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Analysis of child malnutrition associated with community food environments in community kitchens from Argentinian regions with socioeconomic disparities

Análisis de la malnutrición infantil asociada a los entornos alimentarios comunitarios en comedores comunitarios de regiones Argentinas con diferente desarrollo socioeconómico

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ABSTRACT

Background: Malnutrition, defined as an imbalance in macro- and micronutrient intake, mainly affects children and adolescents. In Argentina, both underweight and overweight are prevalent. Socioeconomic and environmental factors, including food environments, play a crucial role in the incidence of this problem in vulnerable communities. The aim was to analyze the relationship between community food environments and malnutrition in children and adolescents aged 0 to 18 years in community kitchens in Patagonia, NEA (Northeast), and NOA (Northwest) of the Argentine territory in the year 2021. **Materials and methods**: Correlational ecological study. A non-probabilistic sample was used to select 449 community kitchens in Patagonia, NEA, and NOA. The environmental and socioeconomic characteristics of the community kitchens were extracted from open data sources and satellite images. Thematic mapping, summary measures, and Poisson regressions were performed to examine the relationship between the prevalence of malnutrition and socioeconomic and environmental variables ($p<0.05$). **Results:** The NOA region has the highest concentration of community kitchens (n=225), with a high prevalence of low height in Salta (10.78%) and low weight in Formosa (6.46%). In socioeconomic terms, the NEA presents the highest marginality (51.82%) and scarcity of drinking water (22.96%). In Patagonia, critical (41.3%) and high (28.26%) levels of food insecurity predominate, while in the NEA, the risks are lower, with a predominance of low (28.65%) and very low (25.84%) risks. **Conclusion:** Geostatistical tools are novel for the study of CAE, facilitating a complete vision of the environment to address the various problems related to food.

Keywords: Child malnutrition, Community Food Environment, Geomatics, Food Insecurity, Community Kitchens.

RESUMEN

Introducción: La malnutrición, definida como desequilibrio en el consumo de nutrientes, afecta principalmente a niños y adolescentes. En Argentina, tanto el bajo peso como el sobrepeso son prevalentes, influenciados por factores socioeconómicos, ambientales y los entornos alimentarios. Este estudio analiza la relación entre los entornos alimentarios comunitarios y la malnutrición en niños y adolescentes de 0 a 18 años en comedores comunitarios de la Patagonia, NEA y NOA del territorio argentino durante el año 2021**. Materiales y métodos:** Estudio ecológico correlacional. Mediante una muestra no probabilística se seleccionaron 449 comedores comunitarios ubicados en la Patagonia, el NEA y el NOA. Las características ambientales y socioeconómicas de los comedores fueron extraídas de fuentes de datos abiertas e imágenes satelitales. Se realizó cartografía temática, medidas resumen y regresiones de Poisson para examinar la relación entre la prevalencia de malnutrición y variables socioeconómicas y ambientales (p<0,05).**Resultados:** La región NOA tiene la mayor concentración de comedores comunitarios (n=225), con altas prevalencias de baja talla en Salta (10.78%) y bajo peso en Formosa (6.46%). En términos socioeconómicos, el NEA presenta la mayor marginalidad (51.82%) y escasez de agua potable (22.96%). En la Patagonia, predominan los niveles de riesgo crítico (41.3%) y alto (28.26%) de inseguridad alimentaria, mientras que en el NEA los riesgos son más bajos, con predominancia de riesgos bajo (28.65%) y muy bajo (25.84%). **Conclusión:** Las herramientas geoestadísticas son novedosas para el estudio de los EAC, facilitando una visión completa del entorno para enfrentar las diversas problemáticas relacionadas con la alimentación.

Keywords: Malnutrición infantil, Entorno Alimentario Comunitario, Geomática, Inseguridad Alimentaria, Comedores Comunitarios.

INTRODUCTION

Malnutrition is defined by the Food and Agriculture Organization of the United Nations (FAO) as an abnormal physiological condition resulting from an insufficient or unbalanced intake of macro- and micronutrients. It affects all age groups, with children and adolescents being particularly vulnerable due to their high nutritional requirements for growth and development (1, 2, 3). In early childhood (0–2 years), malnutrition can increase morbidity, mortality, and disability, impair cognitive, motor, and socio-emotional development, and raise the risk of cardiometabolic diseases (4, 5). Additionally, during adolescence—another critical period for growth and development—the consolidation of unhealthy eating habits may expose individuals to risks such as obesity, chronic diseases, and eating disorders (6, 7).

At the global level, the World Health Organization (WHO) reports that 14.6% of newborns have low birth weight, and 6.7% of children under five suffer from undernutrition. Furthermore, the Pan American Health Organization (PAHO) indicates an overweight prevalence of 5.9% in children under five and 18% among those aged 5 to 19, with Latin America being one of the regions with the highest rates of overweight and obesity (8, 9, 3, 10).

Malnutrition in children and adolescents is not limited to inadequate food intake but is also shaped by environmental, socioeconomic, and community food environment (CFE) factors. According to the model proposed by Glanz et al. (11), CFEs encompass physical, economic, political, and sociocultural conditions that influence food acquisition, preparation, and consumption, thus affecting nutritional status.

Studies conducted in Latin America and the Caribbean have demonstrated that higher levels of socioeconomic poverty and lower access to formal education are associated with increased prevalence of all forms of malnutrition within households (12, 13, 14). Similarly, food inaccessibility, socioeconomic inequality, and a lack of public policies with tangible impacts are common across Latin American countries, contributing to a health scenario where deficiency and excess diseases coexist.

In Argentina's five geopolitical regions (Northeast –NEA–, Northwest -NOA-, Patagonia, Cuyo, and Pampas), interregional disparities have persisted historically due to unequal resource distribution, leading to distinct political and socioeconomic characteristics. The central and southern regions (the last three mentioned) show stronger socioeconomic development, with higher per capita income, better quality of life indices, and improved access to general services, particularly education and healthcare. In contrast, the northern regions have historically been characterized by more vulnerable CFEs (15, 16, 17).

Despite the existence of areas with better CFEs, major deficiencies persist regarding food security. The most recent National Survey on Nutrition and Health (2018–2019) reveals a dual reality in child and adolescent health. Among children under five, 1.7% experience low weight, 10% are overweight, and 3.6% are obese, while 7.9% have stunted growth. Among children aged 5 to 17, low weight affects 1.4%, overweight 20.7%, and obesity 20.4%. For those aged 7 to 17, undernutrition is present in 1.4%, stunting in 3.7%, and overweight in 41.1% (9).

In response to this persistent public health issue, community kitchens (comedores comunitarios) emerged in Argentina at the end of the 20th century and the beginning of the 21st century as key institutions providing food to vulnerable populations. Given their target population, they are particularly affected by the characteristics of the neighborhoods in which they are located, resulting in unequal access to quality food, healthcare, and sanitation services (18, 19). It is also important to note that community kitchens in northern Argentina face greater challenges due to structural poverty, geographic isolation, and weak infrastructure. In contrast, although disparities exist in the south, the general condition of community kitchens reflects less critical situations and better integration with social policies (20, 21).

Based on these considerations, the objective of this study was to analyze the association between the characteristics of community food environments (CFEs) and the prevalence of malnutrition in children and adolescents aged 0 to 18 years attending community kitchens in areas with different levels of socioeconomic development in Argentina (Patagonia, NEA, and NOA).

MATERIALS AND METHODS

Study design

An ecological and correlational study was conducted. The analysis was based on a non-representative sample of 449 community kitchens and food assistance centers included in the Barrial Index of Nutritional Situation (ISBN) survey, carried out by the Institute for Social, Economic and Citizen Policy Research (ISEPCi). These centers were located in the Patagonian (Río Negro, Neuquén, Chubut, Santa Cruz, and Tierra del Fuego), NEA (Formosa, Chaco, Corrientes, and Misiones), and NOA (Jujuy, Salta, Tucumán, Catamarca, La Rioja, and Santiago del Estero) regions of the Argentine Republic during the year 2021.

Data collection

Health indicators (stunting, underweight, overweight, obesity, and malnutrition) were obtained from the ISBN survey, accessible through the open spatial data platform (https://poblaciones.org/). It is important to note that in the original survey, the variable "malnutrition" included both undernutrition and overnutrition (excluding stunting).

Data on community food environments (CFEs) were obtained from open data sources by adapting the original approach of environmental assessment at the regional scale. All available and relevant information related to the problem was extracted. The resulting indicators reflect the specific conditions to which individuals attending the surveyed community kitchens were exposed.

Socioeconomic data—such as level of food insecurity, socioeconomic status of the community kitchens and surrounding households, access to potable water, households without piped water, households with unmet basic needs, educational level of the head of household, school attendance among children and adolescents, and the presence of health facilities—were retrieved from the 2010 National Census of Population, Households, and Housing conducted by the National Institute of Statistics and Censuses (INDEC), which were the latest data available at the time the study began.

In addition, remote sensing data were used to estimate the physical and environmental characteristics of the CFEs. A collection of Sentinel-2 satellite images from the summer season of 2018–2019 was compiled using the Google Earth Engine platform. From these images, the Normalized Difference Vegetation Index (NDVI) was calculated to assess vegetation through the analysis and monitoring of vegetative conditions and land cover dynamics, using the formula NDVI = (NIR - Red) / (NIR + Red), where NIR refers to near-infrared light and Red to visible red light. The Normalized Difference Built-up Index (NDBI) was also calculated to estimate areas with built-up or under-construction surfaces in contrast to vegetated or bare areas, using the formula NDBI = (SWIR - NIR) / (SWIR + NIR), where SWIR refers to shortwave infrared light. Additionally, the Normalized Difference Water Index (NDWI) was used to identify and monitor changes in surface water, applying the formula NDWI = (Green - NIR) / (Green + NIR), where Green corresponds to the green spectral bands.

Statistical and spatial analysis

To evaluate the influence of various factors on the prevalence of malnutrition among children and adolescents attending community kitchens in the Patagonia, NEA, and NOA regions, a Poisson regression analysis for aggregated data was conducted, applying the principle of parsimony for variable selection. Results were reported using a significance level of $p < 0.05$. Descriptive and exploratory statistical analyses were performed using Stata 15 software (https://www.stata.com/).

Thematic cartography was developed using QGIS 3.28 software (https://qgis.org/en/site/).

RESULTADOS

Of the 449 community kitchens and food assistance centers evaluated, 46 were located in the Patagonian region, 178 in the NEA, and 225 in the NOA.

Table 1 presents the prevalence of malnutrition among children and adolescents attending community kitchens.

An average prevalence of 3.21% for underweight and 5.9% for stunting was observed, with the highest proportions for both indicators recorded in the NEA and the lowest in Patagonia.

Table 1. Prevalence of malnutrition among children and adolescents attending community kitchens in the Patagonia, NEA, and NOA regions (Argentina), 2021.

	Underweight n (%)	Overweight n (%)	Obesity n (%)	Malnutrition n (%)	Stunting n (%)
Patagonia					
Neuquén	30 (0.77)	30 (26.30)	30 (22.27)	30 (49.36)	30 (4.08)
Chubut	4 (0.78)	4 (22.66)	4 (40.27)	4 (63.72)	4 (5.91)
Tierra del Fuego	6 (1.04)	6 (19.28)	6 (33.75)	6 (54.07)	6 (2.51)
Río Negro	6 (1.43)	6 (20.61)	6 (34.01)	6 (56.06)	6 (6)
Santa Cruz	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
NEA					
Chaco	108 (3.33)	108 (15.83)	108 (17.5)	108 (36.67)	108 (6.66)
Corrientes	23 (3.75)	23 (17.17)	23 (17.15)	23 (38.07)	23 (10.6)
Misiones	34 (4.58)	34 (13.28)	34 (13.62)	34 (31.05)	34 (2.71)
Formosa	13 (6.46)	13 (16.46)	13 (10.91)	13 (33.84)	13 (33.26)
NOA					
Catamarca	4 (2.13)	4 (18,91)	4 (23.39)	4 (44.43)	4 (6.03)
La Rioja	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Jujuy	15 (2.73)	15 (16.89)	15 (25.67)	15 (45.31)	15 (4.41)
Tucumán	110 (2.86)	110 (17.33)	110 (20.81)	110 (41.19)	6 (2.51)
Santiago del Estero	35 (3.12)	35 (16.44)	35 (20.91)	35 (40.48)	35 (4.02)
Salta	61 (3.95)	61 (18.77)	61 (20.43)	61 (43.16)	61 (10.78)

Figure 1 shows the geospatial distribution of underweight and stunting prevalence. In relation to underweight (Figure 1A), clusters of orange and red points indicate higher prevalence rates in the NOA and NEA regions. In contrast, lower prevalence rates—below 2.1%—predominate in Patagonia and are represented by white and pink points. Figure 1B illustrates that Patagonia is the region with the lowest prevalence of stunting, while the NOA and NEA regions exhibit higher prevalence rates, particularly concentrated in the province of Chaco.

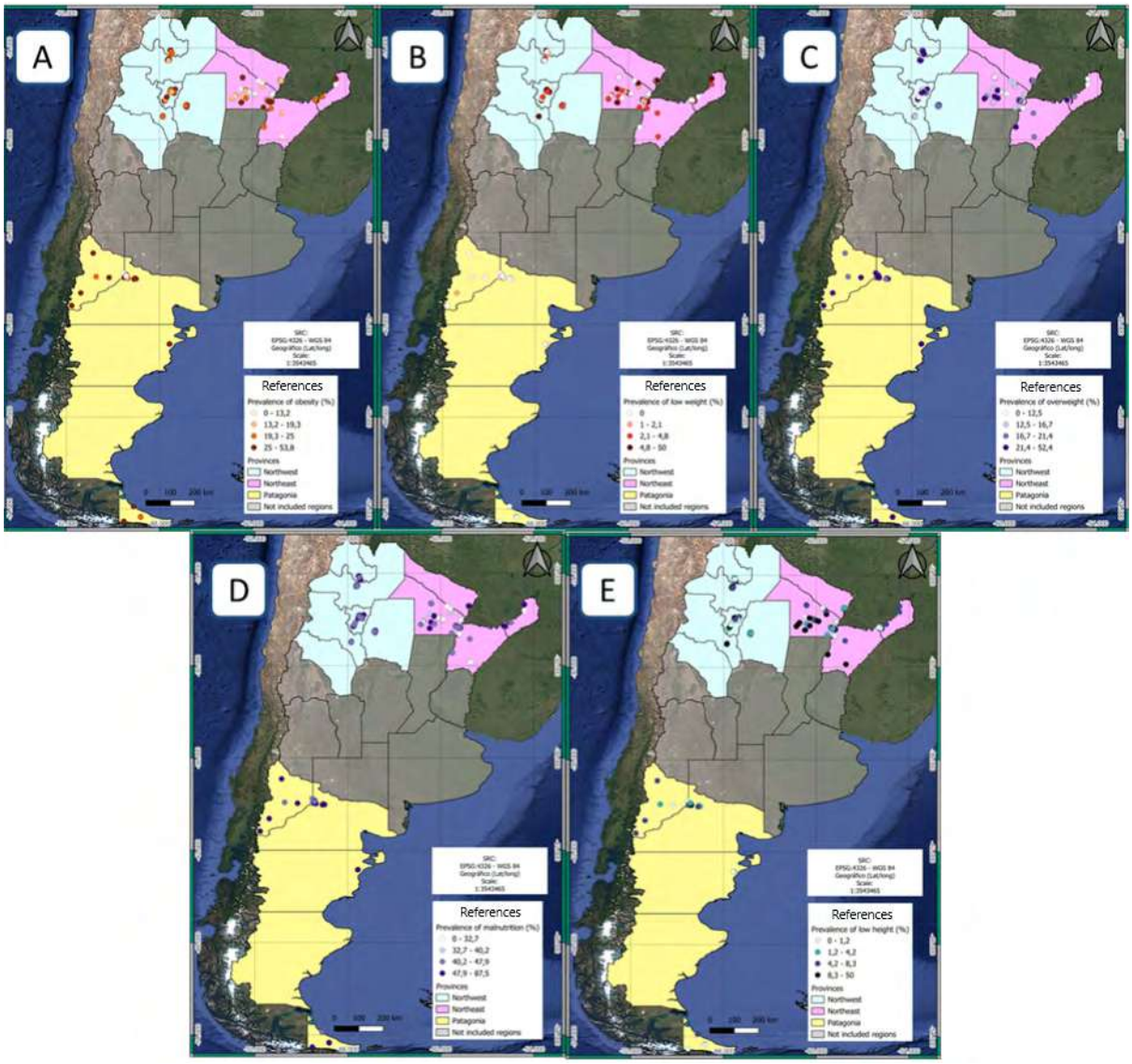

Figure 1. Geospatial distribution of underweight and stunting prevalence among children and adolescents attending community kitchens in the Patagonia, NOA, and NEA regions of Argentina in 2021.

The area included in this study corresponds to the Patagonia, NOA, and NEA regions.

Map data © 2021 Google. Basemap obtained through the QuickMapServices QGIS plugin – QGIS Geographic Information System. Open source: Geospatial Foundation Project. http://qgis.osgeo.org.

Overweight had an average prevalence of 17.47% across all regions. Obesity affected 19.76% of the total population of children and adolescents, with intraregional differences: in Patagonia, Chubut recorded the highest prevalence (40.27%), followed by Tierra del Fuego (33.75%) and Neuquén (22.27%). In the NOA region, obesity averaged close to 20%, while the NEA exhibited the lowest obesity rates.

Patagonia recorded the highest overall levels, with Chubut having the highest prevalence (63.72%), followed by Río Negro (56.06%), Tierra del Fuego (54.07%), and Neuquén (49.36%). In contrast, the NEA showed the lowest malnutrition prevalence rates.

In both Patagonia and the NEA, the most prevalent socioeconomic class was "very low" (42.48% and 46.07%, respectively). In the NOA, the most frequent class was "low," reaching 43.56%. Moreover, low percentages were observed for the lower-middle, middle, and upper-middle classes across all regions studied.

Regarding Unmet Basic Needs (UBN), Patagonia had the highest percentage (28.73%), followed by the NEA (24.07%) and the NOA (21.75%). Overcrowding rates were similar: Patagonia (12.22%), NOA (11.65%), and NEA (11.72%). In terms of marginalization, the NEA presented the highest value (51.82%), whereas Patagonia and the NOA showed lower rates (32.15% and 39.26%, respectively).

Households without access to drinking water were most common in the NEA (22.96%), compared with the NOA (12.08%) and Patagonia (6.27%). Similarly, households without piped water were more frequent in the NEA (25.39%), followed by the NOA (17.24%) and Patagonia (5.73%).

Regarding the educational level of household heads, the NEA had the highest proportion with completed primary and/or incomplete secondary education (65.94%), followed by the NOA (63.19%) and Patagonia (55.74%). Heads of household with completed secondary and/or incomplete higher education were more common in Patagonia (27.97%), while the NOA and NEA showed lower percentages (23.14% and 19.12%, respectively). The proportion of heads with completed university education was low across all regions, highest in Patagonia (7.98%) and lowest in the NEA (4.55%).

School attendance among children aged 6 to 12 was high in all regions: Patagonia (99.29%), NOA (98.78%), and NEA (98.23%). Among adolescents aged 13 to 17, percentages were slightly lower: Patagonia (90.31%), NOA (84.96%), and NEA (82.08%).

Regarding food insecurity, critical and high-risk levels predominated in Patagonia (41.3% and 28.26%, respectively), while the NEA showed a predominance of low (28.65%) and very low (25.84%) risk levels. In the NOA, risk levels were more evenly distributed, with medium risk being the most frequent (27.56%). Both the NOA and NEA reported lower critical risk levels than Patagonia.

A total of 98.79% of community kitchens lacked nearby maternal and child health centers, 99.67% lacked specialized pediatric care, and 87.87% did not have access to geriatric inpatient care. Additionally, 93.37% had no mental health services, and 84.01% lacked general inpatient services.

Regarding the physical environment of the community centers, the NDBI showed an average total vegetative cover of 46.99% (Patagonia: 82.61%, NEA: 79.21%, NOA: 14.22%) and 53.01% of bare/built-up land (NOA: 85.78%, Patagonia: 17.39%). NDVI revealed that non-vegetated land averaged 10.69% (Patagonia: 58.70%, NOA: 8.44%, NEA: 1.12%), and land with sparse vegetation averaged 51.22% (NOA: 75.11%, NEA: 29.44%, Patagonia: 19.57%). Moderate vegetation was most prevalent in the NEA (65.74%), while Patagonia and the NOA showed much lower values (15.22% and 15.56%, respectively). Dense vegetation was more common in Patagonia (6.52%), and least common in the NOA (0.89%). None of the regions exhibited areas with very dense vegetation. NDWI revealed an average surface water coverage of 99.11% (Patagonia: 100%, NOA: 99.56%, NEA: 98.31%).

The average number of pixels corresponding to extensive monoculture in the vicinity of community kitchens was also considered. The NEA showed the highest coverage (11.20%), while Patagonia had the lowest (1.7%).

Table 2 shows that the presence of a nearby maternal and child health center reduces the risk of underweight (IRR = 0.83). In contrast, factors that increase the risk include higher NDVI values (IRR = 2.12), absence of piped water (IRR = 1.04), school attendance among adolescents aged 13–17 years (IRR = 1.06), and the educational level of the head of household. Food insecurity in the "very low" and "almost none" categories increases the risk of underweight by 1.60 and 1.43 times, respectively, compared with the "critical risk" category. Together, these variables explained 6.3% of the variability in underweight prevalence.

Table 2. Multiple Poisson regression model for underweight among children and adolescents attending community kitchens in the Patagonia, NEA, and NOA regions (Argentina), 2021.

Undernutrition			
Variables	**p-value**	**IRR**	**IC 95% (OR)**
Health access			
Presence of a specialized maternal and child health facility	0.002	0.83	0.47 - 0.95
Environmental			
NDVI	0.002	2.12	1.33 - 3.37
Socioeconomic			
Households without piped water in the dwelling	0.000	1.04	1.03 - 1.06
School attendance of children and adolescents aged 13 to 17 years	0.000	1.06	1.03 - 1.09
Households with heads of household having completed primary and/or incomplete secondary education	0.000	1.19	1.13 - 1.26
Households with heads of household having completed secondary and/or incomplete higher education	0.000	1.19	1.12 - 1. 26
Food insecurity			
Very low risk	0.000	1.6	1.31 - 1.94
Almost null risk	0.002	1.43	1.13 - 1.81
IRR: Incidence Rate Ratio; CI: Confidence Interval			

Table 3 shows that a higher NDVI (IRR = 0.74) and the presence of two nearby general health facilities (IRR = 0.16) reduce the risk of being overweight. Factors associated with an increased risk include greater distance to the nearest health center (IRR = 1.000005), higher NDWI values (IRR = 3.84), and school attendance among adolescents aged 13–17 years (IRR = 1.52). Belonging to the middle or lower-middle socioeconomic class increases the risk by 1.35 and 1.26 times, respectively, compared to the upper-middle class. Altogether, these variables explained 6.1% of the variability in overweight prevalence.

Table 3. Multiple Poisson regression model for overweight among children and adolescents attending community kitchens in the Patagonia, NEA, and NOA regions (Argentina), 2021.

Overweight			
Variables	**p-value**	**IRR**	**IC 95% (OR)**
Distances			
Distance to Buenos Aires City (CABA)	0.000	0.0000005	0.0000003 - 0.0000007
Environmental			
NDVI	0.010	0.74	0.28 - 0.91
NDWI	0.035	3.84	1.09 - 13.45
Health access			
Presence of two general inpatient care facilities	0.011	0.16	0.06 - 0.27
Distance to the nearest health center	0.000	1.000005	1.000002 - 1.000008
Socioeconomic			
Household overcrowding	0.20	1.003	1.0006 - 1.007
School attendance of children and adolescents aged 13 to 17 years	0.000	1.52	1.39 - 1.65
Socioeconomic class			
Middle class	0.022	1,35	1.04 - 1.75
Lower-middle class	0.050	1,26	1.0002 - 1.5901
IRR: Incidence Rate Ratio; CI: Confidence Interval			

Regarding obesity, Table 4 shows that among environmental factors, both NDBI (IRR = 0.61) and NDVI (IRR = 0.32) were associated with reduced risk. In terms of socioeconomic status, belonging to the middle class decreased the risk of obesity by 0.43 times, the lower-middle class by 0.40 times, the integrated lower class by 0.19 times, the lower class by 0.31 times, and the very low class by 0.29 times, all in comparison to the upper-middle class.

Together, these variables explained 6.3% of the variability in obesity prevalence.

Table 4. Multiple Poisson regression model for obesity among children and adolescents attending community kitchens in the Patagonia, NEA, and NOA regions (Argentina), 2021.

Obesity			
Variables	**p-value**	**IRR**	**IC 95% (OR)**
Socioeconomic			
School attendance of children and adolescents aged 13 to 17 years	0.013	0.02	0.01 - 0.03
Households without access to drinking and cooking water	0.000	0.03	0.02 - 0.04
Environmentals			
NDBI	0.000	0.61	0.34 - 0.77
NDVI	0.004	0.32	0.12 -0.48
Socioeconomic class			
Middle class	0.000	0.43	0.28 - 0.54
Lower-middle class	0.000	0.40	0.29 - 0.50
Integrated lower class	0.005	0.19	0.07 - 0.30
Lower class	0.000	0.31	0.21 - 0.41
Very low class	0.000	0.29	0.18 - 0.38
IRR: Incidence Rate Ratio; CI: Confidence Interval			

Table 5 shows that extensive monoculture (IRR = 0.011) and having heads of household with completed primary education (IRR = 0.1) reduce the risk of stunting. Conversely, factors associated with higher prevalence include the NDBI (IRR = 25.89), greater distance to cities with ≥50,000 inhabitants (IRR = 1.000002), and household overcrowding (IRR = 1.02).

The risk of stunting also increases across food insecurity categories: high risk (1.18 times), medium (1.43), low (1.75), very low (2.15), and near zero (1.54), compared to the critical risk category.

Together, the variables above explained 8.1% of the variability in stunting prevalence.

Table 5. Multiple Poisson regression model for stunting among children and adolescents attending community kitchens in the Patagonia, NEA, and NOA regions (Argentina), 2021.

Stunting			
Variables	**p-value**	**IRR**	**IC 95% (OR)**
Distances			
Distance to the nearest city with a population of 50,000 or more inhabitants	0.000	1.000002	1.000001 - 1.000004
Environmental			
NDBI	0.000	25.89	12.69 - 52.80
Area of extensive monoculture	0.000	0.011	0.007 - 0.016
Socioeconomic			
School attendance of children and adolescents aged 6 to 12 years	0.000	0.64	0.56 - 0.71
Households with heads of household having completed primary and/or incomplete secondary education	0.000	0.10	0.08 - 0.12
Household overcrowding	0.000	1.026	1.02 - 1.031

Stunting			
Variables	**p-value**	**IRR**	**IC 95% (OR)**
Food insecurity			
High risk	0.034	1.18	1.01 - 1.39
Medium risk	0.000	1.43	1.23 - 1.66
Low risk	0.000	1.75	1.49 - 2.05
Very low risk	0.000	2.15	1.83 - 2.52
Almost null risk	0.000	1.54	1.25 - 1.91
IRR: Incidence Rate Ratio; CI: Confidence Interval			

Table 6 presents the multiple Poisson regression analysis for malnutrition. Environmental factors associated with higher malnutrition prevalence included the NDBI (IRR = 0.68) and the NDVI (IRR = 0.31). Among socioeconomic factors, marginalization (IRR = 0.0019) and lack of access to drinking and cooking water in households (IRR = 0.018) were particularly significant. Regarding food insecurity, being classified under the high-risk category increased the risk by 0.07, medium risk by 0.11, low risk by 0.14, very low risk by 0.09, and near-zero risk by 0.22 times, compared to the critical risk category.

Altogether, these variables explained 7.4% of the variability in malnutrition prevalence.

Table 6. Multiple Poisson regression model for malnutrition among children and adolescents attending community kitchens in the Patagonia, NEA, and NOA regions (Argentina), 2021.

Malnutrition			
Variables	**p-value**	**IRR**	**IC 95% (OR)**
Environmentals			
NDBI	0.000	0.68	0.78 - 0.53
NDVI	0.000	0.31	0.43 - 0.16
Socioeconomic			
Marginality	0.000	0.0019	0.0025 - 0.0013
Households without access to drinking and cooking water	0.000	0.018	0.021 - 0.015
Households with heads of household holding a completed university degree	0.000	0.04	0.05 - 0.02
Food insecurity			
High risk	0.022	0.07	0.12 - 0.01
Medium risk	0.000	0.11	0.16 - 0.06
Low risk	0.000	0.14	0.19 - 0.09
Very low risk	0.004	0.09	0.15 - 0.03
Almost null risk	0.000	0.22	0.28 - 016
IIRR: Incidence Rate Ratio; CI: Confidence Interval			

DISCUSSION

The results obtained are consistent with the global double burden of malnutrition: while underweight rates are decreasing, obesity is on the rise among children and adolescents (22). National studies such as ENNyS, EMSE, and PROSANE support these findings, revealing that overweight and obesity affect 37.7% of youth aged 13–17, while underweight and stunting impact fewer than 5%. Patagonia shows the highest rates of overweight (22.8%) and obesity (19.9%), which aligns with the results found in this study (24.33% and 26.86%, respectively). The NEA region exhibits the highest prevalence of underweight (3.5%), which is comparable to the value observed in the present study (3.85%). For

stunting, NEA (6.17%) and NOA (6.01%) exceed Patagonia (4.29%), mirroring ENNyS data (NEA: 11.9%, NOA: 10.7%, Patagonia: 8.9%) (23).

Previous studies have highlighted that NDWI and extensive monoculture—both linked to urbanization—can increase the prevalence of overweight by negatively affecting food environments and living conditions (3, 24, 25). The availability of health care facilities, especially maternal and child health centers, is a protective factor against malnutrition (9). At the same time, a greater distance to these services contributes to issues related to malnutrition and overweight (26, 27).

Socioeconomic characteristics are also critical: children and adolescents from vulnerable sectors are at higher risk of malnutrition, overweight, and stunting (9, 28). Lack of access to public services and poor physical infrastructure are additional contributing factors (9). Food insecurity is a significant risk factor for underweight and stunting, as it reduces both the quality and quantity of food available (1). As shown on the Poblaciones platform (29), and consistent with the index used, food insecurity is more prevalent in the NEA and NOA regions.

As a limitation, the studied variables exhibit non-parametric relationships and are influenced by multiple factors, which limits the generalizability of findings to all community kitchens. However, this does not undermine the validity of the results. Future studies should expand the sample, incorporate additional food environment variables, and enhance understanding of CFEs and their relationship with malnutrition in children and adolescents.

CONCLUSION

This study aimed to analyze the association between characteristics of community food environments (CFEs) and the prevalence of malnutrition among children and adolescents attending community kitchens in the Patagonia, NEA, and NOA regions. Significant associations were identified between food environment features and various forms of childhood malnutrition. Environmental variables such as NDVI, NDBI, and proximity to health services, along with structural factors including access to water, education, and food insecurity, were shown to influence the nutritional patterns observed. It is essential to address health and disease processes from a holistic perspective, acknowledging the close relationship between nutritional status and the surrounding environment. The application of tools such as geomatics is crucial for evaluating the impact of health policies and programs and for better understanding how the social determinants of health influence communities, thereby enabling a more effective approach to nutrition-related challenges.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS (IN ACCORDANCE WITH CREDIT)

CMN: Conceptualization, Investigation, Methodology, Writing – Review & Editing, Visualization.

MRE: Data Curation, Software, Formal Analysis, Writing.

AT: Data Curation, Software, Formal Analysis, Writing.

PMP: Data Curation, Software, Formal Analysis, Writing.

TGD: Data Curation, Software, Methodology, Formal Analysis, Writing – Review & Editing.

SCM: Resources, Conceptualization, Investigation, Methodology, Formal Analysis, Writing – Review & Editing, Visualization.

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