



Social inequalities in fruit and vegetable consumption by household characteristics in Argentina

Desigualdades sociales en el consumo de verduras y frutas según características de los hogares argentinos

Matías Salvador Ballesteros¹, María Elisa Zapata², Betina Freidin³, Camila Tamburini⁴, Alicia Rovirosa⁵

¹PhD in Social Sciences. Assistant Researcher, Consejo Nacional de Investigaciones Científicas y Técnicas, Instituto de Investigaciones Gino Germani, Facultad de Ciencias Sociales, Universidad de Buenos Aires. Ciudad Autónoma de Buenos Aires, Argentina. ✉ [ID](#)

²PhD in Health Sciences. Adjunct Researcher, Centro de Estudios sobre Nutrición Infantil Dr. Alejandro O'Donnell (CESNI), Ciudad Autónoma de Buenos Aires, Argentina. ✉ [ID](#)

³PhD in Sociology. Independent Researcher, Consejo Nacional de Investigaciones Científicas y Técnicas, Instituto de Investigaciones Gino Germani. Universidad de Buenos Aires. Ciudad Autónoma de Buenos Aires, Argentina. ✉ [ID](#)

⁴Nutritionist. Researcher, Centro de Estudios sobre Nutrición Infantil Dr. Alejandro O'Donnell (CESNI), Ciudad Autónoma de Buenos Aires, Argentina. ✉ [ID](#)

⁵Biochemist. Adjunct Researcher, Centro de Estudios sobre Nutrición Infantil Dr. Alejandro O'Donnell (CESNI), Ciudad Autónoma de Buenos Aires, Argentina. ✉ [ID](#)

ABSTRACT Low consumption of fruits and vegetables contributes to an increased burden of non-communicable diseases. In order to analyze the impact of different factors on fresh fruit and vegetable consumption, an observational, correlational, and cross-sectional study was conducted using data collected in the 2017-2018 National Household Expenditure Survey. We calculated apparent intake of fresh fruits and vegetables in net grams. Descriptive bivariate and multivariate analyses were conducted using multiple linear regression. Apparent intake of fresh fruits and vegetables was well below the recommended level; the lowest consumption was observed in households with lower incomes, with lower educational levels, without elderly members, with children under age 14, with a male head of household, and those residing in the Argentine Northeast region. Identifying social inequalities in food consumption contributes to the development of policies aimed at promoting food and nutrition security.

KEY WORDS Socioeconomic Survey; Fruit; Vegetables; Socioeconomic Factors; Argentina.

RESUMEN El bajo consumo de verduras y frutas contribuye al aumento de la carga de enfermedades no transmisibles. Con el objetivo de analizar cómo inciden distintos factores en el consumo de verduras y frutas frescas se realizó un estudio observacional, correlacional y transversal con datos obtenidos de la Encuesta Nacional de Gastos de los Hogares 2017-2018. Se estimó el consumo aparente de verduras y frutas frescas, en gramos de peso neto. Se realizó un análisis descriptivo bivariado y uno multivariado a partir de regresiones lineales múltiples. El consumo aparente de verduras y frutas frescas está muy por debajo de lo recomendado, los menores consumos se observaron en hogares de menores ingresos, con menor clima educativo, sin adultos mayores, con menores de 14 años, con jefatura masculina y que residen en la región del nordeste argentino. Conocer las desigualdades sociales en el consumo contribuye a la planificación de políticas que garanticen la seguridad alimentaria y nutricional.

PALABRAS CLAVES Socioeconomic Survey; Fruit; Vegetables; Socioeconomic Factors; Argentina.

INTRODUCTION

The purpose of this article is to analyze how different geographical, socioeconomic, and household-level factors contribute to the apparent intake of fruits and vegetables among households in Argentina's urban areas, based on data from the 2017-2018 National Household Expenditure Survey (ENGHo).

Nutrition is a key determinant of health,⁽¹⁾ and plays a central role directly affecting population quality of life.⁽²⁾ The relationship between food consumption and non-communicable chronic diseases has been extensively studied in recent years,^(3,4,5,6) and it has been estimated that one in five deaths and one in six disability-adjusted life years can be attributed to low-quality diets.⁽⁷⁾

Changes in the global food economy have had an impact on dietary habits and patterns that are considered to be determinants of health.^(8,9) Among the most notable changes are the decrease in fruit and vegetable intake and the increased consumption of foods high in caloric content, fats, sugars, and sodium, in particular ultra-processed foods. These food consumption patterns have a negative effect on population health, in particular among low-income groups, who also face a high prevalence of food insecurity and different forms of malnutrition such as stunting, micronutrient deficiencies, overweight and obesity, among others.⁽¹⁰⁾

Fruits and vegetables are an important component of a healthy diet, and low levels of consumption contribute to the increased global burden of non-communicable diseases. In 2017, 3.9 million deaths worldwide were attributed to inadequate fruit and vegetable intake.⁽¹¹⁾ The World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO) recommend a diet that includes at least 400 grams per day of total fruits and vegetables in order to prevent chronic diseases and micronutrient deficiencies.⁽¹⁰⁾ The Dietary Guidelines for the Argentine Population (GAPA) recommend a daily intake of 700 grams, equal to five servings.⁽¹²⁾

As research on dietary patterns in Argentina has shown, between 1996 and 2013 ENGHo data revealed a 27% decrease in apparent intake of fruits and vegetables, specifically attributable to the decline in fruit consumption.⁽¹³⁾ This trend has continued in recent years, with high-income households exhibiting the most complete diets, including a range of fruits and vegetables.⁽¹⁴⁾ Based on the most recent National Survey of Risk Factors (ENFR) from 2018, it is estimated that less than 20% of the adult population consumes the recommended five daily servings of fruits and vegetables, while the 2018 National Nutrition and Health Survey (ENNyS) showed that among those over age two, only 33% consume fruit and 38% consume vegetables at least once per day, with significantly lower figures among low-income groups and those with lower educational levels.⁽¹⁶⁾

The rise in all forms of malnutrition among impoverished groups is associated with food insecurity, low-quality diets, and diets with little variety.⁽¹⁷⁾ According to data collected by the Argentine Social Debt Observatory, severe and extreme food insecurity is found among groups with greater employment, income, and housing vulnerability.⁽¹⁸⁾ In an analysis of household expenditure surveys in the Buenos Aires Metropolitan Area from 1965, 1970, 1985, and 1996, Aguirre observed dietary patterns based on need among poor households – primarily consisting of “filling and high-yield” foods – while higher up on the social ladder it was more common for households to choose healthier foods recommended by national guidelines.^(17,19)

It should be noted that the data used in this study were collected during a period of high inflation and overall decline in quality of life in Argentina (November 2017–November 2018), which particularly impacted vulnerable social groups. According to data from the National Institute of Statistics and Census (INDEC), the consumer price index increased 78.9% between December 2016 and November 2018, while food prices increased 80.4%.⁽²⁰⁾ Moderate or severe food insecurity in Argentina grew 16.6% between

the 2014-2016 period and 2018-2020, increasing from 19.1% to 35.8%.⁽²¹⁾

Regarding the analysis of food and dietary issues in Argentina, it is important to note that the consolidation of the agribusiness model in recent decades has brought with it an increase in food production in the context of a globalized agro-food chain. This has led to a significant decrease in the diversity of food production and has drawn criticism for the quality of food being produced, with high indices of chemical products being employed. This has a negative impact not only on food sovereignty,⁽²²⁾ but also on morbimortality and population quality of life, due to the high levels of environmental pollution generated by the dominant agribusiness model.⁽²³⁾

Analytical perspective

Our analytical perspective on social inequalities on health in the capitalist system has both a conceptual and an ethical dimension. Building on the work of the Latin American collective health movement and critical social epidemiology, inequalities derived from the social class structure intersect with gender and ethno-racial relations and constitute collective modes of living for different social groups.^(24,25) From an ethical standpoint, these inequalities are unjust and morally objectionable insofar as they limit the exercise of human rights for certain social groups, such as health and access to quality food.⁽²⁵⁾ For Breilh, “health develops as a process that links the spatial dimensions of the general, the particular, and the individual (micro); therefore, without understanding the economic forces and relations of the global accumulation system, it is impossible to comprehend the logic of infrastructural installations, the segregation of urban space, the distribution of quality of life among different neighborhoods and urban areas, and the rhythms and flows of living, working, and commuting.” At the microsocial level, “styles of living” based on individual and family consumption patterns are formed – and this includes food

consumption – which may be beneficial or harmful to health.⁽²⁶⁾

A complex array of structural determinants and socio-cultural dynamics influence access to quality food and food choice within households. These include factors related to the production, distribution, and retail system; the food environment in which quality, availability, accessibility, and affordability are combined; and individual and family group dynamics, which depend on tastes, habits, preferences, and asymmetrical economic resources. Purchasing power, in turn, is conditioned by public policies that affect food prices and household income, as well as social assistance programs.^(25,27) Piaggio highlights the importance of expanding the debate on food security beyond just violations of the right to adequate food due to situations of nutritional deficit, but also those produced in “obesogenic” environments, which also require state intervention for their regulation and control. These environments are characterized by high availability and accessibility of ultra-processed foods and beverages with high fat, sugar, and sodium content.⁽²⁸⁾

Analyses of consumption and food practices are also influenced by gender roles, age, interpersonal relations, household composition, and geographic/territorial aspects.

For the most part, women assume the responsibility of feeding the family group; carrying out “foodwork” – and doing so in a healthy way – is a cultural expectation linked to motherhood that is transmitted intergenerationally and cuts across class boundaries.⁽²⁹⁾ To the extent that nutrition is connected to health, well-being, and ultimately life itself, it is a caregiving responsibility within the household that falls to women-mothers.^(30,31,32) Even when fathers participate in household feeding, they often take on a secondary role.⁽³³⁾

Food choice and food practices are also conditioned by age, taken as an indicator of stage in the life cycle and generation. Older adults prepare meals less frequently due to lack of appetite and physical deterioration, as well as health conditions linked to the process of aging, and prefer a leaner diet with more fruits and vegetables. Simplified meal

preparation is also related to the loss of commensality among those who live alone due to widowhood or separation.^(34,35)

Regarding household composition, a number of studies show how mothers of children and adolescents “negotiate” consumption decisions with them, largely due to the increased availability of low-nutrition foods marketed to these groups, exerting a greater influence on their preferences.^(17,31,36) Moreover, when female household heads do not live with a partner, they experience more decision-making power over food choices.⁽³⁴⁾ On the other hand, Aguirre shows that female income earners spend almost twice as much of their income percentage-wise on household food purchases as their male counterparts.⁽²⁷⁾

Lastly, from a historical-cultural and economic perspective on territoriality, it is also necessary to consider the imprint of regional and local cuisines when analyzing household food practices. Displaying hybrid characteristics, “they are a synthesis of culture, productive capacity, and regional history; they are a source of knowledge and cultural resources that forge community identity.”⁽³⁷⁾ With respect to territorial factors in urban areas, differentiated retail offerings in different neighborhoods is one dimension of the built environment that affects options available for household consumption;⁽³⁸⁾ particularly in low-income areas, residents may have reduced ability to commute or to get around in order to satisfy their daily consumption needs non-locally.

METHODOLOGY

An observational, correlational, and cross-sectional study was conducted using secondary data. Data were taken from the ENGHo conducted by the National Institute of Statistics and Census, and were collected between November 2017 and November 2018. A stratified, multi-stage probabilistic sample of 21,547 households in Argentine urban areas with more than 2000 inhabitants was used. For this study, databases corresponding to the

individual, household, and daily expenditure questionnaires were employed.

Each participating household kept a diary of the quantities of food and beverages purchased throughout the course of one week, along with the corresponding expenditure. Additionally, data were collected on household characteristics and income. Apparent intake was defined as the quantity of foods and beverages purchased for consumption by the household. Based on items included in the questionnaire, the variables *apparent intake of fresh fruits* and *apparent intake of fresh vegetables* were constructed. Fresh fruits included: apples, apricots, avocados, bananas, grapefruits, grapes, kiwis, lemons, melons, nectarines, oranges, peaches, pears, pineapples, plums, sour cherries, strawberries, sweet cherries, tangerines, watermelons, other fresh fruits, and fresh or frozen fruit cocktails. Fresh vegetables included: artichokes, arugula, basil, beefsteak tomatoes, beets, broccoli, cabbage, carrots, cauliflower, celery, chard, cherry tomatoes, chicory, cucumber, eggplants, endives, fennel, garlic, green beans, leeks, lettuce, mushrooms, onions, parsley, peas, peppers, plum tomatoes, radishes, spinach, spring onions, squash, and summer squash. Items were also included that corresponded to other fresh vegetables and tubers, as well as fresh or frozen mixed vegetables, tubers, and legumes, given that they were grouped into the same category by the questionnaire, making it impossible to consider vegetables separately for the purpose of this analysis. First, items recorded as units or bundles were converted to quantities using their corresponding values in the weights and measures table included in the SARA software,⁽³⁹⁾ along with the table published by the University of Buenos Aires’ School of Nutrition.⁽⁴⁰⁾ Second, in order to account for non-edible parts of each food item (peels, pits, seeds), a correction factor obtained from the Food Analysis and Registration System (SARA) and the table published by the University of Buenos Aires’ School of Nutrition was applied, and the net weight of each item was determined. Third, total net quantities were divided by the total number

of adult equivalents in the household, and converted to values expressed in daily grams, such that apparent intake is expressed as net grams of fresh fruits and vegetables per adult equivalent per day. Considering that a value of 1 on the adult equivalent scale corresponds to an adult male 30 to 59 years of age with moderate physical activity and energy requirements of 2700 kcal, each individual within the household was assigned a coefficient according to the calorie requirements of their biological group.⁽⁴¹⁾

The analysis was carried out taking into account all households that had purchased food and beverages during the week of the survey.

Variables related to household composition were constructed from the database: sex of household head, presence of children under age 14, and presence of older adults (65 years and over). From the household database, the following variables were constructed: *household educational climate*, *per capita income quintile*, *reception of direct public monetary assistance*, and *geographic location* (region of residence). Household educational climate contemplates average years of schooling for household members aged 18 and over;⁽⁴²⁾ categories were defined as “low” for households with less than 11 average years, “medium” for households with 11 to 16 average years, and “high” for households with 16 or more average years. Direct public monetary assistance refers to beneficiaries of the Universal Child Allowance (AUH), the Universal Pregnancy Allowance (AUE), the “Progresar” Program, or any other cash transfer program. Regarding per capita household income quintiles, income ranges are: \$0 to \$4579 pesos for the 1st quintile, \$4580 to \$7417 pesos for the 2nd, \$7418 to \$10,811 pesos for the 3rd, \$10,812 to \$17,583 pesos for the 4th, and \$17,584 or more for the 5th (17 households declared having no income, representing 0.1% of the sample).

First, bivariate analysis between each of the independent variables and apparent intake of fresh fruits and vegetables was carried out. Then, for both dependent variables, multivariate analysis was conducted using

stepwise multiple linear regression with independent variables grouped into theoretically-defined blocks. The enter method of variable entry was used, which involves simultaneous entry of all selected independent variables in the model.⁽⁴³⁾ Model 1 included the region variable (taken as a geographic variable); in model 2 socioeconomic variables were added (per capita household income quintile, household educational climate, and reception of direct public monetary assistance); and in model 3, household composition variables were included (sex of household head, presence of children under age 14, and presence of older adults). Dummy variables were created for regression analysis and reference categories were defined as follows: Greater Buenos Aires for region; “high” for educational climate; non-beneficiaries for direct public monetary assistance; male for head of household; “none present” for children under age 14; and “none present” for older adults. Per capita income quintile was entered as a quantitative variable.

The tables below present the linear regression coefficient that indicate how many average daily grams per adult equivalent does apparent intake of fresh fruits and vegetables increase or decrease for each category of the independent variables (for dummy variables) or for an increase of one unit of the independent variable (for the quantitative variable), controlling for the effect of other independent variables included in the model. They also include the statistical significance of Student’s t-test, which assesses whether the effects of each independent variable in the sample are statistically significant in the population. Also, the standardized regression coefficient is reported, which assesses the relative importance of each independent variable in the model. Lastly, the R-squared of each model is reported, which represents the proportion of the total variance of each apparent intake variable that is explained by the variance of all independent variables included in the model.^(43,44)

To analyze the data, sampling weights available in the database for each household were used without expanding the results.

RESULTS

Description of the sample

Table 1 summarizes the characteristics of the 21,547 households included in the sample according to the selected variables. The Greater Buenos Aires and Pampas regions account for two thirds of Argentina's total population, while all other regions account for the remaining third, with the lowest proportion residing in Patagonia. Regarding socioeconomic variables, nearly one in five households receives public monetary assistance, and only one in ten households attain a "high" educational climate, referring to adults with at least 16 years of formal schooling on average. With respect to household composition, male-headed household outnumber female-headed ones, 41.5% of households include children and adolescents under age 14 among their members, and 27.5% have older adults present.

Consumption of fresh fruit

Table 2 shows that average daily intake of fresh fruit is 81.5 g per adult equivalent. Higher levels of fruit consumption is observed among the highest-income households (134.6 g in the 5th quintile), those with a high educational climate (131.3 g), those with no children among its members (105.1 g), those with older adults present (129.5 g), those with female heads (90.3 g), those that do not receive direct public monetary assistance (90.7 g), and those that reside in Greater Buenos Aires (86.4 g) or the Pampas region (90.1 g). In contrast, households with the lowest daily fruit intake per adult equivalent include those in the lowest income bracket (38.6 g in the 1st quintile), those with a low educational climate (68.8 g), those with children present (48.2 g), those with no older adults present (63.3 g), those that are male-headed (74.9 g), those that receive direct public monetary assistance (41.3 g), and those that reside in the Argentine Northeast (52.3 g) and in Patagonia (62.3 g).

Table 1. Household characteristics in urban areas, by selected variables. Argentina, 2017-2018.

Variables	%
Region	
GBA	37.9
Pampeana	33.5
NOA	9.2
NEA	7.4
Cuyo	6.2
Patagonia	5.8
Reception of direct public monetary assistance	
Does not receive	81.4
Does receive	18.6
Household educational climate	
Low	45.2
Medium	44.4
High	10.3
Unknown/ no response	0.1
Presence of children under age 14 in the household	
Children present	41.5
No children present	58.5
Presence of older adults in the household	
Older adults present	27.5
No older adults present	72.5
Sex of household head	
Male	57.2
Female	42.8

Source: Own elaboration based on National Household Expenditure Survey 2017-2018.

GBA= Greater Buenos Aires; NOA= Argentine Northwest; NEA= Argentine Northeast.

Table 3 presents the results of multiple linear regression analysis of fresh fruit intake. Beginning with the *region* variable, it can be observed that in model 1 – where this is the only variable included – households residing in NEA, Patagonia, NOA, and Cuyo consume less fruit than those in GBA (differences that are statistically significant), while there are no statistically significant differences with households in the Pampas region. In model 2 – which controls for income, educational climate, and reception of direct public

Table 2. Daily apparent intake of fresh fruit per adult equivalent (in grams) for households in urban areas, by socioeconomic variables. Argentina, 2017-2018.

Variables	DAI of fresh fruit (in grams)
Region	
GBA	86.4
Pampeana	90.1
NOA	70.2
NEA	52.3
Cuyo	74.9
Patagonia	62.3
Reception of direct public monetary assistance	
Does not receive	90.7
Does receive	41.3
Household educational climate	
High	131.3
Medium	82.8
Low	68.8
Per capita household income quintile (national total)	
1st quintil	38.6
2nd quintil	56.1
3rd quintil	78.1
4th quintil	100.2
5th quintil	134.6
Presence of children under age 14 in the household	
No	105.1
Yes	48.2
Presence of older adults in the household	
No	63.3
Yes	129.5
Sex of household head	
Male	74.9
Female	90.3

Source: Own elaboration based on National Household Expenditure Survey 2017-2018.

GBA= Greater Buenos Aires; NOA= Argentine Northwest; NEA= Argentine Northeast; DAI= Daily apparent intake.

monetary assistance – it can be observed that the differences between GBA and both NOA and Cuyo are no longer statistically

significant. On the other hand, differences with NEA continue to be statistically significant, but decrease considerably (from -34.1 g to -10.5 g). This means that if educational climate, per capita household income quintile, and reception of direct public monetary assistance are held constant, the differences between GBA and both Cuyo and NOA are not significant, while differences with NEA are reduced considerably. In contrast, the differences with the Pampas region become statistically significant, as households in this region consume slightly more fruit than those residing in GBA. On the other hand, differences with the Patagonia region retain statistical significance and in fact increase slightly. Lastly, in model 3 which controls for variables related to household composition, households in NEA and Patagonia continue to consume significantly less fruit than those in GBA, while there are no statistically significant differences with the rest of the regions.

All household socioeconomic variables included in model 2 had a significant effect on fresh fruit consumption. With respect to per capita household income, it was possible to observe that as income quintile increased, so did fruit consumption. It was also possible to observe that households receiving direct economic assistance from the state consume less fruit per adult equivalent than households that do not receive assistance. Lastly, households with a high educational climate consume more fruit than those with medium and low educational climates.

In model 3, variables related to household composition were included, which improved the model's fit (R^2 increased from 0.057 to 0.093), but also modified the strength of socioeconomic variables' effect. Starting with the effect of variables related to household composition, it was possible to observe that households with older adults, no children under age 14, and a female head consumed more fruit than those without older adults, with children under age 14, and a male head. The presence of older adults in the household was the variable with the most relative importance in the model (standardized regression coefficient of 0.163).

Table 3. Multiple linear regression of daily apparent intake of fresh fruit per adult equivalent (in grams), households in urban areas. Argentina, 2017-2018.

	Model 1		Model 2		Model 3	
	Linear regression coefficient	Standardized regression coefficient	Linear regression coefficient	Standardized regression coefficient	Linear regression coefficient	Standardized regression coefficient
Region						
GBA (reference category)	-	-	-	-	-	-
Pampeana	3.6	0.011	5.0*	0.016	4.0	0.013
NOA	-16.1**	-0.031	2.8	0.005	-0.2	0.000
NEA	-34.1**	-0.059	-10.5**	-0.018	-11.9**	-0.021
Cuyo	-11.5*	-0.018	-1.1	-0.002	-2.9	-0.005
Patagonia	-24.1**	-0.038	-28.6**	-0.045	-20.4**	-0.032
Reception of direct public monetary assistance						
Does not receive (reference category)	-	-	-	-	-	-
Does receive	-	-	-15.0**	-0.039	-2.5	0.006
Household educational climate						
High (reference category)	-	-	-	-	-	-
Low	-	-	-18.6**	-0.062	-45.4**	-0.151
Medium	-	-	-23.8**	-0.079	-33.1**	-0.110
Per capita household income quintile (national total)						
Income Quintile ¹	-	-	20.9**	0.197	14.7**	0.139
Presence of children under age 14 in the household						
No (reference category)	-	-	-	-	-	-
Yes	-	-	-	-	-22.7**	-0.075
Presence of older adults in the household						
No (reference category)	-	-	-	-	-	-
Yes	-	-	-	-	54.6**	0.163
Sex of household head						
Masculina (reference category)	-	-	-	-	-	-
Femeale	-	-	-	-	13.0**	0.043
Constant (intercept)						
	86.4**		41.2**		61.9**	
R ²	0.006		0.056		0.092	

Source: Own elaboration based on National Household Expenditure Survey 2017-2018.

Note: Multiple linear regression was conducted using the enter selection method and independent variables were included in the following order: model 1 (region); model 2 (region, per capita household income quintile, educational climate, and reception of direct public monetary assistance); and model 3 (region, per capita household income quintile, educational climate, and reception of direct public monetary assistance, presence of older adults, presence of children under age 14, and sex of household head). Reference categories are identified for each variable.

Linear regression coefficient= indicates on average how many daily grams per adult equivalent does apparent intake of fresh fruit increase or decrease for each category of the independent variables, or a one-unit increase for the variable per capita household income.

Standardized regression coefficient= assesses the relative importance of each independent variable in the model. GBA= Greater Buenos Aires; NOA= Argentine Northwest; NEA= Argentine Northeast.

¹Income quintiles were entered as a quantitative variable.

*Statistically significant results: $p < 0.05$.

**Statistically significant results: $p < 0.01$.

Regarding the effect of including household composition variables on socioeconomic variables, it can be observed that receiving direct public monetary assistance loses statistical significance. Moreover, the differences between income quintiles retain significance, but diminish considerably; the relative importance of this variable also diminishes (its standardized regression coefficient decreases from 0.197 in model 2 to 0.139 in model 3). In contrast, differences in fruit consumption by household educational climate increase and maintain a linear relationship, wherein lower educational climate means lower fruit intake. Households with a low educational climate consume 45.4 g less fruit than those with a high educational climate, while those with a medium educational climate consume 33.1 g less per day. The relevance of this variable in the model also increases (in the case of the dummy variable low educational climate, the value of standardized regression coefficient changes from -0.062 in model 2 to -0.151 in model 3). These changes can be explained by the fact that households that do not receive direct economic assistance from the state and those in higher income groups are more likely to include older adults and less likely to have children under age 14. Similarly, in households with a low educational climate, older adults have more representation. As was previously mentioned, households with older adults and those without children consume more fruit per adult equivalent.

Consumption of fresh vegetables

Table 4 shows average daily intake of fresh vegetables per adult equivalent, which averages 126.7 g per day. The highest consumption was recorded in the Cuyo (164.1 g) and NOA (157.1 g) regions, while the NEA (90.4 g) had the lowest. Regarding household educational climate, it can be observed that households with a high educational climate (149.2 g) consume the most, while those with a low educational climate (122.2 g) consume the least. With respect to per capita

Table 4. Daily apparent intake of fresh vegetables per adult equivalent (in grams) for households in urban areas, by socioeconomic variables. Argentina, 2017-2018.

Variables	DAI of fresh vegetables (in grams)
Region	
GBA	120.7
Pampeana	129.1
NOA	151.7
NEA	90.4
Cuyo	164.1
Patagonia	119.0
Reception of direct public monetary assistance	
Does not receive	137.3
Does receive	80.3
Household educational climate	
High	149.2
Medium	126.1
Low	122.2
Per capita household income quintile (national total)	
1st quintile	83.2
2nd quintile	109.1
3rd quintile	127.4
4th quintile	146.7
5th quintile	167.0
Presence of children under age 14 in the household	
No	154.9
Yes	87.0
Presence of older adults in the household	
No	109.1
Yes	173.0
Sex of household head	
Male	117.2
Female	139.4

Source: Own elaboration based on National Household Expenditure Survey 2017-2018.

GBA= Greater Buenos Aires; NOA= Argentine Northwest; NEA= Argentine Northeast; DAI= Daily apparent intake.

household income, households in the 5th quintile consume twice as much (167.0 g) as

those in the 1st quintile (83.2 g). At the same time, intake is higher among households that do not receive direct public monetary assistance (137.3 g) compared with those that do receive assistance (80.3 g). Lastly, with regard to household composition variables, higher levels of consumption is observed among female-headed households (139.4 g), those with no children under age 14 (154.9 g), and those with older adults (173.0 g), in comparison with male headed households (117.2 g), those with children under age 14 (87.0 g), and those with no older adults present (109.1 g).

Table 5 presents the results of multiple linear regression analysis of fresh vegetable intake. Beginning with region of residence, it can be observed that with respect to GBA, households in the Cuyo, NOA, and Pampas regions consume more vegetables, those in NEA consume less, and there are no significant differences with those in Patagonia. This relationship is present in all of the models, although it should be pointed out that in model 2 – which includes socioeconomic variables – differences with NOA and with Cuyo increase (higher consumption than GBA) and differences with households in NEA are no longer significant (lower consumption than in GBA, which regain significance in model 3 when household composition variables are included).

With respect to socioeconomic variables, model 2 in Table 5 (fresh vegetables) displays similar results to those of model 2 in Table 3 (fresh fruit) for the variables income and reception of direct public monetary assistance, but the same cannot be said for household educational climate. Regarding per capita household income quintile, it was possible to observe that as income quintile increased, so does vegetable consumption, and households receiving direct monetary assistance from the state consume less vegetables per adult equivalent. Lastly, it is interesting to note that households with a high educational climate consume less vegetables than those with a low educational climate. In contrast, there are no significant differences with those that have a medium educational climate.

In model 3, which includes household composition variables, it can be observed that differences among income quintiles retain statistical significance but diminish, as in the case of fruit intake. This is evidenced by a reduction in the linear regression coefficient from 20.4 in model 2 to 13.6 in model 3 (this indicates how much fresh vegetable intake increases as income quintile increases). Similarly, the standardized regression coefficient decreases (from 0.163 to 0.109), although it retains its status as the variable with the highest relative importance in the model (similar to presence of older adults with a standardized regression coefficient of 0.103). Furthermore, differences between households that receive direct public monetary assistance and those that do not are reduced, although they retain statistical significance (in comparison to fruit intake, where they lost statistical significance in model 3). Lastly, households with a high educational climate consume more vegetables than those with a medium educational climate, while differences with those with a low educational climate are not statistically significant.

Regarding household composition variables, in model 3 – controlling for the effects of socioeconomic variables and region – it can be observed that households with older adults among their members consume more vegetables per adult equivalent than those with no older adults present, households with no children under age 14 consume more than those with children present, and female-headed households consume more than male-headed households. It can be noted that the effect of household composition variables on fresh vegetable intake is similar to the case of fresh fruit intake.

DISCUSSION

The purpose of this article was to analyze the incidence of different social, economic, geographic, and household composition factors on apparent intake of fruits and vegetables among Argentina's urban population.

Table 5. Multiple linear regression of daily apparent intake of fresh vegetables per adult equivalent (in grams), households in urban areas. Argentina, 2017-2018.

	Model 1		Model 2		Model 3	
	Linear regression coefficient	Standardized regression coefficient	Linear regression coefficient	Standardized regression coefficient	Linear regression coefficient	Standardized regression coefficient
Region						
GBA (reference category)	-	-	-	-	-	-
Pampeana	8.4**	0.023	8.5**	0.023	6.6*	0.018
NOA	31.0**	0.051	49.3**	0.081	47.1**	0.077
NEA	-30.3**	-0.045	-8.6	-0.013	-10.7*	-0.016
Cuyo	43.4**	0.059	53.3**	0.073	52.2**	0.071
Patagonia	-1.8	-0.002	-8.3	-0.011	-0.5	-0.001
Reception of direct public monetary assistance						
Does not received (reference category)	-	-	-	-	-	-
Does received	-	-	-31.9**	-0.070	-12.5**	-0.025
Household educational climate						
High (reference category)	-	-	-	-	-	-
Medium	-	-	0.2	0.000	-9.4*	-0.026
Low	-	-	17.3**	0.049	-8.2	-0.023
Per capita household income quintile (national total)						
Income Quintile ¹			20.4**	0.163	13.6**	0.109
Presence of children under age 14 in the household						
No (reference category)	-	-	-	-	-	-
Yes	-	-	-	-	-37.0**	-0.103
Presence of older adults in the household						
No (reference category)	-	-	-	-	-	-
Yes	-	-	-	-	40.6**	0.103
Sex of household head						
Male (reference category)	-	-	-	-	-	-
Female	-	-	-	-	20.8**	0.058
Constant (intercept)	120.7**		54.1**		82.1**	
R ²	0.008		0.043		0.07	

Source: Own elaboration based on National Household Expenditure Survey 2017-2018.

Note: Multiple linear regression was conducted using the enter selection method and independent variables were included in the following order: model 1 (region); model 2 (region, per capita household income quintile, educational climate, and reception of direct public monetary assistance); and model 3 (region, per capita household income quintile, educational climate, and reception of direct public monetary assistance, presence of older adults, presence of children under age 14, and sex of household head).

Reference categories are identified for each variable.

Linear regression coefficient= indicates on average how many daily grams per adult equivalent does apparent intake of fresh vegetable increase or decrease for each category of the independent variables, or a one-unit increase for the variable per capita household income.

Standardized regression coefficient= assesses the relative importance of each independent variable in the model. GBA= Greater Buenos Aires; NOA= Argentine Northwest; NEA= Argentine Northeast

¹Income quintiles were entered as a quantitative variable.

*Statistically significant results: p<0.05.

**Statistically significant results: p<0.01.

The results show, first of all, that average fresh fruit and vegetable intake is very low, far below the levels recommended by the WHO, and even more so in the case of the Dietary Guidelines for the Argentine Population. These low levels of consumption are consistent with recent data from the 2018 ENNyS⁽¹⁶⁾ and 2018 ENFR⁽¹⁵⁾ surveys. Furthermore, according to trend analyses of ENGHo data, apparent intake of fruits and vegetables is on the decline, with decreases of 41% for fruit and 13% for vegetables between 1996 and 2013.⁽¹³⁾ The results of this study show a continued decline in apparent intake of fresh fruit, which decreased 7% with respect to 2012-2013 data. In contrast, fresh vegetable intake increased 6% with respect to 2012-2013, despite still being lower than 1996-1997 levels⁽¹³⁾ and recommended intake.^(10,12)

Second, bivariate analysis showed that fruit and vegetable consumption increases with household income. Similar results were reported in other studies that used data from household expenditure surveys to analyze apparent intake of fruits and vegetables,^(45,46) as well as other foods.^(17,19,47,48,49,50,51) In this sense, one contribution of this study is its analysis of other variables in order to explain determinants of apparent intake. As for other socioeconomic variables, consumption was also lower among households with lower educational climate and those that received direct public monetary assistance. These data are consistent with the 2018 ENNyS, which showed that daily consumption of fruits and vegetables was significantly lower among low-income groups and those with lower educational levels.⁽¹⁶⁾ Regarding public assistance, existing evaluations of food purchases made with the *Alimentar* Card – a nation-wide program implemented since 2020 – have shown that 82.1% of beneficiary households with children 0 to 6 years of age reported having acquired fruits and vegetables in their most recent food purchase (data on quantities purchased were not available), showing no significant differences with the total population of households with children.⁽⁵²⁾ However, this study shows that among vulnerable households, those that receive the *Alimentar*

Card purchase more fruits and vegetables than those that do not receive it, suggesting the importance of evaluating the differential impact of food assistance policies taking into account household composition and characteristics.⁽⁵³⁾

In terms of household composition variables, lower consumption was observed in households with no older adults present, those with children under age 14, and those with a male head. These results are consistent with previous studies that underscore the fundamental role that women take on in household food decisions, changes in consumption patterns favoring diets with higher fruit and vegetable content often associated with the aging process,^(29,34,35) and the influence of children and adolescents' preferences on food purchasing decisions.^(31,36) Regarding geographic regions, the lowest consumption of fresh fruits and vegetables was reported in households residing in the NEA and Patagonia regions, while the 2018 ENNyS showed that the NEA, along with the NOA and Cuyo regions, had the lowest results in terms of daily fruit intake. On the other hand, differences in vegetable consumption were found, as the 2018 ENNyS reported the highest levels of daily vegetable intake in NEA and the lowest in Cuyo.⁽¹⁶⁾

Third, multivariate analysis provided evidence of the effect of each independent variable while controlling for the others. Therefore, in the case of socioeconomic variables, it was observed that the effect of income considerably diminished when controlling for variables related to household composition. In particular, households with high educational climate reported the highest apparent intake of fruit, and these differences increased when controlling for the effects of household composition. In contrast, there are no statistically significant differences in apparent intake of fresh vegetables with households that have a low educational climate, controlling for the effect of the remaining socioeconomic, geographic, and household composition variables. Whereas households that receive direct public monetary assistance have lower apparent intake of both food

groups, once the effects of the remaining independent variables are controlled for, these differences are no longer statistically significant for apparent intake of fruit, and diminish considerably for vegetables.

Results related to household composition retain statistical significance when controlling for the remaining variables included in the study. It is relevant to note the strong effect held by the presence of older adults in the household, as this variable is the most relevant in terms of its effect on apparent intake of fresh fruit and one of the most important regarding fresh vegetables.

With respect to geographic differences, it should be pointed out that the low apparent intake of both fruits and vegetables observed in the NEA region are maintained even when controlling for the effects of socioeconomic and household composition variables. Along these lines, it can be noted that although lower consumption of fruit was observed in the NOA and Cuyo regions, when the effects of socioeconomic and household composition variables were controlled for, these differences in relation to GBA were no longer statistically significant.

Our study's findings shed light on the importance of including household composition variables along with other structural variables that are often considered more relevant and understood as the principal factors that influence food consumption, such as income or educational level. The utility of multivariate analytical models can also be underscored, as our analysis showed that controlling for the effects of household composition variables modified the effects of structural variables.

It is essential to consider the results obtained in this study from the point of view of food systems and their enduring association with population health.⁽⁵⁴⁾ Our health and well-being are directly affected by the food systems that determine modes of growing, harvesting, manufacturing, transporting, marketing, consuming, and disposing of food, through multiple and interrelated circuits that have all been affected by the Covid-19 pandemic, exacerbating social inequalities.⁽⁵⁵⁾ Regarding food production in

Argentina, according to data from the 2018 National Agricultural Census, only 1.4% (490,770 hectares) of total cultivated area is destined to fruit production and 0.4% (139,585 hectares) to vegetable production. Although gross production is estimated to surpass recommended per capita intake, 50% of production is diverted to industry and 10% is exported, in addition to the significant proportion that is lost or wasted during production, transport, commercialization, and consumption. The low percentages of cultivated area destined to fruits and vegetables can be attributed to their displacement by certain crops due to the expansion of agribusiness, in a context of a globalized agro-food chain.^(22,57)

These issues notwithstanding, data from FAO Food Balance Sheets indicate that per capita supply of fruits and vegetables in Argentina was on average 438 ± 37 g/d between 1961 and 2018, with relatively stable values over time, only in certain periods dropping to the minimum WHO recommendation (400 g/d).⁽⁵⁸⁾ Regarding the type of commercialization, it can be pointed out that indirect marketing (via central markets or large-scale distribution chains involving supermarkets or superstores) is much more common than direct marketing (between producers and retailers or involving food systems and their close links to the health of the consumer population). In the case of vegetables, it is estimated that indirect marketing is four times higher than direct marketing.⁽⁵⁹⁾

Furthermore, in Argentina, price control policies such as "*Precios esenciales*" or "*Precios cuidados*" implemented by the Ministry of Productive Development have been included among the measures taken in the inflationary context of recent years, but these policies have been formulated from an economic logic targeting consumption and do not take into account nutritional and health recommendations, and the list of products covered by the programs only includes 4 or 5 fruits and vegetables.^(60,61) In this regard, it should be noted that following to the period considered in this study (2017-2018), high inflation continued and

increases in food prices – particularly fruits and vegetables – consistently outpaced the consumer price index. According to the most recent data available for this study, in October 2021 the National Institute of Statistics and Census (INDEC) reported an increase of 475.9% in the consumer price index compared to December 2016, while an increase of 478.2% was registered for food products, 475.9% for fruit, and 519.6% for vegetables, greens, and legumes.⁽²⁰⁾

The nutritional situation of the population represents the last link in the food system, and malnutrition is related to production, availability, access, and food consumption behaviors.⁽⁶²⁾ Argentina has a high prevalence of overweight and anemia, moderate prevalence of stunting, and low levels of emaciation and underweight. All forms of malnutrition are closely related to socioeconomic and educational inequalities.⁽⁶³⁾ Several authors coincide that a direct relationship exists between malnutrition in contexts of poverty and the economic accessibility of food.⁽⁶⁴⁾

In turn, food marketing and advertising are mainly directed toward foods with low nutritional quality, as has been shown in several local studies.^(65,66) This has an impact on household purchasing decisions in detriment of healthier foods, particularly in households with children and adolescents.⁽³⁶⁾ From a methodological point of view, due to the scarcity of nationally representative data on food consumption generated with individual collection methods, household expenditure surveys provide a promising source of information.⁽⁶⁷⁾ Only carried out in 22 countries in 1950,⁽⁶⁸⁾ they are now available in more than 100 countries,⁽⁶⁹⁾ and in many cases provide very representative periodic and time series data from urban and rural samples. Moreover, the method for obtaining dietary information in households is less intrusive than others. Nonetheless, the use of food purchases to estimate apparent intake has some inherent limitations, such as the absence of data on how food is distributed among different members of the household and the lack of information on food waste or food purchased for animal consumption,

in addition to food that is obtained through public assistance programs or free of charge. Despite these limitations, household expenditure surveys are an under-utilized tool that have a great deal of potential for evaluating food and beverage consumption, especially in low- and medium-income countries.⁽⁷⁰⁾ The information obtained in low-income families may be more useful, where food waste or other uses for acquired food are minimal. A further limitation of the analysis regarding the region variable was that the level of data aggregation did not make it possible to interrogate the heterogeneity of different areas within the same region.

One final limitation of our study was its quantitative approach based on the analysis of secondary survey data. Food practices, as a socio-cultural phenomenon, have a great deal of complexity that can only be partially captured by survey methodologies. Quantitative studies delimit reality in terms of variables and the relationships between them. Although this approach to social phenomena involves simplifying the richness and depth of the analysis, in the case of surveys with statistically representative samples with national coverage like the ENGHo, it is possible to make statistical generalizations from the patterns of association observed between analyzed variables and social inequalities and aspects related to household organization. It is our view that quantitative studies on food consumption – considering all their limitations and contributions – undoubtedly complement sociological and anthropological qualitative approaches, which allow for a holistic and grounded understanding of consumption decisions and food practices on the part of households, the meanings attributed to them by households members, and their living conditions.

Among the strengths of our study, we can point to the characteristics of our data source as previously discussed, in relation to the sample size and its representativeness of urban areas with at least 2000 inhabitants. Regarding the type of analysis, this is the first study to use multiple regression models to evaluate apparent intake of fruits and vegetables using ENGHo data. In terms of the

analytical perspective, this is the first study to simultaneously include socioeconomic, geographic, and household composition variables. One previous study used multiple linear regression with information on frequency of fruit and vegetable intake using data from the 2013 ENFR and other predictor variables (such as age, income, educational level, physical activity, overweight, and alcohol consumption).⁽⁷¹⁾

CONCLUSION

This analysis provides evidence of the low levels of fruit and vegetable consumption in

the Argentine population, as well as the influence of living conditions and household composition on consumption. In particular, the absence of older adults, the presence of children under age 14, and male-headed households stand out as factors associated with lower consumption of fruits and vegetables in Argentine households.

The findings of this study highlight the importance of generating knowledge on the social inequalities associated with food consumption recommended for a healthy diet, which is central to planning targeted policies and interventions capable of ensuring nutritional and food security and improving population nutrition, particularly among the most vulnerable social groups.

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CONFLICT OF INTERESTS

The authors declare that they have no ties or commitments that can be understood as a conflict of interests and may condition what is expressed in the text.

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