prevalence of food consumption by income class: Groups with an "decreasing" profile



Regarding to our question - *do poor households had different diet (possibly better diet in nutritional terms) than richer households ?*-, these results concerning the prevalence of food groups' consumption do not give straightforward conclusions.

Concerning the "nutritionally bad products", the consumption of the products of the nova 4 group was almost equally distributed between income' classes (83-86% of households in all classes consumed at least one ultra processed product). However, alcoholic beverages with a clear negative nutritional effect were more often consumed in the richer quintiles than in the poorest ones.

Regarding the "nutritionally good products", the consumption of the fruit group was equally distributed between income' classes. On the contrary, the prevalence of consumption of vegetables and pulses ("veg" group) decreased with income (from 85 to 75% between the poorer and the richer income quintile (Table 5) [16].

[16] The consumption of the sub group "pulses" (lentils+ peas+ beans) concerned 59% of the quintile 1 (the poor one) to 43% in quintile 5.

The prevalence of the raw food products (nova1) also decreased with income groups (from 96% 99% to 93% of the households consumed at least one product of this group in respectively the two most income poor quintiles and in the richer' one).

Discussion, conclusion, and perspectives

This preliminary statistical analysis has allowed us to estimate the values of the food and beverages consumption, at the household level, for a representative sample of about 1300 households in Cali in 2006-2007. Values were estimated for different products (238) and groups of products. We examined very carefully the quality of the data and we corrected them when necessary, in a very cautious way (less of 3% of outliers were replaced). We used two different systems of food and beverages classification (COICOP and NOVA), and compared the consumption of these products and groups of products by income. From a methodological point of view, this study shows that Living Standards Measurement Surveys such as this Colombian survey can give very useful insights concerning food consumption practices.

Most of the food products consumed at home were not or minimally processed. Most households were cooking their food, using raw materials. Nevertheless, one quarter of the total value of the household value of consumption was already dedicated to ultra-processed industrial food and beverages products.

The richer households tend to consume much more meat, milk, alcoholic, and ultra processed products than the poorer households, and consequently did not have a better diet, if we consider that the consumption of these latter products in the epidemiological context has a rather negative impact on health. On the opposite, poor households may be regarded as having relatively better food consumption habits regarding certain specific traits of the food diet: high frequency of fresh fruit consumption, low frequency of high processed food. Following Kimura (2013), this study can show that the "poor" have not only "food problems" but that they have also some good ideas and practices that are often underestimated and that should be further looked at. The issue is really to think about the fact that societies in transition have still "good food practices" (as defined by Monteiro et al), That poor households have escaped extreme poverty and deprivation and have not yet entered into the industrial food system with its negative outcomes. These practices may be perceived positively, from a sociological point of view, but they are definitely interesting. Changing the image of food practices of the poor - promoting these - might be a good option for sustainable food practices, from a health and a social perspective.

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