Malnutrition and Body Composition in Urban and Rural Schoolchildren: A Cross-sectional Study in San Rafael, Mendoza (Argentina)

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Objectives: The aim of the present study was to analyze the nutritional status and body composition of children from San Rafael, Mendoza, avoiding urban and rural categorization by generating subpopulations as a function of their socio-environmental characteristics.

Methods: A cross-sectional study was performed in 3,596 schoolchildren from 4.0 to 13.9 years of age. Body weight, height, upper arm circumference, and triceps skinfold were measured. Body mass index, total muscle, and fat areas of the arm were calculated. To estimate nutritional status and body composition, the NHANES III reference was used. The socio-environmental variables were surveyed using a structured questionnaire. These variables were processed by categorical principal-component analysis (catPCA).

Results: The catPCA allowed the differentiation of four groups, three with urban characteristics (high urban, medium urban, impoverished urban), and a rural group. Stunting occurred at a higher rate in the impoverished urban group, and the occurrence of underweight children was higher in the rural group. The prevalence of excess weight varied in the range of 20–26%. The latter value corresponded to children of the high urban group, who also did not show reduced muscle mass.

Conclusion: Children from San Rafael presented differences in nutritional condition and body composition associated with pronounced socio-environmental heterogeneity. Thus, we could observe a gradient from the "high urban" group, with better social, economic, and sanitation conditions and at the same time a more obesogenic environment to the "impoverished urban" and "rural" groups, whose vulnerability reflected a higher prevalence of child undernutrition and the association with excess weight and reduced muscle mass. Am. J. Hum. Biol. 28:796–803, 2016.   © 2016 Wiley Periodicals, Inc.

In recent years, the process of urbanization in Latin America has accelerated, due in part to the uncontrolled expansion of cities as caused by internal rural to urban migration, which has had both social and environmental impacts. In Argentina, migration and spatial redistribution rates have varied as a result of numerous historical events, with a concentrations of events in the second half of the last century (Pizzolitto, 2006; Velázquez and Gómez Lende, 2005). In 1960, the urban population rate was 73%, rising to 82.6 and 89.4% in 1991 and 2001, respectively (CNPyV, 1991, 2001). Currently, approximately 9 out of 10 Argentinians live in urban areas, placing our country among those most urbanized in Latin America (World Bank, 2015).

The impetus for this rural–urban migration is mainly economic, due to the search for a better quality of life (Pizzolitto, 2006). However, in many cases, urban growth has been accompanied by poverty, overcrowding, and environmental degradation (León, 2007; Ruel et al., 2008). In addition, this process has caused remarkably rapid changes in dietary and lifestyle habits (Popkin, 2006), leading to a high incidence of malnutrition that includes both undernutrition and overweight/obesity. So, the prevalence of obesity and noncommunicable diseases such as diabetes and cardiovascular disease coexists with undernutrition and other poverty-related diseases in the same population.

Previous reports in peri-urban areas from different Argentinean cities have shown that inadequate socioeconomic conditions adversely affect child growth (Cesani et al., 2010; Oyhenart et al., 2013). The prevalence of undernutrition and intestinal parasitoses was higher in peri-urban as compared with urban and rural areas (Cesani et al., 2007; Zonta, 2010; Zonta et al., 2014). These inadequate conditions affected both nutritional status and body composition (Marrodán Serrano et al., 2007).

Considering the level of complexity of the above mentioned urban features, it is necessary to critically evaluate the classical criteria used to define them. Some authors have discussed the classification of urban and rural environments in terms of administrative boundaries, agglomerations (physical structure), size, and population density, or a combination of these criteria (Dufour and Piperata, 2004; Fotso, 2007). To avoid the use of the traditional urban–rural classification, in a study performed in General Alvear, province of Mendoza, Argentina, we used the categorical principal components analysis (catPCA)

(Oyhenart et al., 2008). This model generates subpopulations as a function of their socio-environmental characteristics (income, parental education, access to public services, health care, and other parameters). By this means, nutritional status is seen exclusively within the context of the characteristics that define each subpopulation. The results obtained showed a marked urban heterogeneity regarding environmental quality, family socioeconomic level, and child nutritional status. Then, in 2009, using the same model, we performed a preliminary study in San Rafael, a neighboring city to General Alvear, and analyzed the prevalence of excess weight. We observed that overweight distribution was homogeneous and independent of family socio-economic conditions, whereas obesity was concentrated mainly in the rural area (Garraza et al., 2011). Therefore, following this conceptual framework, the aim of the present study was to analyze the nutritional status and body composition of children from San Rafael, Mendoza, avoiding urban and rural categorization by generating subpopulations as a function of their socio-environmental characteristics.

SUBJECTS AND METHODS
Study area

The Department of San Rafael is located in the center of the Province of Mendoza (34°37′ S and 68°20 W), covering an area of 31235 km². It is limited in the north by the Departments of San Carlos, Santa Rosa, and La Paz in the southeast by the Department of Malargüe, in the south by the province of La Pampa, in the east by the Department of General Alvear and the province of San Luis, and in the west by the Andes (Dirección de Estadística e Investigaciones Económicas, DEIE, 2011). The climate is warm and dry, with a mean annual temperature of 14.8°C and an annual precipitation rate of 250–328 mm.

The economy is mainly based on the agricultural industry of vine growing and processing, stone-fruit growing (plum, peach, and olive trees), vegetable growing (garlic, onion, tomato, squash, and sweet corn), and breeding of cows and goats (Instituto de Desarrollo Rural, IDR, 2007).

Sample

A cross-sectional study was performed in 3,596 children (1,776 boys and 1,820 girls; age range: 4.0–13.9 years) attending schools at San Rafael, Mendoza (Table 1). The sample selection was nonprobabilistic and largely determined by voluntary participation in the study. Children were included in the anthropometric study only after the respective parents or legal guardian gave written consent. No cases of chronic diseases or pathological conditions were present among the individuals surveyed.

The research protocols followed the principles outlined in the Helsinki Declaration and its subsequent modifications, as well as those dictated by Argentine National Law N°25.326 on the privacy of personal data.

Anthropometric analysis

One of the authors (M.G.) performed assessments at the schools, following international standardized protocols (Lohman et al., 1988). The instruments were calibrated at the beginning of each session.

The following variables were recorded: age, obtained from identification cards or school records; body weight

TABLE 1. Sample composition

Age (years)	Male	Female	Total
4.0–4.9	123	114	237
5.0–5.9	208	167	375
6.0–6.9	174	193	367
7.0–7.9	202	209	411
8.0–8.9	187	225	412
9.0–9.9	211	227	438
10.0–10.9	229	214	443
11.0–11.9	196	200	396
12.0–12.9	176	194	370
13.0–13.9	70	77	147
Total	1776	1820	3596

(W, kg), measured on a digital scale (100 g accuracy) with the subjects lightly dressed and subtracting the weight of clothes; height (H, cm), using a portable vertical anthropometer (1 mm accuracy), upper arm circumference (UAC, cm) measured with a flexible steel tape (1 mm accuracy), and tricep skinfold (TS) measured in millimeters with a Lange caliper (1 mm accuracy). Body mass index (BMI) was calculated as weight (kg) divided by height squared (m²).

Intra-observer variations were determined with the intra-class correlation coefficient (range, 0–1). Values greater than 0.75 were considered acceptable (Prieto et al., 1998).

Nutritional status was estimated with the NHANES III reference (Frisancho, 2008). The cut-off value was the fifth percentile to determine low weight-for-age (underweight), low height-for-age (stunting), and low weight-for-height (wasting). Individuals were classified as overweight or obese when their BMI was in the 85–95th percentile or above the 95th percentile, respectively (Frisancho, 2008). Then, we considered undernutrition (children with at least one of the following nutritional conditions: underweight, stunting, or wasting) and excess weight (children with overweight or obesity).

The Z-scores were calculated using the NHANES III reference to analyze body composition in children with undernutrition and excess weight. Total (TA), muscular (MA), and fat (FA) areas of the arm were estimated with the formulas proposed by Frisancho (2008): $TA = \{(UAC^2)/(4 \times \pi)\}$; $MA = \{UAC - (TS \times \pi)\}^2/(4 \times \pi)$; $FA = (TA-MA)$.

Socio-environmental analysis

We used a structured questionnaire filled out by the parents to evaluate several socio-environmental characteristics, and to measure housing variables with information regarding structural and physical amenities. These characteristics provided information about indoor housing conditions such as characteristics of housing construction, overcrowding, main source of drinking water, form of sewage disposal, fuel used for cooking and heating, as well as outdoor housing conditions, such as the degree of coverage and access to public services (pavement, electricity, and waste collection). To complement the information on the family socio-economic level, we asked about lodging or housing tenure, level of education and parental employment, medical coverage through explicit health insurance. We also evaluated supplementary income that included access to national or local programs from governmental agencies, nongovernmental organizations, or other entities used to benefit poor families by supplementing their

TABLE 2. *Eigenvectors from catPCA of socio-environmental variables*

| Variable	Abbreviation	Dimension 1	Dimension 2
Gas (piped)	(GP)	0.73	−0.37
Bottled gas (cylinder)	(BG)	−0.68	0.39
Father's education	(FE)	0.61	0.24
Mother's education	(ME)	0.64	0.20
Sewage system	(SS)	0.59	−0.31
Computer	(C)	0.53	0.51
Waste collection	(WC)	0.48	−0.12
Internet	(I)	0.48	0.37
Pavement	(P)	0.47	−0.22
Health Insurance	(HI)	0.46	0.13
Piped water system	(PWS)	0.42	−0.14
Firewood	(F)	−0.42	0.36
Septic tank	(ST)	−0.35	0.33
Television	(T)	0.32	0.52
Car	(CA)	0.31	0.63
Air-conditioning	(AC)	0.30	0.31
Overcrowding	(OC)	−0.28	−0.05
Animal husbandry	(AH)	−0.28	0.27
Protected well	(PW)	−0.24	0.18
Lodging Status	(LS)	−0.23	−0.01
Orchad (agriculture)	(O)	−0.21	0.23
Electricity	(E)	0.20	0.05
Nutritional support	(NS)	−0.16	−0.03
Monetary support	(MS)	−0.08	−0.15

Fig. 1. Eigenvectors corresponding to socio-environmental characteristics. Group I (top right), Group II (lower right), Group III (lower left), and Group IV (top Left). Building material (BM), father and mother's work (FW, MW) are not visible in the figure because they are multiple nominal variables (nonlinear).

food budget (nutritional support) and/or by providing cash relief to the heads of households (monetary support). Animal husbandry and orchard agriculture were also considered. Other aspects taken into account were car ownership, internet access, computer access, and air conditioning (Oyhenart et al., 2008; Garraza, 2013).

The socio-environmental data were analyzed using the catPCA technique, which reduces the complexity of the set of observations related to each child, without losing information. In other words, it can transform a set of inter-correlated variables (p) in another set (q) of uncorrelated variables ($p \leq q$) called principal components (PC). PC were obtained as linear combinations of the original variables and sorted according to the percentage of explained variance. The Cronbach's Alpha coefficient was used to determine the reliability of the test in terms of the number of items (or length of the test), and the proportion of total variance of the test due to the covariance between its parts (Ledesma et al., 2002). A Cronbach's Alpha greater than 0.7 was considered sufficient to ensure the reliability of the scale (Oviedo and Campo-Arias, 2005).

The catPCA allowed for the grouping of children according to their own socio-environmental characteristics of residence. The prevalence of nutritional status was calculated. To know the possible intergroup differences, the chi square test (X^2) at a significance level of $P < 0.05$ was applied. All statistical processing was carried out using the SPSS v 12 program.

RESULTS

Socio-environmental conditions

The first two dimensions (components) represented 26.07% of the total variance. The Cronbach's Alpha values were 0.83 and 0.62 for the first and the second axes, respectively.

Table 2 summarizes eigenvectors from catPCA. The most influential variables in the analysis were parental education and some physical amenities such as piped gas, bottled gas, and sewer system. Nutritional support and monetary support had the lowest eigenvectors.
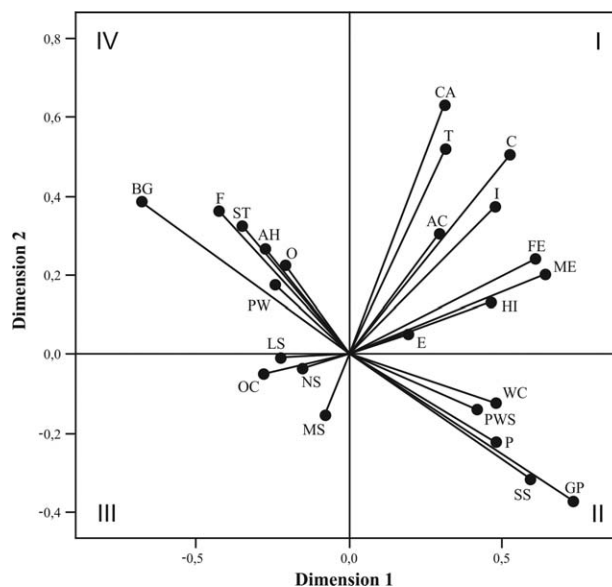
The two-dimensional representation of space allowed the differentiation of four groups (Fig. 1). Table 3 depicts the frequency of each variable (expressed as a percentage) per group.

Group I (dimension-1 positive, dimension-2 positive) ($n = 660$ children): Families had access to health insurance, electricity, television, internet, computers, cars, and air conditioning. Most parents were formally employed or self-employed workers, and had high education levels (high school, tertiary/university). They lived in their own houses, built with fired brick masonry.

Group II (dimension-1 positive, dimension-2 negative) ($n = 801$ children): Families lived in neighborhoods with great access to piped gas, sewage system, pavement, piped water system, and waste collection. Parent education was elementary or high school level and the majority had formal employment. Twenty-five percent of the families perceived monetary support and more than 50% had health insurance. Most families had houses constructed with fired brick masonry.

Group III (dimension-1 negative, dimension-2 negative) ($n = 1084$): Families lived in deficient dwellings with limited public services. Some of these houses had no piped water or sewage system. This Group also had the highest percentage of overcrowding and the lowest parental education. Parental employment was mostly informal, and mothers were unemployed. More than 40% of these families received public assistance (nutritional and/or monetary support), and only 22.5% had health insurance.

Group IV (dimension-1 negative, dimension-2 positive) ($n = 1051$): families that practiced orchard agriculture and animal husbandry for personal consumption, used bottled gas and firewood for heating or cooking. Drinking water was obtained by piped water system or protected well, and sewage was removed by septic tank. This group had middle parental education levels (elementary and

TABLE 3. *Socio-environmental characteristics of the groups*

Characteristics	Percentage by group				X^2	P values
	I	II	III	IV		
Structural qualities and amenities						
Building materials (BM)					114.09	<0.01
Low quality prefab	2.15	2.87	4.72	3.08		
Fired brick masonry	89.70	85.75	72.42	80.30		
Makeshift materials	0.61	1.37	4.34	1.44		
Other	5.22	7.75	15.48	11.77		
Overcrowding (OC)	12.75	14.57	40.11	34.28	242.76	<0.01
Drinking water (main source)						
Piped water system (PWS)	96.36	97.00	78.59	61.75	527.47	<0.01
Protected well (PW)	2.27	0.62	4.77	15.80	215.98	<0.01
Wastewater disposal						
Sewage system (SS)	25.87	49.81	4.86	1.23	912.02	<0.01
Septic tank (ST)	69.19	43.44	71.60	85.22	375.96	<0.01
Fuel (cooking and heating)						
Gas (piped) (GP)	41.51	79.77	5.14	0.66	1820.21	<0.01
Bottled gas (cylinder) (BG)	56.51	17.72	88.77	97.23	1631.20	<0.01
Firewood (F)	38.03	8.73	42.60	69.90	702.91	<0.01
Pavement (P)	50.45	70.66	27.39	13.60	757.92	<0.01
Electricity (E)	97.26	96.37	85.56	90.85	103.57	<0.01
Waste Collection (WC)	89.24	90.88	58.38	41.33	695.52	<0.01
Socioeconomic status						
Lodging Status (LS)					290.33	<0.01
House owner	69.30	49.06	53.30	57.80		
Lease Holder	17.32	33.33	14.46	9.09		
Free lodging	12.76	15.98	29.86	30.52		
Father's Education (FE)					1041.08	<0.01
Elementary	33.58	49.04	60.50	69.09		
High school	44.47	34.98	5.93	13.35		
Tertiary/University	19.17	5.19	0.30	0.59		
Mother's Education (ME)					1105.14	<0.01
Elementary	31.69	45.77	72.11	72.15		
High school	36.90	36.68	7.64	13.82		
Tertiary/University	30.47	13.06	0.19	1.86		
Father's Work (FW)					1124.43	<0.01
Formal employed	63.55	60.82	24.04	29.90		
Laborer	2.29	5.18	11.14	20.67		
Informal worker	5.20	8.09	36.85	34.36		
Self-employed worker	23.76	14.41	1.95	6.79		
Unemployed	1.37	2.90	5.96	3.10		
Retired	0.91	1.01	1.85	1.94		
Mother's Work (MW)					1278.71	<0.01
Formal employer	41.18	41.75	14.20	8.34		
Laborer	0.30	0.62	2.06	2.58		
Informal worker	1.67	2.50	14.11	7.47		
Autonomous worker	9.57	8.37	1.41	3.74		
Unemployed	4.55	20.75	30.76	17.25		
Housewife	41.94	11.62	18.06	52.44		
Retired	0.45	1.00	5.45	6.42		
Health Insurance (HI)	78.80	63.17	22.49	34.03	666.47	<0.01
Public assistance						
Monetary support (MS)	15.60	25.71	31.60	19.40	73.32	<0.01
Nutritional support (NS)	1.50	3.30	11.05	9.53	82.55	<0.01
Farming practice						
Orchad (agriculture) (O)	5.30	1.37	4.31	20.40	274.69	<0.01
Animal husbandry (AH)	8.48	1.87	6.83	34.73	527.73	<0.01
Other						
Internet (I)	29.23	1.01	0.00	0.00	550.98	<0.01
Television (T)	77.44	38.64	10.35	9.30	578.91	<0.01
Computer (C)	74.96	25.42	1.29	10.96	1068.31	<0.01
Air conditioning (AC)	13.54	0.34	0.10	0.00	218.98	<0.01
Car (CA)	84.38	27.55	3.09	49.00	877.82	<0.01

high school). Parental employment was mostly informal and mothers were housewives.

All socio-environmental variables differed significantly among groups (Table 3).

Nutritional status

The highest prevalence of undernutrition was found in Group III (11.2%) followed by Group IV (10.8%), showing a significant difference with Groups I (6.1%) and II (5.2%). Similar results were observed when stunting was analyzed separately (GIII: 10.5%, GIV: 9.9%, GI: 5.2%, and GII: 4.5%). Again, Groups III and IV differed significantly compared with Groups I and II. Underweight was higher in Group IV (2.4%), followed by GIII (1.5%), GII (1.3%), and GI (0.9%), showing a significant difference only between GI and GIV. Finally, wasting values were very low (GI: 0.5%, GII: 0.5%, GIII: 0.4%, GIV: 0.3%), and

nonsignificant differences were recorded among groups (Table 4).

The prevalence of excess weight was higher in Group I (26.2%), and differed significantly from that in Groups II (20.6%), III (20.9%), and IV (20.9%). When overweight and obesity were analyzed separately, differences were not significant (Overweight: GI, 12.4%; GII, 11.4%; GIII, 10.0%; GIV, 9.7%; Obesity: GI, 13.8%; GII, 9.2%; GIII, 11.1%; GIV, 11.2%) (Table 4).

Figures 2 and 3 show the Z-score distributions and skewed percentages of UAC, MA, and FA. In undernourished children from all groups, the distributions of the three variables were skewed to the left, with the MA area the most affected (Fig. 2). Conversely, in the population of children with excess weight, the distributions were skewed to the right, except for the MA area in Groups II, III, and IV (Fig. 3).

DISCUSSION

The study population showed internal differences in both environmental quality conditions and socio-economic level, as already reported for General Alvear and San Rafael, Mendoza (Garraza et al., 2011; Oyhenart et al., 2008). The use of a classification different from the traditional one that establishes an urban–rural dichotomy permitted us to differentiate four groups; three of them associated with urban socio-environmental characteristics, and the fourth group with the rural environment. This is in agreement with the report by Ruel (2000) about the existence of heterogeneity in the urban areas.

Although the three urban groups had access to the basic public services, differences in parental education and occupation, and access to consumer goods and health

TABLE 4. *Prevalence (%) of nutritional status indicators by group*

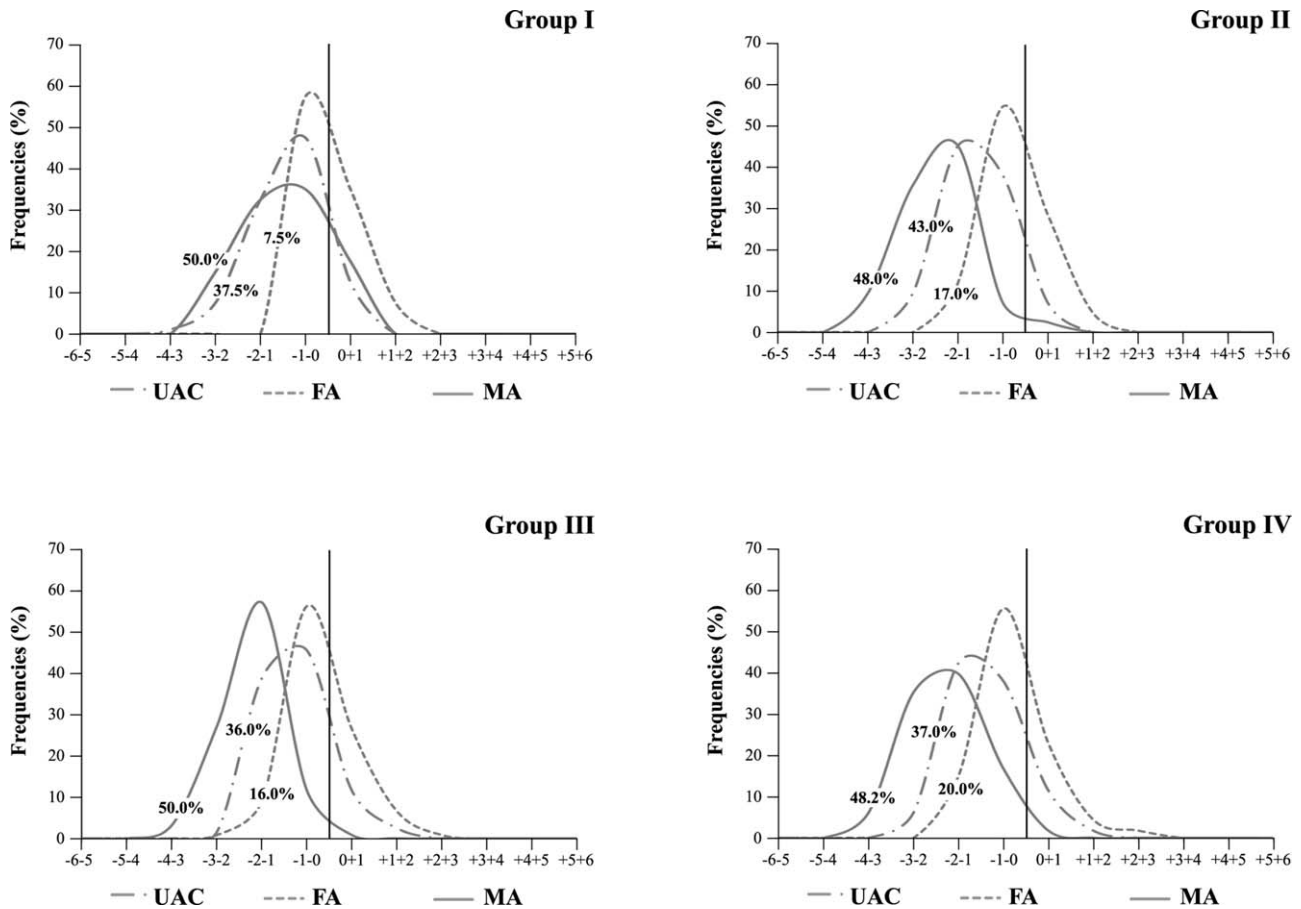| Indicator	Group I	II	III	IV	Comparison	P value
Undernutrition	6.06	5.24	11.16	10.75	I–III	<0.01
					I–IV	<0.01
					II–III	<0.01
					II–IV	<0.01
Underweight	0.91	1.25	1.48	2.38	I–IV	<0.05
Stunting	5.15	4.49	10.52	9.90	I–III	<0.01
					I–IV	<0.01
					II–III	<0.01
					II–IV	<0.01
Wasting	0.50	0.50	0.40	0.30	All	>0.05
Excess of weight	26.21	20.6	20.94	20.93	I–II	<0.01
					I–III	<0.01
					I–IV	<0.01
Overweight	12.42	11.36	9.96	9.71	All	>0.05
Obesity	13.79	9.24	10.98	11.23	All	>0.05

Fig. 2. Z-score distributions of upper arm circumference (UAC), muscular (MA), and fat arm (FA) areas in children with undernutrition. Values correspond to the percentage of skewed distributions for each variable.
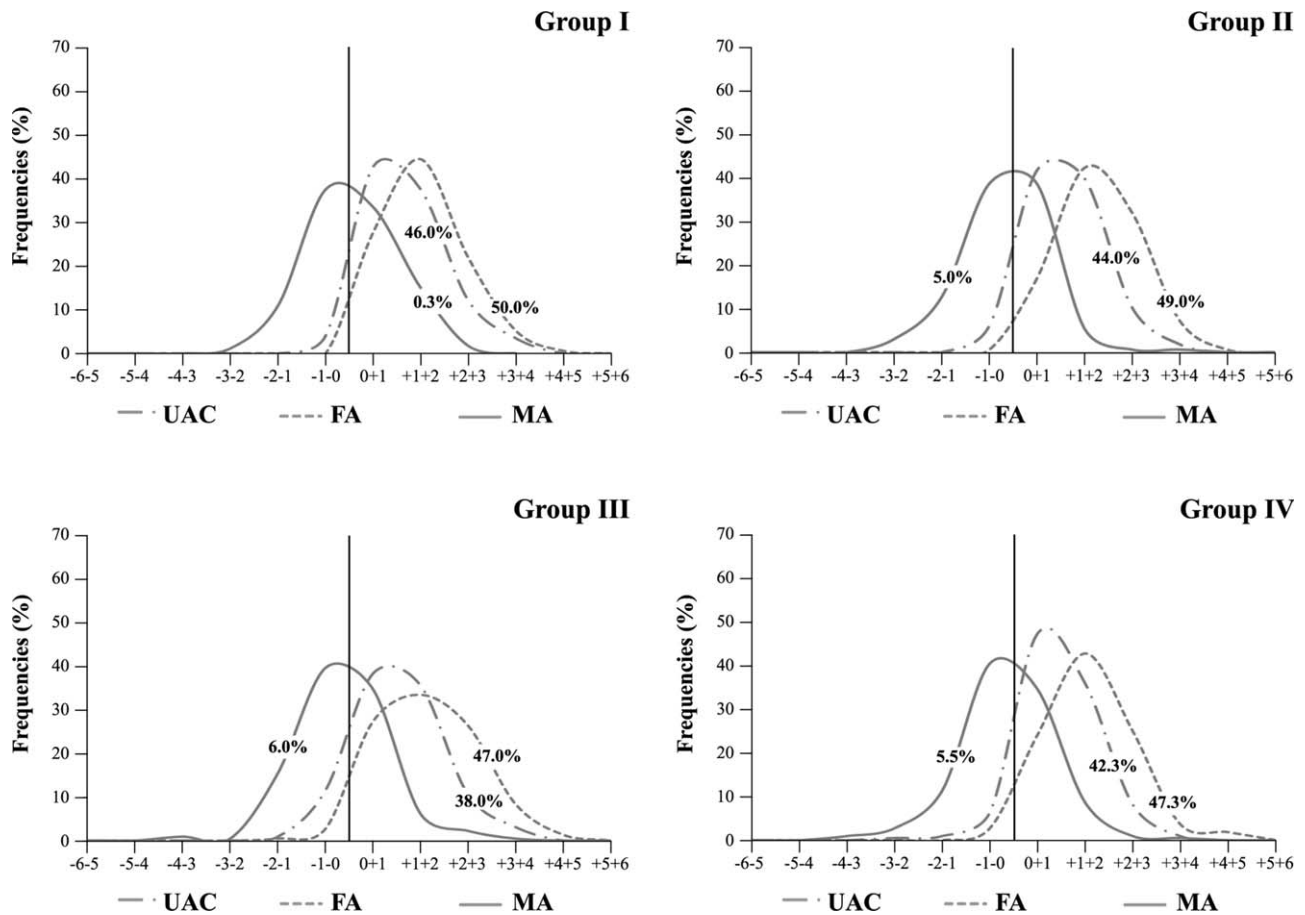
Fig. 3. Z-score distributions of upper arm circumference (UAC), muscular (MA), and fat arm (FA) areas in children with excess weight. Values correspond to the percentage of skewed distributions for each variable.

coverage, enabled us to group them into high urban (I), medium urban (II), and impoverished urban (III) groups. Group I (high urban) exhibited the most favorable socio-environmental conditions of San Rafael, namely, owner-ship of good-quality housing, availability of public serv-ices, high educational level, formal employment, and health coverage of the parents, as well as the lowest and highest prevalence of undernutrition and excess weight, respectively. Indeed, the purchasing power of the families and the education level of parents allowed better food access, probably contributing to the development of an obesogenic environment. This situation falls within the global nutrition transition, mainly characterized by the consumption of diets high in saturated fats, sugar, and refined foods but low in fiber, and a sedentary lifestyle (Popkin and Gordon-Larsen, 2004). In this sense, families from this group had the highest rate of access to consump-tion goods and comfort. The frequent use of different means of transport (bus, car, motorcycle) and recreational activities (watching TV, using a computer, and playing video games) lead to more sedentary lifestyles (Popkin, 2006; Van der Horst et al., 2007).

In Group II (medium urban), the family socio-environmental situation was less favorable compared with Group I. However, the availability of public services was greater, probably because they mostly lived in urban-ized neighborhoods built in the last years by the Mendoza Provincial Housing Institute. In general, people had access to this type of household through special loans for formal employees grouped according to their work activity (i.e., teacher, policeman, bank clerk). The nutritional sta-tus of these children was similar to that of children in Group I, but the prevalence of undernutrition and excess weight was lower.

According to Clichevsky (2002), the environmental con-ditions of urban areas vary depending on the socio-economic level of the population and subsequent effects on populations. In this sense, social inequality can be reflected in a city's production and maintenance, i.e., cities with access to services and lack of environmental degrada-tion, and others without access to services or equipment and a degraded environment. The latter description corre-sponds to the impoverished urban Group III, which includes children from low-income families living in low-cost housing units (adobe, wood, or sheet walls), scarce access to sanitary services, and overcrowded conditions. In this context, 10.5% of children presented chronic undernutrition, reflecting a history of structural vulner-ability. These results agree with those reported by the World Health Organization (WHO, 2004) concerning the

fact that poor sanitation, housing conditions, and family socio-economic level are some of the environmental factors that contribute to growth retardation.

Finally, the rural group included children who lived in houses that were lent, hired, or belonged to the land's owner, and who had less access to public services. As a contribution to their household economies, families had their own orchard agriculture and raised animals for self-consumption. According to the Food and Agriculture Organization, orchard agriculture and animal husbandry are common in peri-urban and rural areas in Latin America; these families' productive undertakings provide them with an income and make them self-sufficient in terms of food, fuel, and other materials (Landon-Lane, 2004). It is clear, however, that while these practices are historically associated with the family lifestyle and rural economy of San Rafael, they were not sufficient to mitigate the nutritional deficiencies of children from this group, whose prevalence of chronic undernutrition was similar to that reported for the urban impoverished group. Children further presented the highest prevalence of low weight-for-age, indicating that food deficiencies are still present. Menon et al. (2000), using information from the Demographic and Health Survey performed in 11 countries, reported that intra-urban differences in chronic infant malnutrition are higher than intra-rural ones, but similar between poor urban and rural populations. Thus, beyond the global tendency toward a decrease in the prevalence of chronic growth retardation (de Onis et al., 2012), low height remains an unresolved nutritional concern.

The analysis of body composition revealed some aspects that would have been masked if only BMI or weight-for-height, weight-for-age, or height-for-age ratios had been considered, thus revealing the etiology of malnutrition (Moreno-Romero and Marrodán Serrano, 2009). Body composition of children at both ends of malnutrition was modified; whereas a high proportion of undernourished children had decreased muscular and adipose mass, overweight and obese children presented increased adipose tissue. However, excess adiposity associated with decreased muscular mass was present in all groups, excepting the high urban one. This may be associated with the consumption of low-protein and high-calorie diets. Difficulties in the access to adequate food would predispose children living in less favorable environments to have weight excess with reduced muscle mass (Adjemian et al., 2007; Oyhenart et al., 2007).

CONCLUSION

Children from San Rafael presented differences in nutritional condition and body composition associated with a pronounced socio-environmental heterogeneity. Thus, we could observe a gradient from the "high urban" group, with better social, economic, and sanitation conditions and at the same time a more obesogenic environment, up to the "impoverished urban" and "rural" groups, whose vulnerability reflected in higher prevalence of child undernutrition, and correlation with excess weight and reduced muscle mass.

ACKNOWLEDGMENTS

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