Obesity and overweight in the context of poverty, high and very high rural marginalization in Mexico. An analysis of the impact of school breakfasts on the population ages 5 to 11 based on ENSANUT results (2012-2016).

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Abstract.

The National Health and Nutrition Survey (ENSANUT 2016) reveals a slight, statistically insignificant drop of 1.2% in the combined prevalence of overweight and obesity in Mexicans ages 5 to 11, in the period 2012-2016. This prevalence is compounded by a high incidence of these problems in children living in poverty in rural areas with high and very high marginalization. This paper explores the impact of the School Breakfast Program (SBP) on the persistence of this phenomenon. The empirical analysis is based on a Propensity Score Matching Model (PSM), drawing on data published by ENSANUT 2012 and 2016. The results, presented here, contribute to the debate on the efficiency of this type of food policy in rural contexts with high and very high marginalization.

Key words: overweight and childhood obesity, poverty and rural marginalization, school breakfasts, impact assessment, Mexico.

Introduction.

Obesity and overweight are epidemic diseases caused by multiple factors, several of which have their origin in childhood. Some studies on this phenomenon show evidence of depressive and anxiety disorders in the child population, caused by dissatisfaction with body image and low self-esteem (Shamah-Levy, Cueva-Nasu, and others 2018).

Likewise, ENSANUT data (2016) reveal a mixed effect on the reduction of overweight and obesity in the Mexican population, ages 5 to 11, from 34.4% in 2012 to 33.2% in 2016. However, this is not statistically significant. There is a high incidence of these conditions among children living in poor households in the country.

In Mexico, one of the strategies for attending the population in a situation of vulnerability is the SBP.

Although school breakfasts can have an indirect effect on maintaining or improving the nutritional status of the child population, evidence shows that this type of feeding system may trigger overweight and obesity in adulthood (Ramírez López et al., 2005, Shamah-Levy and Morales-Ruán 2006, St-Onge, Keller and Heymsfield 2003). This situation is due to the lack of knowledge of the nutritional requirements of the children they serve, and the type of food offered to children in school menus.

In this respect, this article examines the impact of the SBP on the prevalence of overweight and obesity in the child population living in poor households. The document has five sections. The first examines the factors that trigger childhood obesity and overweight, while the second explores the phenomenon under study, within the context of poverty (high and very high rural marginalization in Mexico). The third presents the background and main components of the SBP currently operating in Mexico. Lastly, estimates and results are given, together with the conclusions and public policy recommendations.

Obesity and childhood overweight triggers.

Obesity and overweight are epidemic diseases due to multiple factors, several of which have their roots in childhood (Figueroa-Pedraza 2009, Shamah-Levy, Cueva-Nasu, et al. 2018). The World Health Organization (WHO) defines both conditions as an abnormal or excessive accumulation of fat, which can be harmful to health, both physical (WHO 2019) and emotional (Puhl and Latner 2007). In their origin, these conditions involve genetic and environmental factors, which can trigger metabolic alterations (Cecchini et al. 2010, Mitchell, Catenacci and Wyatt 2011). Both disorders significantly increase the risk of chronic non-communicable diseases (NCD) and premature mortality, as well as reducing the quality of life of individuals suffering from them (Centers for Disease Control and Prevention 2019). They also increase the social cost of health (Hussain and Bloom 2011, Waters and DeVol 2016).

In adults, body mass index (BMI) is the most commonly used indicator to determine whether a person's weight and body fat mass are healthy in relation to their height. It is calculated by dividing the person's weight in kilograms by the square of their height in meters (kg/m^2). In the case of children, it is also necessary to take their age into account to determine overweight and obesity.

Thus, in the child population, overweight occurs when, according to age and sex, the BMI exceeds the median established in the WHO growth patterns by at least one standard deviation; while obesity exists when the index registers two or more typical deviations above that same parameter (OMS 2019).

According to WHO, the energy imbalance between calories consumed and spent is the main cause of overweight and obesity. Since the 1990s, there has been an upward trend in the intake of ultra-processed, high-calorie and micronutrient-poor foods, which generally cost less, but also have lower quality nutrients (Aggarwal, Monsivais and Drewnowski 2012, Goryakin et al. 2015).

The change in eating habits, accompanied by a lower level of physical activity caused by increasingly sedentary forms of work; new modes of transport; and increasing urbanization, have led to a rapid increase in overweight and obesity (WHO 2019). According to projections by the Organization for Economic Cooperation and Development (OECD), one in two adults and one in six children will be overweight or obese by 2030 (OECD 2019).

It is currently estimated that approximately 43 million children under five are obese or overweight worldwide. According to some authors, if this trend continues, levels of obesity in the child and adolescent population will exceed those of low or moderate weight by 2022 (OMS 2019).

Various studies, such as those by Jiménez-Cruz, Bacardi-Gascon, Castillo-Ruiz et al. (2010), and Jones-Smith, Dieckmann, Gottlieb, & Chow (2014), support the hypothesis that in high- and middle-income countries, socioeconomic factors such as educational attainment, urban residence and in particular family income level, are inversely related to childhood overweight and obesity. In recent years, however, in the group ages 5 to 11, obesity and overweight rates have slowed and are even tending to stagnate (WHO 2016).

Conversely, in low- and middle-income countries, such as those in Latin America, overweight and obesity rates in children and adolescents have risen in the past three decades to such an extent that 20 to 25% of the youth population is overweight or obese (de Onis 2015).

Today, many low and middle-income countries are coping with a "double burden" of morbidity (Zheng, Zhen and An 2017, Trabulsi and others 2016). On the one hand, they are facing problems of infectious diseases and child malnutrition while on the other, they are experiencing an increase in risk factors for noncommunicable diseases, such as obesity and overweight (Anzman-Frasca et al. 2015). It has been inferred that changes in morbidity may be associated with increased consumption of high-calorie foods, especially carbohydrates, which increase weight and affect a person's health status (Freely, Pettiflor and Norris 2009) (Gupta et al. 2012).

In Mexico, approximately 50% of the population live in a condition of poverty or vulnerability (CONEVAL 2017) and are undergoing a process of nutritional transition, in which problems of malnutrition and infectious diseases coexist with the profile of obesity and overweight characterizing industrialized nations (Barquera, Campo and Rivera 2013, Bustos et al. 2009, García et al. 2017)

Data published by ENSANUT (2016, 2012) indicate that high levels of malnutrition and anemia remain. In the 5 to 14 age group, chronic malnutrition is 7.25% in urban populations, doubling in rural areas (UNICEF Mexico 2019) whereas, at the individual level, the prevalence of anemia in children ages 5 to 11 years is 2.9%. At the same time, there is an increase in the prevalence of overweight and obesity among the population, especially in children's age groups (Kroker-Lobos et al., Rosas et al. 2011). Although this prevalence has declined in recent years from 34.4% in 2016 to 33.2% in 2012 (1.2%), this decrease is not statistically significant.

Overweight in childhood involves a higher likelihood of presenting obesity in adulthood and therefore a greater risk of suffering from cardiovascular diseases, diabetes mellitus and other disabling diseases that prevent the insertion into the workforce and labor mobility of those suffering from them (Sahoo et al. 2015).

Likewise, overweight and childhood obesity are closely linked to eating habits (García et al. 2017) as well as patterns of limited physical activity in children (Gómez et al. 2012). The latter is derived from urbanization and digitalization processes that occur not only in Mexico, but globally, which translates into sedentary lifestyles (Martínez-Munguía and Navarro-Contreras 2014).

Moreover, overweight and obesity reduce children's opportunities to participate in group physical activities, which predisposes them to a more significant increase in weight and body mass (Costarelli and Manios), as well as depressive and anxiety disorders, caused by

dissatisfaction with body image and low self-esteem (Figueroa-Pedraza 2009, Pajuelo-Ramírez and others 2011, Shamah-Levy, Cueva-Nasu et al. 2018).

Nevertheless, overweight and obesity can be prevented, because although the exact composition of a varied, balanced and healthy diet is determined by the characteristics of each individual (age, sex and lifestyle habits that include body mobility), the socio-economic context in which children are raised tends to be a significant factor in explaining these conditions (Leiner et al. 2016, Rosas et al. 2011). Accordingly, the creation of favorable environments that make it possible to influence people's choices is essential, so that the available, affordable option is also the healthiest (Hawkes, Jewell and Allen 2013).
In this respect, the hypothesis that establishes a positive relationship between obesity and overweight and economic well-being has ceased to be valid. Several studies, undertaken in different poverty contexts, indicate a high correlation between obesity in adulthood and episodes of malnutrition at an early age, and even during intrauterine life (Figueroa-Pedraza 2009, 04). In the urban peripheries of Latin American countries, it is common to find poor households, where an obese parent (with a history of malnutrition in childhood) coexists with children with internal parasites, with frequent infectious processes and stunted growth. (Peña y Bacallao 2001, Uauy y Brevis 2001). This situation lends credence to the idea that considering obesity as the opposite of malnutrition and associated with opulence, is not only wrong but can also have negative consequences on public policy design for addressing nutritional problems (Figueroa-Pedraza 2009, 108).

Obesity and overweight in the context of poverty, high and very high rural marginalization in Mexico.

The nutritional status of an individual may be influenced by their place of residence. Within the Mexican rural area, defined by INEGI (2011) as localities with a population of fewer than 2,500 inhabitants, the combination of poverty and poor diet – caused by the intense penetration of "junk food" (cheap food with little nutritional value, high in salt and fat) – coupled with the absence of adequate nutritional health policies are wreaking havoc on the population.

According to the "malnutrition clock" (Avila Curiel et al. 2007), it is estimated that approximately half a million Mexican children, the majority of whom live in highly marginalized rural areas in the south-southeast of Mexico, suffer some degree of malnutrition. This situation is exacerbated by the fact that a poorly nourished child population is at a high risk of becoming obese or overweight when it reaches adulthood.

In Mexico, poverty is understood as a multidimensional phenomenon, related to the inability of people to exercise their social rights to access to a source of income, education, health, social security, food, basic housing services, and quality housing spaces (CONEVAL 2017). For its part, marginalization is also a multidimensional concept expressed territorially rather than individually. In other words, it is defined as a structural phenomenon, whose causes and effects go beyond individual decisions, and which highlights deficiencies in infrastructure, primal services, education and health (CONAPO 2012).

In terms of measurement, there are also significant differences between the two concepts. Whereas in the case of poverty, the household is used as a reference, in the marginalization index, the unit of analysis is geopolitical or territorial spaces, the smallest of which is the locality. (CONAPO 2012, Bustos 2011). The marginalization index considers four dimensions of analysis and identifies nine forms of exclusion, through which the percentage

of the population that lacks access to essential services, such as education, housing, spatial distribution and a work income of up to two minimum wages (CONAPO 2012). Five degrees of marginalization can be drawn from the conglomerate of this information: very high, high, medium, low, and very low.

Although it is estimated that 68.6% of the 53.4 million people living in poverty live in urban areas, the intensity of the phenomenon is exacerbated in the rural context. Although only a quarter of the population in Mexico lives in rural areas, approximately 75% of them face extreme conditions of shortages (CONEVAL 2017). In the specific case of food poverty, it is estimated that 20.1% of the population in Mexico currently have food insecurity (24 million people), 24.7% of which live in rural areas. (CONEVAL 2017, CONEVAL 2019).

At present, 886 municipalities have high and 365 very high marginalization. A total of 14% of the population in Mexico live in these municipalities (16 million people), the majority being located in the mountain areas of federal states in the south-southeast zone of the country (Senado de la República. Comisión Especial de Zonas Marginadas 2018). It is important to note that the marginalization index tends to be used by the Mexican government for the development and implementation of social programs (Bustos 2011).

Accordingly, within the rural sphere, the right to food does not only depend on monetary income and individual conditions of poverty. A balanced diet is also related to effective physical access to quality inputs. Within the context of high and very high marginalization, the most isolated populations lack various points of sale, roads, and transport that would allow them to access them (Sedibe et al. 2014).

Similarly, spatial dispersion makes it impossible to have access to appropriate medical and hospital services, which would enable them to prevent, diagnose, and treat any chronic noncommunicable condition promptly. As a result, the risk of obesity and overweight is exacerbated in rural areas with high marginalization (70,000 locations in Mexico) (CONAPO 2012).

Therefore, and without ignoring the multifactorial nature of overweight and obesity, individual responsibility for nutritional status can only have full effect if people have access to adequate health and nutrition conditions. Thus, the sustained implementation of appropriate food policies is vital for the population living in poverty in rural areas.

Background of the School Breakfast Program.

The right to food is inherent in every human being. In Mexico, this right is recognized in Article Four of the Mexican Political Constitution. According to the Constitution, the three levels of government (federal, state and municipal) are the guarantors of supporting the nutrition of children in conditions of vulnerability and ensuring that they attend official primary education schools located in areas with high marginalization, particularly those in rural settings (Seguridad Alimentaria y Nutricional (SAN) 2019).

Consequently, for several decades, the National System for Integral Family Development (SNDIF), implemented the SBP, designed to improve the nutritional status of children at public schools living in conditions of vulnerability and thus prevent school dropout.

However, and even though the SBP is one of the programs with the highest national coverage (16.9%) (Morales-Ruán et al. 2018), there are an increasing number of cases of

malnutrition among children of school age coexisting with others with overweight and obesity. This raises the question of the unintended consequences of the program since it seems that rather than solving the problem of malnutrition, there are increasing cases of children ages 5 to 11 with excess body weight.

In response, the SBP has attempted to enhance the quality of its menus, so its design is underpinned by nutritional quality criteria (CCN), based on NOM-043-SSA2-2012, Servicios Básicos de Salud. Promoción y educación para la Salud en materia alimentaria. Criterios para Brindar Orientación (DOF 2013). Since 2011, these criteria have been complemented by the "General guidelines for the sale or distribution of food and beverages in schools for consumption at basic education schools" (Secretaría de Salud 2014). Besides, hot as well as cold breakfasts are now served. This is because hot breakfasts can be more varied and make it easier to incorporate other food groups that enrich the provision of the macro and micronutrients children receive.

It is estimated that 5.6 million school breakfasts are distributed daily (with 24% being delivered in rural areas of the country), through the SNDIF, for consumption within preschool and primary education centers, throughout the school year. These constitute approximately 30% of the energy and protein intake of children's daily diet (SNDIF 2019, Cuevas-Nasu and others 2009, S632).

General Nutrition Quality Criteria (NQC) for the preparation of school breakfasts.

According to NOM-043-SSA2-2012, school breakfasts must include three food groups: i) vegetables and fruit; ii) cereals (or their derivatives, but made with whole grains or from whole-wheat flour); iii) legumes (such as beans, lentils, beans, chickpeas and peas); and/or foods of animal origin such as milk (without flavoring, or caloric and non-caloric sweeteners), and their derivatives; as well as other inputs that help promote good eating habits, such as: nixtamalized tortilla, silversides and sardines (DOF 2013, SNDIF 2019, 39).

It should be noted that the "Guidelines of the Comprehensive Food Aid Strategy," stipulate that school breakfasts should not contain foods that are a significant source of sugars, fats, sodium, and/or refined flours (such as honey and syrups, jam and fruit in syrup); or which resemble sweets, snacks, sweets or desserts (SNDIF 2019, 98). Likewise, it is estimated that whether it is served hot or cold, this meal must constitute 25% of the total daily kilocalories; in other words, an average of 360 kcal, given that the population served is between the ages of 5 and 11.

Cold breakfasts.

Cold school breakfasts consist of: a) skimmed milk (semi-skimmed or whole milk, for preschoolers living in areas with widespread malnutrition) (WHO/FAO 2003) b) wholegrain cereal; c) and fresh or dried fruit.

In the case of whole-grain cereal, in addition to being made from whole grains or whole-wheat flour, it must be shaped like a cookie or bar. Table 1 describes the characteristics of the portion and nutritional criteria this food must-have.

Table 1: Portion and ingredients for whole grains contained in school breakfasts (cold mode).

Portion	30 grams
Fiber	Minimum of 1.8 grams (<10% of RDI)
Sugars	A maximum of 20% of the total calories of input [a/]
Total fats	A maximum of 35% of the total calories of input [a/]
Saturated fats	A maximum of 10% of the total calories of input [a/]
Trans fatty acids	Maximum of 0.5 grams
Sodium	Maximum of 120 milligrams [b]

a / Sodium fiber criteria in relation to a 30 g serving of whole-grain cereal.
b / General labeling specifications for pre-packaged food and non-alcoholic beverages. Commercial and health information (DOF 2010)
Source: Adapted from Lineamientos de la Estrategia Integral de Asistencia Social Alimentaria (SNDIF 2019).

Fresh or dried fruit must be served without added sugar, fat or salt. Dried fruit must be served in 20-gram rations and may be combined with oilseeds (such as peanuts, almonds, nuts, and sunflower seeds). The above applies provided fruit is the main ingredient, and a maximum of 20 grams of these seeds are added (Seguridad Alimentaria y Nutricional (SAN) 2019).

Likewise, five different menus must be designed for each week and children should be encouraged to eat breakfast at school at the beginning of school activities to ensure that they are the ones who actually eat it; in addition to facilitating the monitoring of acceptance by the beneficiaries (ibid.).

Hot breakfasts.

About the program guidelines, hot school breakfasts must meet the same NQC as cold ones. To this end, each entity responsible for the program at the state level must design at least twenty menus, so that every week of the month, and every day of the week, beneficiaries receive different foods (Seguridad Alimentaria y Nutricional (SAN) 2019).

In terms of nutritional calculation, it is established that menus can be designed with formulas defined for this purpose, which requires the specialized knowledge of a nutritionist. Accordingly, the program guidelines are presented in the form of a table with the percentage of suggested energy to be covered by breakfast, the percentage of energy that the different macronutrients (carbohydrates, proteins, and fats) should provide, as well as the maximum amounts of saturated fat, added sugars, sodium and the minimum amount of fiber each serving should have. Table 2 gives caloric and input calculation suggestions for designing hot school breakfast menus.

Table 2: Nutritional calculation for designing hot school breakfasts

Population group	Daily energy requirement (kcal/day)	Energy corresponding to breakfast (kcal) (25% of total kcal)	Carbohydrates (% kcal)	Sugars Additives (g)	Fiber (g)	Protein (% kcal)	Total fats (% kcal)	Saturated Fat (% Kcal)	Sodium c / (mg)
Preschool	1300	325	60%	5	5. 4 c/	15%	25%	10%	360 c/
School	1579	395							
Average	1440	360							

c / 30% of Recommended Daily Intake (IDR).
Source: Lineamientos de la Estrategia Integral de Asistencia Social Alimentaria 2019 (SNDIF 2019)

Moreover, it is estimated that the SBP has an indirect effect on maintaining the nutritional status of the child population, which has a positive impact on their cognitive development, and reduces malnutrition and anemia (Córdoba, Luengo and García 2014) (Segura-Pérez, Grajeda and Pérez-Escamilla 2016). However, an inappropriate strategy in menu designs, or, failures in their provision, may have unintended effects on the population served, such as the development of overweight and obesity (Barrios L., and others 2013) (Kimbro and Rigby 2010). The prevalence of either of these conditions could affect the adult life of children, affecting their health conditions and inhibiting their chances of future access to the labor market.

Estimate and Results.

This part is divided into three sections: the first part describes the set of information used, the second presents the estimation method and the third shows the results and their interpretation.

Data.

The information source is microdata from ENSANUT 2012 and 2016 (Instituto Nacional de Salud Pública 2012, 2016). ENSANUT has national representativeness and several surveys have been conducted since 2000, with 2012 and 2016 being the most recent. The objective of ENSANUT is to gather information on the health conditions of Mexican households since it is part of the National System of Health Surveys, which began operating in 1986. It also provides information on certain occupational and sociodemographic characteristics of household members, as well as housing infrastructure typologies (Instituto Nacional de Salud Pública 2016).

This study identifies infants ages 5 to 11, who correspond to the rural sector and have been cataloged in locations with high and very high marginalization, according to the census index of 2010, reported by CONAPO (2010). Within that classification, the treatment group (343 observations) is defined as children who received the support of school breakfasts (whether cold or hot), while the control group (504 observations) comprises those who did not receive this support (see Table 3).

Table 3. Descriptive statistics for treatment and control groups.

Variable	Treatment		Control	
	Mean	Standard Deviation	Mean	Standard Deviation
Age	37.78	10.65	37.02	9.99
Gender	0.66	0.48	0.67	0.47
Education	5.58	3.89	5.63	4.39
Couple	0.84	0.37	0.89	0.31
South	0.53	0.50	0.46	0.49
Language	0.30	0.46	0.27	0.44
Members	5.01	1.59	4.76	1.51
Old	7.96	1.98	7.98	1.97
Girl	0.54	0.49	0.50	0.51
School	2.96	1.84	2.98	1.62
High	0.89	0.32	0.88	0.31

Source: Compiled by the authors using data from ENSANUT 2012 and 2016.

Specifically, the following observable characteristics were considered for each of the children in the control and treatment groups:

a) The number of household members (Members).
b) Dummy variable to distinguish individuals from the south of the country (South), zero if otherwise.
c) Dummy variable with a value of one, if the head of household is married or living together (Couple), zero if otherwise.
d) The number of years of education of the head of household (Education).
e) Dummy variable to identify the female sex of the head of household (Gender) as one, with zero for other cases.
f) Dummy variable with a value of one, if the head of the household speaks an indigenous language (Language), zero if otherwise.
g) Age of head of household (Age).
h) Age of child (Old)
i) Variable dummy with a value of one, if the child is a girl (Girl), zero if otherwise.
j) Number of years of schooling of the child (School)
k) Dummy variable with a value of one, if the household has high marginalization (*High*), zero if otherwise.

Table 3 shows that, on average, household heads of rural households, with high and very high marginalization in the control and treatment groups, are women, who are usually married or living together. Likewise, these households are more commonly found in the south of the country, with several social backwardness with barely four years of elementary school and an average age of 37. These characteristics are similar between the two groups, making it easier to comply with the assumption of independence to implement the Propensity Score Matching (PSM) procedure.

Methodology:

For the impact evaluation, the PSM model was used, which makes it possible to obtain a control group with observable characteristics similar to those of the treatment group. Once these groups are obtained, the mean differences between the two are estimated, considering the response variables which, in this case, are binary variables that indicate whether a child is overweight or obese, according to WHO (2016). Moreover, the relative frequency of consumption of fruits, vegetables, meats, dairy products, sugary drinks, water and snacks, sweets, and desserts is also taken as a response variable.

The estimation method is PSM, developed by Rosenbaum and Rubin (1983). The objective is to calculate the Average Treatment Effect on Treated (ATT) of the PDE, according to ENSANUT 2012 and 2016, on the beneficiaries in those years.

Formally:

$$ATT = E_{p(X_i)|T_i=1}\{E[Y_{(i)1}|T_i = 1, p(X_i)] - E[Y_{(i)0}|T_i = 0, p(X_i)]\} \quad (1)$$

Where T_i is a binary variable indicating the treatment group, $p(X_i) = P[T_i = 1|X_i]$ is the PSM of observation i, X_i is the vector of observable characteristics of individual i, $Y_{(i)1}$ is the outcome of the treatment group and $Y_{(i)0}$ is the outcome of the control group, which was matched with the treatment group, according to PSM (Imbens, 2014).

Results.

The ATT estimator of the equation (1) is calculated using four different procedures: nearest neighbor (NB), stratification (ST), kernel (KL), and caliper (CA) (Becker and Ichino 2002; Imbens 2014).

Table 4 shows the estimation of the ATT, under the procedures indicated in Becker and Ichino, 2002 and matching, between the control group and the treatment group. One can see that the effect of the program is not significant for the obesity variable and that there is a positive effect of 7.2% on the likelihood of a child's becoming overweight. Likewise, there is evidence that participation in the program increases the weekly probability of eating fruit (10.6%), vegetables (6.3%), sugary drinks (5.2%), dairy products (3.5%) and snacks, sweets and desserts (2.8%). By contrast, there are no significant differences in the relative frequency of water or meat intake.

Table 4. Estimation of Average Effect of Treatment on the Treated (ATT).

Variable	Method	ATT	Standard Deviation	t-statistic
Overweight**	ST	0.072	0.032	2.242
	NB	0.077	0.040	1.926
	KL	0.069	0.033	2.058
	CA	0.071	0.059	1.194
Obesity	ST	0.007	0.025	0.269
	NB	0.004	0.035	0.126
	KL	0.000	0.023	0.019
	CA	0.107	0.075	1.424
Fruit***	ST	0.106	0.029	3.655

	NB	0.066	0.032	2.063
	KL	0.023	0.011	2.091
	CA	0.071	0.031	2.254
Vegetables***	ST	0.063	0.021	2.925
	NB	0.080	0.030	2.681
	KL	0.064	0.021	2.980
	CA	0.097	0.055	1.763
Sugary drinks*	ST	0.052	0.031	1.693
	NB	0.049	0.025	1.961
	KL	0.060	0.032	1.862
	CA	0.057	0.029	1.923
Dairy products*	ST	0.035	0.021	1.779
	NB	0.039	0.023	1.695
	KL	0.033	0.018	1.775
	CA	0.019	0.010	1.900
Meats	ST	0.001	0.014	0.092
	NB	0.003	0.025	0.130
	KL	0.005	0.057	0.090
	CA	0.001	0.016	0.048
Water	ST	0.181	0.195	0.154
	NB	0.163	0.128	1.267
	KL	0.181	0.940	0.193
	CA	0.011	0.371	0.029
Snacks, candies and desserts **	ST	0.028	0.013	2.153
	NB	0.040	0.024	1.667
	KL	0.033	0.015	2.142
	CA	0.028	0.012	2.295

*:10% significance level. **: 5% significance level. ***:1% significance level.
Source: Compiled by the author.

Conclusions

For over a decade, the World Health Organization has declared obesity and overweight as one of the most relevant epidemics of the 21st century. Accordingly, this paper reviewed the various components affecting the persistence of obesity and overweight in the population ages 5 to 11. There is evidence showing a positive relationship between family socioeconomic deprivation and overweight and obesity. For this reason, this research focused on this population range, in a situation of poverty, and living in contexts of high and very high rural marginalization in Mexico.

Using data published by ENSANUT 2012 and 2016, a PMS model was estimated and under the ST, NB, KL, and CA procedures, evidence was found that the effect of the SBP, associated with the obesity problem, is not significant. That is, although the SBP does not contribute to the increase in this condition, it does not show a positive effect on its reduction either. In this regard, (Ramírez-López et al 2005, Shamah-Levy and Morales-Rúan 2006,

St-Onge, Keller and Heymsfield 2003) point out that obesity is usually a long-term consequence. Therefore, although being a beneficiary of school breakfasts is not in principle associated with obesity in children, it cannot be ruled out that this disease can occur in adulthood, particularly if a person was overweight in childhood.

Moreover, in terms of being overweight, there is a significant positive effect between the participation in the SBP of schoolchildren ages 5 to 11 and the presence of this condition. Also, this result is reinforced by the evidence of the low incidence of the SBP in promoting healthy eating habits. The beneficiaries of this program showed a greater likelihood of access to the intake of sugars (through the consumption of sugary fruits and beverages) and dairy products but did not increase the consumption of water or proteins, derived from the consumption of meat.

Likewise, the types of intake yielded by the results (greater likelihood of consumption of sugars and dairy products), together with the characteristics of high and very high marginalization on which this study focuses, lead to suggest, that, for the most part, this population has access to cold rather than hot breakfasts. Cold breakfast, usually exceed the content of dried fruit (over the 20 grams stipulated by NOM-043-SSA2-2012), cereal bars, bottled juices or other sugary drinks, in addition to flavoured milk. Although all these components, tends to contribute to the acceptance of breakfast by children, the high consumption of flour and sugars is inadequate for the prevention and care of overweight. Nonetheless, it should be noted that this hypothesis could not be fully verified, as one of the limitations of this research involves the lack of access to detailed information on the implementation - in situ - of the SBP.

Despite the foregoing, one of the main conclusions is related to the implementation of this type of program in contexts of poverty, especially those with high and very high rural marginalization. The success of these programs, in terms of incidence for the prevention and care of childhood overweight and obesity, must not only recognize and address the particular nutritional needs of this population, but also their socio-economic needs and lack of access to physical infrastructure, in order to have a greater effect on the prevention of these conditions.

Given the aforementioned limitations, one future line of research would be to continue investigating the causes that cause failures in the design and implementation of school breakfast menus. The SBP will, therefore, be able to be more effective, not only in addressing nutrition problems but also in supporting the objectives of the prevention and care of overweight and obesity in the population ages 5 and 11 in the context of poverty with high and very high marginalization.

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