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Obesity Status of Children from 4 to 7 Years of Age in the Commune of Arica: A Comparative Study according to Gender

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ABSTRACT Obesity remains to be a global health problem. Chile has been affected by the high prevalence of obesity in the infant population. Obesity is shown interchangeably at early ages, being necessary to investigate this behavior in age groups of 4 to 7 years. To this end, a general objective has been set: to evaluate the nutritional status, from the anthropometric point of view, of children from 4 to 7 years of age in the district of Arica, carrying out a non-experimental, quantitative, cross-sectional, descriptive-comparative study. As a result, it was found that there weren't statistically significant differences in the prevalence of obesity and overweight among girls and boys, although girls showed values of body mass index and percentage of fat mass discretely higher than boys and, the obesity increase was directly proportional to age.

INTRODUCTION

Obesity continues to be a topic of scientific interest, especially because despite all the actions taken by different governments and countries, high levels of obesity continue to be recorded worldwide, both in adults and infants.

The World Health Organization (WHO) (2016) highlights that the number of infants and young children (from 0 to 5 years) suffering from overweight or obesity increased from 32 million in 1990 to 41 million in 2016. Only in the African Region, the number of overweight or obese children increased from 4 to 9 million in the same period. In developing countries with emerging economies, the prevalence of childhood overweight and obesity in pre-school children exceeds thirty percent. In Chile, childhood obesity has also increased, which was reflected in the results of the System of Measurement of the Quality of Education (SIMCE) 2016. In the area of Physical Education, 9568 eighth grade primary education children in 309 establishments were evaluated, revealing a worrying physical state of Chilean schoolchildren. According to these results, forty-five percent of the students were overweight or obese, which implies an increase of four percentage points, compared to previous studies released by this same entity.

The prevalence of obesity has been shown indiscriminately regarding sex. In a study conducted in the United States by Wang (2011), it is estimated that between 1988-1994 and 2007-2008, men had a faster increase in the prevalence of obesity than women.

Zhang et al. (2018), indicate that, the prevention of childhood obesity in China should focus on gender, especially for children, since they usually show a self-assessment that reflects less likely to be obese in the future, being males, those who mostly reported that they consumed less healthy foods and presented at the same time, more overweight or obese compared to females.

Based on an epidemiological foundation, it can be highlighted that childhood obesity has shown an increase in recent years (Ajejas et al. 2018), which makes it necessary to continue developing research that may contribute to a bet-

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ter understanding of this international problem. Particularly Chile, shows high levels of childhood obesity and the northern region, in the same way, has demonstrated high values of childhood obesity.

On the other hand, it has been proven in the literature that, the increase in obesity occurs parallel with age; seeing its beginning at early ages of life.

In the district of Arica, the behavior of obesity is unknown in children from 4 to 7 years of age, making it necessary to develop research that contributes to a greater epidemiological knowledge in relation to this condition.

In the same way, in the last years, multiple studies have been carried out where the level of obesity according to gender is indistinctly reflected. It is necessary to identify how this behavior manifests itself in the children of the city of Arica since this could give rise to actions that contemplate the characteristics, interests and particular needs of each child, taking gender into account.

In this regard, there is no need in the literature for recent relevant studies that highlight the behavior of childhood obesity in this age group in northern Chile. Likewise, there is no anthropometric characterization, including weight, height, head, thoracic, and waist circumferences, body mass index (BMI), active body mass (MCA) and percentage of fat mass (% BF) of boys and girls 4 to 7 years old from the commune of Arica.

Objectives

General Objective

To evaluate the nutritional state, from the anthropometric point of view, of boys and girls from 4 to 7 years in the city of Arica.

Specific Objectives

1. Analyze comparatively the corporal composition of boys and girls of the city of Arica, according to age and sex.
2. To determine the prevalence of overweight and obesity in children from 4 to 7 years old in the district of Arica.

METHODOLOGY

A non-experimental, quantitative, cross-sectional, descriptive-comparative study was carried out. The sample consisted of children from pre-kinder, kinder, 1st and 2nd grades, with ages between 4 to 7 years old of Cardenal Antonio Samoré and Ignacio Carrera Pinto (G-27) schools of the district of Arica.

Sample Selection

The selection of the sample was carried out intentionally and not stratified, based on inclusion and exclusion criteria. To consider the sample as representative, it was calculated from the sample "n" based on the information provided by the National Institute of Regional Statistics (INE) regarding the universe of the population of children included in these age groups in the district of Arica, obtaining a sample value n = 232 boys and girls.

Inclusion Criteria

- The children should be enrolled in the official school registration.
- Approval of participation in the investigation (informed consent for the children).
- Informed consent of the parents regarding the participation of their children in the investigation.

Exclusion Criteria

- To withdraw from the test.
- Absence on the day of the exam.
- Children who were not in accordance regarding school grade and age.

Considered Variables

Amongst the considered variables, the following stand out as dependent variables: Fat Mass Percentage (% BF), Body Mass Index (BMI). As intervening variables: Quality of the measuring materials, the experience of the evaluator, the time of realization of the measurements, conditions of the place where the measurements were made regarding lighting and pleasant climate. In the same way, it was taken into account

that the child came with appropriate clothing and that they had not performed any physical activity or consumed food prior to the evaluations.

Procedure

In the present investigation, the prevalence of obesity was determined in children from 4 to 7 years, which was established through the analysis of the Body Mass Index.

Body Mass Index (BMI)

BMI= Weight (kg) / Size^2 (m)

Subsequently, the evaluation was performed considering the curves established according to the Centers for Disease Control and Prevention (CDC) that include BMI values, specific for age and sex, in boys and girls.

Body Fat Mass Percentage (% BF)

Deurenberg y Weststrate. Referred by Urrejola et al. (2011).

%BF= [562- 4.2 (age -2)] x D - [525- 4.7 (age-2)].

Where:

Men (Pre-pubertal)

Density (D) = 1.1133-0.0561(log "4 folds) + 1.7 (age x 10^{-3})

Women (Pre-pubertal)

%BF= [562- 1.1 (age -2)] x D- [525- 1.4 (age -2)].

Where:

D= 1.1187 – 0,063 (log " 4 folds) + 1.9 (age x 10^{-3})

"4 Folds= sum of folds: Biceps, Triceps, Subscapular and suprailiac.

Equipment Used

- Digital Balance with Fitness Analyzer. Omron HBF-514 C
- ADE Portable Height Meter. Germany MZ 10042: measuring range from 60 to 200 cm
- Measuring Tape: ADE. Germany
- Adipose Panicle Meter (Pliometer): Holtain Type, Measuring range: 0 mm to 48 mm
- Anthropometer Harpender of Holtain (Game). Range of 50 mm to 570 mm
- Slide Gauge. Measuring range: 0 mm to 250mm. Mitutoyo brand
- Tabs taking measurements
- Pencils
- Pencils for body marking
- Calculator, Sharp brand

Bioethics Aspect

The research protocol respected the principles of the Declaration of Helsinki, the World Medical Association, on Human Rights and Biomedicine. Before obtaining the basic data to develop the research, it was necessary to comply with the bioethical procedures stipulated when investigations are carried out with human beings. To do this, letters were prepared requesting authorization from each director of schools or schools, as well as information to the teachers of the students; In addition, the consent of each parent or guardian was obtained, the informed consent of each child participating in the investigation was obtained, and finally, the approval of the ethics committee of the university was obtained.

Data Analysis

A computerized analysis of all the data obtained through the IBM SPSS static 21 program was carried out. All the variables mentioned above were subjected to mathematical statistical processing, which included, among others: Absolute (n) and relative (%) frequencies, Average (X) and Standard Deviation (DS), depending on the type of data processed. At the same time, the level of significance was assessed through the T-student test.

RESULTS

In this study, anthropometric assessments were developed for children from 4 to 7 years old in the district of Arica, located in northern Chile. The results presented in Table 1 show the body weight, both in male and female, evidencing in the 4-year-old female a weight of 21.4 kg, the males, on the other hand, presented 18.6 kg. When evaluating children of 5 years old, this variable showed 22.26 kg in the female and 22.01 kg in males. For the age of 6 years, the weight was 24.2 and 27.87 kg for female and male respectively. Additionally, in children 7 years old, the weight of the female were 27.84 kg, while the males showed 26.94 kg. Regarding the corporal

Table 1: Body weight boy and girls from 4 to 7 years: Group statistics

Sex	*Age*	*Weight (kg).*	*N*	*Mean*	*Standard deviation of mean*	*Standard error of mean*
Female	4	Weight (kg)	37	21.40	4.82	1.15
	5	Weight (kg)	33	22.26	3.78	0.97
	6	Weight (kg)	33	24.20	4.50	0.85
	7	Weight (kg)	37	27.84	6.15	1.41
Male	4	Weight (kg)	14	18.96	3.96	1.48
	5	Weight (kg)	23	22.01	3.01	0.88
	6	Weight (kg)	21	27.87	6.62	2.03
	7	Weight (kg)	34	26.94	4.87	0.21

Table 2: Size boy and girls from 4 to 7 years: Group statistics

Sex	*Age*	*Size (cm).*	*N*	*Mean*	*Standard deviation of mean*	*Standard error of mean*
Female	4	Size (cm)	37	107.53	6.89	1.65
	5	Size (cm)	33	111.50	5.36	1.37
	6	Size (cm)	33	116.70	4.77	1.18
	7	Size (cm)	37	123.61	5.35	1.24
Male	4	Size (cm)	14	106.57	4.00	1.49
	5	Size (cm)	23	112.25	4.77	1.28
	6	Size (cm)	21	120.31	6.30	1.94
	7	Size (cm)	34	123.05	5.16	1.28

weight of general form, the females showed a more significant weight than the males, presenting an average of 23.9 kg in the female and 22.9 kg in male, with the exception of 6-year-old male and female where male had more weight than female, although this difference was not statistically significant. In the same way, it was possible to verify that increase of the corporal weight is directly proportional to the increase of age.

The results present in Table 2 show the behavior of the size. As evidence, there is an increase in height with age, and this behaved indistinctly in the different age groups, being higher in the female of 4 years and 7 years, and in the males of 5 and 6 years respectively; although these differences were not statistically significant. According to gender, the male presented discretely superior sizes to the female, their average was 115.5 cm, while in the female it was 114.8 cm.

When knowing the results of the measurements of head circumference present in children of northern Chile, it was possible to prove that the evidenced variations, both by age and by gender were not significant, evidencing in the 4-year-old female values of 51.20 cm, while males presented a circumference of 50.5 cm. At the ages of 7 years, this variable showed 51.85 cm in females and 52.03 cm in boys to mention a few examples (Table 3).

Table 4 shows the values of the thoracic circumference, being able to verify that the female

Table 3: Head circumference boys and girls from 4 to 7 years: Group statistics

Sex	*Age*	*Head circumference (cm)*	*N*	*Mean*	*Standard deviation of mean*	*Standard error of mean*
Female	4	Head circumference (cm)	37	51.20	1.82	0.48
	5	Head circumference (cm)	33	51.03	1.73	0.42
	6	Head circumference (cm)	33	51.08	1.54	0.37
	7	Head circumference (cm)	37	51.85	1.86	0.42
Male	4	Head circumference (cm)	14	50.50	0.88	0.31
	5	Head circumference (cm)	23	51.78	2.04	0.47
	6	Head circumference (cm)	21	52.04	1.77	0.54
	7	Head circumference (cm)	34	52.03	1.49	0.36

Table 4: Thorax circumference boys and girls from 4 to 7 years: Group statistics

Sex	*Age*	*Thorax circumference*	*N*	*Mean*	*Standard deviation of mean*	*Standard error of mean*
Female	4	Thorax circumference	37	57.80	6.08	1.43
	5	Thorax circumference	33	59.22	4.22	1.57
	6	Thorax circumference	33	61.11	5.56	1.37
	7	Thorax circumference	37	63.42	6.85	1.58
Male	4	Thorax circumference	14	54.77	8.63	3.69
	5	Thorax circumference	23	59.77	4.37	1.29
	6	Thorax circumference	21	64.06	8.39	2.51
	7	Thorax circumference	34	63.64	5.31	1.32

Table 5: Waist circumference of boys and girls from 4 to 7 years: Group statistics

Sex	*Age*	*Waist circumference*	*N*	*Mean*	*Standard deviation of mean*	*Standard error of mean*
Female	4	Waist circumference	37	55.10	6.35	1.47
	5	Waist circumference	33	56.38	4.98	1.26
	6	Waist circumference	33	59.58	6.92	1.51
	7	Waist circumference	37	59.56	6.74	1.56
Male	4	Waist circumference	14	53.99	4.94	1.87
	5	Waist circumference	23	56.51	4.67	1.37
	6	Waist circumference	21	61.45	8.86	2.72
	7	Waist circumference	34	59.26	5.63	1.40

of general form presented a lower value of thoracic circumference, its average was of 60.3 cm. Meanwhile the males showed an average of 60.5 cm. Only in the 4-year-old females, the values were higher, being 57.8 cm in females and 54.77 cm in males.

Table 5 shows that waist circumference in females aged 4 and 7 years old was higher than in males, while at 5 and 6 years old these results were slightly higher in females than in the male counterparts. Evaluating the behavior by gender, this variable presented an average in the female of 57.6 cm, while in males it was 57.8 cm.

The results presented in Table 6, concerning body mass index (BMI) show that female of 4 years old presented an index of 18.44 kg/m^2 while males exhibited 16.58 kg/m^2. In the group of 5 years, this result was 18.29 kg/m^2 and 17.43 kg/m^2 respectively for female and male, while in the ages of 6 and 7 years old in the female, these results were 17.83 kg/m^2 and 18.21 kg/m^2, and for their part, male presented 19.07 kg/m^2 and 17.68 kg/m^2 respectively. Being generally more significant in the females than in the males, (female 18.1 kg/m^2, males 17.6 kg/m^2) with the only exception of the group of 6 years old that behaved indistinctly.

Table 7 shows the percentage values of fat mass present in children from 4 to 7 years of age. As it can be seen, that an increase in this percentage is directly proportional to the age. Concerning the analysis by gender, it was observed that

Table 6: Body mass index boys and girls from 4 to 7 years: Group statistics

Sex	*Age*	*BMI*	*N*	*Mean*	*Standard deviation of mean*	*Standard error of mean*
Female	4	BMI	37	18.44	3.15	0.74
	5	BMI	33	18.29	2.58	0.65
	6	BMI	33	17.83	2.20	0.58
	7	BMI	37	18.21	2.97	0.68
Male	4	BMI	14	16.58	2.35	0.88
	5	BMI	23	17.43	1.71	0.49
	6	BMI	21	19.07	2.98	0.91
	7	BMI	34	17.68	2.10	0.52

Table 7: Percent body fat boys and girls from 4 to 7 years: Group statistics

Sex	*Age*	*% BF*	*N*	*Mean*	*Standard deviation of mean*	*Tip. error of media*
Female	4	% BF	37	15.13	6.65	1.54
	5	% BF	33	17.78	5.88	1.48
	6	% BF	33	17.74	5.90	1.44
	7	% BF	33	18.65	7.30	1.64
Male	4	% BF	14	13.09	4.52	1.82
	5	% BF	23	15.23	4.30	1.29
	6	% BF	21	18.34	7.44	2.30
	7	% BF	34	16.01	6.03	1.48

the females had a higher percentage of fat mass, excluding the 6-year-old group from this result. The average percentage of fat mass was 17.3 percent, while for male this was 15.6 percent.

When performing an analysis of the active body mass MCA (kg), it was found that this variable in the 4-year-old female behaved at 17.95 kg while in the males it was 16.36 kg. In the group of ages 5 and 6 years, these results were 18.54 kg for female and 18.58 kg for male, as well as 19.79 kg and 22.39 kg for male and female of 6 years old. On the other hand, it was possible to see an index of 22.25 kg in the female of 7 years and 22.40 kg in the children evaluated in the same age group (Table 8). As shown, the MCA was higher in male than in female. Only in the group of 4 years old, this variable showed differences in favor of the female, these differences not being statistically significant.

DISCUSSION

In the present study, the female presented values of overweight and obesity discretely higher than those reported by male, not coinciding with the results obtained in the research conducted by Lasarte-Velillasa et al. (2015), who evaluated a total of 35,824 female and male from 2 to 14 years old, in a health sector of Zaragoza, based on the body mass index. These researchers found 18.3 percent prevalence of obesity in female and male. Checking in their analysis, according to gender, 20.9 percent of males were found with obesity, while in the females this variable was evidenced in at 15.3 percent.

Similarly, Hernández et al. (2016) were able to analyze 2,336,791 children under five in Peru, finding a prevalence of obesity higher in males than in females. Fradkin et al. (2018) emphasized the existence of a higher prevalence of obesity and overweight, in male students from 10 to 13 years old in three geographical regions of Brazil.

On the other hand, a research conducted by Vicente et al. (2018) refer to a high prevalence of obese children from an early age and showed in their research, a more significant presence of obesity in female than in male of 5-6 years old, which corresponds with the results found in researchers' study.

In another recent investigation, carried out by Oliván (2018), it was possible to analyze the prevalence of overweight and obesity in immigrant adolescents in Aragón, Spain. This research included a sample of 274 adolescents

Table 8: Active body mass boys and girls from de 4 to 7 years: Group statistics

Sex	*Age*	*MCA*	*N*	*Mean*	*Standard deviation of mean*	*Tip. error of media*
Female	4	MCA	37	17.95	3.09	0.74
	5	MCA	33	18.54	3.09	0.79
	6	MCA	33	19.79	2.24	0.56
	7	MCA	37	22.25	3.26	0.75
Male	4	MCA	14	16.36	2.72	1.03
	5	MCA	23	18.58	2.20	0.60
	6	MCA	21	22.39	3.63	1.11
	7	MCA	34	22.40	2.31	0.71

between the ages of 11 and 17 years, concluding that, according to the BMI, the females presented more overweight and obesity than the males, coinciding with the results presented in researchers' research.

On the other hand, Shamah-Levy et al. (2018) studied a population under 20 years old in Mexico, based on a representative national survey. They concluded that the prevalence of overweight and obesity in female and adolescents in rural areas showed a significant increase in a short period, while in males, this behavior was lower, coinciding in this way with the results achieved in researchers' study.

On the other hand, Martinez et al. (2018), compared different methods of calculating the percentage of body fat (% BF), by anthropometry and bioimpedance (BIA), in a juvenile-juvenile population of Jujuy, analyzing 232 schoolchildren; showing in female values of %BF of 21.8 percent, higher than the one exposed by the females from Arica (17.56%). On the other hand, male Jijeños exhibited 12.2 percent of BF, these results being lower than those evidenced by children who live in the district of Arica (15.66%). It should be highlighted that in both studies different methodologies were used to calculate the percentage of fat mass.

CONCLUSION

It was concluded that females showed a higher prevalence of obesity than males. The same behavior was evidenced in the percentage of fat mass and body weight, but not in the active muscle mass, in height, in the cephalic and thoracic circumference, highlighting that none of the variables analyzed showed a statistically significant difference.

RECOMMENDATIONS

Expand the studies to other age groups, framed in stages before and after puberty.

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