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Anthropometric evaluation and emotional alterations in adolescents

Avaliação antropométrica e alterações emocionais em adolescentes

Antropometría y alteraciones emocionales en adolescentes

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ABSTRACT

Introduction: Adolescence is a period characterized by physiological, psychological, and behavioral changes, which can cause malnutrition affecting the emotional state. **Objective:** Describe the anthropometric evaluation and emotional alterations in adolescents. **Methods:** This quantitative, non-experimental, cross-sectional study was conducted in Ambato, Ecuador, from September 2023 to February 2024. The population consisted of 49 students from the Intercultural Bilingual Educational Unit of Chimborazo Province, aged 12-14. Anthropometric evaluation and validated psychological questionnaires were applied. **Results:** Among the adolescents with low weight: 11 boys aged 13.2±1.0, weight 42.5±7.9 kg, height 1.54±0.08 m, BMI 17.6±1.5 kg/m^2, waist circumference 69.5±3.7 cm, hip circumference 82.1±5.9 cm, and WHR 0.85±0.05. 12 girls aged 12 showed partially inadequate eating habits and low physical activity levels. Internalizing problems included abnormal emotional symptoms (12.24%) in 13-year-old girls and 14-year-old boys, and borderline social withdrawal (12.24%) in 12-year-old girls and 13-year-old boys. Externalizing problems included abnormal behavior (16.32%) in 12- and 14-year-old girls, normal hyperactivity (16.32%) in 12-year-old girls, and an abnormal prosocial scale (18.36%) in 12- and 14-year-old girls. Depression was mild (14.29%) in 14-year-old boys. Adolescents with normal weight showed internalizing problems (24.49%) in 14-year-old girls, while low-weight adolescents exhibited externalizing problems (20.41%) in 14-year-old boys. **Conclusions:** The highest frequency was evident in adolescents with low weight, abnormal emotional symptoms, borderline social withdrawal, abnormal prosocial scale, normal weight at 14 years of age, internalizing problems in girls, and externalizing problems in low-weight boys.

Keywords: Teen; Nutritional condition; Eating habits; Mental health; Adolescent Behavior.

RESUMO

Introdução: A adolescência é um período caracterizado por mudanças fisiológicas, psicológicas e comportamentais, que podem causar desnutrição afetando o estado emocional. **Objetivo:** Descrever a avaliação antropométrica e as alterações emocionais em adolescentes. **Métodos:** Estudo quantitativo, não experimental, transversal, realizado em Ambato, Equador, de setembro de 2023 a fevereiro de 2024. A população consistiu de 49 estudantes da Unidade Educacional Intercultural Bilíngue da Província de Chimborazo, de 12 a 14 anos. Foram realizadas avaliações antropométricas e questionários psicológicos validados. **Resultados:** Entre os adolescentes com baixo peso: 11 meninos de 13,2±1,0 anos, peso 42,5±7,9 kg, altura 1,54±0,08 m, IMC 17,6±1,5 kg/m^2, circunferência da cintura 69,5±3,7 cm, circunferência do quadril 82,1±5,9 cm e WHR 0,85±0,05. 12 meninas de 12 anos mostraram hábitos alimentares parcialmente inadequados e baixos níveis de atividade física. Problemas internalizantes incluíram sintomas emocionais anormais (12,24%) em meninas de 13 anos e meninos de 14 anos, e retirada social borderline (12,24%) em meninas de 12 anos e meninos de 13 anos. Problemas externalizantes incluíram comportamento anormal (16,32%) em meninas de 12 e 14 anos, hiperatividade normal (16,32%) em meninas de 12 anos, e uma escala prosocial anormal (18,36%) em meninas de 12 e 14 anos. A depressão foi leve (14,29%) em meninos de 14 anos. Adolescentes com peso normal apresentaram problemas internalizantes (24,49%) em meninas de 14 anos, enquanto adolescentes com baixo peso exibiram problemas externalizantes (20,41%) em meninos de 14 anos. **Conclusões:** A maior frequência foi evidente em adolescentes com baixo peso, sintomas emocionais anormais, retirada social borderline, escala prosocial anormal, peso normal aos 14 anos, problemas internalizantes em meninas e problemas externalizantes em meninos com baixo peso.

Palavras-chave:Adolescente;Nutrição; Hábitos alimentares; Saúde mental; Comportamento Adolescente.

RESUMEN

Introducción: La adolescencia es un período caracterizado por cambios fisiológicos, psicológicos y conductuales, que pueden causar malnutrición afectando el estado emocional. **Objetivo:** Describir la evaluación antropométrica y las alteraciones emocionales en adolescentes. **Métodos:** Estudio cuantitativo, no experimental, transversal, realizado en Ambato, Ecuador, de septiembre de 2023 a febrero de 2024. La población consistió en 49 estudiantes de la Unidad Educativa Intercultural Bilingüe de la Provincia de Chimborazo, de 12 a 14 años. Se realizaron evaluaciones antropométricas y cuestionarios psicológicos validados. **Resultados:** Entre los adolescentes con bajo peso: 11 niños de 13.2±1.0 años, peso 42.5±7.9 kg, altura 1.54±0.08 m, IMC 17.6±1.5 kg/m^2, circunferencia de cintura 69.5±3.7 cm, circunferencia de cadera 82.1±5.9 cm y WHR 0.85±0.05. 12 niñas de 12 años mostraron hábitos alimenticios parcialmente inadecuados y bajos niveles de actividad física. Problemas internalizantes incluyeron síntomas emocionales anormales (12.24%) en niñas de 13 años y niños de 14 años, y retirada social borderline (12.24%) en niñas de 12 años y niños de 13 años. Problemas externalizantes incluyeron comportamiento anormal (16.32%) en niñas de 12 y 14 años, hiperactividad normal (16.32%) en niñas de 12 años, y una escala prosocial anormal (18.36%) en niñas de 12 y 14 años. La depresión fue leve (14.29%) en niños de 14 años. Los adolescentes con peso normal mostraron problemas internalizantes (24.49%) en niñas de 14 años, mientras que los adolescentes con bajo peso exhibieron problemas externalizantes (20.41%) en niños de 14 años. **Conclusiones:** La mayor frecuencia fue evidente en adolescentes con bajo peso, síntomas emocionales anormales, retirada social borderline, escala prosocial anormal, peso normal a los 14 años, problemas internalizantes en niñas y problemas externalizantes en niños con bajo peso.

Palabras clave: Adolescente; Estado nutricional; Hábitos alimentarios; Salud mental; Comportamiento adolescente.

INTRODUCTION

Adolescence is a period of growth and development where physiological, psychological and behavioral changes are experienced, the adolescent presents stages of vulnerability, mood changes, difficulty making decisions, changes in routine and detachment from activities that they used to enjoy. This plays an important role in the new dynamics of their life influencing their physical and mental health (Brito & Brito-Manchenoo, 2023). According to the United Nations (UN), adolescence ranges from 10 to 19 years old. It is considered a transition period from childhood to adulthood (Roy et al., 2021).

Malnutrition has become a public health problem, which is present in all age groups, increasing its numbers every year. It is alarming since it affects both the physical and psychological part of the human being (Lakasing & Mirza, 2020). Malnutrition is the lack, excess or imbalance of a person's caloric and nutrient intake (Rivera-Vásquez et al., 2021). It is classified as: malnutrition, overweight or obesity (Organización Mundial de la Salud, 2021). Obesity and overweight are defined as the exponential increase in weight and growth of adipose tissue, producing multiple biological and emotional conditions, inadequate eating habits, reduction in physical activity, increasing the risk of contracting comorbidities (Fonseca et al., 2020). Good nutritional status is important for the correct functioning of the body. It helps prevent and reduce pathologies that may occur due to external or internal factors, consuming high-calorie and hyperlipidic foods can result in poor body functions (Muscaritoli, 2021).

In recent years, mental status has covered a large field in the area of health. Adolescents suffer from decreased self-esteem, school failure, bullying, anxiety or depression when they are overweight or obese (Tamayo et al., 2020). Statistics from the World Health Organization (WHO) report that 20% of adolescents between 10 and 19 years old have mental health problems (Roy et al., 2021). Worldwide, at least 10% of children and adolescents experience problems with anxiety, depression or unstable behavior (Liverpool et al., 2023).

On the other hand, malnutrition is defined as the set of clinical, chemical and anthropometric manifestations produced by the deficit of macro and micronutrients in the diet (Alvarez-Ortega, 2019). The main causes are parasitic diseases, diets with insufficient food intake, food insecurity or socioeconomic factors (Rivera-Vásquez et al., 2021).

Gender stereotypes and beauty standards implemented by society affect the female gender (Lobos-Coyopae, 2022). Adolescents often do not feel accepted because of their body image, which causes problems with self-perception and self-esteem and triggers emotional alterations (Ortiz-Montero & Fernández-Soto, 2022).

A study carried out in Chile established that 16.1% of the total adolescent population suffers from obesity or overweight (Rojas-Calisto et al., 2022). In Peru, the numbers are high. A study showed that adolescents belonging to a high- and middle-income economic circle are more likely to develop obesity and overweight (López-Malque et al., 2023). In Ecuador, in recent years the health standard has been raised, achieving great achievements in the face of morbidity and mortality. However, despite the efforts, there is still a growth in the rate of obesity or overweight in the population (Camelo et al., 2021).

The physiological and behavioral changes suffered by the adolescent in their transition are complex, which is why updates must be maintained on problems that may exist in the adolescent population. For these reasons, the objective of the research is to describe the anthropometric evaluation and emotional alterations in teenagers

METHODS

The present research has a quantitative approach, non-experimental design, cross-sectional, correlational scope. The study was carried out in Ecuador, Tungurahua, Ambato during September 2023–February 2024. The study population was made up of 49 students from the Intercultural Bilingual Educational Unit of the Province of Chimborazo, from the eighth, ninth and tenth grades, between the ages of 12– 14 years old. It included the early adolescence subgroup and 100% of the population through census sampling was selected (López-Roldán & Fachelli, 2018).

Inclusion criteria: Students legally enrolled in eighth, ninth and tenth grades, in early adolescence at the time of taking anthropometric measurements and questionnaires. To have their informed consent signed by their representative and by themselves. **Exclusion criteria**: Population under 12 years of age or over 14 years of age. Adolescents who do not have parental authorization through informed consent or who do not wish to participate voluntarily. Adolescents with acute or chronic pathologies detected by medical histories, physical examination or complementary evaluations. Adolescents with smoking habits and/or alcohol abuse.

Technique and data collection: Anthropometric measurements were taken (height, weight, waist and hip circumference), as well as the application of structured and validated questionnaires.

Anthropometric evaluation: To determine the weight, a "FOSET BASIC" brand digital scale with 4 high-precision pressure sensors, calibrated and with a capacity of up to 180 kg was used. The weight measurement technique involved previously waxing the scale for each measurement. In addition, the adolescents wore light clothing, they did not carry accessories, shoes, or heavy objects in their pockets. Subsequently, the patient was asked to stand in an erect position, with the upper limbs on both sides of the body, the palms and fingers of the hands straight and extended downwards, looking forward, with the weight distributed on both feet (Lesvia & Velázquez, 2021).

For the size, it was indicated that they stand up, leaning against the wall, with their heels together. A fiberglass measuring tape was used, with a length of 2.2 meters and precision of 1.0 mm. To perform the correct technique, they were requested to stand erect next to the carving belt, without shoes or hair accessories (Ministerio de Salud et al., 2018).

Data collection instruments:

Body mass index (BMI) is a value that relates a person's weight to their height, a predictor for vascular and metabolic diseases (Lesvia & Velázquez, 2021). It is calculated based on the following formula (Weight in kg/height in square meters (m2))(Ministry of Health et al., 2018). It has a classification of: underweight <18.5; suitable 18.5-24.9; overweight 25–29.9; obesity I 30–34.9; obesity II 35.0–39.9; obesity III>40.

To interpret the results, the WHO growth curves for children and adolescents aged 5 to 19 years were applied based on anthropometric indicators: BMI/Age (BMI/E), height/Age (Height/E), using a deviation of the value from the mean in terms of standard deviation (SD) units. The score is located on a typical dispersion curve, a z score of zero establishes that the indicators are normal, the positive sign indicates the location above the mean: A z-score of 1SD is one standard deviation above the mean, +2SD is 2 standard deviations above the mean, +3SD is 3 standard deviations above the mean, the negative sign indicates the location below the mean: A z-score -1 SD is one standard deviation below the mean, a score of -2SD is 2 standard deviations below the mean and -3SD is 3 standard deviations below the mean (Ministerio de Salud et al., 2018).

Interpretation of anthropometric indicators with the Z score: BMI/Age: malnutrition: BMI/E≤-2SD, risk of malnutrition: BMI/E≤-1SD and >-2SD, normal or eutrophic: BMI/E>-1SD and < +1SD, overweight: BMI/E≥+1SD and <+2SD, and obesity: BMI/E≥ +2SD and <+3SD. The size/Age indicator (size/E): Low size: T/E≤-2SD, normal low size: T/E≤-1SD and >-2D, normal: T/E >-1SD and <+1SD, high normal height: T/E≥+1SD and <+2SD, high height T/E≥+2SD (Ministerio de Salud et al., 2018)

For waist circumference (WC), the adolescent must remain standing and is taken at the midpoint between the rib and the iliac crest at the height of the midpoint of the armpit. The adolescent was asked to remain wearing a thin T-shirt for the measurement. Waist circumference is part of the nutritional evaluation to qualify this variable it is necessary to relate age and sex. Its classification is normal <p75; risk of abdominal obesity ≥p75-<p90, abdominal obesity ≥p90 (Fundación Española del corazón, 2022).

Waist-hip index (WHR) is the most accurate anthropometric indicator to consider the total value of total body fat and intra-abdominal fat mass (González-Jiménez et al., 2013). To calculate the waist-hip index (WHR), it is necessary to use the formula: waist circumference divided by hip circumference. Its classification is ≤10 years: F: 0.85, M: 0.84; 11-12 years: F:0.85, M: 0.89; 13-14 years: F: 0.85, M: 0.88; 15-16 years: F: 0.84, M: 0.86 (Kaufer-Horwitz et al., 2019).

Self-completed eating habits questionnaire for adolescents: to be used in the Latin American population, it was modified according to the dietary characteristics of the Mexican population aged 12 to 15 years and it has Cronbach's alpha reliability of 0.70 (Flores-Vázquez & MacedoOjeda, 2016). It consists of four sections, three of them evaluate eating habits and the last section physical activity. For the evaluation of eating habits and physical activity, the score was given: 0 to 3 points in items with a single question, 0 to 1.5 points in items with 2 or more questions. Section one has a maximum of 12 points, section two of 21 points, section three of 18 points, giving a total of 51 points for the eating habits section, while section 4 consists of a maximum of 12 points (López-René et al., 2022). The diagnostic category of the questionnaire is (inadequate<25.5; partially inadequate 25.5–38.5; adequate>38.5) and physical activity (inadequate<6; partially inadequate 6–9; adequate>9).

Physical Activity Questionnaire for Adolescents (PAQ-A): is related to other questionnaires that measure physical activity in athletes and teachers (Yáñez Cárdenas et al., 2022). Cronbach's alpha reliability 0.83 can be applied to adolescents from 12 to 17 years old. Each activity has a score of 1 to 5 points. An arithmetic mean must be performed to obtain the score for each item. Once the score for all items is obtained, the total is divided by 9 and the final value is determined. It has a ranking scale: very low (1-1.99 points), low (2-2.99), regular (3-3.99), Intense (4-4.99) and very intense 5 points (Manchola-González et al., 2017).

Strengths and Difficulties Questionnaire (SDQ): derived from its English name Strengths and Difficulties Questionnaires, designed by Goodman in 1997 for populations aged 4 to 16 years. This scale measures five specific indexes and one general index. The subscales measure emotional symptoms, peer problems (social withdrawal), conduct problems, hyperactivity, and prosocial behavior (Rivas-Arribas et al., 2018). There are internalizing factors (emotional problems and peer problems) and externalizing factors (behavioral problems and hyperactivity). It consists of 25 questions, for each subscale we find 5 items with three response options (0=Not true; 1=somewhat true; 2=totally true). However, in items 7, 11, 14, 21, 25 the score changes to (2=not true; 1=somewhat true, 0=completely true). The total subscale is the sum of the first four subscales, while the last subscale measures prosocial behavior (Fenollar-Cortés et al., 2016). The reliability coefficients of the SDQ scale vary according to each subscale, hyperactivity with Cronbach's alpha of 0.63 and prosocial behavior at 0.74. The interpretation of the SDQ questionnaire is total difficulty score (normal: 0–15; borderline: 16–19; abnormal: 20–40) and prosocial behavior (normal: 6–10; borderline: 5; abnormal: 0–4).

Children's Depression Inventory (CDI) questionnaire: it is the Children's Depression Inventory instrument. It was created, validated and standardized by María Kovacs in 1977. Until today, it is one of the most used instruments internationally to identify depression at ages 7 at 17 years (Segura-Camacho et al., 2010). The CDI does not have a psychometric analysis by racial or ethnocultural groups (Ventura-León et al., 2020). It has a Spanish language version that has been used in Chile, Peru and Colombia. It has a Cronbach's alpha reliability of 0.94. It consists of 27 questions with three statements each. The evaluated person must choose the one that best describes their mood regarding the last two weeks with a 3-point Likert-type scale, where the absence of points is 0, low presence is 1 and high presence is 2 (Ventura-León et al., 2020). The CDI evaluates two scales: dysphoria made up of the items (1,2,3,4,6,10,11,12,16,27,18,19,20,21,22,26,27) and negative self-esteem by the items (5,7,8,9,13,14,15,23,24,25), which provides a diagnosis of depression, the maximum score for dysphoria is 34 points and for negative self-esteem is 20 points (Cumba-Avilés, 2020). The CDI diagnostic category by percentile is without the presence of depressive symptoms: 1-25 points; mild: 26-74 points, severe: 75-89 points, maximum degree: 90-99 points (Wang et al., 2019).

The data obtained were processed through the statistical software Statistical Package for the Social Sciences Statistics 29.0 for Windows (SPSS). Statistical analysis was applied through the calculation of the numerical and percentage distribution. The results will be presented through tables (Rivadeneira-Pacheco et al., 2020).

Ethical aspects

The Declaration of Helsinki of the World Medical Association, of the Ethical Principles for Medical Research on Human Beings was complied within its article 8, which establishes, in medical research on human beings, the rights of the person who participates must always have the primacy over all other interests (Del Percio, 2020). The application of informed consent to the representatives and the assent of the students, the anonymity of the participants, confidentiality of their personal data, strictly academic data management and that the intervention did not imply any risk were considered (Peacok et al., 2019). This research was approved by the Bioethics Committee for Research on Human Beings, of the Faculty of Sciences, Technical University of Ambato, Ecuador with the document: 289-CEISH-UTA-2023. It is also linked to the Research Project "Characterization of Immunometabolism as a predictive parameter of the complications of Childhood Malnutrition", from the Operational Research Unit, Faculty of Health Sciences, Directorate of Research and Development (DIDE), approved by the University Council of the Technical University of Ambato with Resolution: UTA -CONIN-2023-0141.

RESULTS AND DISCUSSION

Table 1. Anthropometric variables of adolescents

Anthropometric variables	Female sex			Male sex		
	Underweight adolescents (n=9)	Normal weight adolescents (n=13)	Overweight adolescents (n=2)	Underweight adolescents (n=11)	Normal weight adolescents (n=12)	Overweight adolescents (n=2)
Age (years)	12.6±0.5	12.5±0.5	13.0±0.0	13.2±1.0	13.2±0.6	13.0±0.0
Weight (kg)	39.9±7.0	49.8±9.3	57.5±3.5	42.5±7.9	49.1±8.3	67.5±2.5
Size M)	1.48±0.07	1.54±0.05	1.57±0.01	1.54±0.08	1.58±0.06	1.59±0.03
BMI (kg/m^2)	17.9±2.1	20.9±3.0	23.4±3.2	17.6±1.5	19.5±2.0	26.8±2.1
WC (cm)	66.1±4.3	75.5±5.1	82.5±0.5	69.5±3.7	73.3±5.6	91.0±1.0
HC (cm)	82.5±6.1	92.8±6.7	103.0±1.0	82.1±5.9	88.1±5.1	100.0±3.0
(WHR)	0.80±0.05	0.81±0.03	0.80±0.01	0.85±0.05	0.83±0.04	0.91±0.02

Note. Own elaboration with the research data (2024)
BMI: body mass index; WC: waist circumference; HC: hip circumference; (WHR): waist-hip ratio

Table 1 shows the key anthropometric variables such as age, weight, height, body mass index (BMI), waist and hip circumference, and waist-hip index (WHR) of the 49 adolescents evaluated, classified by sex and nutritional status: underweight, normal weight and overweight. In general, differences are observed in the averages of the variables between the low weight, normal weight and overweight groups, which was expected given the definition of these nutritional categories based on BMI.

Analyzing by sex, in the low weight group, female adolescents (n=9) have on average a lower age (12.6±0.5 years), weight (39.9±7.0 kg), height (1, 48±0.07 m) and BMI (17.9±2.1 kg/m2) than underweight men (n=11) with 13.2±1.0 years, 42.5±7.9 kg, 1.54±0.08 m and 17.6±1.5 kg/m2 respectively. Underweight women also have smaller waist (66.1±4.3 cm vs 69.5±3.7 cm) and hip circumferences (82.5±6.1 cm vs 82.1±5.9 cm), but a slightly lower WHR (0.80±0.05 vs 0.85±0.05).

In the normal weight group, women (n=13) are younger (12.5±0.5 years) than men (n=12) at 13.2±0.6 years. They have higher average weight (49.1±8.3 kg vs 49.8±9.3 kg), height (1.58±0.06 m vs 1.54±0.05 m) and BMI (19 .5±2.0 kg/m2 vs 20.9±3.0 kg/m2). Normal weight adolescents have larger waist circumferences (75.5±5.1 cm) and hips (92.8±6.7 cm) than males (73.3±5.6 cm and 88.1±5.1 cm) respectively, but a lower WHR (0.81±0.03 vs 0.83±0.04).

In the overweight group there is only data for 2 women and 2 men. Adolescents show lower age (13.0 years), weight (57.5±3.5 kg), height (1.57±0.01 m) and BMI (23.4±3.2 kg/m2) than men aged 13.0 years, 67.5±2.5 kg, 1.59±0.03 m and 26.8±2.1 kg/m2 on average. Waist and hip circumferences are smaller in women (82.5±0.5 cm and 103.0±1.0 cm) than in men (91.0±1.0 cm and 100.0±3.0 cm). 0cm). The HC is also lower in overweight adolescents (0.80±0.01 vs 0.91±0.02).

Table 2. Eating habits of adolescents

				Eating habits			Total population
				Inadequate	Partially inadequate	Suitable	
Age	**Sex**						
12		Man	Frequency	1	2	0	3
			Percentage	2.04	4.08	0	6.12
		Women	Frequency	1	8	3	12
			Percentage	2.04	16.33	6.12	24.49
13		Man	Frequency	3	7	0	10
			Percentage	6.12	14.29	0	20.41
		Women	Frequency	0	7	2	9
			Percentage	0	14.29	4.08	18.37
14		Man	Frequency	1	7	0	8
			Percentage	2.04	14.29	0	16.33
		Women	Frequency	2	4	1	7
			Percentage	4.08	8.17	2.04	14.29
Total by Designation			Frequency	8	35	6	49
			Percentage	16.32	71.45	12.24	100

Note. Own elaboration with the research data (2024)

Table 2 shows the results on the eating habits of the sample of 49 adolescents. These habits were classified into three designations: inadequate, partially inadequate and adequate. In general, it is observed that 35 adolescents (71.45%) have partially inadequate eating habits. Only 6 (12.24%) have adequate habits, while the remaining 8 (16.32%) have inadequate habits. Analyzing by age, in the 12-year-old group, 2 men (4.08%) have partially inadequate eating habits and 1 man (2.04%) have inadequate eating habits. No case with proper habits. Among women in this age group, 8 (16.33%) have partially inappropriate habits, 1 (2.04%) have inadequate habits, and 3 women (6.12%) have adequate habits. In 13-year-old adolescents, 7 men (14.29%) presented partially inappropriate habits and 3 (6.12%) presented inappropriate habits. There were also no reported cases with adequate nutrition. In 13-year-old women, 7 (14.29%) had partially inappropriate habits, none had inappropriate habits and 2 women (4.08%) were classified as adequate. Finally, in the 14-year-old group, 7 (14.29%) of the boys recorded partially inappropriate habits and 1 (2.04%) recorded inappropriate habits. There were no cases with adequate habits. Among women of this age, 4 (8.17%) obtained a partially inadequate category in their eating habits, 2 (4.08%) were inadequate and only 1 (2.04%) reached the adequate category.

Regarding gender, no man presented adequate eating habits. Specifically, 16 (32.66%) of the men presented partially inappropriate habits and 5 (10.2%) were inappropriate. This shows that almost half of the male population 21 (42.86%) have moderate to severe deficiencies in their dietary patterns. On the contrary, in women the situation is slightly more positive, although it is still worrying. 19 adolescents (38.79%) presented partially inappropriate habits and 3 (6.12%) were inappropriate. However, unlike men, 6 (12.24%) of women achieved a category of adequate eating habits.

Table 3. Physical activity results of adolescents

					Physical activity				Total population
					Very Low	Low	Regular	Intense	
Age	12	**Sex**	Man	Frequency	0	2	1	0	3
				Percentage	0	4.08	2.04	0	6.12
			Women	Frequency	1	5	6	0	12
				Percentage	2.04	10.2	12.24	0	24.48
	13		Man	Frequency	0	7	3	0	10
				Percentage	0	14.29	6.12	0	20.41
			Women	Frequency	0	5	4	0	9
				Percentage	0	10.2	8.17	0	18.37
	14		Man	Frequency	1	3	2	2	8
				Percentage	2.04	6.12	4.08	4.08	16.32
			Women	Frequency	2	1	4	0	7
				Percentage	4.08	2.04	8.17	0	14.29
Total, by Category				Frequency	4	23	20	2	49
				Percentage	8.16	46.93	40.82	4.08	100

Note. Own elaboration with the research data (2024)

Table 3 shows the levels of physical activity reported by the 49 adolescents evaluated, classified into 5 categories: very low, low, regular, intense and very intense. In general, it is observed that the vast majority of adolescents fall into the categories of low levels of physical activity. Specifically, 23 adolescents (46.93%) had a low level and 20 (40.82%) had a regular level. At the other extreme, only 2 (4.08%) reached an intense level and no case reaches the very intense category. That is, 9 out of 10 adolescents evaluated have insufficient physical activity for the recommended standards. Analyzing by age, in the 12-year-old group, 2 (4.08%) of the men presented a low level of physical activity, 1 (2.04%) a regular level and no cases at very low, intense or very intense levels. In 12-year-old women, 1 (2.04%) was at the very low level, 5 (10.20%) at the low level, 6 (12.24%) at the regular level, and there were no intense or very intense. In the 13-year-old group, no male or female adolescent presented a very low level. However, 7 men (14.29%) showed a low level, 3 (6.12%) showed a regular level and no intense or very intense cases were recorded. In women of this age, 5 (10.20%) obtained a low level, 4 (8.17%) obtained a regular level and did not reach high categories of physical activity. Finally, in those aged 14 years, 1 (2.04%) of the men registered a very low level, 3 (6.12%) a low level, 2 (4.08%) a regular level, 2 (4.08%) an intense level and none very intense. Among women in this age group, the levels were: very low 2 (4.08%), low 1 (2.04%), regular 4 (8.17%), intense 0% and very intense 0%.

Regarding gender, 1 (2.04%) of the men presented a very low level of physical activity, 12 (24.49%) a low level, 6 (12.24%) a regular level, 2 (4.08%) intense level and none in the very intense category. For their part, in women, 3 (6.12%) registered a very low level, 11 (22.44%) a low level, 14 (28.58%) a regular level, nor were any cases reported at the intense or very intense. That is to say, low and regular levels of physical activity clearly predominate in both men and women. The main difference by gender is observed in that men have a higher percentage of intense cases, that is, 2 (4.08%) compared to (0%) in women; while women outperform men at the very low level 3 (6.12%) vs 1 (2.04%) and at the regular level 14 (28.58%) vs 6 (12.24%) in them. But in both sexes the general situation is negative regarding physical activity.

On the other hand, Table 4 shows the findings of the SDQ, which shows a high prevalence of emotional, behavioral and social difficulties in the sample of adolescents evaluated. Regarding the internalizing part, specifically in the emotional symptoms scale, a worrying panorama is observed, with the majority of participants being at abnormal levels. This pattern is especially accentuated at ages 13 and 14, where the highest percentages of abnormal emotional symptoms are recorded, reaching 12.24% in both sexes at age 14 and 12.24% in women and 8. 16% in men at 13 years old. It is worth noting that female adolescents consistently show higher abnormal levels of emotional symptomatology compared to their male peers at ages 12 and 13. Apropos the results of the peer problems score, they are particularly worrying, with high percentages of abnormal levels reported in various age and gender groups. Women aged 13 and 14 show the highest percentages, with 10.2% and 12.24% respectively. Likewise, 13-year-old boys also register a considerable percentage of 8.16% with abnormal problems in this area. Additionally, it is important to highlight the high percentages in the borderline category, highlighting 13-year-old males with 12.24%, 14-year-olds with 10.2%, and 12-year-old females with 12.24%.

Concerning externalizing, regarding the behavioral problems scale, the results are equally alarming, with a high prevalence of abnormal levels reported. Once again, the age groups of 13 and 14 years have the highest percentages, with 14.29% of males and 16.32% of females at age 13, as well as 12.24% in both sexes at 14 years old. Similar to the emotional

scale, female adolescents exhibit higher abnormal levels of behavioral problems than males at ages 12 and 13.

About the hyperactivity scale, although the majority of participants fall within normal ranges, considerable percentages of abnormal levels are observed in specific subgroups. 13-year-old women stand out with 6.12% and 14-year-old men with 4.08% presenting abnormal hyperactivity. Finally, on the prosocial scale, the findings are equally discouraging, with concerning abnormal levels observed in several subgroups. 12-year-old women have the highest percentage with 18.36%, followed by 13-year-old men with 12.24% and 14-year-old men with 10.2%.

Table 4. Internalizing and externalizing problems

Internalizing						
				Emotional symptoms scale		
				Normal	**Limit**	**Abnormal**
Age	Sex	Man	Frequency	0	2	1
			Percentage	0	4.08	2.04
	12	Women	Frequency	6	1	5
			Percentage	12.24	2.04	10.2
		Man	Frequency	4	2	4
			Percentage	8.16	4.08	8.16
	13	Women	Frequency	2	1	6
			Percentage	4.08	2.04	12.24
		Man	Frequency	5	2	6
			Percentage	10.2	4.08	12.24
	14	Women	Frequency	0	1	1
			Percentage	0	2.04	2.04
				Problems with peers (social withdrawal)		
				Normal	**Limit**	**Abnormal**
Age	Sex	Man	Frequency	0	2	1
			Percentage	0	4.08	2.04
	12	Women	Frequency	5	6	1
			Percentage	10.2	12.24	2.04
		Man	Frequency	0	6	4
			Percentage	0	12.24	8.16
	13	Women	Frequency	1	3	5
			Percentage	2.04	6.12	10.2
		Man	Frequency	0	5	3
			Percentage	0	10.2	6.12
	14	Women	Frequency	0	1	6
			Percentage	0	2.04	12.24
Externalizing.						
				Behavioral problems scale		
				Normal	**Limit**	**Abnormal**
Age	Sex	Man	Frequency	0	1	2
			Percentage	0	2.04	4.08
	12	Women	Frequency	2	2	8
			Percentage	4.08	4.08	16.32
		Man	Frequency	0	3	7
			Percentage	0	6.12	14.29
	13	Women	Frequency	0	1	8
			Percentage	0	2.04	16.32
		Man	Frequency	0	4	6
			Percentage	0	8.16	12.24
	14	Women	Frequency	0	0	6
			Percentage	0	0	12.24
				Hyperactivity scale		
				Normal	**Limit**	**Abnormal**
Age	Sex	Man	Frequency	2	0	1
			Percentage	4.08	0	2.04
	12	Women	Frequency	8	3	1
			Percentage	16.32	6.12	2.04
		Man	Frequency	6	3	1
			Percentage	12.24	6.12	2.04
	13	Women	Frequency	3	3	3
			Percentage	6.12	6.12	6.12
		Man	Frequency	5	1	2
			Percentage	10.2	2.04	4.08
	14	Women	Frequency	4	3	0
			Percentage	8.16	6.12	0
Prosocial scale						
				Normal	**Limit**	**Abnormal**
Age	Sex	Man	Frequency	2	0	1
			Percentage	4.08	0	2.04
	12	Women	Frequency	2	1	9
			Percentage	4.08	2.04	18.36
		Man	Frequency	3	1	6
			Percentage	6.12	2.04	12.24
	13	Women	Frequency	6	2	1
			Percentage	12.24	4.08	2.04
		Man	Frequency	3	0	5
			Percentage	6.12	0	10.2
	14	Women	Frequency	3	2	2
			Percentage	6.12	4.08	4.08

Note. Own elaboration with the research data (2024)

Table 5 shows the frequency and percentage of adolescents who do not present depressive symptoms according to the CDI Inventory, classified by age and sex. In general, a low prevalence of adolescents without depression is observed in the sample evaluated, representing only 8 adolescents (16.33%) of the total.

Analyzing by age groups, in 12-year-old adolescents, 4 (8.17%) of women of this age do not present depressive symptoms. In the 13-year-old group, 2 (4.08%) of the males do not show depression. Finally, in those aged 14 years, both males and females present low percentages without depression, with 1 adolescent (2.04%) in each gender. Regarding the analysis by sex, a marked favorable difference is evident for adolescent women. 5 (10.20%) of the women evaluated do not have depression, compared to 3 (6.12%) of the men without this condition. It is evident that the general prevalence of depression is high. On the other hand, more than half have some degree of depression: 18 (36.76%) adolescents with mild depression, 12 (24.49%) with severe depression and 11 (22.45%) with maximum depression.

Analyzing by age, there is no increase in the prevalence of depression with advancing age. The most affected group is 13-year-old adolescents, with a prevalence of 4 (8.17%) with mild depression, 13 (26.53%) with severe depression and maximum degree. In second place, affected is the 12-year-old group, with 5 (10.20%) adolescents with mild depression, 6 (12.24%) with severe depression and maximum degree. Those aged 14 years, mainly had 9 (18.37%) adolescents with mild depression, with a lower proportion of severe depression and 4 (8.17%) in maximum degree. Therefore, the expected pattern of increasing depression with age is not met. Those aged 13 are the most affected, followed by those aged 12. Although the lowest percentage of maximum depression is reported at 14 years of age, mild depression had a significant prevalence of 18.37% in this age group.

In relation to gender, a higher prevalence of depression is observed in women than in men. Regarding mild depression, women also had a lower percentage with 7 (14.29%) versus 11 (22.45%) in men. However, in severe depression women prevail with 9 (18.37%), while men have less than half with only 3 (6.12%). Finally, maximum depression predominated in females with 7 (14.29%), almost double that of males with 4 (14.29%). Distribution of anthropometric evaluation according to internalizing and externalizing problems.

Table 5. Depression in adolescents

				Depression			
				No depression	Mild	Severe	Maximum grade
Age	**Sex**						
12		Man	Frequency	0	2	0	1
			Percentage	0	4.08	0	2.04
		Women	Frequency	4	3	3	2
			Percentage	8.17	6.12	6.12	4.08
13		Man	Frequency	2	2	3	3
			Percentage	4.08	4.08	6.12	6.12
		Women	Frequency	0	2	3	4
			Percentage	0	4.08	6.12	8.17
14		Man	Frequency	1	7	0	0
			Percentage	2.04	14.29	0	0
		Women	Frequency	1	2	3	1
			Percentage	2.04	4.08	6.12	2.04

Note. Own elaboration with the research data (2024)

A comparison was made between the anthropometric assessment and the Scoring results of the Skills and Difficulties Questionnaire (SDQ).

Table 6 shows the relationship between anthropometric evaluation and internalizing and externalizing problems. Regarding internalizing problems, in the 12-year-old group, 6 underweight women presented problems, of which 2 (4.08%) were in an abnormal state, 5 (10.20%) were in a normal state, 5 (10.20%) were in a normal state and 5 (10.20%) in borderline state. In the normal weight group, 5 women presented problems, 1 (2.04%) in an abnormal state, 5 (10.20%) in a normal state and 1 (2.04%) in a borderline state. For overweight, 1 (2.04%) woman presents problems in a normal state and 1 (2.04%) in a borderline state. In the 13-year-old group, 2 (4.08%) underweight men have problems, both in abnormal and borderline state (4.08%). In normal weight, 8 women present problems, 9 (18.37%) in an abnormal state, 3 (6.12%) in a normal state and 4 (8.16%) in a borderline state. For overweight, 2 (4.08%) men exhibit problems, both in an abnormal state and 1 (2.04%) in a normal state. In the 14-year-old group, 6 underweight men have problems, 3 (6.12%) in abnormal state, 4 (8.16%) in normal state and 5 (10.20%) in borderline state. In normal weight, 12 (24.49%) women present problems, all in an abnormal state and 2 (4.08%) in a borderline state.

About externalizing problems, in the 12-year-old group, 8 underweight women presented problems, 1 (2.04%) in an abnormal state, 2 (4.08%) in a normal state and 8 (16.33%) in limit state. In normal weight, 8 men and 8 women exhibit

problems, with 3 men and 8 women in an abnormal state (6.12% and 16.33% respectively), 2 men and 3 women in a normal state (4.08% and 6. 12%) and 1 man and 4 women in borderline state (2.04% and 8.16%). For overweight, 2 (4.08%) men present borderline problems. In the 13-year-old group, 3 underweight men have problems, 2 (4.08%) in abnormal state, 1 (2.04%) in normal state and 3 (6.12%) in borderline state. In normal weight, 10 women present problems, 6 (12.24%) in an abnormal state, 8 (16.33%) in a normal state and 6 (12.24%) in a borderline state. For overweight, 3 men exhibit problems, 2 (4.08%) in an abnormal state and 1 (2.04%) in a normal state. In the 14-year-old group, 10 underweight men have externalizing problems, 2 (4.08%) in an abnormal state, 6 (12.24%) in a normal state and 2 (4.08%) in a borderline state. At normal weight, 8 women present problems, 7 (14.29%) in a normal state and 6 (12.24%) in a borderline state.

Table 6. Anthropometric evaluation related to internalizing and externalizing problems.

Age/Anthropometric Evaluation			**Internalizing**												**Externalizing**											
			Male F(%)						**Female F(%)**						**Male F(%)**						**Female F(%)**					
	h	M	A	%	B	%	C	%	A	%	B	%	C	%	A	%	B	%	C	%	A	%	B	%	C	%
12 year olds	3	12																								
Under weight	1	6	1	2.04	0	0.00	1	2.04	2	4.08	5	10.20	5	10.20	1	2.04	2	4.08	0	0.00	8	16.33	8	16.33	2	4.08
Normal weight	2	5	1	2.04	0	0.00	3	6.12	4	8.16	5	10.20	1	2.04	3	6.12	2	4.08	1	2.04	8	16.33	3	6.12	4	8.16
Overweight	0	1	0	0.00	0	0.00	0	0.00	0	0.00	1	2.04	1	2.04	0	0.00	0	0.00	0	0.00	2	4.08	1	2.04	0	0.00
13 year olds	10	9																								
Under weight	2	0	2	4.08	0	0.00	2	4.08	0	0.00	0	0.00	0	0.00	2	4.08	1	2.04	3	6.12	0	0.00	0	0.00	0	0.00
Normal weight	6	8	4	8.16	3	6.12	5	10.20	9	18.37	3	6.12	4	8.16	9	18.37	6	12.24	3	6.12	10	20.41	8	16.33	6	12.24
Overweight	2	1	2	4.08	1	2.04	1	2.04	2	4.08	0	0.00	0	0.00	3	6.12	2	4.08	1	2.04	2	4.08	1	2.04	0	0.00
14 year olds	8	7																								
Under weight	6	0	3	6.12	4	8.16	5	10.20	0	0.00	0	0.00	0	0.00	10	20.41	6	12.24	2	4.08	0	0.00	0	0.00	0	0.00
Normal weight	2	7	1	2.04	1	2.04	2	4.08	12	24.49	0	0.00	2	4.08	3	6.12	2	4.08	1	2.04	8	16.33	7	14.29	6	12.24
Overweight	0	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Gender: M: male, F: female
Abilities and Difficulties Questionnaire: A: Abnormal, B: Normal, C: Borderline
Note. Anthropometric evaluation and internalizing and externalizing alterations.

One of the aspects evaluated was nutritional status through anthropometric indicators such as Body Mass Index, waist circumference, and waist-hip ratio. The results revealed a worrying prevalence of malnutrition, both due to deficiency and excess. Regarding BMI, it was found that 32.65% of the adolescents were underweight, 51.02% were normal weight, and 16.33% were overweight. These findings partially coincide with those reported by another study carried out by Sánchez-Mata et al., (2018) in an Educational Unit in Ecuador, where a normal nutritional status and height was evident in 72.5% of the participants, with a lower frequency of malnutrition and overweight. In Mexico, a study carried out by Velázquez-Bautista et al., (2017) showed that 82% of adolescents were obese, while the remaining 18% were overweight. However, they differ from the results obtained from another study compared by themselves, where a 46.4% normal nutritional status and a higher proportion of malnutrition and a lower proportion of obesity were observed in a school population.

On the other hand, when analyzing the prevalence of malnutrition due to deficiency (malnutrition and risk of malnutrition) and malnutrition due to excess (overweight and obesity), there was a predominance of the risk of malnutrition (30.60%) and undernutrition (2.20%) compared to overweight (3.70%) and obesity (3.0%). These findings are similar to those reported by Roy et al., (2021) in Singapore, where undernutrition (22%) and risk of undernutrition (19%) were higher than overweight (11%) and obesity (5%). However, they contrast with the results of Díaz et al., (2020) in a population of adolescents from Mexico, where the percentage of overweight in women (22.5%) and in men (15.5%) while obesity in women (14.8%) and in men (19.7%) was higher than low weight in women (0.6%) and in men (4.5%). In Galicia, Pérez-Ríos et al., (2018) mentions that 16 out of every 100 students under 15 years of age present malnutrition due to excess, being obesity predominant. Excess weight during childhood and adolescence increases the risk of morbidity and mortality in adulthood (Debashree et al., 2023).

Regarding the evaluation of eating habits, the results revealed that 71.45% of the adolescents had partially inappropriate habits, while only 12.24% had adequate habits and 16.32% had inadequate habits. These findings coincide with those of Flores-Vázquez & Macedo-Ojeda, (2016) who found that 62.2% of adolescents in Jalisco, Mexico, had inadequate or partially inadequate eating habits. In addition López-René et al., (2022) reported an association between unhealthy eating habits and an unfavorable anthropometric profile in adolescents from Tapachula, Chiapas, Mexico. According to Marí-Sanchis et al., (2022) eating disorders are conditions of multifactorial origin, they are influenced by genetic, environmental, psychological and sports factors. Muha et al., (2024) mentions that depressive disorder is associated with emotional eating in

adolescents, which implies an exponential weight gain in relation to their depressive symptoms.

Another fundamental aspect evaluated was the presence of emotional and behavioral alterations in adolescents. The results obtained through the Skills and Difficulties Questionnaire (SDQ) revealed a high prevalence of emotional, behavioral and social difficulties in the sample studied. Regarding the scale of emotional symptoms, it was observed that the majority of participants were located at abnormal levels, especially at ages 13 and 14, with high percentages of abnormal emotional symptoms that reached 12.24% in both sexes at 14 years old and 12.24% in women and 8.16% in men at 13 years old. These findings are consistent with those reported by Liverpool et al., (2023) who found a high prevalence of mental health problems, including anxiety and depression, in adolescents from the English-speaking Caribbean. A study in China revealed that depression in adolescents and adults has increased in recent years, causing damage to emotions and irritable behavior (Ding et al., 2024).

Furthermore, the results of the peer problems score were particularly concerning, with high percentages of abnormal levels reported across several age and gender groups. These findings coincide with those of Jiménez-López et al., (2013) who observed a high prevalence of social anxiety in Mexican adolescents, which can impact interpersonal relationships and socio-emotional development.

Regarding the behavioral problems scale, the results were equally alarming, with a high prevalence of abnormal levels reported. These findings are consistent with those of Hernández et al., (2017) who found a significant presence of behavioral problems in a sample of adolescents from Toluca, Mexico. According to Cantero-García & Alonso-Tapia, (2018) behavioral problems are one of the main concerns of the family nucleus, since they affect the emotional balance of the adolescent.

Finally, on the prosocial scale, concerning abnormal levels were observed in several subgroups, indicating significant deficiencies in prosocial behaviors and positive social interaction. These results are consistent with those reported by those who found a high prevalence of emotional and behavioral problems in adolescents.

Concerning the assessment of depression through the Children's Depression Inventory (CDI), the results revealed a high general prevalence of depression in the sample studied. More than half of the participants presented some degree of depression, including mild depression (36.76%), severe depression (24.49%), and maximum depression (22.45%). These findings are consistent with those reported by Camarillo-Quiroz et al., (2020) who found a high prevalence of depression in adolescents from public secondary schools in Veracruz, Mexico. In addition, Khanna et al., (2019) conducted a systematic review that showed a significant association between depression and nutritional problems in adolescents. A study carried out on adolescents from the Western Pacific Region demonstrated a decreasing burden of depression between 1990 and 2019, thanks to strategies focused on adolescent mental health (Li et al., 2024).

Also, in the present study, it was observed that the age group most affected by depression were 13-year-old adolescents, with a prevalence of 26.53% of severe and maximum depression. These findings partially coincide with those of Segreda-Castro & Segura-Araya, (2020) who found that the prevalence of depression increases with age in adolescents. Furthermore, a higher prevalence of depression was identified in women than in men, especially at levels of severe and maximum depression. These results are consistent with those reported by Ventura-León et al., (2020) who found a greater presence of depressive symptoms in Peruvian female adolescents compared to males. Ndjatou et al., (2024) in their study, revealed that depression in adolescents is usually associated with non-traditional factors such as violence, death or inadequate parenting.

Adolescents with depression or anxiety present eating problems, as evidenced in the study by Lin et al., (2023) where the intake of macronutrients is disproportionately associated with meeting satisfaction needs. In general, the results obtained in the present study show the importance of comprehensively addressing nutritional and mental health problems in adolescents. It is essential to implement multidisciplinary programs that promote healthy eating, regular physical activity and the development of socio-emotional skills, with the aim of preventing and mitigating the adverse effects of these conditions on the physical and mental well-being of this vulnerable population.

FINAL REMARKS

The nutritional status of the adolescents evaluated in this study presented a worrying situation. Approximately a third of the participants were underweight. In addition, the results revealed that the majority of adolescents had partially inadequate and inadequate eating habits, which could be contributing to this unfavorable nutritional reality. It is crucial to implement nutritional education programs and promote healthy eating habits from an early age, in order to prevent and mitigate the long-term consequences of malnutrition on the physical and cognitive development of adolescents.

Furthermore, the findings obtained through the application of various psychological questionnaires revealed a high prevalence of emotional and behavioral alterations in the sample of adolescents evaluated, such as worrying levels on scales such as emotional symptoms, problems with peers, conduct problems and prosocial behavior. Likewise, the evaluation using the Children's Depression Inventory (CDI) showed that more than half of the participants had some degree of depression: mild, severe, or maximum. These findings highlight the need to implement early detection strategies and intervention programs focused on the prevention and treatment of emotional and behavioral disorders in this vulnerable population.

Finally, when analyzing the relationship between nutritional status and emotional and behavioral alterations, no association was found in the sample evaluated. Although in some cases low weight was associated with abnormal scores on psychological scales and vice versa, this relationship was not uniform. The findings suggest that other factors apart from nutritional status influence the emotional and behavioral alterations of adolescents. It is important to consider a multidimensional approach that takes into account sociodemographic, cultural, family and environmental variables, as well as nutritional and psychological aspects. A comprehensive intervention that addresses these multiple factors may be more effective in promoting adolescents' physical and mental well-being.

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B. data research and statistical analysis:	50%	50%
C. elaboration of figures and tables:	50%	50%
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