



Comparison of Lifestyle and its Relationship with the Incidence of Obesity in Children from Primary Schools of Different Socioeconomic Status from Mexico

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ABSTRACT

Background: Childhood obesity is a global health problem, with Mexico currently ranked in first place in terms of incidence. The lifestyle of school-age children plays a determining role in the excessive gain of body fat. As children advance through grades in school, obesity increases in the child population.

Objectives: The objective of this study was to determine the incidence of obesity in children and its relationship with their lifestyle in two elementary schools of different socioeconomic status, one public and the other private.

Methods: An observational cross-sectional study was carried out in a sample of 299 children from 6 to 11 years old, using a stratified sampling design through the representativeness of the two schools. The incidence of overweight and obesity was determined from the body mass index (BMI) and the body fat percentage (BF%). Lifestyle was examined using the Eating Habits and Physical Activity Questionnaire for a Healthy Life (HLHEPAQ) and a form was applied to assess eating habits and the frequency of physical activity.

Results: The joint prevalence of overweight and obesity by BMI was 49% in public school and 27% in private school, while by BF% the values were 46% and 19% respectively. In both cases deficiencies were found in nutritional patterns, however, in the public school the frequency of physical activity was lower and a higher proportion of children exhibited a lifestyle with risk factors for health, affecting the high incidence of overweight and obesity.

Conclusion: A lifestyle with tendencies to a more active life is the most determining factor in school-age children to enjoy an adequate body weight, even when they present some deficiencies in their eating habits. The results of this study will serve to establish an intervention strategy in schools to promote healthier food preferences and an adequate physical activity in order to reduce childhood obesity.

Keywords: Childhood obesity; School age; Lifestyle risks; Body Mass Index (BMI); Body fat percentage; Eating habits; Frequency of physical activity

Received:	31-May-2023	Manuscript No:	IPJCO-23-16959
Editor assigned:	02-June-2023	PreQC No:	IPJCO-23-16959 (PQ)
Reviewed:	16-June-2023	QC No:	IPJCO-23-16959
Revised:	23-October-2023	Manuscript No:	IPJCO-23-16959 (R)
Published:	30-October-2023	DOI:	10.36648/2572-5394-8.5.54

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Citation Sarabia-Sainz HM, Bernal-Mercado AT, Perez-Sierra AJ, Vega-Orozco SI, Gavotto-Nogales OI, et al. (2023) Comparison of Lifestyle and its Relationship with the Incidence of Obesity in Children from Primary Schools of Different Socioeconomic Status from Mexico. *J Child Obesity*. 8:54.

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INTRODUCTION

In recent years Mexico has ranked first in childhood obesity worldwide [1]. Results from the National Health and Nutrition Survey (2020) reported a combined incidence of overweight and obesity of 38% in children aged 5-11 years old [2]. According to the United Nations Organization (UNO), the rate of childhood obesity has multiplied by 10 in the last decade, and it is estimated that this figure will continue to increase. For this reason, excess body weight in children is considered a public health problem of epidemiological proportions and future consequences, increasing the predisposition to suffer from chronic diseases [3,4].

According to the National Health and Nutrition Survey 2020 (ENSANUT) by its acronym in Spanish), in Mexico the northern states have the highest joint incidence of overweight and obesity in school-aged children (40% in the North Pacific and 47% on the Northern border) [2]. The rapid economic development of the area and the proximity to the neighbouring country to the north have led Mexicans to adopt food customs involving the consumption of industrialized products with a high caloric density and that are poor in nutrients [5]. Consequently, traditional field diets rich in cereals or legumes have been put aside for low-fibre foods with high energy content [6].

The aetiology of overweight and obesity is multifactorial; however poor diet and a sedentary lifestyle are the most influential factors in its development. Unhealthy eating behaviours and limited physical activity provide the imbalance between energy intake and expenditure [7,8]. Currently, children have greater access to mobile devices or video game consoles, opting for more sedentary leisure time than doing physical activity outdoors. The excessive time spent on these activities increases a sedentary lifestyle [9] and decreases the hours of sleep [10]. Children who prefer to watch television and play video games instead of performing physical activity may be programming themselves for a sedentary future and develop chronic diseases associated with obesity [11]. On the other hand, the socio-economic level is a factor that influences lifestyle and can favor the development of obesity [12]. For low-income families, it is difficult to access healthy food groups due to their high prices [13]. The food industry mass produces cheaper products, with a pleasant flavour, rich in sugars and fats with high satiety power, which makes them preferable to the population [14]. Likewise, obesity has been associated with children who can attend private school and have greater purchasing power and accessibility to food [15,16]. Nevertheless, it has been argued that those families with a higher educational level and economic income have a greater possibility of leading a healthy lifestyle with a healthier diet and recreational physical activities [17].

In the present study, the incidence of overweight and obesity was determined in two elementary schools of different socioeconomic levels in Hermosillo Sonora, Mexico. Nutritional and physical activity patterns were evaluated to determine the population with the highest or lowest number of children with risk factors in their lifestyle and their relationship with the incidence of obesity. The results show the existence of bad eating habits in both populations, however, physical activity seems to be the most relevant in excessive body weight gain

in children. From this, a specific intervention strategy can be designed in those habits that seem to be the most determinant in the incidence of obesity in school-age children.

MATERIALS AND METHODS

Type of Study and Subject

An observational analytical comparative cross-sectional study of school-age male children aged 6 to 11 years from two elementary schools in Hermosillo, Sonora, Mexico, was conducted. Hermosillo is the capital of the state of Sonora, located in the North-West of Mexico and borders the United States to the North. The total sample was 299 children (72 from public school and 227 from private school). The calculation of the sample was made from a simple sampling with a maximum acceptable error of 5%, at a confidence level of 95% through a stratified sample design from the representativeness of the two schools [18]. A representativeness of 30% of the population was considered for each stratum, obtaining a minimum sample of 156 students (38 from public schools and 118 from private schools). To carry out this work, the parents' authorization was obtained through an informed consent form whereby they approved the participation of their children in the study. The ethical considerations for health studies stipulated in resolution 8430 of 1993 and the Declaration of Helsinki of the World Medical Association were followed, in addition to the approval of the Research Ethics Committee of the University of Sonora.

Techniques and Instruments

The anthropometric characterization was carried out by two ISAK-certified evaluators in a conditioned area, allowing the children to wear short shorts and a thin cotton shirt. Body mass (kg) and height (m) were measured on an electronic scale equipped with a Tanita stadiometer (TBF-410GS, Arlington Heights, USA). Triceps and subscapular skinfolds were taken on the right side of the body using an anthropometric caliper (Slim Guide D1085). The final value was the average of two repetitions. The BF% was determined using the equation of Boileau et al. which considers the tricipital fold (TR) and subscapularis (SS) for its prediction [19]:

The cohort points of the curves reported by McCarthy [20] were used to define low fat, normal, overweight and obese from the 2nd, 85th and 95th percentiles. The Body Mass Index (BMI) was calculated with the Z score ($BMI=kg/m^2$). For the categorization with overweight or obesity, the reference tables of the World Health Organization were used, using as criteria the values of the 85th and 97th percentiles specific by age and sex [2,22].

Lifestyle Assessment

The HEPALHQ validated by Guerrero et al. was applied with some modifications for its understanding by schoolchildren from 6 to 11 years of age. The interrogative instrument consisted of 27 items, which measured two dimensions, 18 evaluating eating and 9 physical activities, with a reported Cronbach's alpha of 0.81 and a correlation coefficient (r) of 0.82 [23]. The total score of the two dimensions allows the classification of three cohort points. Those who obtained a score lower than 95 were classified as having poor eating habits, due to the presence

of risk factors in their lifestyle. Participants with scores in the range of 95 to 109 were considered to have sufficient eating habits and a lifestyle with health benefits, although they also continue to present risks. Those with a score higher than 109 were considered as children with healthy eating habits and an adequate lifestyle for their health.

Finally, a questionnaire on eating habits and physical activity was applied to them through an inventory answered in a self-administered manner. They were asked about their favourite foods and the frequency of consumption, habits while eating, favourite drinks, activities at school, during break time, in their free time, time in front of the television or electronic devices, hours of sleep. The results or frequencies were graphed to represent the trend of the habits present in the population of children of each school.

Statistical Analysis

For the analysis of the normal distribution of the data, the Anderson-Darling test was applied. Descriptive statistics were used to obtain measures of central tendency and analysis of variance (ANOVA) to determine significant differences. The comparison of means was performed using the Tukey-Kramer test. All data were examined at a 95% confidence level ($p < 0.05$). To determine the cohort points of the score resulting from the HEPALHQ instrument, the 25th percentile values were used, between the 25th and 75th percentile and greater than the 75th percentile. Finally, a descriptive analysis was applied to the results of the frequency of food consumption and physical activity to make inferences. The statistical program SAS 6.08 by PCS was used.

RESULTS

The total children population studied consisted of 228 participants, of which 167 (73%) were from a private school and 61 (27%) from a public school. Of a total of 299 children, 60 from the private school and 11 from the public school were discarded because they did not have the approval of their parents through informed consent. The age range was 6-11 years, with an average of 8.47 ± 2.56 years. According to the BMI, 23% of public school children were overweight and 26% obese, obtaining a joint value of 49%. In addition, it was detected that 1% suffered from lack of weight. In the private school, 23% were overweight and only 4% obese, giving a joint value of 27%. From the BF%, in public schools it was found that 20% of the population suffered from overweight and 26% from obesity, with a joint value of 46%. In addition, 5% exhibited low weight for their age. The values in private school were 14% overweight and 5% obese, obtaining a joint value of 19%.

Table 1: Beverage consumption in children from 6 to 11 years of age from public and private elementary schools of Hermosillo, Sonora, Mexico

Preferred drinks	Public school (%)	Private school (%)
Cola	50	52
Juices and nectars	67	78
Water	88	95
Natural juices	74	78
Milk	62	75

Table 1 shows the means and standard deviation of weight, height, BMI and BF% of the children population studied, according to age and elementary grade. As expected, weight and height increased progressively with age. No significant differences in BMI were detected in children of the same grade between schools, except for in the second grade, where the public school population presented a higher average ($p < 0.05$). Regarding the BF%, the children of first, second and 5th grade of public school showed significantly higher values ($p < 0.05$) compared to the children of private school of the same year.

According to the results of the HEPALHQ, a higher percentage of children (53%) in public schools with poor eating habits and risk factors in their lifestyle were found. On the contrary, in private school a higher percentage of children (68%) showed that they followed sufficient eating habits and lifestyle to have good health (**Figure 1**).

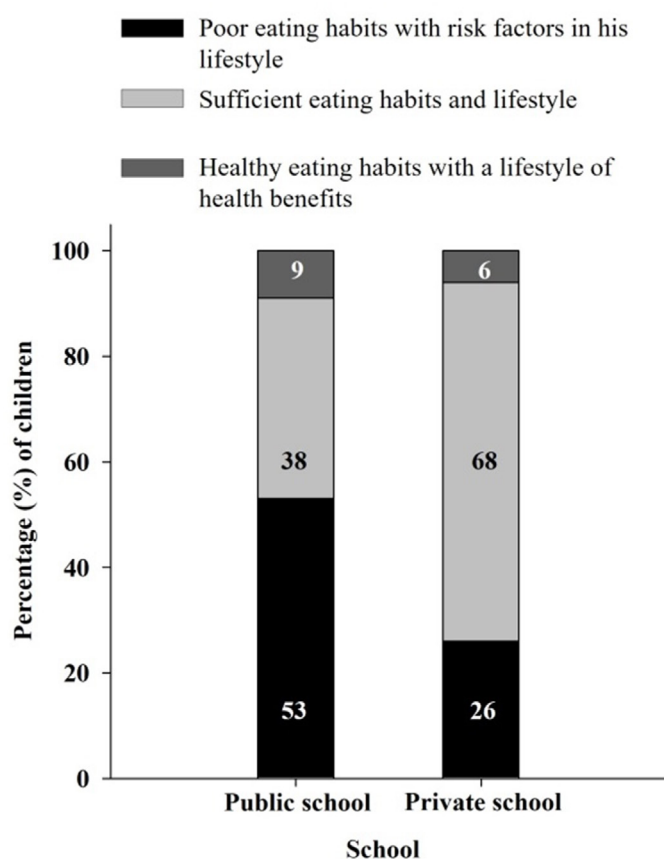


Figure 1: Results (%) of the Healthy Living Habits of Eating and Physical Activity Questionnaire (HLHEPAQ) in a child in private and public elementary schools of Hermosillo, Sonora, Mexico

Regarding preferences and eating habits, 34% and 25% of

Glasses of water a day		
From 1 to 3	69	77
From 4 to 6	22	21
Six or more	9	2
Glasses of cola per day		
One	68	56
Two	20	15
Three or more	6	2
None	6	27

public school and private school children, respectively, used to skip one of the three daily meals, mainly dinner. Regarding the frequency of food consumption (Figure 2), it was found that 30% of the children in both cases almost never eat pasta. Legumes were part of the daily menu of 30% of public school children and 34% of private school children, while 26% and 18% of the respective cases never consumed them. Vegetables had a low percentage of consumption in both groups, where only 48%-49% of children ate them daily. Daily fruit intake was slightly higher in the public school (57%) than in the private school (43%). With regard to protein of animal origin, 47% of public school children almost never included fish in their diet, against 32% in private schools. In both schools, between 29%-32% ate meat, 37%-40% eggs, while only 24%-25% of children declared that they consumed nuts daily. In public school, 15% and 19% daily consumed sweets and fast food, respectively, while in private school the corresponding percentages were 19% and 11%. In the latter, the consumption of fats (dressings, mayonnaise, and margarine) was more frequent.

The child population was asked what activities they did while eating. Public school children were the ones who mostly (32%) who used to eat without being distracted, while chatting during meals was more common in private school children (34%). Watching television while eating presented the same incidence in both groups. The time that public school children spent eating, in 47% of cases, was 15 min versus 39% in private schools, while 23% and 35% respectively, took 20 min. When evaluating how quickly they were considered to eat, between 23%-24% of the children in both schools scored with the highest score. The largest proportion qualified with a score from 4 to 7, indicating that these children are not considered fast or slow to eat (Figure 3).

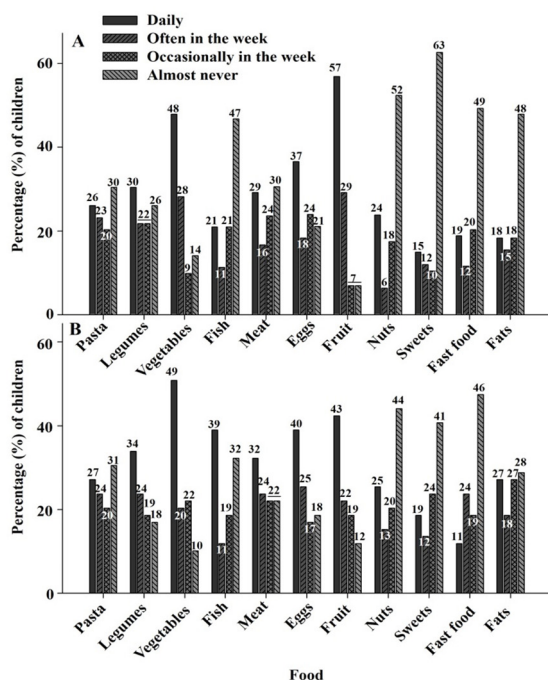


Figure 2: Percentages (%) of the frequency of food consumption in children of public school (A) and private school (B) of Hermosillo, Sonora, Mexico

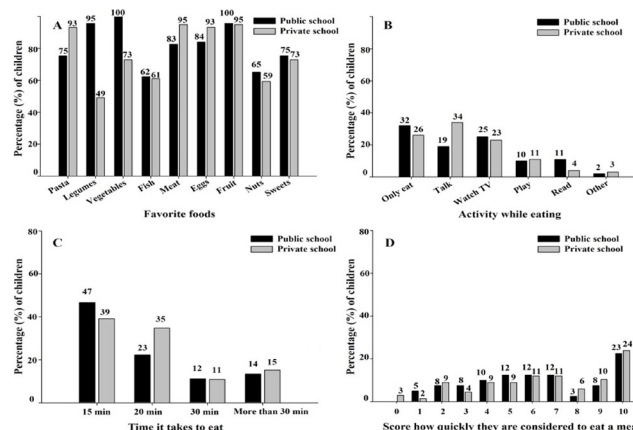


Figure 3: Eating habits in children from 6 to 11 years of public and private schools of Hermosillo, Sonora, Mexico. The values are expressed in percentages (%). A: Favourite foods; B: Activities while eating; C: Time it takes to eat; D: Ratings of how fast they think they eat

In respect to favorite drinks (Table 1), half of the children in both schools selected cola as one of them, while water was preferred by 88% of the children in public school and 95% in private school. In terms of water consumption, a high percentage of children in both cases were found to usually drink a small amount (between 1 and 3 glasses a day). Only 9% in public school and 1% in private school drank more than 6 glasses of water a day. As for cola, 61% in the first case used to drink one glass a day and only 5% drank none. In the second case, 55% consumed a daily glass and 27% did not drink cola.

Table 2 shows the results of the frequency of physical activity. To get to school, a lower percentage of public school children used a car (61%) compared to private school children (86%).

In activities during break time, it was found that 39% of the children in the first case preferred to sit down talking, 31% liked to play sitting down, and only 28% did activities such as running, jumping or playing sports. In the private school, 30% stated that they only talked, 9% played sitting down, and 52% played games or physical activities. Another aspect evaluated were the hours of sleep, where it was observed that in the first case, 52% of the children slept 8 h or more and only 10%

less than 6 h a day. In contrast, in the private school, 70% slept more than 8 h and 5% less than 6 h. The hours spent in front of the television or electronic devices for both cases was of 1 h for most of the children. However, 36% in public school spent more than 4 h a day, compared to 27% in private school. In contrast, in the first case, 59% of the children exercised daily and 17% only on weekends, while in private school the percentages were 75% and 2%, respectively.

Table 2: Frequency of activities of children from 6 to 11 years of age from public and private elementary schools of Hermosillo, Sonora, Mexico

Activities	Percentage of public school children (%)	Percentage of private school children (%)
Transportation to school		
Walking	29	9
Bicycle	7	3
Bus	3	2
Car	61	86
Activity during break time		
I sit and eat	40	30
Sitting play	31	9
I run, jump, practice sports	27	36
Other	2	16
Hours spent in front of the television/electronic devices		
Never	6	2
1 h	43	39
From 2 to 3 h	15	32
More than 4 h	36	27
Frequency of physical activity		
Almost daily	59	76
Only weekends	17	2
Rarely	12	7
Never	12	15

DISCUSSION

The incidence of overweight and obesity determined from the BMI and the BF% was higher in public school than in private school children according to both methods. Categorization by BF% shows lower prevalence values compared to BMI. These discrepancies may be due to the same characteristics of body composition. In accordance with what was indicated by Widhalm et al. the BMI only explains 73% of the variance of body fat in children under 13 years of age. However, the BMI is still considered a practical tool for a simple calculation to detect excess weight in children [24].

The joint prevalence of overweight and obesity found in public school children based on BMI (49%) was higher than that

reported in the ENSANUT 2020 for the northern region of the country (38%) [2]. It is evident that these values are increasing despite the numerous recommendations issued by the Ministry of Health. It has been mentioned that the incidence of overweight and obesity is accentuated more as children move up through elementary school. Olaíz-Fernández et al. observed that upon entering elementary school, the incidence of overweight and obesity in six-year-old children was 24.3%. At 12 years old, when they were about to finish, there was an increase of 12.2%, reaching 32.5% [25]. The same behaviour is observed in the present study in the public school. Starting with the BF%, it is observed that the children with the lowest average (19.15%) have an age range of 6-7 years and those with the highest average (28.76%) are in the range of 10-11 years old. This is not observed in private school children (Table 3).

Table 3: Anthropometric characteristics of children from 6 to 11 years of age in public and private elementary schools of Hermosillo, Sonora, Mexico

Grade/school	Weight (kg)	Height (cm)	BMI	BF%
First (6-7 years)				
Public (n=15)	26.61 ± 1.85b	121.21 ± 2.73a	18.05 ± 3.10a	19.15 ± 2.92b
Private (n=32)	24.18 ± 2.90a	122.78 ± 4.60a	16.00 ± 1.25a	18.18 ± 2.41a

		Second (7-8 years)		
Public (n=8)	26.61 ± 3.26a	124.75 ± 2.69a	16.39 ± 2.10b	19.00 ± 5.00b
Private (n=36)	28.07 ± 4.76a	129.40 ± 5.14a	14.47 ± 2.15a	16.70 ± 2.47a
		Third (8-9 years)		
Public (n=20)	35.45 ± 3.71b	133.59 ± 4.19a	17.69 ± 1.24a	22.42 ± 7.12a
Private (n=25)	31.59 ± 7.52a	134.03 ± 5.12a	17.41 ± 2.82a	17.10 ± 4.06a
		Fourth (9-10 years)		
Public (n=8)	33.41 ± 3.43a	137.41 ± 3.91a	17.80 ± 1.64a	20.13 ± 6.52a
Private (n=46)	36.73 ± 6.90a	137.68 ± 6.50a	19.27 ± 3.12a	13.08 ± 2.66a
		Fifth (10-11 years)		
Public (n=10)	45.9 ± 9.64a	145.09 ± 8.57a	21.56 ± 4.44a	28.76 ± 9.63b
Private (n=28)	41.52 ± 8.90a	146.51 ± 8.24a	19.23 ± 2.99a	15.10 ± 4.43a

Note: Different superscript letters indicates significant differences between schools in children of the same grade according to the analysis of variance (ANOVA) and the comparison of means by Tukey's test ($p < 0.05$). Body mass index (BMI); body fat percentage (BF%).

Regarding their lifestyle, more than half of the private school children followed good eating habits and exercised enough to be in good health. On the contrary, in public school, a higher percentage of children with deficient eating habits and the highest incidence of overweight and obesity were observed. Little physical activity and poor diet are two of the most determining environmental factors for weight gain. Various authors have found an inversely proportional relationship between a high percentage of fat and vigorous or moderate physical activity in school-age children [26-28]. For some time now, the WHO has issued some recommendations mentioning that children should invest at least 60 minutes a day in physical activities of moderate or vigorous intensity, which consist of games, sports, displacements, recreational activities, physical education or programmed exercises in the context of family, school or community activities [29].

In general, the studied population showed some deficiencies in the consumption of fruit and vegetables, finding that only about half ate these on a daily basis. Within the recommendations of the WHO it is mentioned that at least 400 g or 5 servings of fruit and vegetables should be consumed per day to prevent non-communicable diseases and guarantee a sufficient intake of dietary fibre. The low intake of fruit and vegetables has already been observed in the child population from 6 to 12 years of age in Mexico, where only 34% meet the daily recommendations [30,31]. Additionally, it has been observed that the children with normal weight are those who consume fruit and vegetables more frequently [32].

The frequency of fish consumption was lower in public school, and less than half of the children in both schools ate meat or eggs daily. According to the Spanish Association of Paediatrics (AEP), in children the daily intake of lean meat, fish and eggs should be two servings (200 grams of meat or 250 grams of

fish or one egg). The daily intake of meat in children is not necessary, since it can be alternated with other protein food groups such as legumes or dairy products [33]. However, in this study it was observed that 30% and 22% of the cases in the public and private schools, respectively, almost never ate meat, and this was accompanied, in both cases, by a low percentage of daily consumption of legumes, which could have otherwise, complemented the diet.

One very positive finding in the study population's eating habits was the low frequency of consumption of sweets, fast food, and fats. In contrast, approximately half of the participants in both schools almost never ate nuts. These foods contain a high content of antioxidants, B vitamins and minerals. The low predilection for their consumption may be associated with outside influences. Although parents are the major decision-makers for feeding, children can shape their preferences by the influence of their schoolmates and food advertisements [34]. Availability of, and repeated exposure to, healthy foods is key to developing preferences and can overcome food aversion.

Legumes have a low acceptance as favourite foods in private school children (49%). Almost a quarter of the study population said that they almost never ate legumes. Due to their low fat, sodium and glycaemic index content, in addition to being an excellent source of protein, iron, fibre, folate and potassium, the presence of legumes in a child's diet should be highly encouraged. According to the Food and Agriculture Organization of the United Nations (FAO), endocrinologists and dietitians recommend eating legumes at least two to three times a week. Fish is another food that is unattractive to children [35]. Due to the benefits of its consumption, it has been proposed that its intake should be promoted in the school population through the creation of attractive products and an education programme for children and parents [36]. As for sweets, as

expected these are favourites for the majority of the children population (75%). Children's environment plays an important role in their food preferences. It has been estimated that, in Mexico, more than 80% of children who attend elementary school bring money to buy food, mainly sweets, fried foods or drinks, and to a lesser extent sugary drinks or foods such as cakes or sandwiches [37]. Morales-Ruán et al. when evaluating the incidence of school overweight and obesity among groups of different socio-economic levels, found a higher prevalence in children with a greater availability of food at school and a high socio-economic index compared to those with a high availability of food and a lower socio-economic level, or low availability of food and a medium socio-economic level [16]. Flores-Huerta et al. suggested that parents should prepare their children breakfast or lunch with healthy foods to combat the obesogenic environment that could exist in their school [38].

Furthermore, 75% in public school and 67% in private school reported doing some activity while eating, which increases the risk of being overweight or obese. This same eating behaviour was found in school children in Barcelona, Spain, where 70% of the respondents carried out activities during food intake, of which watching television was the most reported [39]. It is necessary that parents watch that their children do not watch television or do other activities during the meal, since this is distracting, and they do not have a good perception of the amount of food consumed. In addition, more than half of the children consume food in a very short time. Fogel et al. pointed out that eating quickly and not chewing food well can lead to a gradual increase in body weight. This is because more energy than necessary is consumed in a very short time, without giving the brain time to send a satiety signal [40].

Among the favourite drinks, the order of preference in both schools was water, fruit or flavoured juices, milk and cola. Drinking pure water instead of caloric drinks helps control body weight by reducing energy intake [41]. In Mexican children it has been reported that the daily total consumption of water derives from 24% of the intake of pure water, 19% from milk, 14% from natural or flavoured juices, 9% from soft drinks and 29% from food moisture [42]. Even though water is the favourite drink in the population of children, it was observed that its consumption is very low. Less than 10% of all children drink more than 6 glasses a day. The results show the existence of bad hydration habits, especially in public school since the consumption of beverages is associated with increased energy intake in children and the risk of being overweight or obese [43].

With regard to physical activity, it was found that a higher proportion of public school children go to school by bicycle or walking. Despite having a higher proportion of children who perform active transportation, this did not translate into a decrease in the incidence of overweight or obesity. According to the American College of Sports Medicine, moderate and vigorous-intensity activities 3-6 and 6-9 metabolic equivalents (METs), respectively) must be performed to obtain significant benefits in weight control [44]. However, walking is usually not enough since its metabolic equivalent is 2 to 3.5 METS [45].

In the activities during break time, most of the children in public

school remained seated, while in private school the majority do physical activities. Due to the significant number of children who do not exercise during break time, it would be opportune to apply physical activity programmes to take advantage of this time to achieve an increase in energy expenditure. In some studies, it has been observed that exercise can be increased significantly by providing children with some simple items to play with, such as jump ropes, beach paddles, balls, or some inclusive games appropriate for their age [46].

The time that children spend in front of the television or electronic devices is relatively high, to such an extent that in both schools there were cases where some dedicated more than 4 h a day doing so. Reyes-Sepeda et al. pointed out that watching television for less than one hour a day can be considered a protective effect against the risk of obesity [47]. While another study carried out in ages 8 to 10 years showed that overweight or obese children were more sedentary and spend more time watching television (more than 2 h a day) than children with normal weight [48]. An interesting study carried out by Patriarca et al. observed that public or state school students whose parents were of a lower socio-economic level, spent more time in front of devices such as televisions, video games and computers, compared to their counterparts at private schools [49,50].

Regarding daily physical activity, a higher frequency was detected in private school students. Children are active by nature, however not all play or do sports outside of school. Reyes-Sepeda et al. reported some risk factors for being overweight or obese [47]. For example, staying at home without doing physical activities increases the risk 1.5 times and not having a set time to play or do physical activities increases the risk 1.3 times. Not all parents, especially those who work all day, have time to take their children to sports or activities in the afternoon. According to what has been observed, children from the private institution find it easier to travel by car. Particularly, the case of this school, it has a sports programme in which all students must return to sports sessions in the afternoon. This obligation seems to have an effect on the low incidence of overweight and obesity found in children who attend private school.

CONCLUSION

The incidence of children overweight and obesity is higher in public school compared to private school. This is related to the existence of a higher proportion of children with risks in their lifestyle due to lack of physical activity and poor eating habits. Regardless of the socioeconomic level of the families to which the children belong, poor eating habits are present, however, a higher level of physical activity inside and outside of school significantly reduces the incidence of obesity. It is evident that nutrition can be improved through education, but this must also include parents who are the ones who decide what food is consumed at home. On the other hand, schools in Mexico should promote exercise during recess and alert parents of the consequences of inactive children outside of school hours. Reducing the consumption of foods rich in calories and poor in nutrients and increasing physical activity should be the main focus of a future intervention to reduce obesity in elementary schools in Mexico.

DISCLOSURE STATEMENT

The authors declare that they have no conflicts of interest in the authorship of the information presented in the present investigation.

FUNDING

We would like to thank the Division of Biological and Health Sciences of the University of Sonora for their help by providing support for the financing of research projects.

ACKNOWLEDGEMENT

The authors are grateful for the support of professors Natanael Revilla Gutiérrez, Javier Gloria Rivera, Isaac López and Karim Gonzalez in carrying out this work.

CONFLICT OF INTEREST

The author has no conflict of interest.

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