La adecuación del consumo aparente de frutas, verduras y proteínas en hogares con niños menores de 19 años en el Paraguay, 2012

The apparent adequacy of fruits, vegetables and protein foods consumption in households with children under 19 years of age in Paraguay, 2012

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RESUMEN

Introducción: Frutas, verduras y alimentos proteicos en conjunto representaron el 46% del gasto total de alimentos de los hogares paraguayos en 2011-12. Comprender los patrones de consumo de estos alimentos es una parte importante del sistema de vigilancia nutricional.

Objetivo: Evaluar el consumo aparente y la adecuación del consumo aparente de frutas, verduras y alimentos proteicos en hogares paraguayos con niños menores de 19 años en 2011/12.

Materiales y Métodos: Un análisis de una muestra representativa de hogares de la Encuesta de Ingresos y Gastos 2011-12, la cual es representativa a nivel nacional. El análisis se realizó tanto por quintiles de ingreso como por área de residencia (rural/urbana). Para evaluar la adecuación del consumo aparente de frutas, verduras y alimentos con proteínas, las cantidades de ingesta recomendadas (RIA) de los miembros del hogar se agregaron primero al nivel de hogar teniendo en cuenta la edad, sexo y requerimientos de calorías de cada miembro y se expresaron en unidades equivalentes por hombre adulto (AME), luego se compararon con el consumo diario promedio del hogar. También se consideró la importancia del autoconsumo.

Resultados: Nuestro análisis muestra que, incluida la producción propia, el consumo promedio (aparente) de frutas fue de 35,1 tazas equivalentes por semana, de hortalizas fue de 81,6 tazas equivalentes por semana y de alimentos proteínicos de 193,6 onzas equivalentes por semana. La relación promedio entre el consumo aparente de frutas (verduras, alimentos proteí-nicos) y la cantidad de ingesta recomendada (RIA) semanal del hogar fue de 0,72 (1,10; 1,28), respectivamente. Se encontraron diferencias significativas entre las áreas rurales y urbanas en el consumo promedio de vegetales (rural: 100,5 tazas equivalentes vs. urbano: 67,7 tazas equivalentes; $p<0,05$). Se encontró una relación positiva entre el quintil de ingreso y el consumo promedio de frutas y carnes y una relación negativa entre el quintil de ingreso y el consumo promedio de vegetales. El análisis de la incidencia del logro de RIA (es decir, el porcentaje de hogares cuyo consumo diario del grupo en particular fue inferior al 100% de RIA) mostró que el 77,3% (55,9%; 49,4%) de los hogares no alcanzó el RIA para las frutas (vegetales, alimentos proteínicos), respectivamente. Estos valores fueron en cada caso significativamente más bajos en comparación con los obtenidos cuando no se incluyó el autoconsumo.

Conclusiones: El presente estudio resalta la necesidad de promover el consumo de frutas, vegetales y alimentos con proteínas a nivel de hogar, especialmente en hogares de ingresos bajos a medios.

Palabras clave: Consumo Aparente, Nutrición, América Latina.

Introduction

Fruits, vegetables, and protein group are among the food groups whose consumption is undergoing significant changes as part of the nutrition transition process. Understanding these changes thus represents an important goal of the nutritional surveillance system.

Fruits and vegetables make a significant contribution to the population's nutrient intakes. Legumes and vegetables are rich sources of proteins, fats, carbohydrates, minerals, antioxidants, fiber and water, as well as being excellent sources of β-carotene (provitamin A), thiamin (B1), riboflavin (B2), niacin, pyridoxine (B6), pantothenic acid, folic acid (folacin), ascorbic acid, and vitamin E and K (Block et al. 1992, Karmas and Harris 1988).

Similarly, protein foods – and meat in particular – constitute an important component of a healthy and well-balanced diet due to its nutritional richness. Meat is a valuable source of high biological value protein, iron, vitamin B12 as well as other B complex vitamins, zinc, selenium and phosphorus (Pereira and Vicente 2012).

In this paper, we evaluate the apparent consumption of three major food groups (fruits, vegetables, and protein foods) in the Paraguayan households with children younger than 19 years of age. We use data from the nationally representative 2011-12 Income and Expenditure Household Survey (EIG 2011-12).3 The objective of our analysis is two-fold: to analyze the apparent consumption of each of the three food groups (and the relevant sub-groups) at the household; and, to evaluate the incidence of non-attaining the Recommended Intake Amount of each food group (and the relevant sub-groups) across the set of households analyzed. The analysis is performed for all households and, separately, for considering households' area of residence and economic status. The contribution of self-production is also analyzed.

Methodology

Study population

Data for this study were obtained from the National Income and Expenditure Survey of 2011-12 (EIG 2011-12), carried out between August 2011 and July 2012 by the General Directorate of Statistics, Surveys and Censuses (DGEEC). This was a nationally and sub-nationally representative national household survey that used a two-stage stratified household design.[4]

The survey examined a total of 5,417 households, of which 3,738 households (69.0 percent) had children less than 19 years old. Retaining only the households with non-missing food expenditure information produced a sample of 3,698 households (41.7% rural and 58.3% urban) that was used a basis of our analysis. These households contained a total of 17,471 members, including 8,480 children under the age of 19. The average age of these children was 9.21 years (SD. 5.43) and the median age was 9 years.

Food data

The EIG 2011/12 survey included modules on household income and food expenditures, among others. The food expenditure module was employed to collect a detailed information

[3] To the authors' best knowledge, there are no other studies that would examine the consumption of any of these three food groups using Paraguayan data.

[4] The survey was representative at the department level and by urban and rural regions. The EIG 2011-12 dataset is publicly available from the DGEEC's website.

about the quantities of and the corresponding expenditures on over 900 different food items purchased (or otherwise acquired) by the household over the previous 7 days. In the analysis, we only considered food items that the household either purchased or self-produced; we did not consider food items that the household received from another household, from a social protection or nutrition program, as a gift from church or a non-profit institution, or that either member of the household took from the business.[5]

The survey also collected information about the frequency with which the particular food item was acquired. We transformed the quantities of and the expenditures on food items acquired with a higher than weekly frequency (e.g. every day, every other day, 2-, 3-, and 4-times a week, or once a week) into their weekly equivalents, but left unchanged the quantities of and the expenditures on food items acquired with less than weekly frequency.[6] All quantities were later converted to daily amounts.

Finally, prior to the analysis, we also transformed the household food acquisition data into standard units of weight (grams) or volume (milliliters).[7]

Food group classification

For the purpose of analyzing household expenditures, we classified food items into 13 general groups, including 1) cereals, 2) vegetables, 3) fruits, 4) meat, 5) eggs, 6) dairy and dairy products, 7) oils and fats, 8) sweets, 9) non-alcoholic drinks, 10) alcoholic drinks, 11) spices and condiments, 12) other food items (not included in other groups), and 13) foods eaten outside of home.[8] Specifically, the fruits group was created by including all the fruit varieties, including fresh, frozen, canned, and dried fruits and fruit juices (e.g., bananas, grapes, raisins, oranges, and orange juice); the vegetables group was created by including all the vegetable varieties in fresh, frozen, or canned form; and the meat group was created by including fish/seafood, meat and poultry.

To analyze the apparent consumption of fruits, vegetables, and protein foods, the vegetables group was further classified into five sub-groups: dark-green vegetables (e.g., broccoli, collard greens, kale, spinach), red and orange vegetables (e.g., carrots, pumpkin, red peppers, sweet potato, tomatoes), legumes (e.g., black beans, garbanzos, green soybeans, kidney beans, lentils, pinto beans, white beans),[9] starchy vegetables (e.g., cassava, green lima beans, green peas, plantains, potatoes), and other vegetables (e.g., common lettuce,

[5] Food items that the household either purchased or self-produced account for 90.01% of the total of 162,865 food items available in the original sample. Food items that either member of the household took from a business account for 5.36%, while food items that the household received from another household account for 3.82%. Food items received by the household from a social protection or nutrition program, or as a gift from church or a non-profit institution, account for the remainder (<1%).

[6] We left unchanged the quantities and expenditures on food items obtained with less than weekly frequency as it was not generally clear whether the household consumed the particular food over multiple days or in a given week.

[7] In some instances, grams of juice needed to converted into milliliters of juice. In that case, we used an average juice density of 1.048 g/cm^3.

[8] Additional information on this classification can be found in Bubak, Ramírez and Sanabria (2018).

[9] Does not include green beans or green peas.

onion, cucumber, cabbage, celery, mushrooms, green peppers).[10] The protein foods group was created to include three sub-groups: meats, eggs, and soy products, nuts, and seeds.[11]

Measuring adequacy of apparent consumption

In order to measure the apparent consumption of fruits, vegetables, and protein foods, we first converted each food item to its cup- (in case of fruits and vegetables) or ounce- (in case of protein foods) equivalents (USDA 2015). For fruits and vegetables, 1 cup-equivalent corresponds to 1 cup of vegetable or fruit, 1 cup of vegetable or fruit juice, 2 cups of leafy salad greens, and 0.5 cup of dried fruit or vegetable. For protein foods, 1 ounce-equivalent corresponds to approximately 1 ounce of lean meat, poultry, or fish/seafood, 1 egg, 1 tablespoon of peanut butter, and 0.5 ounce of nuts or seeds.

We applied the "Food Patterns Equivalents Ingredients Database" (FPID) cup equivalent weights and, where appropriate, the FPID in combination with "ARS Food Intakes Converted to Retail Commodities Database" (FICRCD) conversion factors to estimate the amount of raw fruits and vegetables to be purchased in order to obtain one cup equivalent of raw (edible) portion of each food item (Bowman et al. 2013, Bowman et al. 2017).

The weight/volume of the particular food item can vary significantly depending on whether it is consumed raw or prepared (boiled, cooked). Therefore, for each food item *traditionally* consumed in a cooked state (such as pumpkin, lentils, meats), we converted the raw amounts to cooked amounts using a yield factor (Bognár 2002, Showell et al. 2012).[12] For the meats, we fixed the yield factor at 0.8. Table A1. in the Appendix provides examples of ounce- and cup-equivalent food amounts and raw/cooked conversions.

The adequacy of the apparent consumption of each food group (fruits, vegetables, and proteins) as well as of the corresponding sub-groups was evaluated at the household level following the healthy U.S.-style eating pattern (USDA 2015). This pattern identifies recommended intake amounts (RIA) of foods, in nutrient-dense forms, that an individual should consume from five major food groups (fruits, vegetables, grains, dairy, protein foods, and oils) and their subgroups in order to meet nutrient and dietary guidelines standards.[13] To determine the adequacy of household's apparent (or, "usual") consumption, we first aggregated household members' RIAs to the household level considering the age, sex, and calorie requirements of each household member and then compared this aggregate to the household's usual daily consumption. We used the calorie needs estimates provided by the Institute of Medicine (IOM) (2002), while restricting our analysis to the sedentary level of physical activity.[14] The RIA for each food group/sub-group and each calorie level

[10] Legumes (beans and peas) can be considered part of the protein group as well as the vegetable group; we included these as a separate group within 'Vegetables'.

[11] 'Meat' and 'eggs' represented by the far the most important constituents of the protein group, both in terms of volumes purchased and the relative expenditures. The consumption of soy-based dairy products was very small (in relative terms) as it remains limited in Paraguay. In the general 13-group classification, the soy products, nuts, and seeds appear under the item "Other food items".

[12] We used internet resources to determine the yield factors for the food items that were not available in Bognár (2002) or Showell et al. (2012).

[13] The pattern includes a limit on the maximum number of calories available for other uses, such as added sugars, solid fats, added refined starches, or alcohol (USDA 2015).

[14] Daily calorie needs estimates for the sedentary physical activity level (by age and sex) used in this study are provided in Table A3. in the Appendix. We note that these estimates are based on the Estimated Energy Requirements (EER) equations, using reference heights (average) and reference weights (healthy) for each age-sex group. For adults, the reference man is 5 feet 10 inches tall and

corresponding to the sedentary level of physical activity is provided in Table A2. in the Appendix.

Statistical analysis

Statistical significance of the differences between the rural and urban areas was evaluated using the $\chi 2$ test and among the five income quintiles using the $\chi 2$ test and Cochran–Armitage test for linear trend. All tests accounted for the survey's sampling design. The analysis was performed using Stata/IC 14.2 for Windows (Statacorp 2013).

Results

We begin our analysis by examining the *relative* household food expenditures on individual food groups with respect to total household food expenditures. Table 1. summarizes this information, both for the full sample and by income quintiles. The table shows that the 'meat' group represented by far the largest share of the total food expenditures of the Paraguayan households in 2012 (29.6%). 'Fruits' (4.3%) and 'vegetables' (10.7%) jointly represented the third largest share of the total household food expenditures (15%) after 'cereals' (16.9%). Considered together, 'fruits', 'vegetables', and 'protein foods' ('meats' and 'eggs') accounted for about 46% of the total household food expenditures in 2011-12.[15]

Table 1.

Relative Expenditures on Individual Food Groups for All Households and by Income Quintiles (in %)

Food Groups	TH	Q1	Q2	Q3	Q4	Q5
Cereals	16.9	23.6	18.7	17.4	15.5	13.0
Vegetables	10.7	11.4	11.2	11.0	10.7	9.3
Fruits	4.3	2.5	3.4	4.2	4.8	5.5
Meat (incl. poultry and fish)	29.6	27.7	30.4	30.0	29.7	29.4
Eggs	1.4	1.1	1.4	1.6	1.6	1.3
Milk and dairy products	13.0	9.4	11.7	12.6	14.1	14.9
Oils and fats	3.5	6.1	4.0	3.2	2.9	2.6
Sweets	5.0	6.1	5.1	5.0	4.7	4.7
Non-alcoholic drinks	7.9	6.7	7.2	7.6	8.2	8.9
Alcoholic drinks	2.1	0.9	1.8	2.0	2.2	2.7
Spices and condiments	1.3	1.3	1.3	1.2	1.2	1.3
Other food items	1.3	1.6	1.3	1.1	1.2	1.3
Prepared foods and FAH	3.3	1.5	2.5	3.0	3.1	4.9
	100.0	100.0	100.0	100.0	100.0	100.0

Table 2. summarizes the percentage changes in relative expenditures on individual food groups with respect to total food expenditures over the 1997-98 and 2011-12 periods; this table is borrowed from Bubak, Ramírez and Sanabria (2017). [16] One can observe a

weighs 154 pounds; the reference woman is 5 feet 4 inches tall and weighs 126 pounds. For children and adolescents, reference height and weight vary (USDA 2015).

[15] Meat (incl. poultry and fish meat) and eggs are by the far the most important constituents of the protein group. Soy products, nuts, and seeds constitute a fraction of total household food expenditures. In the classification presented in the table, the soy products, nuts, and seeds appear for the most part under the item "Other food items". The consumption of soy-based dairy products remains limited in Paraguay.

[16] We expressed food expenditures in real terms using constant December 2011 prices. To this end, we used a monthly consumer price (CPI) CPI for food (a component of the all-items CPI) to adjust the food prices. Given that between August 2011 and July 2012, the average (food) prices increased by 11.8 percent, we used an average food CPI for this period when calculating the adjustment. The consumer price indices are available from the Paraguayan Central Bank website.

significant decrease in the relative food expenditures on 'fruits', 'vegetables', and 'eggs' over the period (among others) and an increase in the relative food expenditures on 'meats', both for all households and across the income quintiles.

It is worth highlighting three observations: first, the drop in the relative expenditures on vegetables was the largest in the fifth income quintile households (Q5); second, the drop in the relative expenditures on fruits was the largest in the first income quintile households (Q1); and, finally, while the relative food expenditures on 'meats' increased to a similar extent for the second through the fifth income quintile households (Q2-Q5), they actually stagnated for the first income quintile households (Q1).

Table 2.

Changes in Relative Expenditures on Food Groups for All Households and by Income Quintiles (in %)

Grupo de alimentos	Δ TH	Δ Q1	Δ Q2	Δ Q3	Δ Q4	Δ Q5
Cereals	1.6	17.7	0.0	0.7	0.5	-8.2
Vegetables	-21.3	-18.7	-15.5	-21.6	-19.1	-30.0
Fruits	-18.8	-31.6	-10.8	-7.8	-18.2	-23.5
Meat (incl. poultry and fish)	8.5	2.1	8.9	8.4	9.0	9.3
Eggs	-30.5	-48.9	-27.3	-28.8	-20.4	-32.5
Milk and dairy products	1.2	-17.0	-5.3	2.0	10.1	4.5
Oils and fats	-21.5	-2.2	-31.2	-34.0	-19.6	-16.0
Sweets	31.7	40.5	18.4	34.7	28.4	35.9
Non-alcoholic drinks	4.0	0.0	1.1	0.9	4.9	7.7
Alcoholic drinks	-13.8	-37.7	11.8	-1.9	-33.0	-3.1
Spices and condiments	-15.1	-6.3	-16.4	-23.7	-15.3	-13.2
Other food items	175.6	429.7	251.9	156.8	94.0	157.1
Prepared foods and FAH	61.1	30.0	95.9	89.1	6.9	98.6

Average Apparent Consumption vs. RIA

Table 3. presents the results of the analysis of the apparent consumption of fruits, for all households as well as by household's area of residence (urban/rural) and income quintiles. We observe that, on average, households consumed 35.1 cup-eq. amounts (or, cup-eq.'s) of fruits per week. The corresponding (average) RIA was 52.8 cup-eq.'s. The average ratio of the apparent consumption to the RIA – calculated over all households – was 0.72. In other words, Paraguayan households consumed on average 0.72 of the RIA per week.

Analysis by household's area of residence shows no significant difference between the apparent consumption of fruits in rural and urban households. However, analysis by household's income quintile shows that the apparent consumption generally increases with income, with the lower income quintile households consuming significantly less than the highest income quintile households (Q1: 33.7 cup-eq.'s vs. Q5: 44.9 cup-eq.'s; $p<0,05$). As a result, only the highest income quintile households consumed – on average – more than the RIA.

Table 3.

Comparison of average household consumption of fruits vs. corresponding average household RIA (both in cup-eq./week), by household's area of residence (rural/urban) and income quintile

		Consumption		RIA		Ratio	
	N	$\bar{x}$	95% IC	$\bar{x}$	95% IC	$\bar{x}$	95% IC
Todos Hogares							
All	2,832	35.1	32.9 – 37.3	52.8	51.6 – 53.9	0.72	0.68 – 0.76
Rural	948	37.0	32.5 – 41.5	54.2	51.9 – 56.5	0.74	0.66 – 0.83
Urban	1,884	34.0	31.6 – 36.5	51.9	50.7 – 53.2	0.71	0.66 – 0.76
Quintiles de Ingreso							
Q1	457	33.7[a]	27.8 – 39.6	60.0[c]	57.3 – 62.7	0.59[a]	0.49 – 0.69
Q2	585	30.9[a]	27.4 – 34.5	56.1[b]	53.8 – 58.5	0.59[a]	0.53 – 0.64
Q3	571	32.8[a]	29.8 – 35.9	53.9[b]	51.5 – 56.4	0.66[a]	0.60 – 0.72
Q4	619	33.3[a]	29.4 – 37.2	48.9[a]	46.8 – 51.1	0.72[a]	0.65 – 0.79
Q5	600	44.9[b]	40.0 – 49.9	47.1[a]	45.5 – 48.8	1.03[b]	0.93 – 1.13

Values with different superscript letters are statistically significantly different among quintile groups within average household consumption, average household RIA, and ratio ($p<0.05$; a<b<c). Source: Authors' calculations.

Table 4. presents the results of the analysis of the apparent consumption of vegetables. The results show that, on average, households consumed 81.6 cup-eq.'s of vegetables per week. The corresponding (average) RIA in this case was 76.5 cup-eq.'s. The average ratio of the apparent consumption to the RIA was 1.10.

Analysis by household's area of residence shows significant difference between the apparent consumption of fruits in rural and urban households, with rural households consuming substantially larger amounts of vegetables than urban households (rural: 100.5 cup-eq.'s vs. urban: 67.7 cup-eq.'s; $p<0,05$). As a result, only rural households consume – on average – more than the RIA, while urban households come close to the RIA.

Analysis by household's income quintile shows that the apparent consumption of vegetables generally decreases with income, with the lower income quintile households consuming significantly more than the highest income quintile households (Q1: 100.6 cup-eq.'s vs. Q5: 67.3 cup-eq.'s; $p<0,05$).

Table 4.

Comparison of average household consumption of vegetables vs. corresponding average household RIA (both in cup-eq./week), by household's area of residence and income quintile

		Consumption		RIA		Ratio	
	N	$\bar{x}$	95% IC	$\bar{x}$	95% IC	$\bar{x}$	95% IC
Todos Hogares							
All	3,506	81.6	77.6– 85.8	76.5	74.8– 78.3	1.10	1.05– 1.14
Rural	1,394	100.5	91.8 – 109.3	77.2	73.6 – 80.7	1.31	1.21 – 1.41
Urban	2,112	67.7[a]	64.1 – 71.2	76.1	74.4 – 77.7	0.94[a]	0.90 – 0.98
Quintiles de Ingreso							
Q1	748	100.6[b]	88.3 – 112.9	82.3[b]	76.9 – 87.7	1.23[b]	1.09 – 1.36
Q2	767	83.4[a]	76.6 – 90.2	80.0[b]	77.1 – 82.9	1.08[a]	1.00 – 1.17
Q3	682	80.3[a]	73.9 – 86.7	78.2[b]	74.7 – 81.6	1.08[a]	1.00 – 1.16
Q4	683	74.8[a]	67.0 – 82.6	71.8[a]	69.0 – 74.6	1.06[a]	0.97 – 1.14
Q5	626	67.3[a]	62.7 – 71.8	69.2[a]	66.7 – 71.6	1.02[a]	0.95 – 1.08

Values with different superscript letters are statistically significantly different among quintile groups within average household consumption, average household RIA, and ratio ($p<0.05$; a<b<c). Source: Authors' calculations.

Finally, Table 5. presents the results of the analysis of the apparent consumption of proteins. We observe that, on average, households consumed 193.6 ounce-equivalents (oz-eq.'s) of proteins per week. The equivalent (average) RIA was 163.6 oz-eq.'s. The average ratio of the apparent consumption to the RIA was 1.28.

Analysis by household's area of residence shows no significant difference between the apparent consumption of proteins in rural and urban households. However, similarly to the apparent consumption of fruits, the apparent consumption of vegetables generally increases with income, with the lower income quintile households consuming substantially less protein than the higher income quintile households (Q1: 154.3 oz-eq.'s vs. Q5: 253.3 oz-eq.'s; p<0,05).

Table 5.

Comparison of average household consumption of proteins vs. corresponding average household RIA (both in oz-eq./week), by household's area of residence (rural/urban) and income quintile

		Consumption		RIA		Ratio	
	N	$\bar{x}$	95% IC	$\bar{x}$	95% IC	$\bar{x}$	95% IC
Todos Hogares							
All	3,625	193.6	183.0– 204.2	163.6	160.0– 167.1	1.28	1.21– 1.35
Rural	1,418	188.3	166.3 – 210.2	165.6	158.4 – 172.7	1.25	1.09– 1.41
Urban	2,207	197.4	188.4 – 206.4	162.2	158.7 – 165.6	1.30	1.25– 1.35
Quintiles de Ingreso							
Q1	762	154.3[a]	139.8 – 168.7	177.7[b]	166.5 – 188.9	0.93[a]	0.87 – 1.00
Q2	784	180.6[b]	169.7 – 191.5	172.2[b]	166.0 – 178.5	1.14[b]	1.06 – 1.21
Q3	711	193.8[b]	182.6 – 205.0	165.6[b]	158.6 – 172.5	1.24[c]	1.17 – 1.31
Q4	717	194.4[b]	180.9 – 208.0	152.8[a]	147.0 – 158.7	1.33[c]	1.25 – 1.42
Q5	651	253.3[c]	206.1 – 300.5	147.4[a]	142.4 – 152.5	1.83[d]	1.49 – 2.18

Values with different superscript letters are statistically significantly different among quintile groups within average household consumption, average household RIA, and ratio (p<0.05; a<b<c). Source: Authors' calculations.

Incidence of RIA Non-Attainment

Table 6. presents the results of the analysis of households' non-attainment of the Recommended Intake Amount (RIA) for each of the tree food groups analyzed in the study (fruits, vegetables, and protein foods) and the corresponding sub-groups. In other words, for each food group and each sub-group the table shows the percentage of households whose daily consumption of the particular group was less than 100% of RIA. As in the previous analyses, household's area of residence and income quintiles are also considered. In addition, the table also shows the incidence of RIA non-attainment with and without self-consumption (sometimes referred to as self-production); the numbers shown as default include self-consumption.

The results for the fruits intake show that, overall, 77.3% of households do not attain the corresponding RIA; this number is lower (by 3.5% percentage points) than in case of no self-consumption. Analysis by households' area of residence shows no significant difference between the number of households that attain the RIA. Finally, the analysis by income quintiles shows that the percentage of households that do not attain the corresponding RIA decreases monotonically in income quintiles. In other words, there are significantly more lower income households than higher income households that do not attain the RIA for fruits (Q1: 82.8 vs. Q5: 63.4).

Table 6.

Percentage of households whose daily consumption of fruits, vegetables, and protein foods is less than 100% of total Recommended Intake Amount (RIA), by household's area of residence and income quintiles, with and without self-consumption

	TH	Rural.	Urban.	P*	Q1	Q2	Q3	Q4	Q5	P*	P trend*
Fruits	77.3	76.7	77.6	0.667	82.8	84.7	78.9	77.8	63.4	<0.001	<0.001
w/ – w/out SC (p.p.)	-3.5[a]	-8.1[a]	-1.6[a]		-8.2[a]	-5.7[a]	-4.1[a]	-2.4[a]	-2.6[a]		
Vegetables	55.9	44.4	64.5	<0.001	48.8	55.6	58.2	59.5	57.7	0.046	0.027
w/– w/out SC (p.p.)	-16.6[a]	-36.4[a]	-2.3[a]		-37.0[a]	-20.3[a]	-11.8[a]	-7.9[a]	-5.3[a]		
Sub-Groups											
Dark Green	28.8	31.2	27.2	<0.001	36.0	31.8	26.8	24.8	24.6	<0.001	<0.001
w/– w/out SC (p.p.)	-2.1[a]	-6.8[a]	0.0		-9.4[a]	-3.2[a]	-1.4[a]	0.0	0.3[a]		
Red and Orange	70.5	68.7	71.8	0.120	72.1	73.5	70.7	68.6	67.1	0.003	0.001
w/– w/out SC (p.p.)	-5.2[a]	-12.4[a]	-0.9[a]		-13.6[a]	-6.3[a]	-3.4[a]	-2.7[a]	-2.5[a]		
Legumes	26.0	28.0	24.6	0.002	31.6	28.4	24.5	23.0	22.6	<0.001	0.002
w/– w/out SC (p.p.)	-1.9[a]	-5.9[a]	0.0		-8.2[a]	-2.8[a]	-1.0[a]	-0.2[a]	0.3[a]		
Starchy	69.3	67.7	70.5	0.022	71.7	73.0	69.2	66.3	65.8	<0.001	<0.001
w/– w/out SC (p.p.)	-5.2[a]	-12.5[a]	-0.9[a]		-13.6[a]	-6.2[a]	-3.6[a]	-2.9[a]	-2.3[a]		
Other	62.2	61.3	62.8	0.189	67.0	66.0	62.2	58.6	56.4	<0.001	<0.001
w/– w/out SC (p.p.)	-4.8[a]	-11.6[a]	-0.8[a]		-13.3[a]	-6.1[a]	-3.6[a]	-2.3[a]	-1.5[a]		
Protein Foods	49.4	52.6	47.0	0.030	68.7	53.8	45.5	43.1	34.0	<0.001	<0.001
w/– w/out SC (p.p.)	-6.1[a]	-13.4[a]	-1.3[a]		-12.0a	-8.4a	-3.9a	-3.4a	-3.1a		
Sub-Groups											
Fish/Seafood	12.6	10.7	13.9	0.003	13.2	10.5	10.5	12.6	16.2	0.013	0.063
w/– w/out SC (p.p.)	-1.3[a]	-3.4a	0.2[a]		-5.9[a]	-1.9[a]	-0.1	0.0	0.7[a]		
Poultry, Meats, Eggs	41.9	44.2	40.3	0.043	56.8	41.0	36.0	38.2	38.1	<0.001	<0.001
w/– w/out SC (p.p.)	-3.0	-7.7[a]	-0.3[a]		-10.0[a]	-5.9[a]	-1.0[a]	-0.6[a]	-0.1		
Nuts, Seeds, Soy Prod.	6.7	4.6	8.1	<0.001	5.9	5.1	5.3	6.9	10.1	0.011	0.005
w/– w/out SC (p.p.)	0.0	-0.2[a]	0.3[a]		-1.0[a]	-1.9[a]	0.0	0.2[a]	0.6[a]		

The table reports the percentage of households whose daily consumption of fruits, vegetables, and protein foods - including self-consumption (SC) - is less than 100% of RDA. Rows marked "w/ - w/out SC (p.p.)" present the differences (in percentage points or p.p.) between household consumptions that consider SC (with: w/) and that do not consider SC (without: w/out). Superscript letters denote statistical significance of the differences between the percentage of households whose consumption is less than 100% of RIA w/ and w/out SC. * Statistical significance of the differences between the rural and urban areas ($\chi 2$ test) and among the five income quintiles ($\chi 2$ test and Cochran–Armitage test for linear trend). All tests account for the sampling design. Source: Authors' calculations.

The situation is different in case of vegetables, where overall 55.9% of households do not attain the corresponding RIA; this number is significantly lower (by 16.6% percentage points) than in case of no self-consumption. Analysis by households' area of residence shows significant difference between the number of rural and urban households that attain the RIA, with less rural than urban households not attaining the RIA (rural: 44.4%, urban: 64.5; $p<0.001$). Finally, the analysis by income quintiles shows that the percentage of households that do not attain the corresponding RIA increases nearly monotonically in income quintiles. In other words, there are significantly less lower income households than higher income households that do not attain the RIA for fruits (Q1: 48.8 vs. Q5: 57.7).

Examining the results for individual vegetable sub-groups shows that about 1 in 4 households does not attain the RIA for Dark Green vegetables and Legumes (28.8% and

26%), and just over 2 in 3 households do not attain the RIA for Red and Orange and Starchy vegetables (70% and 69.3%).

The results for proteins intake show that, about 1 in 2 households (49.4%) did not attain the corresponding RIA; this number by 6.1% percentage points lower than in case of no self-consumption. Analysis by households' area of residence shows significant difference between the number of rural and urban households that attain the RIA, with more rural than urban households not attaining the RIA (rural: 52.6%, urban: 47.0; p=0.03). However, no significant difference was found when the non-attainment was evaluated by households' income quintile.

Discussion

This study analyzes the apparent consumption of fruits, vegetables, and protein groups in Paraguayan households with children under 19 years of age, both for all households and across income quintiles as well as by rural/urban areas.

Our analysis shows that, including self-production, the average (apparent) consumption of fruits was 35.1 cup-equivalents/week, of vegetables 81.6 cup-equivalents/week, and of protein foods 193.6 ounce-equivalents/week. The average ratio of the apparent consumption of fruits (vegetables, protein foods) to the weekly household Recommended Intake Amount (RIA) was 0.72 (1.10, 1.28), respectively. Significant differences between rural and urban areas were found in the average consumption of vegetables (rural: 100.5 cup-eq.'s vs. urban: 67.7 cup-eq.'s; p<0,05). A positive relationship was found between the income quintile and the average consumption of fruits and meats and a negative relationship between the income quintile and the average consumption of vegetables. As for fruits, only the highest income quintile households consumed more fruits than the RIA. In case of protein foods, the highest income quintile households consumed more than 60% more proteins foods than the lowest income quintile households (154.3 vs. 253.3 ounce-equivalents).

Analysis of the incidence of RIA attainment (that is, the percentage of households whose daily consumption of the particular group was less than 100% of RIA) shows that, overall, 77.3% (55.9%, 49.4%) of households did not attain the RIA for fruits (vegetables, protein foods), respectively. These values were in each case significantly lower compared to those obtained when no self-consumption was included (3.5 percentage points for fruits, 16.6 percentage points for vegetables, and 6.1 percentage points for protein foods), highlighting the importance of self-consumption for nutritional attainment of Paraguayan households. Indeed, the self-consumption appears to be especially relevant in rural areas, particularly in case of vegetables.

It is worth mentioning some of the limitations of the present study. One limitation has to do with the nature of the household food consumption data that is available in the EIG 2011-12 survey. This information comes from food use data, rather than from food intake data. While the former refers to food and beverages used from household food purchases or self-production, the latter refers to foods actually eaten, and is – in general – considerably less than food used by the household. (10) Another limitation is of the present study is that it does not take into account the consumption of foods outside the household, which can underestimate the nutritional intake of household members.

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Appendix

Table A1.

Examples of ounce- and cup-equivalent food amounts and raw/cooked conversions

A: Fruits		1-cup eq.	In Grams	Notes	Raw State
Apple		1 cup	110.0	1.30	143.0
Strawberry		1 cup	145.0	1.06	153.7
Apple juice		1 cup	236.5	—	236.5
Raisins		0.5 cup	75.0	—	75.0
B: Vegetables	**Sub-Group**	**1-cup eq.**	**In Grams**	**Conv. Factor**	**Raw State**
Brocoli	Green	1 cup*	155.0	1.64	254.2
Cassava	Starchy	1 cup*	130.0	1.48	192.4
Lentils	Legumes	1 cup*	175.4	0.34	60.0
Onion	Other	1 cup	160.0	1.11	177.6
Pepper (green)	Other	1 cup	120.0	1.22	146.4
Potatoes (white)	Starchy	1 cup*	155.0	1.48	229.4
Spinach	Green	2 cups	140.0	1.39	194.6
Tomato	Red and Orange	1 medium size	170.0	1.10	187.0
C: Proteins	**Sub-Group**	**1-oz eq.****	**In Grams**	**Conv. Factor**	**Raw State**
Beef (top)	Meats, Poultry, Eggs	1 oz*	28.4	1.29	36.6
Chicken (thighs)	Meats, Poultry, Eggs	1 oz*	28.4	1.26	35.8
Eggs	Meats, Poultry, Eggs	1 egg	56.0	—	56.0
Peanuts	Nuts or Seeds	0.5 oz	14.2	—	14.2

** 1 ounce = 28.3495 grams

Table A2.

Recommended Intake Amounts from Each Food Group and the Corresponding Sub-Groups at the 9 Calorie Levels Corresponding to Sedentary Physical Activity*

Food Group	1,000	1,200	1,400	1,600	1,800	2,000	2,200	2,400	2,600
Vegetables (c-eq/wk)	7	10.5	10.5	14	17.5	17.5	21	21	24.5
Dark-green vegetables	0.5	1	1	1.5	1.5	1.5	2	2	2.5
Red and orange vegetables	2.5	3	3	4	5.5	5.5	6	6	7
Legumes (beans and peas)	0.5	0.5	0.5	1	1.5	1.5	2	2	2.5
Starchy vegetables	2	3.5	3.5	4	5	5	6	6	7
Other vegetables	1.5	2.5	2.5	3.5	4	4	5	5	5.5
Fruits (c-eq/wk)	7	7	10.5	10.5	10.5	14	14	14	14
Protein Foods (oz-eq/wk)	14	21	28	35	35	38.5	42	45.5	45.5
Seafood	3	4	6	8	8	8	9	10	10
Meats, poultry, eggs	10	14	19	23	23	26	28	31	31
Nuts seeds, soy products	2	2	3	4	4	5	5	5	5

* See Table A3. for calorie levels (by age/sex) corresponding to sedentary physical activity

Table A3.

Daily Calorie Needs for Sedentary Physical Activity Level, by Age and Sex

Age	Males	Females
2	1,000	1,000
3	1,000	1,000
4	1,200	1,200
5	1,200	1,200
6	1,400	1,200
7	1,400	1,200
8	1,400	1,400
9	1,600	1,400
10	1,600	1,400
11	1,800	1,600
12	1,800	1,600
13	2,000	1,600
14	2,000	1,800
15	2,200	1,800
16	2,400	1,800
17	2,400	1,800
18	2,400	1,800
19-20	2,600	2,000
21-25	2,400	2,000
26-30	2,400	1,800
31-35	2,400	1,800
36-40	2,400	1,800
41-45	2,200	1,800
46-50	2,200	1,800
51-55	2,200	1,600
56-60	2,200	1,600
61-65	2,000	1,600
66-70	2,000	1,600
71-75	2,000	1,600
76 and up	2,000	1,600

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