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Research Article

Evaluation of the nutritional situation of the students of the "Benito Juarez" Elementary School according to the Body Mass Index. Jose Maria Morelos, Quintana Roo, Mexico

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Abstract

Introduction. The Body Mass Index, also called the Quetelet Index, is a measurement (kg/m^2) used as an indicator of weight adequacy for a given height. The resulting value is interpreted as an indicator of different nutritional situations, both physiological (normal weight) and pathological (low weight, overweight and obesity). **Objective.** To evaluate the nutritional situation of the students of the "Benito Juarez" Elementary School in the Maya municipality of Jose Maria Morelos, Quintana Roo, Mexico, during the period from June 3, 2019, to July 12, 2020. **Material and methods.** Cross–sectional descriptive observational epidemiological study without directionality and with prospective temporality. One hundred and twenty–eight students from "Benito Juarez" Elementary School were evaluated. As a hypothesis test or statistical significance test, the Mantel–Haenszel Chi–Square statistic (x^2_{M-H}) was used. Likewise, the Epi Info software for Windows, version 7.1.4.0, was used to obtain the values of both the x^2_{M-H} statistic and the probability (p). **Results.** Fifty–four (42.19%), 70 (54.69%), 3 (2.34%) and 1 (0.78%) students presented low weight, normal weight, overweight and obesity, respectively. **Conclusion.** It is concluded that the students of the "Benito Juarez" Elementary School present health problems with respect to their nutritional situation, since 45.31% (58/128) have a pathological nutritional situation (low weight, overweight and obesity).

Keywords: Assessment, nutritional status, school–age students, body mass index

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INTRODUCTION

A newborn is considered to be low weight if he weighs less than 2,500 g. It is estimated that the appropriate weight is in the interval of 2,500 to 3,999 g [1].

The birth weight is a general health indicator of the newborn linked, directly or indirectly, with the subsequent development and with the greater or lesser possibility of manifesting acute or chronic diseases. Thus, for example, more frequency of respiratory tract infections, diarrheal diseases, and mortality during the first year of life in children with low birth weight [2–4].

The prevalence of low birth weight depends on the population studied. A study in adolescent women in Cuba reported a prevalence of 10.3%, while another one conducted in the Dominican Republic reported prevalence in premature products (≤ 36 weeks of pregnancy) of 7.2%. In Neuquén, Argentina, it was reported that 8.43% of the children had low birth weight [5–7].

Among the risk factors studied is the mother's job history. According to Cerón and collaborators [8], the incidence of low birth weight was 11.2% in a sample of 2,623 workers who attended their birth in three selected hospitals from Mexico City. In another study in street vendors, also from Mexico City, it was reported that in women who worked during pregnancy, the prevalence was 14% compared to those who did not work whose prevalence was 13% [8–9].

Other concomitant characteristics with the highest incidence of low birth weight are the extreme age of the mother ≥ 36 years, low school grade, singleness as marital status, the intergenic interval ≤ 24 months, smoking, alcoholism, and inappropriate control prenatal, among others. Intestinal parasitosis in pregnancy is also related to less birth weight [10–12].

In Latin America, more than 20% (approximately 42.5 million) of children between 0 and 19 years old are overweight or obesity [13].

Specifically, in children under 5, it was estimated that in 2016 more than 41 million children worldwide were overweight or were obese [14].

This panorama leads to reflecting on the factors that contribute to developing it, its consequences, and the challenge of identifying sociocultural and contextual factors that predispose children to the development of obesity and determine ways of giving account of these factors in the development of effective solutions [15].

During the first years and before 18 years obesity has important consequences for physical and mental health. Obesed children are more likely to suffer from diseases such as metabolic syndrome, diabetes mellitus, arterial hypertension, heart disease and orthopedic problems, among others, in the future [16].

There is also a strong association of this condition at an early age with problems of self–esteem and discrimination [17–18].

As in other countries of the world, Mexico has been immersed in this epidemic that affects millions of infants and adolescents. With information from National Nutrition Surveys in Mexico since 1988, the permanent tendency to increase overweight and obesity in schoolchildren and adolescents has been documented [19].

Background

This research work starts from an objective that consisted of diagnosing the nutritional situation and detecting the incidence of overweight and obesity in preschool and schools of 4–16 years of a peri–urban community of Otomi origin of the municipality of Toluca, State of Mexico. To determine the prevalence, the body mass index (BMI) of 2,208 preschool and schools of three schools of different academic, primary, and secondary levels was obtained. The three levels analyzed the gender and age variables and only at the secondary level the ethnic variable was introduced. The results show that there are alert school degrees (end of each school level) where the prevalence of overweight increases significantly for school men up to the age of 12. At the secondary level, women are the ones who have the greatest incidence of overweight and obesity, but the risk is higher when there are no Otomi origins. It is concluded that BMI can be a useful indicator to establish prevention measures before the age of 16, but not sufficient. It is necessary to include the abdominal circumference in nutritional surveillance from preschool age to sifle those individuals with central obesity as a marker of cardiovascular disease risk [20].

The ENSANUT 2016 is a probabilistic national survey. The Z score of the body mass index was estimated. The risk of overweight and obesity was classified according to the WHO reference pattern. Sociodemographic variables were studied with overweight by logistics regression. The national prevalence of overweight and obesity in < 5 years was 5.8% girls; children 6.5%; School girls 32.8%; School children 33.7%; adolescents women 39.2%; and adolescents men 33.5%. Adolescent women from rural towns showed an increase from 2012 to 2016 of 9.5 percentage points. The prevalence of overweight and obesity in girls and women in rural areas show an important increase in a brief period, which calls to implement immediate attention actions [21].

Overweight and obesity are defined as an abnormal or excessive accumulation of fat that can be harmful to health. A simple way to measure obesity is the BMI, this is the weight of a person in kg divided by the square of the height in m. A person with an BMI ≥ 30.00 kg/m^2 is considered obese and with an BMI ≥ 25.00 kg/m^2 is considered overweight. Overweight and obesity are risk factors for numerous chronic diseases including diabetes mellitus; cardiovascular diseases; and cancer. The fundamental cause of overweight and obesity is an energy imbalance between calories ingested and spent. In the world, there has been an increase in the intake of hypercaloric foods that are rich in fat, salt, and sugars, but poor in vitamins, minerals, and other micronutrients, as well as a decrease in physical activity as a result of nature every time more sedentary of many forms of work, the new modes of displacement and a growing urbanization. Often, changes in food and physical activity habits are a consequence of environmental and social changes associated with development and lack of support policies in sectors such as health and agriculture; transportation; urban planning; environment; processing, distribution, and commercialization of food; and education. A high BMI is an important risk factor of noncommunicable diseases such as cardiovascular diseases (mainly heart disease and stroke) that in 2008 were the main cause of death; diabetes mellitus; locomotor apparatus disorders (especially osteoarthritis, a degenerative disease of very disabled joints); and cardiovascular diseases (mainly heart disease and stroke) that in 2008 were the main cause of death; diabetes mellitus; locomotor apparatus disorders (especially osteoarthritis, a degenerative disease of very disabled joints); and some cancers (endometrium, breast and colon). The risk of contracting these noncommunicable diseases grows with the increase in BMI. Child obesity is associated with a greater probability of obesity, of premature death and disability in adulthood. But in addition to these greatest future risks, obese children suffer respiratory distress, greater risk of fractures and hypertension, and have early markers of cardiovascular disease, insulin resistance and psychological effects [22].

In Mexico it has also fallen into neglect. The majority of the population is of low socioeconomic status and therefore there are factors that make people more vulnerable to suffering immense malnutrition and obesity. Figueroa (2009) comments "Obesity has a multifactorial etiology in which the strongest factors are related to lifestyles. Both the socioeconomic level could condition the presence of obesity and obesity could have social consequences in the individual (if social mobility is the most relevant factor, it is obesity that would condition the individual's social position). In 2003, she conducted research with Mexican boys and girls from five to eleven years old and concluded that: "Overweight and obesity are highly prevalent health problems in school–age children in Mexico, especially girls, and are positively associated with the socioeconomic level; the age of the students; and the education of the mothers. They also have a higher prevalence of metabolic syndrome. Apart from the economic issue, there are other aspects that generate obesity in society such as the political and social. Some Topics that do not give importance in education centers are bullying; child abuse; poverty; self–harm; and obesity, the latter especially in early childhood and primary education" [23].

General objective

Evaluate the nutritional situation of the students of the "Benito Juarez" Elementary school of the Mayan municipality of Jose Maria Morelos, Quintana Roo, Mexico, during the period from June 3, 2019, to July 12, 2020.

Specific objectives

1. Evaluate the nutritional situation of students through the BMI anthropometric indicator;
2. Establish in what percentage the low weight is presented more frequently;
3. Establish in what percentage the normal or normal weight is presented most frequently;

4. Establish in what percentage the overweight is presented more frequently; &
5. Establish in what percentage obesity is most frequently presented.

Hypothesis formulation

–Null hypothesis (H_0)

The nutritional situation of the students of the "Benito Juarez" Elementary school of the Mayan municipality of Jose Maria Morelos, Quintana Roo, Mexico, corresponds to the Normopeso physiological nutritional situation, that is, 18.50 $kg/m^2 \leq BMI \leq 24.99\ kg/m^2$.

–Alternate hypothesis, work hypothesis or research hypothesis (H_1)

The nutritional situation of the students of the "Benito Juarez" Primary School of the Mayan municipality of Jose Maria Morelos, Quintana Roo, Mexico, does not correspond to a normopeso physiological nutrition and yes to pathological nutritional situations such as low weight ($BMI < 18.50\ kg/m^2$), overweight or preobesity ($25.00\ kg/m^2 \leq BMI \leq 29.99\ kg/m^2$) and obesity ($BMI \geq 30.00\ kg/m^2$).

MATERIAL AND METHODS

–Epistemological approach

Quantitative approach, probabilistic approach, or positivist approach [24].

–Study Design

Cross–sectional descriptive observational epidemiological study without directionality (cause ►effect, or effect►cause) and with prospective temporality [25].

–Universe of study

In the period from June 3, 2019, to July 12, 2020, 128 students from the "Benito Juarez" Elementary School located in the Maya municipality of Jose Maria Morelos were evaluated.

––Geographic location. The Mayan municipality of Jose Maria Morelos is located in the west center of the Mexican state of Quintana Roo. It has an area of 6,739 km^2, which represents 13.2% of the state area and ranks third in territorial extension. It is located within the geographic coordinates 20º19' north latitude and 89º19' west longitude [26].

––Population. The Mayan municipality of Jose Maria Morelos is located in the Mexican state of Quintana Roo and according to the last Census conducted in 2015, it has a population of 37,502 inhabitants, of which 19,194 (51.18%) are men and 18,308 (48.82%) are women. Jose Maria Morelos is a developing municipality, so it has various institutions which are for the support of the locality, such as the "Jose Maria Morelos" Comprehensive Hospital and the soup kitchen for the elderly. It also has a multiple attention center; two initials; seven preschools; a full–time Elementary school; three Primary Schools with morning and afternoon shifts; a double–shift high school; a double–shift preparatory school; and the Intercultural Maya University of Quintana Roo, which, likewise, is a double shift [26].

––Climate. The climate is warm–subhumid with summer rains, with an average annual rainfall of 1,268 mm and an average annual temperature of 25.9ºC. The warm–subhumid climate favors the cultivation of sugar cane; jalapeno pepper; corn; rice; vegetables and fruit trees such as sapodilla; orange; pink grapefruit; papaya; bitter lemon; mango; and pineapple; among other [26].

––Hydrography. It does not have coastlines or surface water currents, but there are two main lagoons: the Chichankanab and Esmeralda lagoons. It also has cenotes and water holes in some communities [26].

––Services. The services that the municipality has are basic services such as electricity; drinking water; and excused. Only in the last Census conducted, 96% of the population has electricity and the rest of the solar systems. With regard to the water service, not all families have it, since some families obtain water from wells, rainwater harvesting and drinking water. Finally, the surveys conducted in the 2015 Census showed that 82% of the population has drainage [26].

––Streets. It has streets, but these are in poor condition. It can be said that 90% of the municipality has paved streets [26].

––Parks. It has a main park in good condition where children go out to play and adults to talk. Similarly, it has a sports unit; 18 basketball courts; 2 baseball fields; 3 fast soccer fields; 8 multipurpose fields; and 2 soccer fields [26].

––Flora. The medium subperennifolia forest predominates, from which woods such as mahogany (*Swietenia macrophylla*) are extracted; sapodilla (*Manilkara zapota*); the chacté (*Tecoma stans*); the ramón (*Brosimun alicastrum*); the tzalán (*Lysiloma latisiliquum*); guaya (*Melicoccus bijugatus*); the balche (*Lonchocarpus longistylus*); and the cedar (*Cedrus*). It is important to mention that the municipality has important timber forest resources estimated at more than 52,000 m^3 of precious wood and around 32,000 m^3 of tropical type [26].

––Fauna. There are important animals for their ecological, economic and tourist values such as the deer (*Cervidae*); the jaguar (*Panthera onca*); the opossum (*Didelphimorphia*); the armadillo (*Dasypodidae*); the ocelot (*Leopardus pardalis*); the otter (*Lutrinae*); the spider monkey (*Ateles*); the howler monkey (*Alouatta palliata*); the tapir (*Tapirus*); wild boar (*Sus scrofa*); the fox (*Vulpes*); and the badger (*Meles meles*). Reptiles such as the boa (*Boa*); the coral snake (*Lampropeltis*); the tortoises (*Testudine*); and iguanas (*Iguanidae*). Among the typical birds of the area are the toucan (*Ramphastidae*); the macaws (*Ara*); parrots (*Psittacara holochlorus*); the woodpecker (*Picidae*); the pheasant (*Phasianus colchicus*); the chachalacas (*Ortalis*); herons (*Ardeidae*); the mockingbird (*Mimus polyglottos*); hummingbirds (*Trochilidae*); and the falcons (*Falco*) [26].

––Scholarship. In 2010, 86.8% of children between the ages of 3 and 5 attend school, while in 2015 the results were that 98% attend school. Therefore, making a comparison of illiteracy, only in 2000, 7.5% of 15–year–old did not know how

to read or write, but this indicator was reduced to 3.9% in 2015. Regarding the level of education of the inhabitants, the Census of 2015 showed that 7.5% of people barely finished high school [26].

––Employment. Until 2017, 59% of the population is economically active, the rest works in non–economic activities (housework, students, retirees, and pensioners), with women being characterized by conducting non–economically active activities, while men predominate. in the economically active population [26].

––Living place. In 2015, most homes had 2 and 3 rooms, 35.5% respectively. Therefore, dwellings with 1 or 2 bedrooms were 56.2%, respectively. Only 4.42% of the total households had Internet access (415 households); 79.3% owned at least one television (7,455 households); 11.7% claimed to have a computer (1,100 households); and 57.1% purchased at least one mobile phone (5,364 households) [26].

––Fertility rate. The last Census conducted in 2015 showed that women have 2 or more children between the ages of 15 and 49 [26].

––Mortality rate. In the same way, it stands out among the populations with more than 6% of deceased children [26].

––Health. It has a Comprehensive Hospital, a Clinic of the Mexican Social Security Institute, and a Social Security Health Institute for State Workers, as well as private institutions. 90% are affiliated with Seguro Popular and the rest in other institutions. It is worth mentioning that in the municipality, SESA coordinates 31 health houses and 32 health technicians. The most used health care options in 2015 were the Health Center or Hospital of the SSA (Popular Insurance); consulting room; private clinic or hospital; and Social Security Health Institute for State Workers. In the same year, the social insurances that grouped the greatest number of people were Seguro Popular or for a New Generation (Siglo XXI) and they do not receive medical attention. In 2015, 52.4% of the population was in a situation of moderate poverty and 27.1% in a situation of extreme poverty. The vulnerable population due to social deprivation reached 14%, while the vulnerable population due to income was 2.32%. It is important to mention that Jose Maria Morelos has the "Doctor in your House" service, since with this program he approaches and provides more and better opportunities for access to health services to people with physical, economic, or demographic difficulties to go to a health unit. During these days consultations are provided; application of tests for diabetes mellitus; obesity; arterial hypertension; prostatic hyperplasia; breast scans; and cytologies for the prevention of cervical cancer. Nutrition talks are also given; prevention of family and gender violence; family planning; and use of contraceptive methods, among others [26].

– Operational definitions of variables

––Nutritional status. It is the situation in which a person finds himself in relation to the intake and physiological adaptations that take place after the intake of nutrients, while the evaluation of the nutritional situation is the action and effect of estimating, appreciating, and calculating the condition in an individual is found according to nutritional modifications.

––Malnutrition. Malnutrition has been the deficiency of food in the body which leads people to a sick situation in different degrees and in different clinical manifestations. Just as it also says that it is any abnormal loss of body weight, from the slightest to the most serious. It is worth mentioning that the United Nations Children's Fund (UNICEF) mentions that malnutrition occurs more in the southern states of Mexico, since 1 in 8 children in rural communities suffer from chronic malnutrition, while in urban communities few children suffer from malnutrition.

––Healthy weight. A healthy weight is one that allows us to maintain a good state of health and quality of life. It is also understood as weight values within which there is no risk to the person's health.

––Overweight and obesity. The WHO (2020) defines that overweight and obesity are the abnormal or excessive accumulation of fat in the body that can be harmful to health. A clear example of this is that only in 2015, Mexico was among the first places in childhood obesity worldwide and in 2016 there were more than 340 million children and adolescents (5–19 years old) who were overweight or obese. This is because the prevalence has been increasing dramatically, from 4% in 1975 to more than 18% in 2016. This increase has been similar in both genders: 18% of girls and 19% of boys are overweight.

––Anthropometry. It is the study and technique of taking measurements on the human body. Therefore, for its evaluation, the most used measures are weight, height, age, and gender. These measurements are one of the best indicators of the nutritional situation, since they are essential for the evaluation of the child's physical growth, which is a complex and dynamic process influenced by environmental, genetic, and nutritional factors.

––Weight and height. Weight and height are parameters for evaluating growth, so weight is a measure influenced by several factors that are a mixture of different tissues such as bone, muscle and adipose. While height is the distance between the top of the head and the soles of the feet. To conduct this evaluation, it is suggested to conduct the measurement placing the child with his eyes forward and his head erect, without shoes or hairstyles that alter the measurement; you should have your knees straight, your back straight and your eyes straight ahead; finally, height is recorded in m and weight in kg.

––Body Mass Index. It is the weight of an individual in relation to their height. It is obtained by dividing the weight expressed in kg by the square of the height expressed in m. That is, the BMI= Weight in kilograms/height in meters^2. Thus, through this value the nutritional situation can be determined according to the classification recommended by the WHO.

Table 1: Physiological and pathological nutritional situations according to Body Mass Index.

Nutritional situations	**Body Mass Index**
Low weight	BMI < 18.50 kg/m^2
–Slight underweight	17.00 kg/m^2 ≤ BMI ≤ 18.49 kg/m^2
–Moderately underweight	16.00 kg/m^2 ≤ BMI ≤ 16.99 kg/m^2
–Severe underweight	BMI < 16.00 kg/m^2
Normal weight	18.50 kg/m^2 ≤ BMI ≤ 24.99 kg/m^2
Overweight	25.00 kg/m^2 ≤ BMI ≤ 29.99 kg/m^2
Obesity	BMI ≥ 30.00 kg/m^2
–Mild obesity	30.00 kg/m^2 ≤ BMI ≤ 34.99 kg/m^2
–Moderate obesity	35.00 kg/m^2 ≤ BMI ≤ 39.99 kg/m^2
–Severe or morbid obesity	40.00 kg/m^2 ≤ BMI ≤ 49.99 kg/m^2
–Extreme obesity	BMI ≥ 50.00 kg/m^2

Source. Own elaboration

––Growth and development. Regarding growth and development, Erik (2013) considers them as all the changes that occur in the human being from conception to adulthood, which are physiological, psychological, and social. In the same way, he mentions that the school stage begins at 6 years of age and ends with the appearance of secondary sexual characteristics, which occurs between 10–12 years of age in girls and between 12–14 years of age in boys.

––Nutritional requirements in schoolchildren. Regarding eating patterns and nutrient needs during childhood, it is mentioned that they are conditioned to the energy that a person needs to cover all their physiological needs. Therefore, the imbalance between consumption and expenditure of nutrients is the cause of the appearance of excess weight [27].

Finally, it is vitally important to know that the nutritional requirements recommended by the WHO from the age of 6 are proteins, which provide elements for the formation of the body's tissues; carbohydrates that provide energy for the body's function; lipids that also provide energy; vitamins that help the normal metabolic functioning of the organism; water and fibers which help the body function through hydration and intestinal regulation and, finally, minerals that are substances that our body cannot synthesize such as calcium (Ca), iron (Fe) and iodine (I), among others.

–Techniques and procedures

For the evaluation of the nutritional situation of the students the Body Mass Index (BMI), also called the Quetelet Index (QI) was used.

Robust, sensitive, and calibrated scales with 100 g precision in weighing were used. The weight was taken with the student placed on the center of the scale in an upright position and without contact with anything around him. Care was taken that he is only provided with the least amount of clothing possible.

Calibrated stadiometers with 1 mm precision were used. Height was determined with the subject's body in a vertical position and the head in a horizontal position according to the Frankfort plane (imaginary horizontal line tangent to the lower area of the bony orbit of the eye (orbitalis) and the upper area of the external auditory canal (tragion).

Two x two contingency tables were constructed from which the percentages were calculated. As a statistical significance test, the Mantel and Haenszel Chi–Square statistic (x^2_{M-H}) was used. The Epi Info software for Windows, version 7.1.4.0, was used to obtain the values of x^2_{M-H} and probabilities (p). The criterion used in performing the hypothesis tests for the difference between two percentages was based on the following recommendations formulated by Cochran [28]: 1. When N > 40, use the x^2_{M-H} test; 2. When 20 ≤ N ≤ 40 use the x^2_{M-H} test if, and only if, all expected frequencies are ≥ 5; if an expected frequency < 5 is found in any cell, then use Fisher's exact probability test (PPEF); and 3. When N < 20 use the PPEF.

$$x^2_{M-H} = [ad - bc / \sqrt{(a+b)(c+d)(a+c)(b+d)(N-1)}]^2$$

$$PPEF = (a+b)!\,(c+d)!\,(a+c)!\,(b+d)! / n!\,a!\,b!\,c!\,d!$$

–Data processing

In the elaboration stage the data was reviewed; classified; computerized; presented (in Tables and Graphs); and summarized. The Microsoft Office Excel 365 software was used to prepare the graphs. In the analysis and interpretation stages the data were analyzed and interpreted, respectively, using the Epi Info software for Windows, version 7.1.4.0.

RESULTS

In the period from June 3, 2019, to July 12, 2020, 128 students from the "Benito Juarez" Elementary School were studied.

Table 2 shows the absolute frequencies and the relative frequencies of the students of the "Benito Juarez" Elementary School according to their nutritional status.

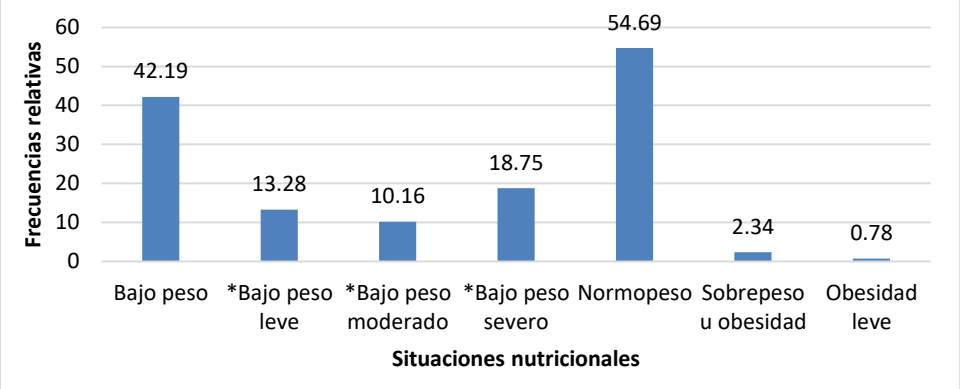
Graph 1 shows the relative frequencies.

Table 2: Absolute frequencies and relative frequencies of students according to nutritional status. "Benito Juarez" Elementary School. Jose Maria Morelos, Quintana Roo, Mexico.

Nutritional situations	Absolute frequencies	Relative frequencies
Low weight	**54**	**42.19**
–Slight underweight	17	13.28
–Moderately underweight	13	10.16
–Severe underweight	24	18.75
Normal weight	**70**	**54.69**
Overweight	**3**	**2.34**
Obesity	**1**	**0.78**
–Obesidad leve	1	0.78
Totals	**128**	**100.00**

Source. Own elaboration

Graph 1: Relative frequencies of students according to nutritional status. "Benito Juarez" Elementary School. Jose Maria Morelos, Quintana Roo, Mexico.



Source. Table 2

DISCUSSION

In descending numerical order, the highest prevalence rate was observed in the pathological nutritional situation "underweight" (42.19%; 54/128) and then in the pathological nutritional situations "overweight" (2.34%; 3/128) and "obesity" (0.78%; 1/128).

A statistical comparison was made of the prevalence rate of the pathological nutritional situation "underweight" (42.19%; 54/128) *versus* the corresponding prevalence rate of the pathological nutritional situation "overweight" (2.34%; 3/128) finding a statistically significant difference: x^2_{M-H} (α= 0.0500; df= 1) ≥ 3.8416; $p \leq 0.0500$.

Next, we proceeded to the statistical comparison of the prevalence rate of the pathological nutritional situation "low weight" (42.19%; 54/128) *versus* the corresponding prevalence rate of the pathological nutritional situation "obesity" (0.78%; 1/128) finding a statistically significant difference: x^2_{M-H} (α= 0.0500; df= 1) ≥ 3.8416; $p \leq 0.0500$.

Finally, when comparing the prevalence rate of the pathological nutritional situation "overweight" (2.34%; 3/128) *versus* the corresponding prevalence rate of the pathological nutritional situation "obesity" (0.78%; 1/128), not a statistically significant difference was found: x^2_{M-H} (α= 0.0500; df= 1) < 3.8416; $p > 0.0500$.

CONCLUSIONS

The students of the "Benito Juarez" Elementary School present health problems with respect to their nutritional situation, since only 54.69% presented the physiological nutritional situation "normal weight" while the remaining percentage (45.31%) presented the nutritional situations pathological "low weight" (42.19%), "overweight" (2.34%) and "obesity" (0.78%).

In addition, the students of the "Benito Juarez" Elementary School also present serious health problems with respect to their "low weight" pathological nutritional situation, since 13.28%, 10.16% and 18.75% presented pathological nutritional situations "mildly underweight", "moderately underweight" and "severely underweight", respectively.

Likewise, in relation to the pathological nutritional situations "underweight", "overweight" and "obesity" corresponding to the students of the "Benito Juarez" Elementary School, the results observed in the present study are consistent with the results reported by other authors [20–23].

In the present study, the pathological nutritional situations "moderate obesity" "severe or morbid obesity" and "extreme obesity" were not observed.

RECOMMENDATIONS

1. Develop a health education program with the aim of promoting in the students at the school studied the development of attitudes and behaviors that allow them to participate in the prevention of individual and collective diseases to protect themselves in this way from the risks that endanger your health;
2. Eat a variety of foods because that way they will obtain the nutrients and energy they require to face the day;
3. Never skip breakfast. It will give them the energy and nutrients they need to start the day;
4. Make 4 to 5 meals a day. That way they will properly distribute nutrients and energy. Also, avoid coming to meals with excessive hunger and compulsive eating;
5. Drink between 1.5–2.0 liters of water per day;
6. Moderate the consumption of meats rich in fats, sugars, and pastries, among others;
7. Increase the consumption of fruits, vegetables and vegetables that will provide minerals, vitamins, and fiber with very few calories;
8. Control the consumption of fried, battered, or cooked foods with excessive fat;
9. Lead an active life. Perform physical activity on a regular basis and try to change certain habits that make life sedentary;
10. Continue with an investigation related to the evaluation of the nutritional situation in the school studied once the corresponding health authorities have applied the aforementioned health education program;
11. Disseminate the results of the study with institutions in charge of health and education in order to improve the strategies used;
12. Promote research related to the topic;
13. Conduct more frequent control of anthropometric data by the unit in charge; &
14. Hold frequent meetings by teachers with parents to discuss issues on the adequate and inappropriate consumption of food in children.

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