Received: 1 August 2023 | Revised: 1 September 2023 | Accepted: 9 September 2023

DOI: 10.1002/ajhb.23994

ORIGINAL ARTICLE

American Journal of Human Biology WILEY

Composite indexes of anthropometric failure in children under 5 years of age in Argentina: Comparative analysis among regions: 2019–2020

Ramiro Joaquín Salazar Burgos[1,2] | **Hugo Fernando Longhi**[3,4] | **María Dolores Marrodán Serrano**[5,6]

[1]Escuela Universitaria de Enfermería, Facultad de Medicina, Universidad Nacional de Tucumán (UNT), Tucumán, Argentina

[2]Instituto de Investigaciones Territoriales y Tecnologicas para la Produccion del Hábitat (INTEPH), CONICET—Universidad Nacional de Tucumán, Tucumán, Argentina

[3]Insituto Superior de Estudios Sociales (ISES), CONICET—Universidad Nacional de Tucumán, Tucumán, Argentina

[4]Facultad de Humanidades, Ciencias Sociales y de la Salud, Universidad Nacional de Santiago de Estero (UNSE), Santiago del Estero, Argentina

[5]Grupo de Investigación EPINUT, Universidad Complutense de Madrid, Madrid, Spain

[6]Departamento de Biodiversidad, Ecología y Evolución, Universidad Complutense de Madrid, Madrid, Spain

Correspondence
Ramiro Joaquín Salazar Burgos, Escuela Universitaria de Enfermería, Facultad de Medicina, Universidad Nacional de Tucumán (UNT), General Paz 885, CP4000, San Miguel de Tucumán, Tucumán, Argentina.
Email: rsalazarburgos@gmail.com

Funding information
Consejo Nacional de Investigaciones Científicas y Técnicas Resolution, Grant/Award Number: 6492/2012

Abstract

Objectives: Composite Index of Anthropometric Failure (CIAF) and Extended CIAF (ECIAF) allow for the identification of simultaneous presence of two or more types of malnutrition. The objective of this study was to analyze anthropometric failure in Argentinean children under 5 years old, taking into consideration regional and socioeconomic perspectives.

Materials and Methods: Data from the National Survey of Children and Adolescents MICS 2019–2020 were used, which included 5473 children under 5 years old of both sexes residing in the six regions of Argentina. CIAF and ECIAF excludes children not in anthropometric failure (group A) and was calculated from a percentage of children included in malnutrition categories B: wasting only; C: wasting and underweight; D: wasting, stunting, and underweight; E: stunting and underweight; F: stunting only; Y: underweight only; G: only weight excess; and H: stunting and weight excess. The data were analyzed according to region and wealth quintile.

Results: In children aged 0–2.99 years, CIAF was 12.5% and ECIAF was 27.7%, with boys being more affected. In children aged 3–4.99 years, the rates were 9.7% and 22.3%, respectively, with girls showing a higher prevalence. The highest ECIAF was recorded in the Patagonia region (31.3%), while the highest ECIAF was observed in the poorest quintile.

Discussion: The presence of double burden of malnutrition has been observed across all regions and household income levels. Additionally, overweight has shown a higher intensity in economically prosperous regions and households, while stunting has been more prevalent in economically disadvantaged areas.

1 | INTRODUCTION

In the transition from the 20th to the 21st century, Argentina suffered the worst political and economic crisis in its history, which was reflected in deep socioeconomic inequalities that were, in turn, articulated with high poverty rates (Arakaki, 2011). At that time, inequality was evidenced, for example, in the coexistence between social

sectors with an optimal quality of life and large marginal sectors in which the minimum subsistence needs were not being guaranteed. Piovani and Salvia's (2018) work elaborated on the basis of the National Survey on Social Structure conducted between 2014 and 2015 highlighted that these social inequalities remained high and that the region of the country where one is born largely determines living and working conditions.

In this context, it is clear the wide margin of action for public policies to reduce poverty in the country in agreement with the first Sustainable Development Goal (SDG) of the 2030 Agenda (United Nations, 2018), which postulates ending poverty in all its forms worldwide. It is known that the condition of poverty, beyond any conceptual universe that seeks to identify it, generates different consequences in terms of health, education and employment opportunities, among many others, but it also has a severe impact on nutritional status, conditioning child growth and development.

Considerable evidence has been generated regarding the fact that child nutrition is subject to different conditioning factors, and poverty plays an essential role among them. Adequate nutrition is known to be fundamental for child growth and development. Deficiency, especially in the first years of life, has serious consequences in different aspects, both for the individual and for the society to which he or she belongs (Salazar Burgos, 2020). According to recent global estimates by FAO, IFAD, UNICEF, WFP and WHO (2022), 45.4 million children under 5 years of age suffer from acute malnutrition, which increases the risk of infant mortality (Salazar Burgos, 2020). In addition, 149.2 million children under the age of five suffer from stunted growth and development due to a chronic lack of essential nutrients in their diet, whereas 38.9 million are overweight. Likewise, statistics indicate that in the year 2020 in Latin America and the Caribbean, 5.8 million children under 5 years of age were affected by growth stunting, 0.7 million by wasting or acute malnutrition and 3.9 million by overweight (FAO, IFAD, PAHO, UNICEF, & WFP, 2023).

In Argentina, the results of the first National Nutrition and Health Survey (ENNyS 1 for its acronym in Spanish) conducted in 2004–2005 detected a proportion of children with low weight for their age (2.1%), wasting (1.3%), low height for their age (8.0%) and overweight (10.4%). In addition, there was a surprising number of children with anemia (also called hidden malnutrition), which in some provinces of northern Argentina such as Chaco reached 36% of the children surveyed (National Ministry of Health, 2007). The second edition of the same survey (ENNyS 2) reported that 10% of the children under 5 years of age in the country were overweight and 3.6% of them were obese. The figures for underweight and wasting were 1.7% and 1.6%, respectively, whereas the figure for short stature was 7.9%. However, the prevalence of stunting reached 11.5% in children belonging to the most socially vulnerable households (lowest income quintile) (Ministry of Health and Social Development, 2019). These results show that in Argentina, poverty and food insecurity compromise the health of vast sectors, being the child population the most vulnerable (United Nations Children's Fund [UNICEF], 2021a). This problem is closely related to SDG 2, which postulates the eradication of hunger and all forms of malnutrition by the year 2030 (United Nations, 2018).

There are limited analyses on the magnitudes, trends and characteristics of some nutritional problems in closer time periods, and these are even more necessary in a country where inequality is a distinctive attribute. However, it is worth mentioning as an exception the Multiple Indicator Cluster Survey (MICS) implemented by the UNICEF in collaboration with the National Council for the Coordination of Social Policies, which was published under the title National Survey of Children and Adolescents MICS 2019–2020 (UNICEF, 2021b). On the other hand, tools such as the Extended Composite Index of Anthropometric Failure (ECIAF) have recently been reformulated (Bejarano et al., 2019), allowing for a more accurate and deeper diagnosis of malnutrition in its various forms and combinations. This type of indicators is optimal to evaluate trends and establish comparisons in nutritional epidemiology studies. Therefore, the aim of the present paper is to examine the information contained in the aforementioned MICS 2019–2020 by applying synthetic indicators of anthropometric failure in order to diagnose the nutritional status of Argentinian children under 5 years of age, from a regional and socioeconomic perspective.

2 | MATERIALS AND METHODS

2.1 | Information sources and sample composition

The information source used is the National Survey of Children and Adolescents MICS 2019–2020 (UNICEF, 2021b). This study is part of an international program referred to as Multiple Indicator Cluster Surveys (MICS) that UNICEF applies in households around the world and collects information on 10 out of the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda. This is the second MICS program carried out in the country and was designed on the basis of the 2010 National Population, Household and Housing Census carried out by the National Institute of Statistics and Census (INDEC for its

TABLE 1 Sample composition by sex, age group and region of residence.

	AMBA		Cuyo		NEA		NOA		Pampa		Patagonia		Total	
Age (years)	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**
0.00–2.99	422	394	103	130	184	157	200	243	527	507	87	64	1523	1495
3.00–4.99	385	369	105	77	119	109	190	155	430	394	58	64	1287	1168
Total	807	763	208	207	303	266	390	398	957	901	145	128	2810	2663

Abbreviations: AMBA, Buenos Aires Metropolitan Area; B, boys; G, girls; NEA, Northeastern Argentina; NOA: Northwestern Argentina.
Source: MICS Argentina 2019–2020 (UNICEF, 2021b).

acronym in Spanish, 2012). The information analyzed was collected using the MICS6 questionnaire for children under 5 years of age and was administered to children's mothers or caregivers. Anthropometric measurements (height and weight) were performed by previously trained personnel, using standardized procedures (UNICEF, 2021b).

The survey was conducted with a multistage cluster design to obtain a representative sample of the national geography. It should be noted that, according to the provisional data of the 2022 National Population, Households and Housing Census, Argentina has 46 044 703 inhabitants distributed over a large territory (2.78 million km^2) (INDEC, 2023), divided into six regions according to the INDEC proposal for the 1980 National Population and Housing Census (1982).

1. Northwestern Argentina (NOA for its acronym in Spanish) Region: includes the provinces of Catamarca, Jujuy, La Rioja, Salta, Santiago del Estero and Tucumán.
2. Northeastern Argentina (NEA) Region: includes the provinces of Corrientes, Chaco, Formosa and Misiones.
3. Cuyo Region: includes the provinces of Mendoza, San Juan and San Luis.
4. Pampa Region: includes the provinces of Buenos Aires, Córdoba, Entre Ríos, La Pampa and Santa Fe.
5. Buenos Aires Metropolitan Area (AMBA for its acronym in Spanish) Region includes the Autonomous City of Buenos Aires and 31 districts belonging to the province of Buenos Aires.
6. Patagonia Region: includes the provinces of Río Negro, Neuquén, Chubut, Santa Cruz, Tierra del Fuego, Antarctica and South Atlantic Islands.

The total sample consisted of 6157 children under 5 years of age. For the present study, those cases with at least one of the following incomplete data were excluded: date of birth, height or weight; also excluded were those with measurements outside a plausible range, that is, values that according to WHO and UNICEF (2019) criteria are not compatible with life. Thus, the sample finally consisted of 5473 children under 5 years of age (2810 boys, 2663 girls) who were grouped for analysis into two age groups (0–2.99 and 3.00 to 4.99 years) that were distributed by region as shown in Table 1. These ages cut off were established following the classification of the Pan American Health Organization, which separates the first 2 years of life from early childhood or preschool age (3–5 years), because, among other aspects, it is from the age of three that longitudinal growth begins to slow down (Cusminsky et al., 1993).

In agreement with the aims set out, this sample was analyzed in terms of the Composite Index of Anthropometric Failure Index (CIAF) and the Household Wealth Index (WI).

2.2 | Data availability statement

All National Survey of Children and Adolescents MICS 2019–2020 data used in this study are publicly available through the UNICEF (https://www.unicef.org/argentina/informes/mics-2019-2020). The data that support the finding of this study are available from the corresponding author upon reasonable request.

2.3 | Composite indexes of anthropometric failure (CIAF and ECIAF)

Growth curves and charts show the ontogenic evolution of body dimensions and are used to assess the nutritional status of children. The WHO developed standards for height-for-age (HA), weight-for-age (WA) and weight-for-height (WH) in children under 5 years of age, which were elaborated from a semi-longitudinal study of an international sample, with series from Brazil, Ghana, India, Norway, Oman, and the United States (WHO, 2006a). The multiethnic composition and the selection of healthy children (middle class, exclusively breastfed, nonsmoking mothers) was intended to ensure growth in the best conditions for the children. The

population differences were practically nil and therefore these values could be applied universally (WHO, 2006b). Subsequent studies, in which the authors of the present study participated and which have been published in this same journal (Lescure et al., 2023; Martín-Turrero et al., 2022) have shown that growth patterns of healthy children may vary among populations of different origins, so that the WHO standards may moderately overestimate or underestimate the rates of child malnutrition in some populations.

According to WHO standards, stunting, retarded growth or chronic malnutrition is considered to be a low height-for-age (HA) < −2SD usually caused by intrauterine growth retardation, by poor nutrition, and repeated infection. However, diet is partly independent of other factors such as inadequate psychosocial stimulation, stature or maternal education that are also related to stunting (Karlsson et al., 2022; Dorjee et al., 2023) and for some authors who analyze the issue from an evolutionary perspective, short stature may interpreted in certain human groups as an adaptive strategy against situations of food shortage (Hochberg & Albertsson-Wikland, 2008).

A low weight-for-height (WH) < −2SD is classified as wasting or acute malnutrition, which is caused by a recent major food deficit or by an illness that prevents weight gain. In contrast, if weight-for-height (WH) > +2SD, the child is classified as overweight, and finally, a low weight-for-age (WA) < −2SD is considered global undernutrition. These categories, alone or combined, are the ones that appear in the so-called anthropometric failure indices. These cut-off points are used by International Organizations such as WHO, UNICEF or Non-Governmental Organizations (Action Against Hunger, Doctors without Borders) to make decisions or administer treatments and always with a protective character. Even with the above considerations, WHO growth standards are always useful for detecting health problems and the most serious cases of malnutrition and are informative as a reference against which to compare different populations or to carry out secular studies.

The different categories of nutritional status can be analyzed individually. However, the same child may present two or more types of malnutrition simultaneously, so that the analysis of the prevalence of each type or nutritional category does not provide a broad view of child malnutrition at the population level. Therefore, Svedberg (2000) proposed categorizing children into six groups ranging from category "A" to "F," where the first one corresponded to those who had no anthropometric failure and the rest included different categories and/or combinations of malnutrition whose sum of percentages resulted in a Composite Index of Anthropometric Failure (CIAF.) Subsequently, Nandy et al. (2005) added the "Y" group, corresponding to underweight children only. CIAF was applied in different countries in Asia (Nandy et al., 2005; Mandal & Bose, 2009; Biswas et al., 2009; Boregowda et al., 2015), Africa (Nandy & Svedberg, 2012; Endris et al., 2017) and Latin America (Nandy & Miranda, 2008; Bejarano et al., 2014; Díez Navarro, 2018).

However, CIAF did not consider overweight, an emerging problem in different parts of the world, particularly in Latin America and in the child age range where its prevalence at the beginning of the 21st century was among the highest worldwide (Bejarano et al., 2019). Therefore, Bejarano et al. (2019) recently proposed ECIAF, incorporating groups G and H that considered overweight, whether or not associated with stunted growth (Table 2). To establish the categories, ECIAF takes as a reference the WHO (2006a) standards for children under 5 years of age. In the present paper, ECIAF is analyzed, but CIAF -including only categories A, B, C, D, E, F and Y- is also offered.

TABLE 2 Categories composing the Extended Composite Index of Anthropometric Failure (ECIAF).

Group	Description	W/H < −2SD	W/H > 2SD	H/A < −2SD	W/A < −2SD
A	Without anthropometric failure	No	No	No	No
B	Wasting only	Yes	No	No	No
C	Wasting and underweight	Yes	No	No	Yes
D	Wasting, stunting and underweight	Yes	No	Yes	Yes
E	Stunting and underweight	No	No	Yes	Yes
F	Stunting only	No	No	Yes	No
Y	Underweight only	No	No	No	Yes
G	Weight excess (being overweight or obese) only	No	Yes	No	No
H	Stunting and weight excess	No	Yes	Yes	No

Abbreviations: A, age; H, height; SD, standard deviation; W, weight.
Source: Bejarano et al., 2019.

2.4 | Wealth index

The wealth index (WI) is a composite index that represents a measure of household wealth. It involves key asset ownership variables and has advantages over other economic indicators because it shows a more stable status than the expenditures or income of a household and requires fewer questions. In most cases, only one respondent per household is needed. It is calculated using simple-to-collect data on ownership of consumer goods, materials used for housing construction and types of water access and sanitation facilities (Rutstein & Johnson, 2004). In the MICS Argentina 2019–2020 survey (UNICEF, 2021b), the following variables were considered with respect to housing: (a) housing characteristics (electricity, cooking fuel, Internet access in the home, main floor material, main roof material, main exterior wall material, number of bedrooms, location, type of housing); (b) public services in the environment (street with concrete pavement, street with drainage, lighting, waste collection, drinking water network, gas network, sewer), persons per bedroom and persons with access to electricity in the home. With respect to assets, it involves: (a) household (television, refrigerator without freezer, refrigerator with freezer, independent freezer, automatic washing machine, electric stove or stove without oven, microwave oven/electric oven, air conditioning, TV service, closet, bed for each family member, dining table, sofa, cupboard); (b) percentage of households where at least one member owns (bicycle, motorcycle, car or truck model year 2009 or older, computer or tablet, cell phone, bank account), property of the dwelling. From these variables, WI is generated by means of a principal components analysis with the purpose of weighting each of the items used. In this way, each household in the sample is assigned a wealth score according to the assets it has and their final scores. In the present paper, the children under 5 years of age in the sample were classified according to the WI score of the household where they lived, establishing quintiles in which the lowest was the poorest and the highest was the richest.

2.5 | Statistical procedures

As indicated, principal component analysis was applied for the calculation of WI, and Chi-square ($\chi 2$) tests were used to compare prevalences and proportions between sexes and regions, considering a significance level of $p < .05$. All procedures were carried out with the IBM SPSS 26.0 program.

3 | RESULTS

The proportion of ECIAF practically doubles that of CIAF, which illustrates the importance of overweight as a condition of malnutrition in the Argentinian infant population. A total of 27.7% of children under 3 years of age presented some type of anthropometric failure with significant sex differences to the detriment of boys. Excess weight alone (G: 10.8%) or together with stunting (H: 4.3%) showed no differences between sexes, whereas the prevalences of groups F (short stature) and C (wasting and underweight) were higher in the boy series (Table 3). In the case of boys and girls from 3.00 to 4.99 years, on the contrary, the highest percentage of anthropometric failure corresponded to the girl series. In this age group, overweight alone or concomitant with low height reached 12.7% of children of both sexes, whereas stunted growth affected more girls (F: 8.8%) than boys (F: 3.5%).

Figure 1 shows the proportional distribution of households in the sample according to wealth index quintiles by region. The highest concentration of households classified in the poorest quintile is located in the NOA and NEA regions, whereas the highest proportion of wealthier households corresponds to Patagonia.

An analysis of ECIAF by region (Figure 2) shows that the highest prevalences of anthropometric failure correspond to the Patagonia and NOA regions, with 31.3% and 29.8%, respectively. In both territories, the category that contributes the most is G (overweight), which in the case of Patagonia reaches the highest figure in the country. On the contrary, Cuyo has the lowest ECIAF (16.9%), to which excess weight also contributes the most, in this case having the lowest prevalence of all the regions. Categories C (wasting and underweight) and E (underweight and short stature) also show territorial differences, with higher prevalence in the AMBA region and the Pampa region, with 1.8% and 2.6%, respectively.

When contrasting the anthropometric failure categories with the WI quintiles (Table 4), differences ($p < .001$) are reported in categories F, G and in CIAF, which excludes the categories that integrate excess weight. Chronic undernutrition (F) reaches its highest magnitude in the poorest quintile and gradually decreases as it approaches the wealthiest quintiles. Category G (overweight) clearly shows the opposite trend; from the fourth quintile, the prevalence decreases

TABLE 3 CIAF and ECIAF according to sex and age ($N = 5473$).

Group	Total	Boys	Girls		
	N (%)	*N* (%)	*N* (%)	$\chi 2$	*p*
0.00–2.99 years ($n = 3019$)					
A: Without anthropometric failure	2184 (72.3)	1070 (70.2)	1114 (74.6)	7.305	**.007**
B: Wasting only	59 (2.0)	31 (2.0)	28 (1.9)	0.101	.751
C: Wasting and underweight	27 (0.9)	21 (1.4)	6 (0.4)	8.111	**.004**
D: Wasting, stunting and underweight	2 (0.1)	2 (0.1)	0 (0.0)	1.962	.161
E: Stunting and underweight	60 (2.0)	29 (1.9)	31 (2.1)	0.113	.737
F: Stunting only	224 (7.4)	147 (9.6)	77 (5.2)	22.103	**.000**
Y: Underweight only	6 (0.2)	3 (0.2)	3 (0.2)	0.001	.981
G: Weight excess (being overweight or obese) only	326 (10.8)	160 (10.4)	166 (11.1)	0.361	.548
H: Stunting and weight excess	131 (4.3)	62 (4.1)	69 (4.6)	0.55	.458
CIAF	378 (12.5)	233 (15.3)	145 (9.7)	21.465	**.000**
ECIAF	835 (27.7)	455 (29.8)	380 (25.4)	7.305	**.007**
3.00–4.999 years ($n = 2454$)					
A: Without anthropometric failure	1906 (77.7)	1035 (80.6)	871 (74.5)	13.176	**.000**
B: Wasting only	18 (0.7)	12 (0.9)	6 (0.5)	1.471	.225
C: Wasting and underweight	25 (1.0)	18 (1.4)	7 (0.6)	3.873	**.049**
D: Wasting, stunting and underweight	2 (0.1)	0 (0.0)	2 (0.2)	2.206	.138
E: Stunting and underweight	42 (1.7)	17 (1.3)	25 (2.1)	2.454	.117
F: Stunting only	148 (6.0)	45 (3.5)	103 (8.8)	30.675	**.000**
Y: Underweight only	2 (0.1)	1 (0.1)	1 (0.1)	0.005	.945
G: Weight excess (being overweight or obese) only	274 (11.2)	136 (10.6)	138 (11.8)	0.962	.327
H: Stunting and weight excess	37 (1.5)	21 (1.6)	16 (1.4)	0.28	.597
CIAF	237 (9.7)	93 (7.2)	144 (12.3)	18.34	**.000**
ECIAF	548 (22.3)	250 (19.4)	298 (25.5)	13.176	**.000**

Note: χ^2: chi square statistical test. Bolder values: $p < .05$.

progressively until reaching the lowest value in the poorest quintile.

4 | DISCUSSION

The present work evidences that both CIAF and ECIAF provide information that goes beyond the classic analysis of nutritional categories, allowing for a broader view of malnutrition and, at the same time, with greater specificity. CIAF, an indicator that synthesizes the problems of nutritional deficit, finds its highest values in the NOA region, an area characterized by historical patterns of poverty concentration (Bolsi & Paolasso, 2009). It is precisely in this region of the NOA where the sample may have a greater component of indigenous ancestry. It should also be taken into account that, as some researchers have debated, in certain circumstances, it is more beneficial to accumulate fat tissue than to grow taller. This would be a variation in growth trajectories that has been tested in indigenous populations where poverty and marginalization subject children to socio-evolutionary pressures (Alfonso-Durruty & Valeggia, 2018).

In this area as well, category H, which combines overweight and stunting, shows the highest regional value ($p < .05$). This highlights the so-called double burden of malnutrition dominant in this region. The double burden of malnutrition is the coexistence of overnutrition (overweight and obesity) alongside undernutrition (stunting and wasting), at all levels of the population—country, city, community, household, and individual (Popkin et al., 2020). The reality in low-income and middle-income countries is that different forms of growth failure are interconnected and this situation complicates effective public health measures. In social environments of

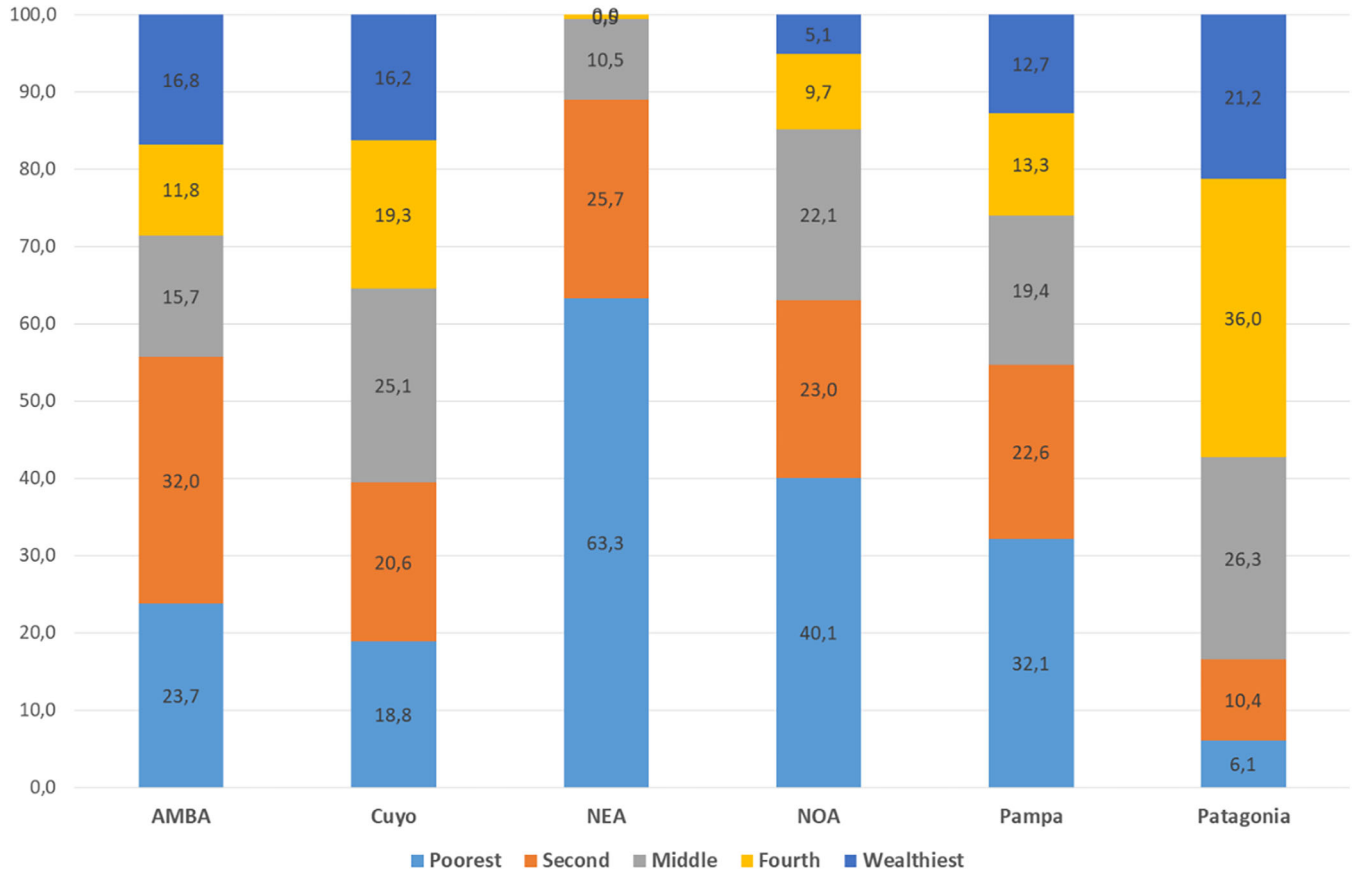

FIGURE 1 Percentage of children in households according to Wealth Index quintiles by region. AMBA, Buenos Aires Metropolitan Area; NEA, Northeastern Argentina; NOA, Northwestern Argentina.

greater poverty and food insecurity, cheaper foods are consumed, which are generally the most caloric and least nutritious. Obesogenic foods (ultra-processed foods, soft drinks) with large amounts of sugar and few vitamins and minerals, which favor the accumulation of fat but not the increase of skeletal muscle mass.

On the other hand, malnutrition during gestation and early life leads to imbalance of the intestinal microbiome, inflammation, metabolic dysregulation and impaired insulin signaling. This coupled with a hypercaloric diet, high in sugar and poor in protein and nutrients leads very easily to overweight and increases the risk of metabolic diseases by imposing a high metabolic load on a reduced homeostasis capacity (Wells et al., 2020).

Data show that the prevalences of ECIAF and CIAF -from the sample with regional representativeness considered- decrease with age, contrary to what has been found in previous studies conducted in Argentine provinces (Bejarano et al., 2019). In this regard, it is worth mentioning that whereas in the present paper age groups of children under 3 years are compared with children aged 3.00–4.99 years, in the aforementioned work the groups consisted of preschoolers under 5 years versus schoolchildren aged 5–13 years.

Furthermore, in the present work, sex differences are observed in both ECIAF and CIAF, with both indexes being higher in boys in the younger age group (0.00–2.99 years) and higher in girls in the older age group (3.00–4.99 years). Strikingly, in the work by Bejarano et al. (2019), a higher prevalence of anthropometric failure was observed among girls in the youngest age group (0–4 years), whereas this was reversed toward a higher prevalence among boys in the oldest age group (5–13 years). Previous studies have shown that, especially in the early ages, boys are more sensitive to changes (detrimental or beneficial) in the socioenvironmental environment (Thurstans et al., 2020). In contrast, girls, who are born with smaller body size and accumulate more fat, are energetically more stable and less vulnerable to malnutrition and infections during the first years of life (Díez Navarro et al., 2017). At later ages, it is possible that social factors, such as better care of sons, may reverse the tendency to malnutrition in both sexes.

There are scarce antecedents that have applied ECIAF so that to allow an in-depth discussion regarding the results found in the present study. There is more evidence regarding the application of CIAF in different global contexts. Most of them come from Asian and

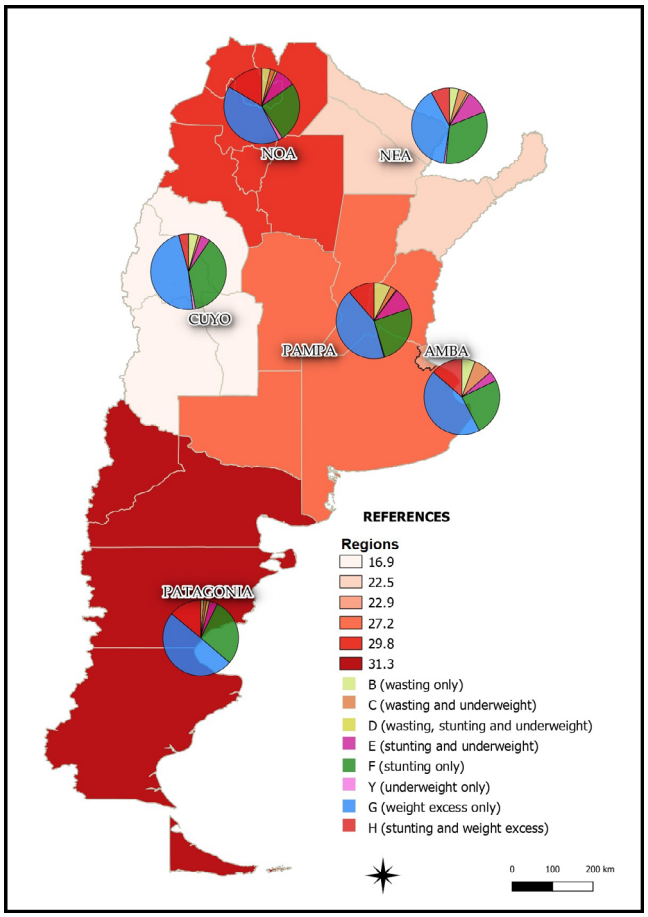

FIGURE 2 Regional differentiation according to ECIAF categories. Argentina. Own elaboration based on MICS Argentina 2019–2020 (UNICEF 2021b).

African countries such as Bangladesh, Bissau, Ghana, Guinea, India, Indonesia, Nepal, Philippines, Senegal, Sudan (McDonald et al., 2013), Ethiopia, Tanzania and Zimbabwe (Nandy & Miranda, 2008). There are also studies in Latin America conducted in Peru, Bolivia, Dominican Republic and Argentina (Nandy & Miranda, 2008; Nandy & Svedberg, 2012; Bejarano, et al., 2014). The latter highlights the problems of inequality and its implications on child nutritional status.

In this regard, Latin American countries have the highest levels of inequality in terms of income and the most expensive healthy diet compared to the rest of the world. In this context, the economic contractions or stagnation faced by the region since 2015 have a disproportionate effect on food insecurity and malnutrition in lower income sectors (FAO, IFAD, PAHO, UNICEF & WFP, 2023). Data show that in Latin America and the Caribbean there are 6 million children under 5 years of age who are stunted and 4 million with obesity (UNICEF, WHO & World Bank Group, 2021). The latest data published by the WHO (2022), show that prevalence of stunting in children under 5 years of age worldwide is 22.3%. In Latin America specifically, Guatemala with 43.5% leads the ranking, followed by Ecuador (22.7%), Haiti (19.5%), Honduras (17.5%) and Nicaragua (14.9%). Lower figures are found in Panama (13.8%), Mexico (12.6%), Colombia (11.2%), Bolivia (11.1%) and Venezuela (10.5%). The value obtained in the present study for Argentina (8%) is in the group with prevalences below 10%, together with Costa Rica (9.5%), Brazil (7.2%), Cuba (7%), Uruguay (6.5%) and Chile (1.6%). Unfortunately, in this study we do not have data corresponding to sitting height or limb length, an important aspect to determine the possible adaptive evolutionary significance of the stunting cases detected at the regional level (Yim et al., 2023). Although in the present work we focus on the effect of socioeconomic conditions, proportionality is a factor that could add information on the effect of climatic effects, which have a remarkable variation in a country as large as Argentina. On the other hand, the present work analyzes only children under 5 years of age, that is, a short part of ontogeny, and as Lampl and Schoen (2017) discuss, in growth trajectories there are many critical moments in which genetic programming can be enhanced or altered.

In Argentina, prevalences from ENNyS2 by the Ministry of Health and Social Development (2019) indicate that 13.6% of children under 5 years of age were overweight and 7.9% were stunted. In comparison, the results of the present paper show 14% for groups G and H and 11.3% for groups D, E, F, and H, respectively. The highest prevalence in the latter indicator could be related to the strong growth of child poverty that has occurred in the country since 2017 (UNICEF, 2021a) and the significant increase in food insecurity in households with children and adolescents (particularly in those under 5 years of age) in 2018 (Tuñón, 2023). In this regard, the rates published in ENNyS2 in relation to the socioeconomic conditions of households show that stunting amounted to 11.5% in the poorest quintile and decreased to 4% in the highest income quintile, whereas it did not evidence significant differences in excess weight (Ministry of Health and Social Development, 2019). In this sense, the data of the present study show significant differences between the richest and poorest quintile both in stunting (groups D, E, F and H) with values of 8.8% and 38.7%, respectively, and in overweight (groups G and H), with 10.4% and 27.1%, respectively.

Argentina has been described as a country with an unequal social structure; on the one hand, there are sectors with high incomes and greater access to health and education; on the other hand, numerous groups survive with low incomes, difficulties in accessing public services and unfavorable labor and housing conditions (UNDP—

TABLE 4 ECIAF according to WI quintiles.

	Total	Poorest	Second	Middle	Fourth	Wealthiest		
Group	***N* (%)**	***N* (%)**	***N* (%)**	***N* (%)**	***N* (%)**	***N* (%)**	***χ2***	***p***
A	4089 (74.7)	1265 (73.5)	1079 (76.6)	727 (72.1)	503 (73.2)	515 (79.6)	16.641	**.002**
B	77 (1.4)	22 (1.3)	15 (1.1)	19 (1.9)	13 (1.9)	8 (1.2)	4.360	.359
C	53 (1.0)	19 (1.1)	15 (1.1)	10 (1.0)	8 (1.2)	1 (0.2)	5.214	.266
D	4 (0.1)	4 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	8.710	.069
E	103 (1.9)	49 (2.8)	13 (0.9)	20 (2.0)	8 (1.2)	13 (2.0)	17.673	**.001**
F	369 (6.7)	153 (8.9)	89 (6.3)	65 (6.4)	34 (5.0)	28 (4.5)	22.367	**.000**
Y	9 (0.2)	2 (0.1)	1 (0.1)	4 (0.4)	1 (0.1)	1 (0.2)	4.331	.363
G	600 (11.0)	164 (9.6)	135 (9.6)	136 (13.5)	100 (14.4)	65 (10.0)	21.800	**.000**
H	169 (3.1)	44 (2.6)	62 (4.4)	27 (2.7)	20 (2.9)	16 (2.5)	11.203	**.024**
CIAF	615 (11.2)	249 (14.5)	133 (9.4)	118 (11.7)	64 (9.3)	51 (7.9)	32.370	**.000**
ECIAF	1384 (25.3)	457 (26.5)	330 (23.4)	281 (27.9)	184 (26.8)	132 (20.4)	16.641	**.002**

Note: Test of χ2. A: Without anthropometric failure; B: Wasting only; C: Wasting and underweight; D: Wasting, stunting and underweight; E: Stunting and underweight; F: Stunting only; Y: Underweight only; G: Weight excess (being overweight or obese) only; H: Stunting and weight excess. χ^2: Chi square statistical test. Bolder values: $p < .05$.

United Nations Development Programme, 2017). According to Paolasso et al. (2019), in Argentina, socioeconomic inequality—understood as a statistical gap—and its spatial manifestation, that is, what they referred to as territorial fragmentation, have been persistent and complex issues over time. Throughout its history, the country has faced challenges in terms of income distribution, access to opportunities and quality of life for different population segments, leading to a territorial framework that identifies, within the same country, an extreme polarization of well-being situations that are reflected in different scales. The northern provinces present socioeconomic indicators that double the magnitudes of deficiencies in central or Patagonian provinces. For example, the prevalence of households with unsatisfied basic needs (UBN) in 2010 reached 19.7% of households in Formosa while in the Ciudad Autónoma de Buenos Aires the same condition involved 6% of households. At the departmental level, the gap was growing, with departments such as Ramón Lista (Formosa), where 68.2% of households had UBN while in Puán, a district in the southwest of Buenos Aires, UBN reached 1.1% of households (INDEC, 2012). However, it is at the level of *census radii* (smallest aggregate spatial unit with available information) in certain urban areas where the gap reached its maximum expression, with magnitudes of deficiencies that position inequality as the main attribute and socioeconomic problem of the country. In the Área Metropolitana de Buenos Aires (AMBA), one of the largest urban agglomerates in Latin America with a population close to 13 million inhabitants, there were *census radii* with no poor households while others included more than 90% of their households in poverty condition. The geographical distance between them was a few kilometers.

These inequalities and asymmetries that characterize Argentine society are also evident in different aspects of well-being (housing, education, services, employment, income, etc.), but they take on special significance in nutritional terms. More than a decade ago, Oyhenart et al. (2008) described the existence of a north–south gradient that revealed the highest proportions of undernutrition in the north and obesity in the south of the country. According to the data of the present paper, this description is still valid today, with the highest prevalence of CIAF in the NOA region (12.7%) and ECIAF in Patagonia (31.3%).

The province of Jujuy has played a leading role in the few national analyses carried out on CIAF. In this regard, Vilca and Bejarano (2020), when analyzing children under 5 years of age in Jujuy between 1990 and 2008, found prevalences of 7.6%, a lower value than that recorded in any of the regions considered in the present study. On the other hand, in relation to ECIAF, a recent study by Bustamante et al. (2019) using data from children from Jujuy aged 4 to 9 years in 2003, reported the high magnitudes reached by this index in the province, similar to those of the present study for the NOA region. Indeed, in that study they found prevalences of 34.2% and 27.4% in two intra-annual measurements, whereas in the present study we report a prevalence of 29.8%.

Likewise, Bejarano et al. (2019) analyzed six Argentine provinces and confirmed the existence of the aforementioned north–south gradient, but found the highest rates of ECIAF in the province of Mendoza (Cuyo

region), with a significant burden of overweight and obesity. In contrast, in the present study, the Cuyo region shows the lowest percentages of both CIAF and ECIAF. In addition, it was observed that this region presents the greatest equality among its wealth quintiles in contrast to the NEA region, where these quintiles show the greatest inequality.

5 | CONCLUSIONS

Results in the present paper show the important magnitude of malnutrition in Argentina and the complex relationship it has with socioeconomic and territorial inequality. The presence of a double burden of malnutrition is observed in all regions and household income levels. However, overweight exhibits greater intensity in the most economically prosperous regions and households, whereas stunting is more prevalent in the most underprivileged ones.

Therefore, an uncertain panorama for the fulfillment of SDGs in Argentina is exposed, particularly in relation to the target that seeks to end hunger and all forms of malnutrition by 2030. However, the use of ECIAF together with the MICS database surveyed by UNICEF between 2019 and 2020 has proven to be a valuable tool for the development of nutritional situation diagnoses that may and should be expanded to serve as input in the planning and development of public policies aimed at reversing the current scenario of nutritional and food inequality that affects the Argentinian child population.

AUTHOR CONTRIBUTIONS

Ramiro Joaquin Salazar Burgos: Conceptualization (lead); data curation (lead); formal analysis (equal); investigation (equal); methodology (equal); visualization (equal); writing – original draft (lead); writing – review and editing (equal). **Fernando Longhi:** Conceptualization (equal); data curation (equal); formal analysis (lead); investigation (lead); methodology (equal); visualization (equal); writing – original draft (lead); writing – review and editing (equal). **Maria Dolores Marrodan Serrano:** Conceptualization (supporting); formal analysis (supporting); methodology (equal); visualization (lead); writing – original draft (equal); writing – review and editing (lead).

ACKNOWLEDGMENTS

To UNICEF Argentina, for providing us with the metadata of the MICS 2019-2020 to carry out this work, and to the National Council of Scientific and Technical Research (CONICET) of Argentina.

CONFLICT OF INTEREST STATEMENT

The authors state that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

All National Survey of Children and Adolescents MICS 2019-2020 data used in this study are publicly available through the UNICEF (https://www.unicef.org/argentina/informes/mics-2019-2020). The data that support the finding of this study are available from the corresponding author upon reasonable request.

ORCID

Ramiro Joaquín Salazar Burgos https://orcid.org/0000-0003-2295-7172

REFERENCES

Alfonso-Durruty, M. P., & Valeggia, C. R. (2018). Height, weight, and body mass index of Wichí children from Formosa. *Argentina. Archivos Argentinos de Pediatría*, *116*(5), 359–364. https://doi.org/10.5546/aap.2018.eng.359

Arakaki, G. A. (2011). *La pobreza en ArgentinaArgentina 1974–2006 construcción y análisis de la información. Documentos de trabajo (15)*. CEPED. Faculty of Economic Sciences. university of http://bibliotecadigital.econ.uba.ar/download/docin/docin_ceped_d_015.pdf

Bejarano, I. F., Carrillo, A. R., Dipierri, J. E., Román, E. M., & Abdo, G. (2014). Composite index of anthropometric failure and geographic altitude in children from Jujuy (1 to 5 years old). *Archivos Argentinos de Pediatria*, *112*(6), 526–531. https://doi.org/10.5546/aap.2014.eng.526

Bejarano, I. F., Oyhenart, E. E., Torres, M. F., Cesani, M. F., Garraza, M., Navazo, B., Zonta, M. L., … Marrodán, M. D. (2019). Extended composite index of anthropometric failure in Argentinean preschool and school children. *Public Health Nutrition*, *22*(18), 3327–3335. https://doi.org/10.1017/S1368980019002027

Biswas, S., Bose, K., Mukhopadhyay, A., & Bhadra, M. (2009). Prevalence of undernutrition among pre-school children of Chapra, Nadia District, West Bengal, India, measured by composite index of anthropometric failure (CIAF). *Anthropologischer Anzeiger; Bericht Uber Die Biologisch-Anthropologische Literatur*, *67*(3), 269–279. https://doi.org/10.1127/0003-5548/2009/0025

Bolsi, A., & Paolasso, P. (Compilers). (2009). *Geografía de la pobreza en el Norte Grande argentino*. CONICET-UNDP-UNT.

Boregowda, G. S., Soni, G. P., Jain, K., & Agrawal, S. (2015). Assessment of under nutrition using composite index of anthropometric failure (CIAF) amongst toddlers residing in urban slums of Raipur City, Chhattisgarh, India. *Journal of Clinical and Diagnostic Research*, *9*(7), LC04–LC06. https://doi.org/10.7860/JCDR/2015/12822.6197

Bustamante, M. J., Martínez, J. L., Alfaro, E. L., Sánchez Álvarez, M., Dipierri, J. E., & Tabera, C. (2019). Fracaso antropométrico y altura geográfica en escolares jujeños asistidos alimentariamente. *Revista Nutrición Clínica y Dietética Hospitalaria*, *39*(4), 16–23. https://doi.org/10.12873/3943bustamante

Cusminsky, M., Lejarraga, H., Mercer, H., Fescina, R., & Martelli, M. (1993). *Manual de crecimiento y desarrollo del niño* (2nd ed.). Pan American Health Organization—World Health Organization.

Díez Navarro, A. (2018). *Análisis comparativo de indicadores antropométricos para el diagnóstico de la desnutrición infantil*. [Doctoral thesis]. Faculty of Nursing. Complutense University of Madrid. Madrid, España.

Díez Navarro, A., Marrodán Serrano, D., Gómez de Arriba, A., Vargas Brizuela, A., Pacheco del Cerro, J. L., Sánchez Álvarez, M., López Ejeda, N., Moreno Romero, S., Prado Martínez, C., Cabañas Armesilla, M. D., & Martínez Álvarez, J. R. (2017). Female eco-stability and severe malnutrition in children: Evidence from humanitarian aid interventions of action against hunger in African, Asian and Latin American countries. *Revista Nutrición Clínica y Dietética Hospitalaria*, *34*(4), 127–134. https://doi.org/10.12873/374dnavarro

Dorjee, B., Debnath, M., & Bogin, B. (2023). Impact of maternal education on the growth of children in a patriarchy. *Human Biology and Public Health*, *1*, 1–9. https://doi.org/10.52905/hbph2023.1.60

Endris, N., Asefa, H., & Dube, L. (2017). Prevalence of malnutrition and associated factors among children in rural Ethiopia. *BioMed Research International*, *2017*, 6587853. https://doi.org/10.1155/2017/6587853

FAO, IFAD, PAHO, UNICEF, & WFP. (2023). *Regional overview of food security and nutrition—Latin America and the Caribbean 2022: Towards improving affordability of healthy diets*. FAO. https://doi.org/10.4060/cc3859en

FAO, IFAD, UNICEF, WFP, & WHO. (2022). *In brief to the state of food security and nutrition in the world 2022. Repurposing food and agricultural policies to make healthy diets more affordable*. FAO. https://doi.org/10.4060/cc0640en

Hochberg, Z., & Albertsson-Wikland, K. (2008). Evo-devo of infantile and childhood growth. *Pediatric Research*, *64*(1), 2–7. https://doi.org/10.1203/PDR.0b013e318177590f

INDEC. (1982). *Censo nacional de población y vivienda 1980. Serie B. Características generales. total del país*. INDEC.

INDEC. (2012). *Censo nacional de población, hogares y viviendas 2010: Censo del Bicentenario: resultados definitivos*. INDEC.

INDEC (Ed.). (2023). *Censo Nacional de Población, Hogares y Viviendas 2022: resultados provisionales* (1st ed.). INDEC https://www.indec.gob.ar/ftp/cuadros/poblacion/cnphv2022_resultados_provisionales.pdf

Karlsson, O., Kim, R., Bogin, B., & Subramanian, S. V. (2022). Maternal height-standardized prevalence of stunting in 67 low- and middle-income countries. *Journal of Epidemiology*, *32*(7), 337–344. https://doi.org/10.2188/jea.JE20200537

Lampl, M., & Schoen, M. (2017). How long bones grow children: Mechanistic paths to variation in human height growth. *American Journal of Human Biology*, *29*(2), e22983. https://doi.org/10.1002/ajhb.22983

Lescure, J., Martín-Turrero, I., López-Ejeda, N., Vargas, A., & Marrodán, M. D. (2023). Differences in wasting assessment through middle-upper arm circumference (MUAC) adjusted by sex, age and geographic origin for children aged 6–59 months: New reference based on anthropometric surveys from 22 low-and-middle-income countries. *American Journal of Human Biology*, *35*(3), e23837. https://doi.org/10.1002/ajhb.23837

Mandal, G., & Bose, K. (2009). Assessment of overall prevalence of undernutrition using composite index of anthropometric failure (CIAF) among preschool children of West Bengal, India. *Iranian Journal of Pediatrics*, *19*(3), 237–243.

Martín-Turrero, I., Lescure Rodríguez, J., Lora Pablos, D., López-Ejeda, N., Vargas Brizuela, A., Martínez Álvarez, J. R., & Marrodán Serrano, M. D. (2022). Growth patterns of normo-nourished Afghan, Haitian and Congolese children aged 6–59 months: A comparative study. *American Journal of Human Biology*, *34*(2), e23620. https://doi.org/10.1002/ajhb.23620

McDonald, C. M., Olofin, I., Flaxman, S., Fawzi, W. W., Spiegelman, D., Caulfield, L. E., Black, R. E., Ezzati, M., Danaei, G., & Nutrition Impact Model Study. (2013). The effect of multiple anthropometric deficits on child mortality: Meta-analysis of individual data in 10 prospective studies from developing countries. *The American Journal of Clinical Nutrition*, *97*(4), 896–901. https://doi.org/10.3945/ajcn.112.047639

Ministry of Health and Social Development. (2019). *2° Encuesta Nacional de Nutrición y Salud (ENNyS 2). Indicadores Priorizados*. Ministry of Health and Social Development https://bancos.salud.gob.ar/recurso/2deg-encuesta-nacional-de-nutricion-y-salud-indicadores-priorizados

Nandy, S., Irving, M., Gordon, D., Subramanian, S. V., & Smith, G. D. (2005). Poverty, child undernutrition and morbidity: New evidence from India. *Bulletin of the World Health Organization*, *83*(3), 210–216. World Health Organization. https://apps.who.int/iris/handle/10665/269373

Nandy, S., & Miranda, J. J. (2008). Overlooking undernutrition? Using a composite index of anthropometric failure to assess how underweight misses and misleads the assessment of undernutrition in young children. *Social Science & Medicine (1982)*, *66*(9), 1963–1966. https://doi.org/10.1016/j.socscimed.2008.01.021

Nandy, S., & Svedberg, P. (2012). The composite index of anthropometric failure (CIAF): An alternative indicator of malnutrition in young children. In V. Preedy (Ed.), *Handbook of anthropometry: Physical measures of human form in health and disease*. Springer. https://doi.org/10.1007/978-1-4419-1788-1_6

National Ministry of Health. (2007). *Encuesta nacional de nutrición y salud (ENNyS). Documento de resultados*. National Ministry of Health http://www.extensioncbc.com.ar/wp-content/uploads/ENNyS-2007.pdf

Oyhenart, E. E., Dahinten, S. L., Alba, J. A., Alfaro, E. L., Bejarano, I. F., Cabrera, G. E., Cesani, M. F., Dipierri, J. E., Forte, L. M., Lomaglio, D. B., Luis, M. A., Luna, M. E., Marrodán, M. D., Moreno Romero, S., Orden, A. B., Quintero, F. A., Sicre, M. L., Torres, M. F., Verón, J. A., & Savatti, J. R. (2008). Estado nutricional infanto juvenil en seis provincias de Argentina: variacion regional. *Revista Argentina de Antropología Biológica*, *10*(1), 5–62. http://sedici.unlp.edu.ar/handle/10915/6018

Paolasso, P., Longhi, F., & Velázquez, G. A. (Eds.). (2019). *Desigualdades y fragmentación territorial en la Argentina durante la primera década del siglo XXI*. Editions Imago Mundi.

Piovani, J. I., & Salvia, A. (2018). *La Argentina en el siglo XXI: Cómo somos, vivimos y convivimos en una sociedad desigual: Encuesta Nacional sobre la Estructura Social* (1st ed.). Siglo XXI Editores.

Popkin, B. M., Corvalan, C., & Grummer-Strawn, L. M. (2020). Dynamics of the double burden of malnutrition and the

changing nutrition reality. *Lancet (London, England)*, *395*(10217), 65–74. https://doi.org/10.1016/S0140-6736(19)32497-3

Rutstein, S. O., & Johnson, K. (2004). *The DHS wealth index* (report no. 6). ORC Macro, Measure DHS.

Salazar Burgos, R. J. (2020). *Estado nutricional de la juventud rural tucumana en los comienzos del siglo XXI*. [Unpublished doctoral thesis]. National University of Tucumán. Tucumán, Argentina.

Svedberg, P. (2000). *Poverty and undernutrition: Theory, measurement and policy*. Oxford University Press.

Thurstans, S., Opondo, C., Seal, A., Wells, J., Khara, T., Dolan, C., Briend, A., Myatt, M., Garenne, M., Sear, R., & Kerac, M. (2020). Boys are more likely to be undernourished than girls: A systematic review and meta-analysis of sex differences in undernutrition. *BMJ Global Health*, *5*(12), e004030. https://doi.org/10.1136/bmjgh-2020-004030

Tuñón, I. (2023). *La cuestión alimentaria en tiempos de ASPO-COVID-19*. Biblos https://repositorio.uca.edu.ar/handle/123456789/14391

UNDP—United Nations Development Programme. (2017). *Informe nacional sobre desarrollo humano 2017. Información para el desarrollo sostenible: Argentina y la Agenda 2030*. http://www.ar.undp.org/content/argentina/es/home/library/human_development/INDH2017

UNICEF. (2021a). *Análisis de Situación de la Niñez y Adolescencia en Argentina 2020* (1st ed.). UNICEF. https://www.unicef.org/argentina/media/11671/file/Análisis%20de%20Situación%20de%20la%20Niñez%20y%20la%20Adolescencia%20en%20Argentina%20(SITAN).pdf

UNICEF. (2021b). *Encuesta Nacional de Niñas, Niños y Adolescentes (MICS), 2019-2020*. https://www.unicef.org/argentina/media/12071/file/MICS%202019-2020.pdf

UNICEF, WHO, & World Bank Group. (2021). *Joint child malnutrition estimates*. UNICEF/WHO/The World Bank https://www.who.int/publications/i/item/9789240025257

United Nations. (2018). *La Agenda 2030 y los Objetivos de Desarrollo Sostenible: una oportunidad para América Latina y el Caribe (LC/G.2681-P/Rev.3)*. United Nations https://repositorio.cepal.org/bitstream/handle/11362/40155/24/S1801141_es.pdf

Vilca, N. G., & Bejarano, I. F. (2020). Evaluación del estado nutricional de la población infantil jujeña (0–5 años) a través del índice de fracaso antropométrico. *Revista Difusiones*, *19*, 29–45. https://ri.conicet.gov.ar/bitstream/handle/11336/141142/CONICET_Digital_Nro.eeb47714-60fb-405b-b05e-e904a0fb6a50_A.pdf?sequence=2&isAllowed=y

Wells, J. C., Sawaya, A. L., Wibaek, R., Mwangome, M., Poullas, M. S., Yajnik, C. S., & Demaio, A. (2020). The double burden of malnutrition: Aetiological pathways and consequences for health. *Lancet (London, England)*, *395*(10217), 75–88. https://doi.org/10.1016/S0140-6736(19)32472-9

WHO. (2006a). *WHO child growth standards: Length/height-for-age, weight-for-age, weight-for-length, weight -for-height and body mass index-for-age: Methods and development*. World Health Organization https://apps.who.int/iris/handle/10665/43413

WHO. (2006b). Multicentre growth reference study group. Enrolment and baseline characteristics in the WHO multicentre growth reference study. *Acta Paediatrica (Oslo, Norway: 1992).*, *450*(Suppl), 7–15. https://doi.org/10.1111/j.1651-2227.2006.tb02371.x

WHO. (2022). *The Global Health Observatory. Stunting prevalence among children under 5 years of age (% height-for-age < −2 SD), model based estimates*. https://www.who.int/data/gho/data/indicators/indicator-details/GHO/gho-jme-country-children-aged-5-years-stunted-(-height-for-age--2-sd)

WHO, & UNICEF. (2019). *Recommendations for data collection, analysis and reporting on anthropometric indicators in children under 5 years old*. WHO, UNICEF https://data.unicef.org/resources/data-collection-analysis-reporting-on-anthropometric-indicators-in-children-under-5/

Yim, A. D., Cowgill, L., Katz, D. C., & Roseman, C. C. (2023). Variation in ontogenetic trajectories of limb dimensions in humans is attributable to both climatic effects and neutral evolution. *Journal of Human Evolution*, *179*, 103369. https://doi.org/10.1016/j.jhevol.2023.103369

How to cite this article: Salazar Burgos, R. J., Longhi, H. F., & Marrodán Serrano, M. D. (2023). Composite indexes of anthropometric failure in children under 5 years of age in Argentina: Comparative analysis among regions: 2019–2020. *American Journal of Human Biology*, e23994. https://doi.org/10.1002/ajhb.23994