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Research Article

Overweight and Obesity in Students of the Primary School "Miguel Hidalgo y Costilla". Polyuc, Felipe Carrillo Puerto, Quintana Roo, Mexico

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ABSTRACT

Background: The Body Mass Index also called the Quetelet Index is a measure (kg/m²) used as an indicator of the adequacy of weight for a certain 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: Evaluate the nutritional situation of the students of the "Miguel Hidalgo y Costilla" Elementary School of the Polyuc community of the Mayan municipality of Felipe Carrillo Puerto, Quintana Roo, Mexico, during the period from 6 de March de 2019 to 7 de December de 2020.

Material and Methods: Descriptive cross–sectional epidemiological study with no directionality and prospective temporality. In the period from 6 de March de 2019 to 7 de December de 2020, 136 students from the "Miguel Hidalgo y Costilla" Elementary School were evaluated. The Mantel–Haenszel Chi–Square statistic ($x^2M–H$) was used as a hypothesis test or test of statistical significance. Likewise, the Epi Info software for Windows, version 7.1.4.0, was used to obtain the values of both the $x^2M–H$ statistic and the probability (p).

Results: Seventy–one (52.21%), 54 (39.71%), 9 (6.62%) and 2 (1.47%) students presented low weight, normal weight, overweight and obesity, respectively.

Conclusion: It is concluded that the students of the "Miguel Hidalgo y Costilla" Elementary School have health problems with respect to their nutritional situation since 60.29% (82/136) have a pathological nutritional situation (low weight, overweight and obesity).

Keywords

High-fidelity simulation, Diabetes, Nursing students, Diabetic ketoacidosis, Learning outcomes.

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Introduction

During the last years, together with the globalization process, important demographic, sociocultural, technological and economic transformations have taken place worldwide. Its most visible consequences have been changes in the epidemiological profile, in lifestyles, in food consumption patterns and in the morbidity and mortality rates of Latin American societies [1-3] among which a decrease in pathologies of infectious origin and a progressive increase in non–communicable chronic–degenerative diseases such as obesity [1] stand out.

Due to the magnitude and rapid growth of its prevalence in increasingly younger populations, obesity has begun to be treated as a global epidemic [4] directly affecting the child population of all socioeconomic levels, including those sectors that have not overcome poverty, but have sustained or deteriorated their socioeconomic level [5].

Paradoxically, in many of these low sectors, such as indigenous populations, high rates of child malnutrition have been registered for decades [6,7].

In the case of Mexico, it has been observed that in poor rural and indigenous populations that benefit from assistance programs to improve child nutrition and nutrition, child malnutrition coexists with overweight and obesity in adulthood [8,9].

However, reality suggests that the current child health problem is overweight and obesity, making these pathologies a social and public health problem [10].

On the one hand, because they give way to other chronic pathologies such as diabetes mellitus, high blood pressure and dyslipidemia, among others, which although they used to occur in adulthood, today children and adolescents suffer from them. On the other hand, because the nutritional status of children and adolescents who are at the age where maximum body development occurs, they also acquire the social behaviors that will guide their life styles and habits and, therefore, their profile in the state of health in productive or working age [5].

In indigenous populations that have experienced transformations –such as urbanization– obesity is acquiring characteristics little studied in Mexico. It is known that in urban aboriginal or autochthonous populations in North America (Canada and the United States of America) the prevalence of childhood and adolescent obesity has doubled in the last decade, acquiring a faster speed than in the rest of the countries where they lie not only because of the habits acquired from Western lifestyles, but also because of their ethnic and environmental vulnerability [11,12].

However, in a recent study by Bustos et al., 2009, in Chilean children, poverty turned out to be a risk factor for short stature, but a protector of obesity independent of ethnicity, which does not rule out that the low prevalence of obesity in schoolchildren should be marginalized because a decade ago obesity was not present in these populations [13].

Therefore, it is of interest to present the nutritional situation and the prevalence of overweight and obesity found in schoolchildren from the Polyuc community belonging to the Mayan municipality of Felipe Carrillo Puerto, Quintana Roo, Mexico.

For this, the following premises were considered: a) Childhood obesity is detected when 20% of the ideal weight is exceeded and the probability of being an obese adult when one has been an obese child is different, depending on the age of onset of said obesity [14,15]; b) Obesity that begins in childhood can have worse consequences than obesity that begins in adulthood [16,17]; and c) It is known that 40% of adults with obesity began to present it when they were overweight from 6 months to 7 years, and 70% for those who began with obesity between 10 and 13 years [18]. In addition to age, belonging to an ethnic group, class and gender are considered, since it is known that they should be transversal axes in epidemiological studies [19].

Reinforcing the approach, some pediatric studies have indicated that between the ages of 4 and 7 is when children slow down the rate at which they gain weight, forming a slight "V" in their growth curve called "adiposity rebound" [20]; this early decline in BMI reflects a corresponding decline in subcutaneous fat and percent body fat for age [21], but from ages 7 to 13 years they acquire increased numbers of adipose cells. In other words, the difference is explained because the cells that store fat multiply especially at this stage of life [18].

It should be recognized that there is a political concern in terms of health and social development to know when more public resources should be invested to prevent obesity and other chronic–degenerative diseases related to poverty, ethnicity, and poor eating habits, with the lack of physical activity and with the acquisition of urbanized and western lifestyles. This study also aims to point out the importance of knowing the prevalence of nutritional status through the Body Mass Index (BMI), at least once a year, as a simple tool to diagnose the development of obesity in childhood and in adolescence [22] since the BMI has the advantage of accounting for both weight and height of the individual. In practice, it has been shown that detecting if a child is gaining too much weight and at a faster rate than normal for their height helps to establish effective intervention policies to prevent childhood obesity from becoming a risk factor for obesity same morbid obesity in adulthood and other diseases that are related to the metabolic syndrome [19,23].

Background – Overweight and obesity – ENSANUT 2012 – Quintana Roo – School–age children (5–11 years)

Data from 517 school–age boys and girls were analyzed which, when applying the expansion factors, represented a population of 185,106 individuals. The sample size was 364 in urban areas, representing 152,702 children, and 153 in rural areas, representing 32,404 children. For the male gender, 275 representative observations of 95,130 boys were analyzed and for the female gender, 242 representative observations of 89,976 girls.

In 2012, the prevalences of overweight and obesity were 20.5% and 18.6%, respectively (sum of overweight and obesity= 39.1%). The national prevalences of overweight and obesity for this age group were 19.8% and 14.6%, respectively.

The prevalence of overweight in urban localities went from 24.7% in 2006 to 21.3% in 2012 and for rural ones it increased from 7.7% to 16.7%. The sum of both nutritional status conditions (overweight + obesity) in 2012 was higher for boys (45.5%) compared to girls (32.3%).

Anemia – School–age children (5–11 years)

Data from 375 children aged 5–11 years, representing a population of 181,685 individuals, were analyzed. The sample size was 263 in urban areas, representing 154,335 individuals, and 112 in rural areas, representing 27,350 individuals.

Of the school–age children in Quintana Roo, 10.9% (95%CI= 7.6–15.4) suffered from anemia, which represented 19,882 anemic children. The national prevalence of anemia for this age group was 10.1% (95% CI= 9.3–10.9).

A higher prevalence of anemia was observed in school children in rural areas compared to urban areas. 9.1% of schoolchildren in urban areas and 21.2% in rural areas had anemia. These prevalences represented 14,083 schoolchildren in the urban area and 5,799 schoolchildren in the rural area.

When comparing with the data from 2006 (11.5%; CI95%= 7.4–17.4), no statistically significant differences were observed in the prevalence of anemia in 2012.

It is important to point out that due to the sample size of both surveys, there was not enough statistical power to establish whether the changes in the prevalence of anemia were significant, so the data should be interpreted with caution.

General Objective

To identify the risk factors for overweight and obesity in the students of the "Miguel Hidalgo y Costilla" Elementary School in the community of Polyuc, Felipe Carrillo Puerto, Quintana Roo, Mexico.

Specific Objectives

Inform students through workshops about the foods and beverages they should consume according to their needs; & Create initiatives where physical activity is carried out at least twice a week.

Hypothesis Formulation

Null hypothesis (H0)

The nutritional situation of the students of the "Miguel Hidalgo y Costilla" Elementary School of the Polyuc community of the Maya municipality of Felipe Carrillo Puerto, Quintana Roo, Mexico, corresponds to the "normal weight" physiological nutritional situation, that is, 18.50 kg/m² ≤ BMI ≤ 24.99 kg/m².

Alternate Hypothesis, Working Hypothesis or Research Hypothesis (H1)

The nutritional situation of the students of the "Miguel Hidalgo y Costilla" Elementary School of the Polyuc community of the Maya municipality of Felipe Carrillo Puerto, Quintana Roo, Mexico, does not correspond to the "normal weight" physiological nutritional situation, that is, 18.50 kg/m² ≤ BMI ≤ 24.99 kg/m², and yes to pathological nutritional situations such as "low weight" (BMI < 18.50 kg/m²), "overweight" (25.00 kg/m² ≤ BMI ≤ 29.99 kg/m²) and "obesity" (BMI ≥ 30.00 kg/m²).

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, 136 students from the "Miguel Hidalgo y Costilla" Elementary School located in the Polyuc community of the Maya municipality of Felipe Carrillo Puerto, Quintana Roo, Mexico, were evaluated.

Figure 1: Polyuc, Felipe Carrillo Puerto, Quintana Roo, Mexico.

Population

It is located in the Mexican state of Quintana Roo in the municipality of Felipe Carrillo Puerto. Located at a height of 20 m. Polyuc provides a home for 1,226 inhabitants of which 623 are men or boys and 603 women or girls. 715 of Polyuc's population are adults and 103 are over 60 years of age. 800 inhabitants have access to social security.

Scholarship

Although 95 people aged 15 and over did not visit the school, only about 102 do not know how to read or write. In comparison, within

the group of young people between 6 and 14 years old, only a small number have no school education. Thus, the median time in which an inhabitant of Polyuc visits the school is 7 years.

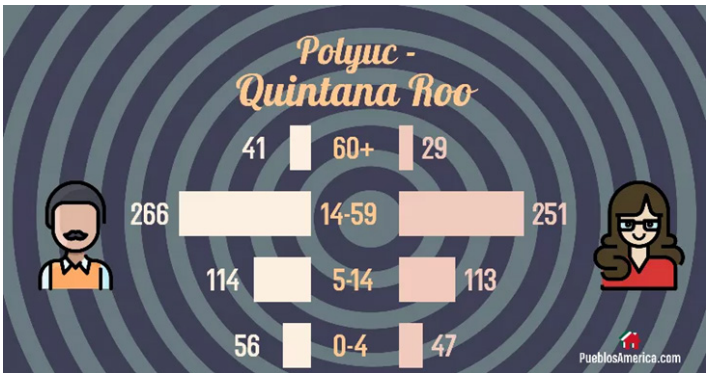


Figure 2: Population pyramid of the community of Polyuc, Felipe Carrillo Puerto, and Quintana Roo, Mexico.

Homes and Dwellings

Two hundred and ninety four households in Polyuc are equivalent to 294 habitable dwellings, of which 34 consist of a single room and 27 have dirt floors.

Of all the homes in Polyuc with 265, the vast majority have fixed sanitary installations and 194 are connected to the public network. On electric light they have 278 homes. Sixteen households have one or more computers, 174 have a washing machine, and as many as 222 have one or more televisions of their own.

Geodata

Polyuc's latitude (decimal) is 19.610000 and longitude (decimal) is –88.562222. In the DMS system the latitude is 193636 and the longitude is –883344.

Climate

It is located at an average height of 40 meters above sea level. Summers are short, hot, oppressive, and partly cloudy; the winters are hot, muggy, wet, and mostly clear. During the course of the year the temperature generally varies from 18°C to 34°C and rarely drops below 13°C or rises above 36°C. The hot season lasts 1.8 months –from April 6 to May 30– and the average daily maximum temperature is over 33°C. The hottest day of the year is May 5 with an average maximum temperature of 34°C and an average minimum temperature of 24°C. The cool season lasts 3.5 months –from October 23 to February 7– and the average daily maximum temperature is below 30°C. The coldest day of the year is January 15 with an average minimum temperature of 18°C and an average maximum of 29°C (Weather Spark. Retrieved from Polyuc Average Weather: https://es.weatherspark.com/y/13054/Climate–average–in–Polyuc–M%C3%A9xico–during–all–a%C3%B1o).

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; the evaluation of the nutritional situation is the action and effect of estimating, appreciating and calculating the condition in which 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 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 there are few children suffering 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.

Anthropometry

It is the study and technique of taking measurements in 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 carry out this evaluation, it is suggested to carry out the measurement placing the child with his eyes forward and his head erect, without shoes or hairstyles that alter the measurement; he should have his knees straight, his back straight and his eyes straight ahead; finally, height is recorded in m and weight in kg. Height is defined as the height of an individual in an upright position from the highest point of the head to the heels in a "standing at attention" position; it is measured in m [26].

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 kg/Height in m^2. Thus, through this value the nutritional situation can be determined according to the classification recommended by the WHO. The BMI is a method used to estimate the amount of body fat that a person has and, therefore, determine if the weight is within the normal range or, on the contrary, if they are overweight or underweight. To do this, the individual's height and current weight are related. This mathematical formula was devised by

the Belgian statistician Adolphe Quetelet, which is why it is also known as the Quetelet Index (QI) or Body Mass Index (BMI). The BMI is a formula that is calculated by dividing the weight, always expressed in kg, by the height, always expressed in m^2. Something to emphasize is that nutritionists advise against using the same measures in adults and children (Take care plus).

Overweight and Obesity

According to the WHO [27], overweight and obesity are defined as an abnormal or excessive accumulation of fat that can be detrimental to health. Given that, in 2016, an estimated 41 million children under the age of five were overweight or obese, and the prevalence of overweight and obesity in children and adolescents (5–19 years) has increased 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 with overweight in 2016. The WHO, 2020, defines that overweight and obesity are the abnormal or excessive accumulation of fat in the body that can be detrimental 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.

Nutritional Status

Using the words of Pedraza, 2003, the nutritional situation is, primarily, the result of the balance between the needs and expenditure of food energy and other essential nutrients and, secondarily, the result of a large number of determinants in a given space represented by physical, genetic, biological, cultural, psycho–socio–economic and environmental factors. These factors can lead to insufficient or excessive intake of nutrients or prevent the optimal utilization of ingested food. It should be added that there are three factors that lead to this nutritional situation, such as: 1. the scarce availability of food; 2. the low use of health services or their poor management; and 3. the family's ability to care for the most vulnerable.

Calories

Measurement of the energy content of food. The body needs calories to carry out its functions such as breathing, blood circulation and physical activity. When a person is sick, their body may need extra calories to fight fever or other problems. It is known that the body needs these calories, since it provides us with energy to do the activities in the day, but excessive consumption can harm our health since it is very common to find these calories in fast food and sugars, for which consumption excess can cause diseases such as overweight and obesity [28].

Physical Activity

Sanchez Bañuelos, 1996, considers that "physical activity can be seen as bodily movement of any kind produced by muscle contraction and that leads to a substantial increase in the person's energy expenditure". Like Garcia, 1997, who defines physical activity as: "the science, technology and practice that aims to study the elements and their intervening interrelationships in the physical educational field and that tries to explain and regulate normatively its processes of differentiated accommodation tending to achieve the educational objectives, proposed in advance, in the institutional framework that concretizes it". Since when carrying out these activities that are very positive for our health and keeping us healthy, it is also advisable not to do it in excess since not doing it correctly or with the warm–up steps can harm us.

Degenerative Diseases

Degenerative diseases occur when the body's regeneration mechanisms do not work properly and damage both the structure and function of organs, tissues and cells. People who experience a condition of this type gradually lose vital functions. Diseases such as cancer, muscular dystrophy or osteoarthritis are some of the pathologies of this type [29].

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 a precision of one mm 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 ($x^2M–H$) was used. The Epi Info software for Windows, version 7.1.4.0, was used to obtain the values of $x^2M–H$ 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 (1909–1980) [28]: 1. When $N > 40$, use the $x^2M–H$ test; 2. When $20 \leq N \leq 40$ use the $x^2M–H$ 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.

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

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

Data Processing

In the preparation stage, the data was reviewed (information

quality control); classified (on qualitative and quantitative scales); computerized (using IBM SPSS Statistics software for Windows, Version 22); presented (in Tables and Graphs); and summarized (the summary measures corresponding to the qualitative and quantitative scales were used). 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, 136 students from the "Miguel Hidalgo y Costilla" Elementary School located in the Polyuc community of the Maya municipality of Felipe Carrillo Puerto, Quintana Roo, Mexico, were evaluated.

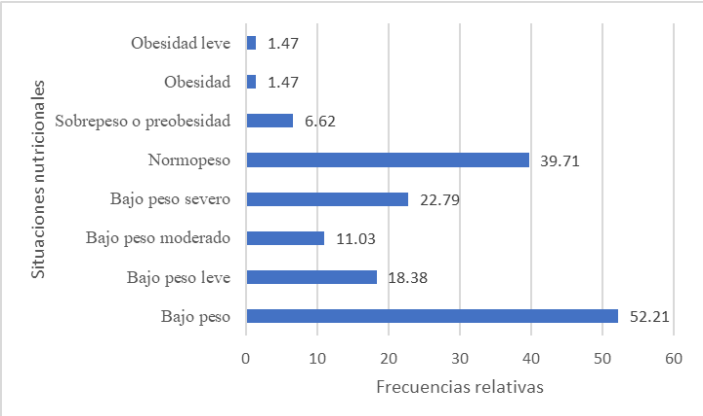
Table 1 shows the absolute frequencies and the relative frequencies of the students of the "Miguel Hidalgo y Costilla" Elementary School according to their nutritional status.

Graph 1 shows the corresponding relative frequencies.

Table 1: Absolute frequencies and relative frequencies of students according to nutritional status. Elementary School "Miguel Hidalgo y Costilla". Polyuc, Felipe Carrillo Puerto, Quintana Roo, Mexico.

Nutritional Situations	Absolute Frequencies	Relative Frequencies
Low weight	71	52.21
–Slightly underweight	25	18.38
–Moderate underweight	15	11.03
–Severe underweight	31	22.79
Normal weight	54	39.71
Overweight	9	6.62
Obesity	2	1.47
–Mild obesity	2	1.47
Totals	136	100.00

Source. Own elaboration.



Graph 1: Relative frequencies of students according to nutritional status. Elementary School "Miguel Hidalgo y Costilla". Polyuc, Felipe Carrillo Puerto, Quintana Roo, Mexico.

In descending numerical order, the highest prevalence rate was observed in the pathological nutritional situation "underweight" (52.21%; 71/136) and then in the pathological nutritional situation "overweight" (6.62%; 9/136) and "obesity" (1.47%; 2/136).

A statistical comparison was made of the prevalence rate of the pathological nutritional situation "low weight" (52.21%; 71/136) versus the corresponding prevalence rate of the pathological nutritional situation "overweight" (6.62%; 9/136) finding a statistically significant difference: $x^2M–H(\alpha= 0.0500; df= 1) \geq 3.8416; p \leq 0.0500$.

Next, we proceeded to the statistical comparison of the prevalence rate of the pathological nutritional situation "low weight" (52.21%; 71/136) versus the corresponding prevalence rate of the pathological nutritional situation "obesity" (1.47%; 2/136) finding a statistically significant difference: $x^2M–H(\alpha= 0.0500; df= 1) \geq 3.8416; p \leq 0.0500$.

Finally, when comparing the prevalence rate of the pathological nutritional situation "overweight" (6.62%; 9/136) versus the corresponding prevalence rate of the pathological nutritional situation "obesity" (1.47%; 2/136), found a statistically significant difference: $x^2M–H(\alpha= 0.0500; df= 1) \geq 3.8416; p \leq 0.0500$.

Discussion

In descending numerical order, the highest prevalence rate was observed in the pathological nutritional situation "low weight" (52.21%; 71/136) and then in the pathological nutritional situation "overweight" (6.62%; 9/136) and "obesity" (1.47%; 2/136).

A statistical comparison was made of the prevalence rate of the pathological nutritional situation "low weight" (52.21%; 71/136) versus the corresponding prevalence rate of the pathological nutritional situation "overweight" (6.62%; 9/136) finding a statistically significant difference: $x^2M–H(\alpha= 0.0500; df= 1) \geq 3.8416; p \leq 0.0500$.

Next, we proceeded to the statistical comparison of the prevalence rate of the pathological nutritional situation "low weight" (52.21%; 71/136) versus the corresponding prevalence rate of the pathological nutritional situation "obesity" (1.47%; 2 /136) finding a statistically significant difference: $x^2M–H(\alpha= 0.0500; df= 1) \geq 3.8416; p \leq 0.0500$.

Finally, when comparing the prevalence rate of the pathological nutritional situation "overweight" (6.62%; 9/136) versus the corresponding prevalence rate of the pathological nutritional situation "obesity" (1.47%; 2/136), found a statistically significant difference: $x^2M–H(\alpha= 0.0500; df= 1) \geq 3.8416; p \leq 0.0500$.

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