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SPACES OF OBESITY: [1]

EXPLORING CLUSTERS OF CHILDHOOD OBESITY, RESIDENTIAL SEGREGATION, AND FOOD ENVIRONMENT IN THE METROPOLITAN AREA OF SANTIAGO, CHILE

ESPACIOS DE OBESIDAD: EXPLORANDO CLÚSTERES DE OBESIDAD INFANTIL, SEGREGACIÓN RESIDENCIAL Y AMBIENTE ALIMENTARIO EN EL ÁREA METROPOLITANA DE SANTIAGO, CHILE

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En 2018, el 50,9% de todos los niños chilenos medidos por el "Mapa nutricional" elaborado por el Ministerio de Educación fueron categorizados con sobrepeso u obesidad, lo cual es evidencia de las crecientes tasas de obesidad en América Latina. Los debates sobre el tema giran en torno a la tensión entre determinantes de agencia, como los hábitos de alimentación y ejercicio, y estructurales, apuntando a las correlaciones entre altos niveles de obesidad y pobreza. Sin embargo, existe también una dimensión territorial que se destaca especialmente en los casos con altos niveles de segregación residencial, como sucede en muchas ciudades latinoamericanas. Aquí hay potenciales clústeres de ambientes alimentarios más o menos obesogénicos, en los que se correlacionan el nivel socioeconómico, el estado nutricional del sector y la oferta alimentaria del lugar. En este artículo mapeamos las dimensiones espaciales de la obesidad infantil argumentando que la segregación del estado nutricional se superpone a la naturaleza de las desigualdades multidimensionales en las ciudades chilenas. El estudio se hizo mediante la organización y combinación de bases de datos públicas y técnicas de análisis espacial para crear mapas de diagnóstico. Los resultados muestran una tendencia hacia mayores tasas de obesidad a medida que disminuye el nivel socioeconómico del barrio, mientras que los entornos alimentarios varían según la disponibilidad de diferentes combinaciones de oferta (ferias libres, cantidad y tamaño de supermercado, canal tradicional) para cada nivel socioeconómico, lo que sugiere la existencia de diferentes tipos de entornos alimentarios. El trabajo concluye con reflexiones sobre cómo ha cambiado el contexto nutricional desde la pandemia de Covid19 y abre una discusión sobre el rol en la planificación urbana en la creación de las condiciones de (in)equidad nutricional.

Palabras clave: Obesidad infantil, desigualdad nutricional, segregación urbana

In 2018, 50.9% of all Chilean children, measured by the "Nutritional Map" of the Ministry of Education, were categorized as overweight or obese, which is evidence of rising obesity rates in Latin America. Discussions on the subject revolve around the tension between agency-determining factors, such as eating and exercise habits, and structural ones, pointing to the correlations between high levels of obesity and poverty. However, there is also a territorial dimension that stands out, especially in cases with high levels of residential segregation, as is the case in many Latin American cities. Here there are potential clusters of more or less obesogenic food environments, where the socioeconomic level, the nutritional status of the sector, and the food supply of the place are correlated. In this article, the spatial dimensions of childhood obesity are mapped, arguing that the segregation of nutritional status overlaps with the nature of multidimensional inequalities in Chilean cities. The study was done by organizing and combining public databases and spatial analysis techniques to create diagnostic maps. The results show a trend towards higher obesity rates as the socioeconomic level of the neighborhood decreases, while food environments vary according to the availability of different combinations of supply (street markets, quantity and size of supermarkets, traditional channels) for each socioeconomic level, suggesting the presence of different types of food environments. The paper concludes with reflections on how the nutritional context has changed since the Covid-19 pandemic and opens a discussion on the role of urban planning in creating nutritional (in)equity conditions.

Keywords: childhood obesity, nutritional inequity, urban segregation.

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I. INTRODUCTION

Childhood obesity, associated with a series of non-communicable diseases that reduce life expectancy and quality of life, is one of the greatest challenges for public health at a global level. Its prevalence has quadrupled in the last five decades[4] and in Chile, it is estimated that 50.9% of all girls and boys fall into one of the nutritional status categories defined as malnutrition due to excess: overweight, obesity, or morbid obesity (JUNAEB, 2019). Although obesity tends to be understood by public policies as an individual problem - a view that is reflected in programs such as Choose To Live Healthily (*Elige Vivir Sano*), whose focus is to provide guidelines on diet and physical activity -, the World Health Organization warns that obesity is conditioned by structural factors, especially in developing countries[5].

The nutritional situation in countries such as Chile, which have experienced rapid economic growth and food transition processes, is of particular concern (Popkin et al., 2006). This inequality in the global distribution of malnutrition due to excess is replicated at an intra-national level. From the biomedical and social sciences, an inverse correlation between socioeconomic status and childhood obesity has been observed, namely, girls and boys from families with fewer socioeconomic resources are more likely to be in the overweight categories (Salinas & Goldsmith Weil, 2020).

The objective of this work is to take the discussion on inequality in the distribution of childhood obesity to its spatial dimension by observing the case of Greater Santiago. Given the high levels of segregation in this city, the work started from the premise that in neighborhoods with residents of lower socioeconomic levels, there would be a higher rate of childhood obesity. To verify this, nutritional states, socioeconomic levels, and the food supply, expressed in their territorial dimensions, are organized and visualized. Then, the configurations that occur between the socio-economic conditions of the population, their access to the food supply, and nutritional states are explored, focusing on childhood obesity. Finally, the different food environments of Greater Santiago are identified.

The analysis was done by organizing and combining public databases and spatial analysis techniques, creating diagnostic maps that examine the food supply including, on one hand, street markets, supermarkets, and traditional channels, and on the other, the socioeconomic levels and body mass indexes of children, to then make an integrated analysis of their spatial expression.

The findings reinforce the conclusions of previous studies, regarding the existence of a trend towards higher obesity rates as socioeconomic status decreases, enriching these discussions when viewing the neighborhood scale. At the same time, it is possible to find variations regarding the combination of the food supply that is also organized by socioeconomic level, suggesting the existence of more and less obesogenic urban food environments. This research is concluded by making recommendations regarding urban planning that seek to reduce nutritional gaps.

II. STATE-OF-THE-ART

Although much of the debate on obesity in the public sphere focuses on its causes at an individual level, such as diet and healthy habits, the scientific community, on the contrary, conceptualizes it as a multidimensional phenomenon. There are multiple approaches contained in the specialized literature, which reveals the complexity that this phenomenon raises. A small sample of this is the study of obesity as a measurable biomedical problem (Azar et al., 2015; Celis-Morales et al., 2017; Mönckeberg & Muzzo, 2015), or, research that tracks changes in consumption patterns (Crovetto & Uauy, 2014; Llorca-Jaña et al., 2020) and lifestyle habits (Olivares et al., 2007; Pontigo et al., 2016). There is even a more critical line from social science that focuses on the cultural constructs of "fatness" (Radrigan & Orellana, 2016; Rothblum & Solovay, 2009).

An empirical look at an aggregate level, shows that, in practice, childhood obesity is associated with socioeconomic status and, at the population level, has behaviors that resemble that of a hereditary and potentially contagious condition. At an international and national level, there is a higher concentration of overweight people in sectors with a lower socioeconomic status (Dinsa et al., 2012; González-Zapata et al., 2017; Herrera et al., 2018; Martelet et al., 2018; Ranjit et al., 2015).

The similarity to a hereditary condition refers to the fact that, both in international studies and preliminary analyses in Chile, the mother's weight appears as the best predictor of childhood obesity (Davison & Birch, 2001; Guillaume et al., 1995; Oken, 2009; Parsons et al., 1999; Salinas & Goldsmith Weil, 2020; Whitaker et al., 1997). As for its behavior similar to that of a contagious condition, there is a spatial concentration of nutritional states. This has

4 World Health Organization 2023: https://www.who.int/es/health-topics/obesity#tab=tab_1
5 Idem

led to a classification of food environments categorizing as obesogenic those urban sectors with less access to healthy foods (Black et al., 2014; Booth et al., 2005; Camargo et al., 2019; Casey et al., 2014; Martínez-Espinosa, 2017; Morland et al., 2002; Nogueira et al., 2020).

Within this line, some studies analyze the effects of the type of commercial offer (González-Alejo et al., 2019) and, for the case of Chile, there are indications that shopping in street markets provides opportunities to consume fruit and vegetables at a lower price than in supermarkets (PASO, 2016; Silva et al., 2021).

Regarding the discussion on socioeconomic inequality, this includes a spatial dimension that evidences the high segmentation of many Latin American cities, in terms of the separation of social groups within them. This fragmentation in space is reproduced in an unequal distribution of services and opportunities aggravating the consequences of segregation for the vulnerable population (Borsdof, 2003; Massey & Denton, 1988; Sanhueza & Larrañaga, 2008). In Chilean cities, these processes have been accentuated in recent decades (Link & Fuentes, 2015; Rasse et al., 2015; Sabatini et al., 2010; Sabatini & Wormald, 2013). In the following analysis, the article seeks to build a bridge between findings on socioeconomic inequalities, nutritional states, and food environment for the case of Greater Santiago.

III. METHODOLOGY

Data used

Childhood Obesity: 2018 data obtained from JUNAEB from the "nutritional map" survey, which are biometric measurements applied in 1,169 public and subsidized schools out of a total of 1,508 establishments, i.e., they cover 77.5% of the establishments of Greater Santiago (57,816 measurements). They exclude the 224 paid private schools that cover 14.9% of the schools and that are concentrated in the sectors with the highest incomes. Data source: JUNAEB, Chile.

Household socioeconomic status (NSE, in Spanish): Socioeconomic classification of households with categories defined by the Association of Market Researchers (AIM Chile) based on data from the 2017 Population and Housing Census. The indicator by zone is calculated using methodological recommendations of the Chilean National Institute of Statistics. Data source: GfK Chile.

Food supply: Following the classification proposed by the Ministry of Health for food environments in Chile, the focus is paid to the "Supply Environment" (Gálvarez Espinoza et al., 2017) which here comprises supermarkets, traditional channels, and street markets. Restaurants (catering food environment), street or informal vendors (public food environment), institutional canteens (institutional and organizational food environment), and delivery services are not included.

- Supermarkets: The French National Institute of Statistics and Economic Studies (INSEE) defines supermarkets as non-specialized retail stores that make more than two-thirds of their turnover on the sale of food products[6]. In this analysis, the criteria for relevance in this category are two: i. Self-definition as supermarkets and ii. Having at least 150 m^2 of sales floor area[7]. Data source: GfK Chile.

- Traditional channel: neighborhood scale commerce with the sale of food products measured in their business amount. This includes grocers, butchers, delicatessens, greengrocers, and bakeries, although liquor stores and convenience stores are excluded. The latter are mostly chains, which have a supply mainly comprising prepared and ultra-processed meals intended for purchase and/or consumption on the go which were excluded from this analysis. Data source: GfK Chile.

- Street Markets: These are grouped in the National Trade Union Confederation of Organizations of Street, Flea, and Related Markets of Chile (ASOF C.G.) and the information about them is found in the databases of the Office of Agricultural Studies and Policies of the Ministry of Agriculture (ODEPA), which includes outreach (m) and days active in the week. Data source: ODEPA.

Data spatialization

Identification of territorial-socio-economic units. The analysis required the integration of territory-related data to explore spatial relationships between the three variables: child weight category, socio-economic conditions of the population, and their access to food supply. A geostatistical analysis was made to identify territorial units with similar socioeconomic levels. These allow a more accurate analysis than at a communal level, which is particularly complex in those communes with greater socio-economic heterogeneity. A geographical clustering process was made using the GeoDa software,

6 INSEE. Définitions, méthodes et qualité en: https://www.insee.fr/fr/metadonnees/definition/c1825 retrieved March 21, 2023
7 This second criterion was adopted in order not to consider small stores whose commercial name includes the word "supermarket".

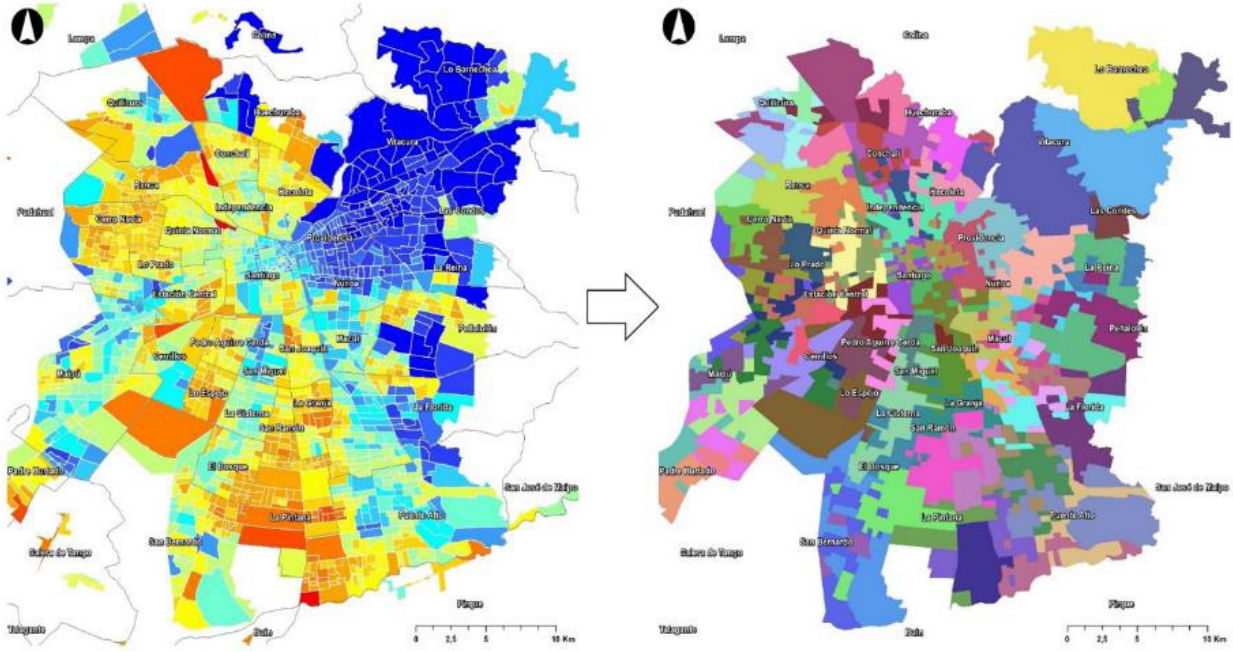

Figure 1. Spatial clustering. Source: Preparation by the authors.

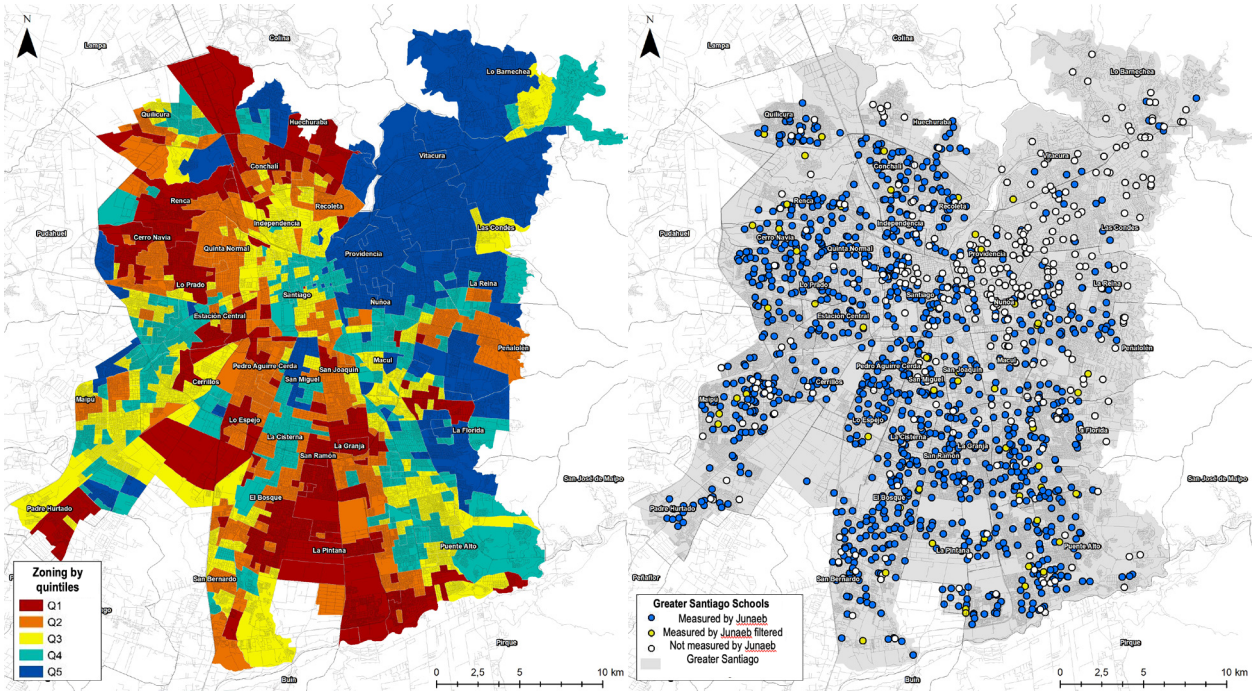

Figure 2: Map of quintiles by the average socioeconomic status of the area. Source: Preparation by the authors.
Figure 3: Coverage of the JUNAEB Nutritional Survey. Source: Preparation by the authors using JUNAEB data, 2019.

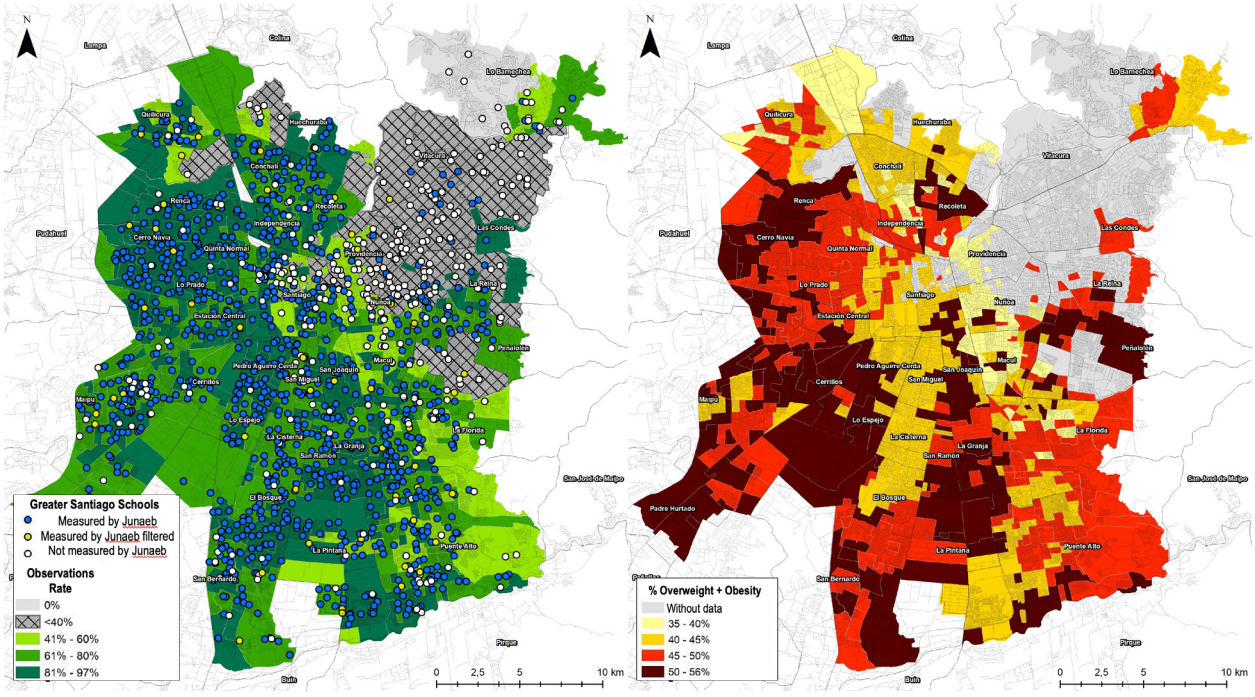

Figure 4: Observations rate by territorial-socioeconomic unit. Source: Preparation by the authors using JUNAEB data, 2019.
Figure 5: Percentage overweight + obesity by territorial-socioeconomic unit. Source: Preparation by the authors using JUNAEB data, 2019.

which allowed grouping areas by socioeconomic level and proximity, both equally weighted criteria (see Figure 1).

On the left, the socio-economic index prepared with geographical data from the national census is mapped for each block. These were grouped generating zones by socioeconomic level and proximity to each other. With this spatial clustering process, 80 territorial units of a similar socioeconomic level were generated. The child weight and food environment data were later mapped on these 80 territorial-socioeconomic units.

Each territorial-socioeconomic unit was assigned the average NSE of the households in the unit. Figure 2 graphs the territorial-socioeconomic units organized into NSE quintiles, where the first quintile (Q1) is the group with the lowest socioeconomic status. High levels of socio-economic segregation are observed in Greater Santiago.

Childhood obesity rate. The educational establishments were georeferenced using the Ministry of Education's geographical database, through their database number (RBD, in Spanish) as a binding field, and then transferred to their spatial dimension (Figure 3).

In Figure 3, all the educational establishments of Greater Santiago (circles) are included. The blues and yellows are those included in the JUNAEB (2019), nutritional list, the blues are those where at least three measurements are available at a Year 1 level, and the yellows, are those with two or less. From the 57,816 measurements, those from establishments with less than three measurements at the elementary school level were excluded, considering that mapping this IMC as an average of the area would skew the results randomly (Figure 2).

56 schools were filtered, leaving 1,113 (4.8% less) and a total of 57,741 students (0.13% less). As can be seen on the map (Figure 3), these seem to have a heterogeneous distribution throughout the city, which leads to thinking that their exclusion does not bias the results.

In Figure 4, the coverage of observations is mapped by territorial-socioeconomic unit. As can be seen, some sectors of the city's eastern quadrant have a larger unmeasured child population, who mainly are students from private schools. Given their level of concentration, it is considered that the assignment of the measurement's average IMC would not be representative of the territory and would generate a systematic distortion of the results. Therefore, the territorial-socioeconomic

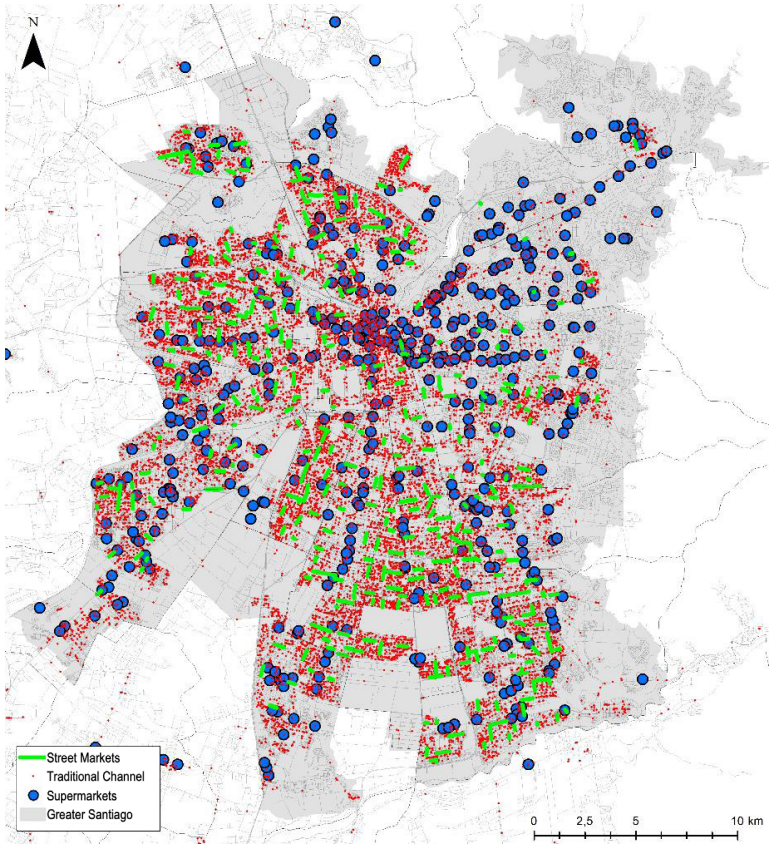

FigurE 6: Food supply by type of commercial establishment. Source: Preparation by the authors.

units where a coverage percentage of less than 40% is reached, are filtered. With this criterion, seven of the eighty territorial-socioeconomic units (12.5%) are classified as "without data for IMC". For those territories with a measurement coverage above 40% (87.5% of Greater Santiago), it is deemed that with the measurements there are, a trend can already be observed (Figure 5).

The four JUNAEB weight categories were reorganized into two categories: "overweight + obesity" which is the total of girls and boys in the categories of overweight, obesity, severe obesity, and "not overweight + obesity". The last one includes members of the normal weight and underweight categories. The infant overweight + obesity rate was estimated considering the total overweight-obesity compared to the total measured in schools for each territorial-socioeconomic unit.

Spatialization of the food supply

The supermarkets were mapped taking into account their location and size. Under the categorization of the French Institute of Self-Service, supermarkets over 2,500m^2 are called "hypermarkets" and it is estimated that, in general, their greater size does not mean only a greater food supply, but a greater offer of non-edible items. In order not to overestimate the effects of hypermarkets in terms of availability of food supply, in this analysis those stores that have a sales room greater than 2,500m^2 are counted as 2,500m^2 and, therefore, the total range is from 150-2,500m^2.

On the other hand, accessibility to street markets is mapped according to their linear meters by active days per week (7, 3, 2, or 1).

The food establishments are mapped in Figure 6, differentiating by type of supply (supermarket, street market, or traditional channel).

8 INSEE. Définitions, méthodes et qualité en: https://www.insee.fr/fr/metadonnees/definition/c1825 retrieved March 21, 2023

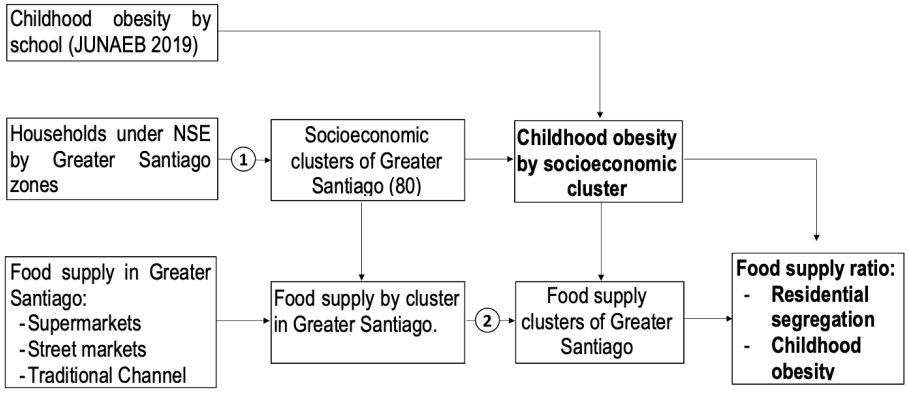

FigurE 7: Methodological flow of the analysis. Source: Preparation by the authors.

Data integration

Figure 7 shows the data spatial integration process. This process allows integrating data of children measured by schools in the same geographical scale, observing child weight by socioeconomic category of the sector, that is, from the socio-spatial dimension, to then be analyzed according to the supply. All supply data were standardized as "per 100,000 households" in their respective area.

In this second step (2 in Figure 7), the food supply configurations in the city are identified using the zoning made, creating a synthesis of typologies from a clustering of K-means with the supply indicators by sector. The latter will be discussed in the next section.

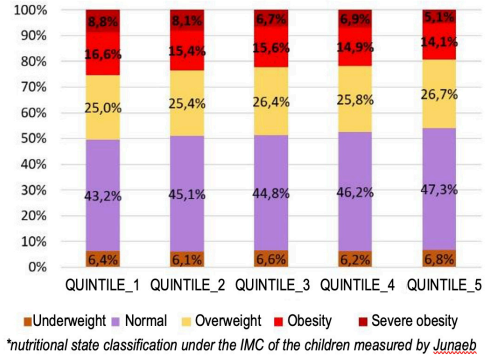

Figura 8. Nutritional classification in girls and boys in Year 1 by socioeconomic groups of their territorial unit-socioeconomic. Source: Preparation by the authors.

IV. RESULTS

This section, first of all, addresses the results in terms of NSE of the territorial unit and nutritional category and, secondly, presents a typology of food environments. In general terms, total childhood obesity decreases as the socioeconomic level of the sector increases.

Figure 8 groups all the available biometric measurements by NSE. The NSE measurement allocation was made using the average NSE of the territorial-socioeconomic unit where the educational establishment is located. It was seen that total childhood obesity is higher in the first quintile (lower income), with 25.4%[9]. At the same time, it was observed how the difference compared to severe obesity is accentuated for 40% of the lower socioeconomic status sectors (Q1- Q2), where it is 8.8% and 8.1% respectively.

Preliminarily, densely populated food environments[10] are observed, which do not give any reason to suspect there are environments with insufficient levels of access because of proximity to supply channels for healthy eating in Greater Santiago[11]. In the following figures (Figures 9, 10, and 11), the

9 For all the observations, there are statistically significant differences according to the Chi-square hypothesis test (X2).
10 The analysis of supply environments covers all of Greater Santiago, including those seven territorial-socioeconomic units where available biometric measures were insufficient for the analysis.
11 Sometimes referred to as "food deserts" in the specialized literature. See Cooksey-Stowers et al., 2017 to examine further about this term.

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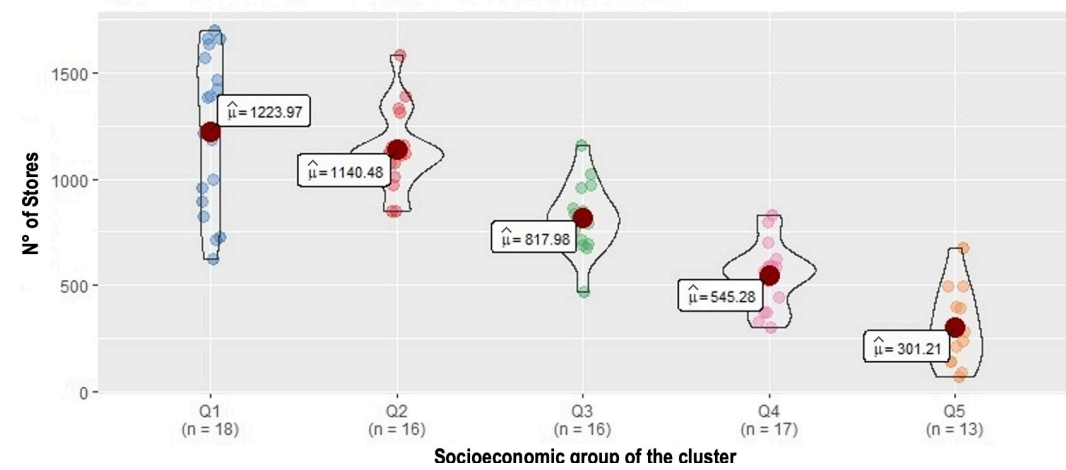

Figure 9: Traditional channel supply by territorial-socio-economic unit in Greater Santiago. Source: Preparation by the authors.

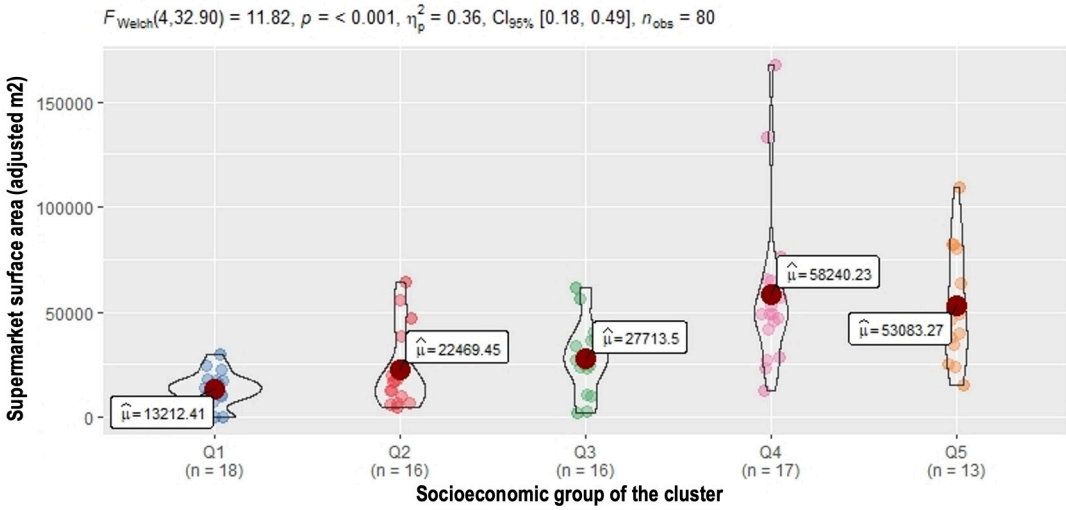

Figure 10: Supermarkets by territorial socio-economic unit of Greater Santiago. Source: Preparation by the authors with GFK data.

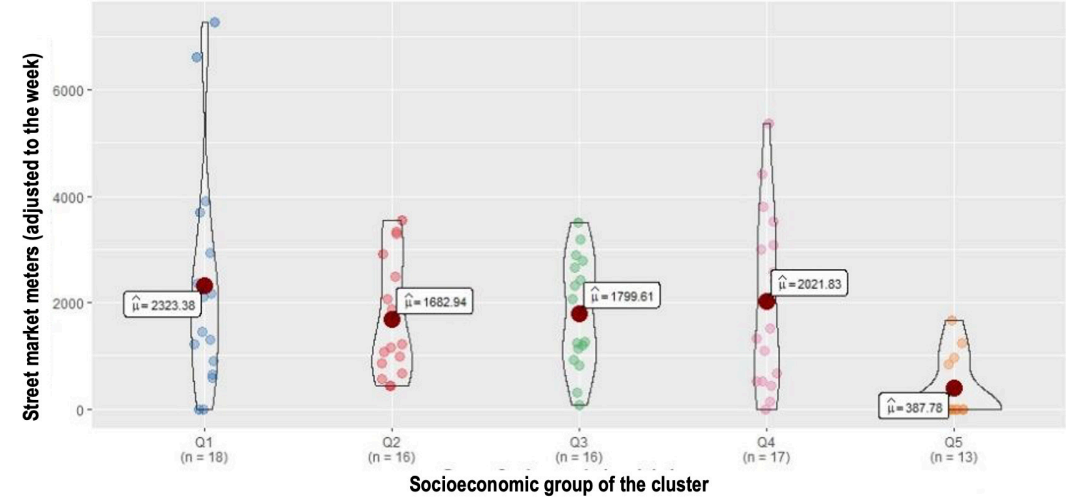

Figure 11: Street market by territorial-socioeconomic unit of Greater Santiago. Source: Preparation by the authors with GFK data.

	1	2	3	4	5	6
m2 of supermarkets per 100,000 households	40,720	14,934	23,729	136,685	5,207	45,130
n traditional channels per 100,000 households	677	1,416	926	670	1,052	340
m street markets per week per 100,000 households	3,244	2,364	926	1,265	6,944	507

Table 1. Average food supply grouped by cluster. Source: Preparation by the authors.

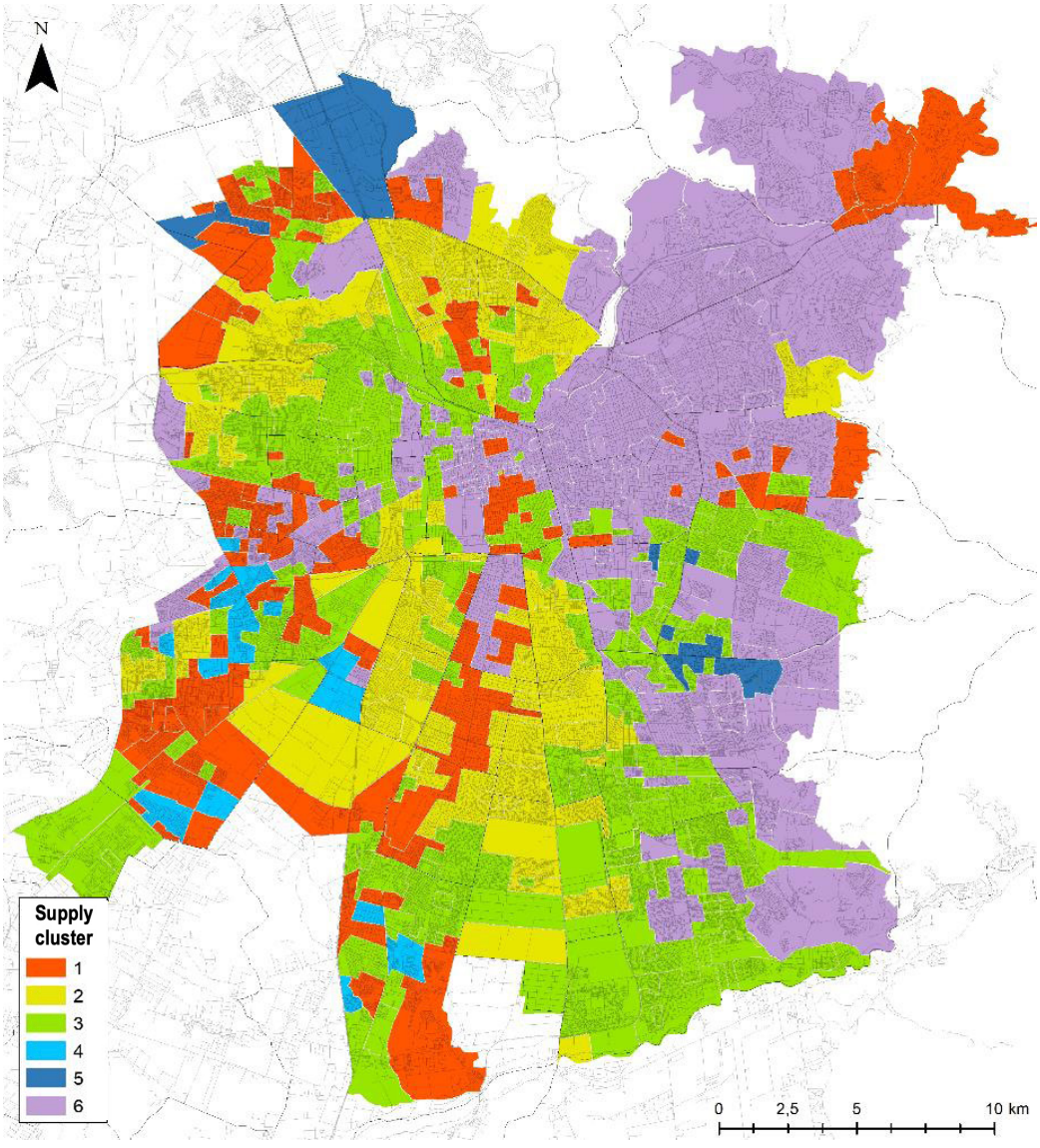

Figure 12. Map of food supply clusters in Greater Santiago. Source: Preparation by the authors.

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concentration of the type of commercial establishment by NSE of the territorial unit is seen.

A greater supply of traditional channel establishments at a lower socioeconomic level of the sector is seen.

The opposite happens with supermarkets, whose concentration increases the higher the NSE is, with cases that reach extreme values (*outliers*) associated with central areas and trade poles with a greater floating population.

Finally, the only visible trend in the street market layout is their noticeable decrease in Q5, the one with the highest revenues.

Food supply clusters

Using the territorial-socioeconomic units as case studies, it is seen that different types of food supply are found in the city (Table 1).

In Table 1, a range of food environments can be seen that includes well-supplied sectors with a varied supply mix (*type 1*) and sectors where one type of supply predominates, such as *type 2* for the traditional channel or *type 6* with supermarkets.

The geographical distribution of the food supply clusters (Figure 12) points to a relationship between the socioeconomic distribution and the predominant type of supply.

In Figure 12, it can be seen that in the high-income sectors, there is a greater offer of supermarkets and a low presence of traditional channels and street markets. There is an inverse configuration (low in supermarkets, high in street markets and traditional channels) in lower socioeconomic status sectors.

V. DISCUSSION

Through the analysis it can be verified that the inverse relationship between socioeconomic status and child weight (the higher the socioeconomic status, the lower the obesity rate) has a spatial dimension in Greater Santiago, forming in practice, a segregation between areas with a greater number of obese children and those where normal weight boys and girls predominate. This territorial link between NSE and childhood weight is, in turn, related to distinctive urban food environments that are characterized by varied combinations of the type of supply.

It should also be noted that the study has significant limitations that will be addressed in the following paragraphs. In terms of coverage, there is a spatial concentration of unmeasured (private) schools in the eastern quadrant of the city, particularly in the municipalities of Providencia, Las Condes, Lo Barnechea, Nuñoa, and Vitacura; which are those that concentrate the highest levels of wealth. That means that this study does not cover the *food environment-childhood weight* ratio for those sectors of these communes where the measured school population is less than 40% of the total. Studies with data from other sources such as the National Health Survey or the National Socio-Economic Characterization Survey (CASEN) allow having the expectation that, as a general trend, the *child weight-socioeconomic status* correlation would be maintained (Herrera et al., 2018) and, along with this, suggest the existence of a relationship between high educational achievements in mothers and lower rates of childhood obesity (Salinas & Goldsmith Weil, 2020).

The limitations of this analysis - regarding accessibility understood as proximity to three types of supply channels - are visualized by adopting a view from the specific aspects that build local realities. For example, in the municipalities of Recoleta and Pedro Aguirre Cerda, where the La Vega and Lo Valledor wholesale markets are located, there were fewer street markets. This cannot be interpreted as a lack of access to fruit and vegetables since, in practice, these mega-markets offer better access than a street market (greater variety of products, prices, and longer opening hours).

On the other hand, observing the specific local aspects of supermarkets reinforces the idea that the proximity link cannot be assumed mechanically. For example, the Plaza Oeste Mall, located in the commune of Cerrillos, includes many square meters of supermarkets and stores. However, its design primarily considers vehicle access, making it difficult for residents of the surrounding sector to visit, which are characterized as low-income neighborhoods with high obesity rates.

A third limitation is that the impact of proximity on food access varies for different socioeconomic groups. It is reasonable to think that the relative absence of street markets in high-income sectors does not result in less access to healthy food, since residents can use private transport to travel to other communes to shop at these or in wholesale markets. They also have the resources to buy at organic markets[12], use *delivery* services, or pay the prices in greengrocers and/or supermarkets. Possibly, the lack of local street markets in these territories is partially due to a preference to avoid negative externalities in public spaces, such as an increased flow of people, vehicular congestion, and the need to deal with waste generated by the market. At the same

12 To date, the authors have confirmed the existence of just two of these in greater Santiago, both in the eastern area of the capital. They are not in the map.

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time, although there is a greater presence of street markets in middle- and low-income sectors, the possibility of accessing this greater supply is conditioned by the purchasing power, financial liquidity, and availability of time (in limited market schedules) of residents to be able to buy them.

Similarly, the greater penetration of traditional channels in lower-income neighborhoods opens up multiple interpretations. These offer a mixture of ultra-processed products and healthy meals, presenting a variety limited by their infrastructure and usually at higher prices. In these sectors, mobility is a determining factor for accessing supply spaces, namely, proximity probably has a greater predictive power of access than in more affluent sectors.

The analysis presented in this article is a diagnosis before the Covid-19 pandemic. Since March 2020, one could talk about coexistence with the so-called obesity pandemic.

The negative effects of the health pandemic were not homogeneously distributed but were added to existing urban inequities, exacerbating gaps in socioeconomic status, gender, and between those who can and cannot do their jobs remotely (Zazo & Álvarez, 2020), as there were higher rates of contagion in sectors that live with greater overcrowding and worse outcomes in obese patients, both factors inversely correlated with NSE (Mena et al., 2016).

The sanitary measures imposed to prevent Covid-19's spread included long quarantines that made it difficult to maintain healthy environments for the most vulnerable sectors, both due to the loss of income and the conditions in which the lockdown had to be lived. There were temporary breaks in the fresh food supply chains and channels and adaptations in school meal programs, from prepared fresh foods to food boxes.

Overall, the Covid-19 pandemic revealed high degrees of precariousness in terms of food security and also the role of urban planning in contributing to nutritional segmentation. The street markets, although they are key to food security, are regularly set up precariously on urban structures that do not contemplate them in their design. In addition, during the emergency, they had fewer possibilities than supermarkets to control their capacities and maintain social distancing. At the same time, the food supply exhibited variable levels of vulnerability considering the different territories and road infrastructure.

VI. CONCLUSIONS

The case of Greater Santiago, with a delimited high-income sector to the city's northeast and low-income neighborhoods to the south and west, is expressive of significant differences in all the variables analyzed. It highlights that the areas with the highest prevalence of childhood obesity are segregated neighborhoods with low socioeconomic status. In turn, the presence and distribution of food supply categories vary according to these conditions and could constitute a fundamental factor for the analysis of opportunities to access healthy food in large cities.

Although this analysis of Greater Santiago does not identify causal mechanisms between the NSE supply and weight category, nor does it weigh the relative weight of the multiple determinants of childhood obesity, it does provide visibility of its spatial dimension that is linked to various elements of the city, looking further into the accessibility to food supply spaces. In this vein, the exploration of the relationship between proximity and access contributes to a reflection on the importance of urban space planning in generating healthy environments, with an emphasis on nutritional gaps.

In a macro-spatial analysis such as the one presented here, the items most purchased by local residents cannot be seen and, therefore, determine their likely effect on household supplies. In this way, this line of inquiry opens a series of questions about important aspects such as the management of food supplies, mobility practices for shopping, criteria when shopping, culinary knowledge, and the time available for preparations and if healthier ones fit the preferences of children, how tasks and food are distributed among family members, among others, which can only be solved by complementing with another type of research.

VII. BIBLIOGRAPHIC REFERENCES

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