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Quali-quantitative study of nutritional status and eating patterns in children aged 1-3 years from low-income families in two population groups with different productive activities (Buenos Aires, Argentina), 2007-2008

Estudio cuali-cuantitativo del estado nutricional y la alimentación en niños de 1 a 3 años de familias de bajos recursos en dos grupos poblacionales con diferentes actividades productivas (Buenos Aires, Argentina), 2007-2008

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ABSTRACT The aim of this article is to describe the nutritional status and eating patterns of children aged 1-3 years from low-income families who reside in areas with different productive activities: primary production and production of goods and services. A descriptive cross-sectional study was performed with a qualitative and quantitative methodology, evaluating anthropometric and biochemical nutritional status, food intake, economic and demographic characteristics, dietary practices and representations. The results show that children from areas of primary production had a lower prevalence of anemia and iron deficiency. They also had a higher consumption of energy, calcium, zinc, vitamin A and protein and a greater diversity and quality in food consumption. We can conclude that the geographical context of families closer to sources of primary production favors interaction with individuals outside of the family, expanding both the informal social network and access to better quality nutritional food.
KEY WORDS Nutritional Status; Food Preferences; Child; Anemia; Zinc; Argentina.

RESUMEN El objetivo de este artículo es describir el estado nutricional y los patrones de alimentación de niños de 1 a 3 años de familias de bajos recursos, que residen en dos áreas con diferentes actividades productivas: producción primaria y de bienes y servicios. Se realizó un estudio descriptivo de corte transversal, con metodología cuali-cuantitativa; se evaluó el estado nutricional antropométrico y bioquímico, ingesta alimentaria, características económicas y sociodemográficas, prácticas alimentarias y representaciones. Los resultados muestran que los niños del área de producción primaria presentaron menor prevalencia de anemia y deficiencia de hierro. Asimismo tuvieron un consumo superior de energía, calcio, zinc, vitamina A y proteínas y una mayor diversidad y calidad en el consumo de alimentos. Podemos concluir que el contexto geográfico de las familias que residen cerca de fuentes de producción primaria favorecería la interacción con individuos ajenos a la familia, ampliando la red social informal y el acceso a alimentos de mejor calidad nutricional.
PALABRAS CLAVES Estado Nutricional; Preferencias Alimentarias; Niños; Anemia; Zinc; Argentina.

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INTRODUCTION

The nutritional status of children under 5 years of age is a sensitive sign of the health status of a country's population, as well as of the country's economic situation, and it is related to the geographical context, the availability of economic resources, the types of productive activities carried out by the population, and especially to the access and availability of food and the quality of the food consumed.[1,2,3,4] In this sense, several research studies compared the population's characteristics, for which they classified them into rural and urban areas, referring to the rural area as the most deprived area due to restricted food production and accessibility.[5,6] However, when stratifying rural and urban areas according to the availability of economic resources, the differences related to the nutritional status of children show that malnutrition is not only associated with rural areas.[5]

The availability of food and the dietary diversity in children is not only an economic concern, but also a consequence of the place where they live.[7] The high prevalence of anemia and malnutrition in children does not decrease by living in an urban area,[8,9,10] however, in broad terms, children living in urban areas are believed to have better living conditions than those children living in rural areas. Nevertheless, living within easy reach of utility services in large urban areas does not necessarily assure access to any of them.[11] Several studies have shown that in many countries, children under 5 years of age living in poverty in urban areas have as bad or worse living conditions as those of children living in poverty in rural areas, in terms of their height to weight ratio or of their mortality rate.[8,12]

Given the increasing social inequalities, it is necessary to develop different approaches to help show these inequalities within the health contexts as well as their causes in different population groups. Knowing the characteristics of each population group enables understanding of how the different productive activities might influence the access and availability of food, as well as the quality of the food consumed.[2,13] This situation requires an interdisciplinary approach to the nutritional status of children living in areas where productive activities are different.

The context of this study, i.e. the province of Buenos Aires (Argentina), is the most populated area in the country. It presents a particular situation as its geographical scope determines that the distribution, of both the population density and productive activities, is very diverse. There are areas with low population density engaged in primary and secondary exploitation activities which account for around 40% of the agricultural production (of wheat, corn, sunflower and barley) and 37% of the bovine stock in Argentina. In other locations, industrial and administrative activities are carried out, including utilities in the areas of construction, electricity, gas and water, financial institutes, insurances or real property, and the highest share of population is located in said locations.[14]

The aim of this study is to describe the (anthropometric and biochemical) nutritional status and the eating patterns of children aged 1-3 years from low-income families who live in two areas engaged in different productive activities in the province of Buenos Aires. One group lives in primary production areas where agricultural and livestock activity prevails, and the other group resides in areas where the main activity is the production of goods and services.

METHODOLOGY

Design

A descriptive cross-sectional study was conducted using a qualitative and quantitative approach, during the years 2007 and 2008.

Ethical review

The research protocol and the informed consent were approved by the Committee for the Scientific Review of Protocols [*Comité*

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de Revisión de Protocolos de Investigación] within the Institute of Development and Pediatric Research "Professor Dr. Fernando E. Viteri" (IDIP) [*Instituto de Desarrollo e Investigaciones Pediátricas*], Sor María Ludovica Children's Hospital [*Hospital de Niños Sor María Ludovica*] (La Plata, Buenos Aires, Argentina) in the year 2007.

All parents and/or legal guardians of the children who participated in the study were asked to sign an informed consent form, and the confidentiality and anonymity of the information provided by and/or obtained from them in this research study were respected.

Population and area

The sampling was deliberate. Healthy children aged 1-3 years attending the health public sector in six different locations of the province of Buenos Aires were evaluated. Children who suffered from diagnosed chronic diseases or acute or infectious diseases at the time of the study were not eligible; neither were children whose parents did not consent to participate in the study.

The group within the area of production of goods and services was made up of a sample of children living in Arturo Seguí, a suburban area located 20 km away from the city of La Plata, the capital city of the province. The group within the primary production area consisted of a sample of children living in the locations of Ayacucho, Balcarce, Dolores, Las Flores and Rauch, located in the rural area of the province of Buenos Aires over 150 km away from the capital city. Livestock (farming) and agriculture are the principal economic activities in these areas.[15]

The field work was carried out during the period from November 2007 to May 2008. The call for participation was organized by each location's work team that decided on the most suitable option(s) to facilitate voluntary participation. The field evaluation was conducted at the health centers and/or hospitals based in the locations included in this study. Ethnographic interviews were conducted at the participants' homes.

Sample size calculation

The sampling size was determined in order to detect an 8% difference between both areas in the prevalence of anemia, with a significance level of $\alpha = 0.05$ and with power $\beta = 0.80$. It was estimated that at least 79 children in each area needed to be interviewed. The National Survey of Nutrition and Health (ENNyS) [*Encuesta Nacional de Nutrición y Salud*] was used as baseline information.[16]

Data collection: methods and instruments used

A sample of venous blood was collected from all children on an empty stomach to calculate their levels of hemoglobin, ferritin and zinc. The hemoglobin level was calculated by using an automated hematology counter (ABX Pentra 60); ferritin was determined by immunoassay using a Beckman Coulter Access automated system of chemiluminiscence and zinc was calculated by flame atomic absorption spectrophotometry (AA-6200 Shimadzu). The variables anemia (Hb < 11 g/dl),[16] iron deficiency (serum ferritin < 12ng/ml),[17] and zinc deficiency (serum zinc < 70 μg/dl)[18] were defined.

Weight and height measurements were obtained on site by using standard methods.[19] The participants were weighed using a digital electronic scale model Tanita Um-061 with 100 g divisions and a maximum capacity of 150 kg. Height was taken using a Seca portable altimeter with 1mm graduation. Measurements were taken in each location by nutritionists previously trained during a standardization day according to the Habitch's method.[20] The error in height measurement was 0.41 cm.

The indicators weight/age, height/age, and body-mass index (BMI) were analyzed and evaluated using the tables suggested by the World Health Organization (WHO).[19] In order to perform the nutritional classification, the following indicators were used: low height for age < -2 Z-score of height/age;

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low weight for age < -2 Z-score; weight/age and obesity > + 2.0 Z-score according to BMI.

The adult responsible for the child's care was given a 24-hour reminder to evaluate the food intake as per the multi-step method.[21] The reminder was given so that all days of the week were represented in an equivalent way, except when the children's intake of food of the previous day was affected by a disease. In order to standardize quantities and measurements, replication kits and visual models of the most frequently consumed food were used (Fornax SRL-Food Replicas, Rosario, Argentina). The reported quantities of food, beverages, and supplements were turned into nutrients by using the chemical composition tables of the United States Department of Agriculture (USDA).[22] These tables were bound to worksheets especially designed for this purpose in the Access software. The following nutrients were evaluated: energy (kcal), proteins (g), Vitamin A (μgr RE), folates (mg), calcium (mg), iron (mg), and zinc (mg).

A questionnaire about the sociodemographic and economic characteristics of the participants' homes was conducted to determine the percentage of unsatisfied basic needs according to the indicators of the National Institute of Statistics and Censuses (INDEC) [*Instituto Nacional de Estadísticas y Censos*].[23] The questionnaire included the age of the child and mother as well as her occupation and level of education (partially complete primary school represents less than 7 years of education; complete primary school represents 7 years of education; and more than complete primary school represents over 7 years of education).

Moreover, in all the locations included in this study, semi-structured interviews were carried out using a qualitative methodology with the aim of obtaining information related to food practices and their representations. The interviews were done with the mothers of the participating children; they were an average length of an hour and were recorded using a digital recorder.

Analysis

SPSS 18 for Windows was used for processing quantitative data. Ferritin concentrations were expressed as geometric means with 95% confidence intervals, given that the population distribution of this variable is not normal. Mann-Whitney and Chi-Square tests were respectively used to compare means and prevalence.

In order to assess confusion, models of logistic regression for the prevalence of anemia and zinc deficiency were adjusted. These models included *geographic region* as a dependent variable and *age, sex, maternal education,* and *unsatisfied basic needs* as independent variables. As a result, the *odds ratio* (OR) corrected by the model was estimated.

The information obtained from the qualitative interviews was transcribed literally and processed in Microsoft Word. The resulting material was included in NVivo software, which helps organize the information contained in the discursive corpus by choosing units and bounding them to "nodes," to which significant categories of food were associated within the context selected for this study. An analysis of the references and their frequency was done and a set of nodes and sub-nodes which helped organize the material in terms of the proposed description was established. Subsequently, the recurrences and differences in the comments and opinions of the interviewed individuals were recorded.

RESULTS

A total of 88 children from the area of production of goods and services and 114 children from the area of primary production were evaluated. Both populations were comparable according to the variables considered, except at the level of maternal education, which was significantly higher in the area of primary production (Table 1). Although the percentage of families with unsatisfied basic needs was comparable in both areas, the homes in the area of production

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Table 1. Socioeconomic characteristics of the area of production of goods and services and of the area of primary production (n=202). Province of Buenos Aires, Argentina, 2007-2008.

Socioeconomic Characteristics	Area of production of goods and services (n=88)	Area of primary production (n=114)
Age of the children (years) (median ± SD)	1.6 ± 0.4	1.7 ± 0.5
Maternal age (years) (median ± SD)	26.2 ± 6.4	26.3 ± 6.6
Unsatisfied basic needs (%)	40.9	38.9
Maternal education level[1] (%)		
Partially complete primary school	44.2	17.3
Complete primary school	27.9	48.2
More than complete primary school	27.9	34.5
Maternal employment (%)	31.8	27.8

Source: Own elaboration.
[1]p=0.000

of goods and services do not have running water or a system of sewage drainage.

With regard to the activity of the household head, in the area of production of goods and services, casual work or "*changas*" predominated (e.g., building and lawn mowing activities, horticulture). Women were homemakers or worked occasionally as domestic helpers. In the area of primary production, the male household heads had stable jobs as field workers (i.e., beekeepers, woodcutters, installers of wire fences, and so on), factory workers, or municipal employees. Women who were mothers did not work outside their homes; they either worked as domestic helpers or looked after individuals in family houses.

In terms of biochemical parameters, the average values for hemoglobin and ferritin

Table 2. Prevalence of anemia and iron, and zinc deficiency in the area of production of goods and services and in the area of primary production. Province of Buenos Aires, Argentina, 2007-2008.

Prevalence	Area of production of goods and services (n=88)		Area of primary production (n=144)		*p*-Value
	(%)	CI95%	(%)	CI95%	
Anemia	42.0	31.7; 52.3	25.9	17.7; 34.2	0.017
Iron deficiency	48.3	37.8; 58.8	32.3	22.9; 41.6	0.027
Zinc deficiency	10.3	3.9; 16.7	6.5	2.6; 10.2	0.338

Source: Own elaboration.
CI95% = Confidence Interval 95%.

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Table 3. Model of logistic regression for the prevalence of anemia and iron deficiency (n=202). Province of Buenos Aires, Argentina, 2007-2008.

Risk factor	Anemia[1]		*p*-Value	Iron deficiency[2]		*p*-Value
	OR	CI95%		OR	CI95%	
Area of production of goods and services	2.035	1.094; 3.784	0.025	2.427	1.284; 4.586	0.006
Age	0.460	0.224; 0.944	0.034	0.561	0.276; 1.141	0.111
Sex	0.806	0.428; 1.519	0.505	2.009	1.057; 3.819	0.033

Source: Own elaboration.
1) $\chi^2 = 0.077$
2) $\chi^2 = 0.078$

were lower in the area of production of goods and services. This group showed a higher prevalence of anemia and iron deficiency. There were no differences regarding zinc (Table 2). The application of the model of logistic regression showed that, even by adjusting per variable of confusion, the prevalence of anemia was associated to the area of production of goods and services, and to the children's age. With respect to iron deficiency, there was a relation between this same area and the male sex (Table 3).

The anthropometric evaluation showed that the prevalent problems were: low height (13.6% *vs*.15.9%) and obesity (15.9% *vs*. 16.8%), in both the area of production of goods and services and in the primary production area, respectively, without significant differences between both groups.

Moreover, the results of the food survey revealed that the values of the daily consumption of energy, calcium, zinc, vitamin A, and proteins were significantly lower in the area of production of goods and services (Table 4).

Based on the semi-structured interviews, considerable similarity between the families in both groups was observed. The household groups consisted of nuclear families and single-parent families. Their members were from these towns or from nearby towns. Several household groups consisted of individuals from Argentine provinces or from bordering countries such as Paraguay or Bolivia. Food supplies in the primary production area were purchased in nearby shops (markets, grocery stores and butcher shops) whereas in the area of production of goods and services, families did their shopping in leading supermarkets due to the difference in prices with nearby shops, which was common practice in the primary production group.

With regard to the production of their own food, in the primary production area, several household units stated that they got supplies from orchards and fruit trees, a resource that was not mentioned in the area of production of goods and services. Both groups reported breeding hens and chickens for meat consumption and egg production. In the primary production area, certain foods were obtained through barter or exchange (generally, meat) and through gifts from relatives or neighbors (fruits, vegetables, and/or eggs).

With respect to types of food, both groups mentioned consuming certain "pot" dishes (rice, meat and vegetable stews, *polenta*, corn flour), breaded meat, tarts, salads, rice, steaks, and spaghetti. As for beverages, the cheapest soft drinks in the market and powdered fruit juices to be prepared at home were preferred. Nevertheless, when asked about food cooking, in the area of production

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Table 4. Data of the food survey of the area of production of goods and services and the primary production area (n=202). Province of Buenos Aires, Argentina, 2007-2008.

Nutrients	Area of production of goods and services (n=88)		Area of primary production (n=114)		*p* -Value
	Median	Interquartile Range	Median	Interquartile range	
Energy (kcal/d)	1,127	816; 1,344	1,448	1,142; 1,840	0.000
Calcium (mg/d)	625	374; 831	813	486; 1,136	0.001
Iron (mg/d)	6.2	4.8; 9.7	6.2	4.5; 8.8	NS
Zinc (mg/d)	5.2	3.7; 7.9	6.3	5.0; 9.2	0.018
Folates (µgr/d)	151	92; 197	159	107; 227	NS
Vitamin A (µgr RE/Dd)	196	85; 533	310	150; 582	0.042
Proteins	44.1	34.9; 59.1	54.9	44.6; 69.4	0.000

Source: Own elaboration.
NS = Non-Significant.

of goods and services, the individuals interviewed mentioned the consumption of certain foods in general, without giving any details about ingredients, ways of cooking, or frequency of consumption, whereas the primary production area provided detailed information about the ingredients used in each dish. Furthermore, this group gave information regarding the larger amounts of vegetable and meats included in their everyday meals as well as the consumption of fruit and sweets, which was not mentioned in the area of production of goods and services.

Another observable difference was related to the ways of cooking dishes. In the area of production of goods and services, food was generally steamed or fried in pots, and ovens were barely used; whereas in the area of primary production, an increased consumption of raw food, the use of ovens, and the grilling of meat were mentioned.

In both groups, the children's mothers agreed that their children "can eat everything," "whatever they like," focusing on the consumption of fruit, yoghurts, milk, and they added "there is always some meat included." In the primary production area, the importance of consuming vegetables and cereals was highlighted, as they "are rich in iron" and "vitamins." The need to have "the four meals" was also remarked. As for the restrictions in the consumption of certain types of food, the mothers explained the need to reduce or exclude very salty and/or spicy food, sausages, fried or very fatty food from their small children's diet. However, in the area of production of goods and services, the consumption of sweet food and "junk food" was restricted.

DISCUSSION

In this study, the children residing in the primary production area (agricultural and livestock activities) showed a better nutritional status than those children residing in the area of production of goods and services.

The prevalence of anemia and the iron deficiency in children from the primary production area was comparable to the deficiency reported at a provincial and national level by the ENNyS,[16] whereas the results of

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such levels in children residing in the area of production of goods and services were higher. Moreover, there was a correlation between iron deficiency and the children's sex. A higher prevalence of this deficiency was found in males. The correlation between sex and anemia has been described in several countries,[24,25,26] and it may mean that there are higher iron requirements for males (0,9 mg/d) than for females, particularly within the second half of the breastfeeding period.[27]

In this study, there were no differences in the nutritional status of zinc between both groups. The zinc deficiency was similar to that found in another study conducted with children of 1 to 2 years of age from families enrolled in the *Better Life Plan* (PMV) [*Plan Más Vida*] program developed by the province of Buenos Aires.[28]

The differences found might also be explained by considering the distinctive characteristics of each region. The group in the primary production area is likely to benefit from being in a geographical area located near agricultural and livestock activities which have facilitated access and availability to iron-rich foods. In this group, the importance of vegetable and cereal consumption, and the breeding and consumption of hens and chicken were underlined. Some authors stated that those households producing farm foods (vegetables, fruit, eggs, and poultry) had a more varied diet and greater consumption of micronutrient-rich foods.[7,29,30]

This advantage is not reflected in better economic conditions but — as the analysis of the interviews showed — in the possibility of getting food using strategies such as barter, exchange (generally, meat), and gifts from relatives and neighbors, which played an important role in food access and availability. This interaction with individuals who do not belong to the family group helped expand the informal social network and available resources. These results were comparable to other research studies conducted in Brazil which highlight the existence of a neighbor and familial cooperation network to ensure a minimum amount of food in low-income households.[31,32,33]

The results of the food survey show that the consumption of energy and nutrients was higher in the area of primary production, although there were no statistically significant differences regarding iron intake. However, in both groups, the median of iron consumption was lower than the values recommended by international agencies.[34] In a study conducted in children aged 3-24 months from a low socioeconomic level Nolan *et al*.[35] reported that the consumption of energy exceeded the recommended values, as in the case of other developing countries such as Ghana, Guatemala and Mexico;[35,36] whereas iron consumption did not exceed the recommended values, which matches the results of this study. A frequent inadequate zinc consumption is the most likely cause of deficiency.[37] Nevertheless, in this study, zinc consumption in both population groups was found to be adequate.[34] It is likely that the food survey may be a limited tool to evaluate consumption, thus providing an inaccurate estimation of intake.[38]

Another factor that plays an important role in the quality of children's diet is the level of maternal education. Darapheak *et al*. found that children whose mothers had attained the highest level of education had a more varied diet, including higher consumption of meat and vegetables, which reflected a better nutritional status than that of children whose mothers had a lower level of education.[7] The qualitative analysis shows differences regarding the ways in which food is cooked: the mothers of children from the primary production area, who had a higher level of education, gave greater details about the cooking of food and highlighted the importance of the consumption of fruits and vegetables so as to have an adequate diet. These two factors may have contributed to a higher nutritional quality diet, which was reflected in the lower prevalence observed. Furthermore, several studies coincide in the fact that a higher maternal level of education would have a protective effect on the risk of anemia development in children.[39,40]

The nutritional evaluation by the anthropometric method revealed that the most

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frequent nutritional issues in both groups were low height and obesity, which could be related to the access to certain types of cheaper food but inadequate from a qualitative and quantitative perspective. This phenomenon is comparable to other studies with similar results.[8,16,28,41] Once again, the epidemiological nutritional transition is expressed in the coexistence of low height along with overweight and obesity in different areas of the province of Buenos Aires.

One weakness of this study was not revealing the presence of enteroparasitosis which might affect food intake, digestion, and absorption of micronutrients.[42] The research study by Orden *et al.*[43] revealed that the highest concentration of parasites found in suburb areas of the province of Buenos Aires is related to the most unfavorable socio-environmental conditions, which suggests a negative impact of urbanization when it is not accompanied by the provision of vital infrastructure services. In the area of production of goods and services, not having running water and sewage might encourage the development of these infections. This might partly explain the high prevalence of anemia and iron deficiency found.

In this study there were no differences in the prevalence of anemia and iron deficiency among children with or without unsatisfied basic needs. Had the economic situation of both populations been approached from another perspective, perhaps several masked differences in the poverty indicators would have been found between the groups.[44]

Although the sampling was deliberate, it helped obtain vital data and trends of the variables of interest. The strength of this study was to add the qualitative approach to the traditional analysis of the nutritional status, which helped go further into the contextual aspects that have an impact on children's diet. This type of comprehensive approach is essential for the design of nutritional interventions that may help optimize resources and actions in terms of the needs such as, for instance, a nutritional education which contributes to promoting good dietary habits and sharing family meals, taking into account the cultural patterns of the population as well as the productive activities of the context.

CONCLUSIONS

Children from the primary production area related to agricultural and livestock activities showed a lower prevalence of anemia and iron deficiency than those children from the area of production of goods and services. Similarly, in that group there was a higher consumption of energy, calcium, zinc, vitamin A, proteins and a greater diversity and quality of food consumption.

The geographical context of the families living close to the sources of primary production could favor the interaction with individuals outside the family group, thus expanding both the informal social network and the access to better nutritional quality food.

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