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Obesity in children and adolescents, as measured by BMI and ideal weight: case educational institutions in Caracas, Venezuela

Abstract

This study was carried out, whose objective was to compare obesity using ideal weight and BMI, in a group of children and adolescents of Caracas, for which it was taken as probabilistic sample, the students of two educational institutions of the Capital District, conformed by 441 schoolchildren, of them 255 (52.68%) males and 229 (47.32%) females. The variables were measured: sex, age, weight, ideal weight, height and BMI, descriptive statistical measures were applied, as well as relationship, sensitivity and specificity. The results revealed that percentages of similar overweight between CDC and PV, and between OMS and PI; likewise, it is observed that the percentage of obesity with the PI is much higher than that obtained with OMS; However, when the WHO model was considered as a reference model, a sensitivity of 0.95 and a specificity of 0.84 were obtained for the PI criterion. In conclusion, it can be affirmed that for this group of schoolchildren, the criterion of the PI is acceptable, since, it allows to placing the students in the category of obesity with a 95% probability.

Keywords: overweight, obesity, ideal weight, body mass index, children, adolescents

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Abbreviations: RR, relative risks; BMI, body mass index; WHO, world health organization; CDC, center for disease control and prevention

Introduction

Nowadays, globally, both overweight and obesity are a health problem, because in many countries it has been present, particularly in vulnerable groups, such as children and adolescents.[1] On the other hand, obesity and overweight are serious problems that involve an increasing economic burden for families, particularly in families with lower incomes, since it implies continuous attendance at the medical consultation, as a consequence of the problems it causes. Moreover, if one takes into account that overweight acquired during childhood or adolescence can persist during adulthood, and increase future risks of coronary heart disease, diabetes, gallbladder diseases, some types of cancer and osteoarthritis of the joints that support weight. Fortunately, this evil can be prevented to a large extent by introducing appropriate changes in lifestyle.[2] Additionally, in the case of nutritional deficiencies such as protein malnutrition, energy, iron, vitamin A and iodine deficiency, these affect the participation and learning of schoolchildren, because they are a very vulnerable age group.[3] It must be borne in mind that obesity is a complex disease characterized by the excessive accumulation of fat tissue in the body, weight gain and its consequences, with numerous complications, and can be caused by many causes. Obesity results from an imbalance between consumption and energy expenditure, although it is also associated with social, behavioral, cultural, physiological, metabolic and genetic factors. Obesity does not distinguish between skin color, age, socioeconomic status, sex or geographical location, and it has multiple health consequences.[4,5] Similarly, obesity is part of the metabolic syndrome; It is a known risk factor for chronic diseases such as: heart disease, diabetes, high blood pressure, stroke and some forms of cancer. The evidence suggests that it is a multifactorial disease: genetic, environmental, and psychological, among others, excessive accumulation of fat in the body, general hypertrophy of adipose tissue.[6] Additionally, obesity is a disease whose prevalence has had a marked increase in the last four decades; such an increase has led to obesity being considered as a public health problem since 1997,[7] which must be addressed promptly, since as expressed by the WHO, "The health of the population contributes decisively to economic development And social"; In addition, it is important to bear in mind that "Health is both an objective and a decisive contribution to the achievement of other objectives.[7,8] The latest calculations of the World Health Organization (WHO), indicate that in 2005 there were around 1600 million adults (over 15 years old) overweight worldwide; at least 400 million obese adults and at least 20 million children under 5 overweight.[9,10] However, even though overweight and obesity were previously considered a problem unique to high-income countries, recent studies show that it is increasing alarmingly in low- and middle-income countries, particularly in urban areas.[9,10]

However, for many specialists worldwide, defining obesity is difficult, and this is due to the fact that there are many factors that cause it and vary among populations. In such a way that in the case of children, it becomes much more difficult to define it, but it is important to know that it is considered normal that at four months of age there is a large amount of fat, which decreases steadily between two and six years and increase around seven years. On the other hand, it is known that when a child is obese between six months and seven years of age, the probability of this being obese in adulthood is 40%. If a child is obese between ten and thirteen, the odds are 70%; This is explained because the cells that store fat, that is, the adipocytes, multiply at this stage of life, which increases the child's chance of being obese as an adult.[1,2]

In the case of Venezuela, figures for the year 2004, place obesity for the group of children and adolescents from 7 to 14 years old, in 13.7%.[4,6] And according to the Food and Nutritional Surveillance System (SISVAN), in Venezuela, for the year 2007, the figure of boys and girls with overweight reached 13.12%, higher than the previous year, which stood at 11.67%.[11] More recently, according to the INN, in the voice of María Alejandra Chávez, who affirms that "It is said that for every ten children, three are obese, which indicates that in the future our society will be obese".[12] While according to the AVN, for the year 2010, the obesity figure is 9.0%.[13] The complications of overweight and obesity in childhood are several: cardiovascular (cardiopathies and cerebral vascular accidents), diabetes, hypertension, increase in total cholesterol, increase in serum triglycerides, increase in LDL (low density lipoprotein), increase of VLDL (very low density lipoproteins), decrease in HDL (high density lipoprotein), hyperinsulinism, cholelithiasis, sliding and flattening of the capital femoral epiphysis, pseudotumor cerebri, Pickwick syndrome, abnormal pulmonary function tests, etc.[3,14,] This may be linked to sociocultural factors of these low-income populations, where access to food is limited by the low purchasing power of families, as well as the lack of knowledge about the benefits of many foods that do not consume.

Materials and methods

The sample was selected through a probabilistic stratified sampling procedure, with a reliability of 95% and a maximum error of 3.3%; It is made up of 340 schoolchildren of the El Libertador Educational Unit, located in the Chacao Municipality, Miranda State and 144 students of the Antímano II Educational Unit, located in the West Sector of the Libertador Municipality, Capital District, for a total of n=484 school The information collection period was between November 2010 and March 2011. The following variables were considered: sex, age, weight, height, BMI and Ideal Weight. For the measurement of these variables, the criteria suggested by the WHO were taken into account;[3] likewise, internationally validated anthropometric techniques were used.[15] Measurements were made for each of these variables, with the support of a group of previously standardized students of Nutrition and Dietetics; the students were measured and weighed without shoes, in their underwear, following established and internationally accepted techniques.[16,17] The BMI was obtained through the methods a) Center for Disease Control and Prevention (CDC, 2000), percentile≥85 and <95, risk of overweight, percentile≥95, obesity; b) WHO, BMI>+1DE, overweight and BMI≥+2DE, obesity; c) Venezuela Project, percentile between P90 and P97, risk of overweight, d) ideal weight,% of ideal weight between 110 and 120, overweight; percentage of ideal weight>120; obesity.

The World Health Organization (WHO) published in 2006 a new International Child Growth Pattern, referring to infants and young children and suggests the following table to classify the Body Mass Index. Severe thinness (<- 3DE); Thinness (<-2DE); Normal (-1DE to+1DE); Overweight (>+1DE); Obesity (≥+2DE). The overweight category is equivalent to BMI 25 kg/m^2 to 19 years, and the obesity category is equivalent to BMI 30kg/m^2 to 19 years.[18] Similarly, the Center for Disease Control, CDC for its acronym in English, presented in 2000, the revised version of the growth charts, specifically the Tables of Body Mass Index (BMI) for age and sex, establishing as criterion the percentiles, and suggest the following cut-off points: Below the appropriate weight (P<5%); Healthy weight (P5 to P85); Overweight risk (P>95%); Overweight (P85 to P95),[19] For its part, the Venezuela Project considers as a classification criterion for overweight and obesity, based on the percentiles according to weight and gender, the following: Deficit (P<3%); Deficit risk (P3 to P10); Normal ((P10 to 90); Overweight risk (P90 to P97) and Overweight (P>97%).[20] The French physician and surgeon Paul Pierre Broca, in the year 1871, based on studies carried out in a group of soldiers, proposed the use of an index that consists in obtaining the body weight of an individual from his height; this way it has that the suitable weight or ideal weight comes given by: P (kg)=E (cm)-100; where P is the weight, expressed in kg and E the height, measured in cm. The value obtained varies according to sex: men:±10% and women:±15%; also it has limitations, since applicable only to people with less than 1.65 m height; reason why other methods are used, particularly the body mass index (BMI).[21] For the classification a percentage of Ideal Weight is taken into account, which is given by% PI= Real Weight x 100 / Ideal Weight, and the following categories: Severe malnutrition (<60% of the PI), Moderate malnutrition (60% to 90% of the PI), Normality (90% to 110% of the PI), Overweight (110% to 120% of the PI) and Obesity (>120% of the PI). The BMI Group Calculator-Metric_no99. xls program of the CDC was used to calculate the BMI values and the corresponding percentiles. Descriptive statistical measures were obtained as average, deviation and coefficient of variation; measures of association such as chi-square and evaluation as sensitivity and specificity.

Result

The group made up of 484 schoolchildren distributed as follows: 144 of the Antímano II Educational Unit and 340 of the Libertador Educational Unit, both of the Capital District, Caracas, Venezuela, enrolled in the 2010-2011 school years. As can be seen in the results presented in (Table 1), the averages for age, weight and BMI are higher in the Educational Liberating Unit, while the average of the size is the same in both institutions. With regard to the ideal weight, the averages are very similar for both institutions, although the standard deviation is slightly higher in the El Libertador Educational Unit. When comparing the results, by gender and institution, it can be seen that in the Antímano II Educational Unit, the averages, of all the variables, for the female gender are higher than the averages for the male gender; while in the El Libertador Educational Unit, the averages, of all the variables, for the female gender, are lower than the averages for the male gender. Similarly, for the variables age, weight and BMI, the averages are higher in the El Libertador Educational Unit, with average height and ideal weight being very similar. According to the WHO criteria, the prevalence of overweight is 8.88%; while the prevalence of obesity is 4.14%. By gender, overweight is similar in children (8.63%) and girls (9.17%).

Regarding the classification, according to the CDC the results indicate that the prevalence of overweight 18.39% and prevalence of risk of overweight (obesity) of 9.71%. In the case of Overweight, the prevalence is higher in girls than in boys; likewise, there is a higher percentage (Prevalence) of risk of overweight in children (11.76%) than in girls (7.42%). Regarding the Venezuela Project criteria, the prevalence of Overweight Risk is 16.74%, being similar in both genders (46.91% and 43.09% for boys and girls, respectively), while prevalence of overweight is 7.43%, being much higher in children (63.89%) than in girls (36.11%). On the other hand, the classification according to the criterion of Ideal Weight the prevalence of Obesity is 19.63% and of Overweight is of 9.71%. When considering each gender, we have that for Obesity there are 21.96% in children and

17.03% in girls, while for Overweight there are 10.20% in boys and 9.17% in girls. When the WHO criterion was considered as a model, and the criterion was compared using the Ideal Weight, to classify the children and adolescents in obese and non-obese, a Sensitivity of 0.95 and a Specificity of 0 was obtained, 8362, which allows to affirm that there is a probability of 0.95 to classify them as obese, using the PI; while there is a probability of 0.84 to classify them as non-obese, when using this criterion Table 2.

Table 1 Statistical measures of the variables: Age, Weight, Size, BMI and Ideal Weight, school children of the Educational Units Antímano II and Libertador, by gender,

Caracas Venezuela. School year 2010-2011

Variable	**Antímano II educational unit**											
	Male				**Female**				**Total**			
	Media	**Desv.**	**Maximum**	**Minimum**	**Media**	**Desv.**	**Maximum**	**Minimum**	**Media**	**Desv.**	**Maximum**	**Minimum**
		1,76	13,00	6,00	9,80	1,77	13,00	6,00	9,61	1,77	13,00	6,00
Peso	33,55	9,63	68,00	19,50	35,50	10,27	67,00	20,10	34,51	9,96	68,00	19,50
Talla	136,14	11,86	166,00	111,00	138,20	10,81	160,00	113,00	137,15	11,37	166,00	111,00
IMC	17,79	3,09	30,22	13,92	18,23	3,16	28,62	12,89	18,00	3,12	30,22	12,89
Peso Ideal (Brocca)	36,14	11,86	66,00	11,00	38,20	10,81	60,00	13,00	37,15	11,37	66,00	11,00
Variable	**Libertador Educational Unit**											
	Male				**Female**				**Total**			
	Media	**Desv.**	**Maximum**	**Minimum**	**Media**	**Desv.**	**Maximum**	**Minimum**	**Media**	**Desv.**	**Maximum**	**Minimum**
Edad	10,54	2,08	15,00	6,00	10,06	2,01	15,00	2,08	10,32	2,05	15,00	6,00
Peso	37,47	14,15	108,80	18,80	35,96	10,87	108,80	14,14	36,77	12,73	108,80	17,80
Talla	137,24	14,13	173,00	108,00	136,74	13,53	173,00	14,13	137,01	13,84	173,00	105,00
IMC	19,29	4,09	40,45	12,96	18,83	3,15	40,45	4,09	19,08	3,68	40,45	12,20
Peso Ideal (Brocca)	37,24	14,13	73,00	8,00	36,74	13,53	73,00	5,00	37,01	13,84	73,00	5,00

Table 2 Distribution of school children, according to WHO, CDC, Venezuela Project and Ideal Weight criteria. Antímano II and El Libertador Educational Units. Caracas, November 2010 - March 2011

OMS criterio (2006)	**Condition**	**M**	**%**	**F**	**%**	**T**	**%**
-2DE < IMC≤-1DE	Undefined	28	10,98	31	13,54	59	12,19
-1 DE < IMC≤ 1DE	Normal	191	74,90	171	74,67	362	74,79
+1DE <IMC≤+2DE	Overweight(a)	22	8,63	21	9,17	43	8,88
IMC >+2 DE	Obesity(b)	14	5,49	6	2,62	20	4,14
Total		255	52,69	229	47,31	484	100,00
CDC criterion	**Condition**	M	%	**F**	%	**T**	%
IMC < %5	Under weight	7	2,75	9	3,93	16	3,30
5% ≤ IMC < 85%	Healthy weight	175	68,63	157	68,56	332	68,60
85% ≤ IMC < 95%	Overweight Risk	43	16,86	46	20,09	89	18,39
IMC ≥ %95	Overweight	30	11,76	17	7,42	47	9,71
Total		255	52,69	229	47,31	484	100,00
Venezuela project criterion	**Condition**	**M**	%	**F**	%	**T**	%
P < 3%	Deficit	2	50,00	2	50,00	4	0,83
P3 - P10	Deficit risk	4	36,36	7	63,64	11	2,27
P10 – P90	Normal	188	53,41	164	46,59	352	72,73
P90 - P97	Overweight Risk	38	46,91	43	43,09	81	16,74

Table continuded

P > 97%	Overweight	23	63,89	13	36,11	36	7,43
OMS criterio (2006)	**Condition**	**M**	**%**	**F**	**%**	**T**	**%**
Total		255	52,69	229	47,31	484	100,00
Ideal weight criterion	**Nutritional situation**	**M**	**%**	**F**	**%**	**T**	**%**
< 60	Severe Malnutrition	0	0	1	0,44	1	0,21
60 - 90	Moderate malnutrition	89	34,90	75	32,75	164	33,88
90 - 110	Normal	84	32,94	93	40,61	177	36,57
110 - 120	Overweight	26	10,20	21	9,17	47	9,71
>120	Obesity	56	21,96	39	17,03	95	19,63
Total		255	52,69	229	47,31	484	100,00

Discussion

The classification according to the CDC reflects an incidence of risk of overweight of 9.71% and overweight of 18.38%, results higher than those reported by Arbes et al, who found that about 16.00% of children and young Americans from 2 to 19 years old are obese, as reported by Tango, who found that about 24.00% of children aged 2 to 5 years are obese,[22,23] higher than those reported by Somaya & Mustafa[22] who found that BMI according to the CDC classification, 5.8%, of children with overweight, as well as greater than the result obtained by Marqués et al.,[23] 8.3% of obesity; and also higher than those reported by Bauce, who reports 10.20%.[24] The WHO classification allowed obtaining an obesity prevalence of 4.14% and 8.88% of overweight, which is lower than those reported by Arbes & Tango et al.,[20,21] where the incidence of obesity is 16.0% and 24.0%, respectively, although the percentage of obesity of 4.14% is lower than that reported by Somaya & Mustafa[22,25] who report 5.8%. Similarly, these results are lower than those reported by Tovar Mojica et al.,[26] who studied a group of 655 children between 7 and 18 years old, and the prevalence of overweight and obesity was 20% and 18.1%.

Respectively, and both the percentage of obesity and the overweight, lower than that reported by Bauce (4.93% and 9.54%).[24] percentage of overweight is significantly lower (20.8%).[27] Regarding the results obtained when applying the criteria of the Venezuela Project, there is a 7.43% overweight, higher than that reported by Somaya and Muatafa, but lower than reported by Arbes et al, Tango, Tovar Mojica;[20–23,28] although similar to that reported by Bauce (7.24%).[24] Likewise, when applying the criterion of Ideal Weight, it is necessary that 19.63% of Obesity, is lower than that obtained by Somaya & Mustafa[22] and that obtained by Tovar Mojica; although higher than that obtained by Arbes & Tango et a.,[20–23] and much higher than that obtained by Bauce (2,63%).[24] On the other hand, the application of several methods or criteria to estimate the prevalence of overweight and obesity in children and adolescents, leads to obtaining dissimilar results, however, when calculating the Relative Risks (RR), considering the genders, we have that for the CDC method, for overweight the RR is equal to 1.33 and the RR for obesity is 1.59, which means that it is 1.3 times more likely that there is a male overweight than in females; while it is 1.59 times more likely that there is an obese male than a female. Likewise, the RR was calculated for the other two methods used, and it is tained that for the WHO method, it is 0.91 more likely to find an overweight male than a female, and it is 1.21 times more likely to find an obese male than a female; while for the PV method, it turns out that it is 1.07 times more likely to find an overweight male than to find an overweight female and it is 0.79 times more likely to find an obese male than to find an obese female. As we can see, with the PV method, the RR value is lower R=0.78) in the case of obesity, and with the WHO method the RR value is lower (RR=0.91) in the case of overweight. Additionally, the WHO model was considered as a reference model, and the PI model was used to classify children and adolescents in obese and non-obese, and a sensitivity of 0.95 and a specificity of 0.84 were obtained. However, no references were found from previous studies that consider these two indicators, in order to make a comparison.

Conclusion

The application of several methods to estimate overweight and obesity, involves the use of different criteria that therefore produce results that may vary in terms of the prevalence of these two health situations, more when it comes to populations that by their very nature are vulnerable. However, the results obtained by the method suggested by the Project Venezuela, are lower in terms of risk of overweight, and even lower in the case of overweight, which if assumed as obesity estimated by the other methods, is still much less. There is a need to continue carrying out this type of study with more numerous populations, in order to verify the results obtained here, and in this way to validate one of the methods used. It must be taken into account that since obesity is associated with chronic diseases, it is interesting to keep in mind what was affirmed by Farías Yáñez,[27] such as the fact that obesity leads to "insulin resistance and increases circulating levels of insulin". Such situation is aggravated because" at some point the control of the glycemia is lost and the glucose intolerance occurs; and finally type 2 diabetes occurs. Likewise, it is very important to carry out studies on the incidence of childhood obesity, taking into account that according to the WHO, in 2013, more than 42 million children under the age of five was overweight, which evidence that the near future will be potential obese adults.[28]

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Conflict of interest

Author declares no conflict of interest.

References

1. Ministry of Health. Presidency of the Nation. *World Survey of School Health Results*. Argentina; 2007.

2. Taras Howar. Nutrition and student performance at school. *Journal of School Health*. 2006;75(6):199–213.

3. WHO Expert Committee on physical status: *Physical status: use and interpretation of anthropometry*. Series of technical reports, 854. Geneva, Switzerland; 1995.

4. For a better quality of life. 2017.

5. *Obesity*. 2017.

6. Speakman John. Obesity: the integrated roles of environment and genetics. *J Nutr*. 2004;134(8):2090S–2105S.

7. World Health Organization. *Report on health in the world*. Forging the future. 2003.

8. Narvaez G, Narvaez J. *Body Mass Index (BMI) New Vision and Perspectives Laboratory of Morphofunctional Evaluations*. LABEMORF, Quito, Ecuador, 2017.

9. Better lifestyle. *A meeting of health and welfare*.

10. *Journalism in Health*.

11. Chávez María, Alejandra INN. *The obesity index in Venezuela grows*.

12. AVN. Social management. *Childhood obesity in Venezuela registers 9% incidence*. 2010.

13. *Overweight and Obesity Criteria*. World Health Organization (WHO), 1995.

14. López M, Landaeta M. *Growth and development manual. Venezuelan Society of Childcare and Pediatrics*. Caracas: Fundacredes, Serono Laboratory, Caracas; 1991.

15. WHO Expert Committee on Obesity. *Obesity: preventing and managing the global epidemic*. Report of a WHO consultation on obesity. WHO technical report series, 894. Geneva, Switzerland; 2000.

16. Appropriate body-mass index for Asian populations and their implications for policy and intervention strategies. *Lancet*. 2004;363(9403):157–163.

17. Centers for Disease Control and Prevention. *About BMI for children and teen*. 2009.

18. Funda credesa. *National Study of Human Growth and Development of the Republic of Venezuela*. Project Venezuela. Caracas Venezuela, Index Broca, 1995.

19. M Dolores Cabañas Armasilla. *Anthropometry and Health Indices*. Complutense University of Madrid, Spain.

20. Arbes SJ, Muilenberg M, Burgge H, et al. The relationship between the dust and the allergen and asthma in the first national survey of lead and allergens in housing. *Jorn Alle Cli Imm*. 2002;(109)1:S357.

21. Tango. *Health Day News*.

22. Somaya Al Jawder. *Comparison between schools students performance (high and low) in relation to BMI and anemia*.

23. Marqués LL, Olivares Cortés S, Leyton Dinamarca B, et al. Patrones alimentarios y su relación con sobrepeso y obesidad en niñas chilenas de nivel socioeconómico medio-alto. *Arch Lat Nutr*. 2006;56(2):165–170.

24. Bauce Gerardo. Comparación entre referencias del IMC, para obesidad y sobrepeso, en niños de tres ciudades de Venezuela. *En: Revista del Instituto Nacional de Higiene Rafael Rangel*. Caracas, 2011;42(1):7–15.

25. Pérez EC, Sandoval MJ, Schneider SE. Epidemiología del sobrepeso y la obesidad en niños y adolescentes. *Revista de Posgrado de la VIa Cátedra de Medicina*. Marzo 2008;179:16.

26. Tovar Mojica G, Gutiérrez Poveda J, Ibañez Padilla M, et al. Sobrepeso, inactividad física y baja condición física en un colegio de Bogotá, Colombia. *Arch Latinoam Nutr.* 200858(3):265–273.

27. Farías Yañez A. Obesidad y síndrome metabólico en niños. Prevalencia y Fisiopatología. *Rev Venez Endocrinol Metab*. 2007;5(2):3–7.

28. OMS. *Obesity and overweight*. Centro de Prensa Nota descriptive, 2015;311.