

NUTRITIONAL STATUS, FOOD CONSUMPTION, PHYSICAL ACTIVITY AND EATING DISORDERS IN ADOLESCENTS FROM URBAN AND RURAL AREAS IN THE ANDEAN REGION OF ECUADOR

ESTADO NUTRICIONAL, CONSUMO DE ALIMENTOS, ACTIVIDAD FISICA Y DESORDENES ALIMENTARES EN ADOLESCENTES DE ZONAS URBANA Y RURAL DE LA REGION ANDINA DE ECUADOR

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Abstract: Main: *The aim of this study was to evaluate the nutritional status, dietary intake, physical activity and eating disorders of adolescents in a population from the Andean region of Ecuador and compare differences between urban and rural areas. **Materials and methods:** This was a cross-sectional study (n = 131). 24-hour recall, anthropometry, physical activity and risk of eating disorder questionnaires were collected. **Results:** 19.1% of the population had short stature by age, and 17.6% risk of overweight according to BMI/Age. Adequate macronutrient percentages throughout the population were low (66.5% carbohydrate, 60.5% protein and 79.8% fat). Statistically significant differences were found between protein (p = 0.012), fats (p <0.001) carbohydrates (p = 0.013) and energy (p <0.001) according to the zones; (urban areas showed higher consumption compared to rural areas). **Conclusions:** The study found that diet of adolescents differs according to the geographical area with poorer diets consumed in rural areas.*

Keywords: Diet, adolescents, eating disorders, urban, rural.

Resumen: Objetivo: *El objetivo de este estudio fue evaluar el estado nutricional, la ingesta dietética, la actividad física y los trastornos alimentarios de los adolescentes en una población de la región andina de Ecuador y comparar las diferencias entre las áreas urbanas y rurales. **Materiales y métodos:** este fue un estudio transversal (n = 131). Se recogieron los cuestionarios de 24 horas de recordación, antropometría, actividad física y riesgo de trastorno alimentario. **Resultados:** el 19.1% de la población tenía estatura baja por edad y el 17.6% de riesgo de sobrepeso según el IMC / edad. Los porcentajes de adecuación de macronutrientes en toda la población fueron bajos (66,5% de carbohidratos, 60,5% de proteínas y 79,8% de grasas). Se encontraron diferencias estadísticamente significativas entre proteína*

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($p = 0.012$), grasas ($p < 0.001$) carbohidratos ($p = 0.013$) y energía ($p < 0.001$) según las zonas; (las áreas urbanas mostraron un mayor consumo en comparación con las áreas rurales). **Conclusiones:** *El estudio encontró que la dieta de los adolescentes difiere según el área geográfica, las dietas más pobres se consumen en las áreas rurales.*

Palabras clave: *Dieta, adolescentes, desórdenes alimenticios, urbano, rural.*

I. INTRODUCTION

In Ecuador, adolescents represent 19.3% of the population according to the 2010 census (INEC, 2017) According to the World Health Organization (WHO), adolescence is defined as the period of life between the ages of 11 to 19, a period which is characterized by many physical, physiological and psychological changes in which a child becomes an adult (Chulani, 2014; WHO, 2016). During this period, adolescents gain up to 50% of their adult weight, 50% of their adult skeletal mass and growth stops. This transition requires an adaptation of the factors that allow to the adolescent to develop all the organic functions with normality (Chulani, 2014; Maiti 2011).

In addition, there is a change in body composition according to sex (increase in lean mass in males and fat mass in females). Accelerated physical growth during puberty requires an increase in daily energy of both macro and micronutrients (Marugán de Miguel Sanz, 2010).

Nutrition is crucial for the development and growth of human beings from the moment of conception and throughout their lives, according to the Ministry of Public Health of Ecuador. Like most countries in the region, the population shows simultaneously deficits and nutritional excesses, problems that can be grouped into three categories: delay in height, micronutrient deficiency, and overweight and obesity (Freire, 2013). In recent decades, Ecuador has undergone significant demographic and socioeconomic changes in the supply and marketing of food, all changes that have probably influenced the quality of food and dietary preferences of Ecuadorians (Freire, 2013).

Nutritional transition is a process that is characterized by changes in eating behaviour that are observed in a country at a time of economic expansion.

The main change observed is the replacement of traditional foods with processed foods, generally high in fat and sodium (Drewnowski, 1997; Popkin, 2012). Food patterns are modified by different factors: psychological, social, economic, friends, purchasing power, urbanization, etc. that continue in the future. Adolescence from a nutritional point of view is a vulnerable stage for several reasons, such as omission of foods, increase in consumption of foods rich in sugar, and sugars, body dissatisfaction especially in women, diets with dietary restrictions, among others (Guidetti, 2016, Salam, 2016).

In the Andean countries, as well as in Ecuador, important data have been found reflecting about the high prevalence of malnutrition in children especially in rural areas (Freire, 2014, Iannotti, 2017). Diet can influence the health status of adolescents. This study aims to evaluate nutritional status, food consumption, physical activity and eating disorders of adolescents from a population of the Andean region of Ecuador and differences between the urban and rural areas.

II. MATERIALS AND METHODS

A. Study design and study population

A cross-sectional study was carried out between September 2015, and March 2016 with 131 adolescents of both sexes, aged between 10 to 18 years old, who live in the urban and rural areas in the province of Chimborazo, Ecuador. Sampling was non-probabilistic. Data from adolescents were first collected in the urban areas and then rural adolescents were matched by age and sex. Students from the urban zone were from the canton Riobamba, Captain Edmundo Chiriboga High school and from the rural zone from the Guano canton, San Andrés Parish, San Andrés National High school. All the parents, and adolescents participating in the

study were informed about the procedures and the privacy of the study, and they signed an informed consent form. **Exclusion criteria:** Pregnant adolescents and teenagers with some pathology related to nutritional components and affecting nutrient intake were excluded.

B. *Nutritional status:*

Gender, date of birth, weight and height, anthropometric measurements were taken according to the National Health and Nutrition Examination Survey (NANHES, 2007) The weight was taken using a “SECA “ measuring scale, with the minimum amount of clothing, with a reading range from 0 to 120 kg and an accuracy of 100 grams, height was measured with an inextensible rigid wall height meter of 60 to 210 cm, with a precision of 0.1 cm. Using the Anthro Plus V-14.1 (WHO, 2011) program, the Z-score of the Body Mass Index kg/m² for age (BAZ) and height-for-age (HAZ) were calculated.

C. *Assessment of energy intake and macronutrients:*

In order to determine the energy intake, the following were determined: a) Food habits through a 24-hour recall for a weekday, energy and macronutrient calculations were then performed using the Composition Table of Ecuadorian Foods, obtaining the amounts of energy (Kcal.), Macro (gr.) and micronutrients (mgr.) Adequacy was calculated according to the recommendations for macronutrients and energy of the National Institute of Medicine of the United States (Food and Nutrition Board, 2005) according to age and sex.

D. *Risk assessment of eating disorders and levels of physical activity.*

To evaluate the risk of eating disorders, the SCOFF questionnaire (Morgan, 1999; Rueda, 2005) was used. This instrument rates five questions: Do you have the feeling of being sick because you feel your stomach so full that you find it uncomfortable? Are you worried that you have to control how much you eat? Have you recently lost more than 6Kgs

of weight over a period of three months? Do you think you're fat even though others say you're too thin? Would you say that food dominates your life? It is rated with a point for affirmative answers and zero for negative answers, to obtain the final score. If the final score is 0-1 there is no risk of having an eating disorder, while if => 2 there is a risk of having an eating disorder. To assess the level of physical activity of adolescents, the questionnaire, IPAQ-A (Kowalski, 2004) was used, consisting of 9 questions about sports and games, physical activities at school or in their free time. Each question scores 1 point (did not practice any activity) to 5 points (practiced every day of the week) and the final score is evaluated with the average of the questions establishing a range from very sedentary to very active (from 1 to 5): 1 = very sedentary; 2 = sedentary; 3 = moderately active; 4 = active; and 5 = very active. All the data were collected by trained personnel (students on the Nutrition and Dietetics course at the School of Public Health, Superior Polytechnic School of Chimborazo).

E. *Statistical analysis*

The z scores for HAZ and BAZ were calculated in WHO Anthro Plus software version 10.4 (WHO, 2011). Data are presented as: overage, standard deviation, 95% confidence intervals, and/or percentages, the statistical analysis of the variables was performed with the student T test, the statistical significance for all cases was assumed when the p-value was <0.05. The mentioned data were calculated with the statistics software STATA, version 14 (Stata, 2014).

III. RESULTS

A total of 131 adolescents of both sexes living in the urban (N = 64) and rural (n = 67) areas in the province of Chimborazo-Ecuador were evaluat-

ed. The youngest were 10 years old and the oldest 17.89 years old at the time of the survey.

Nutritional status or nutritional assessment:

19.1% and 9.2% of adolescents (total sample) presented low HAZ and very low HAZ respectively. 17.6% presented risk of overweight and 4.6% had very high weight as a function of the BAZ (data not presented in the Tables). The mean weight and height of adolescents in the urban area were higher than those of students from the rural area ($p < 0.001$). However, the mean BAZ was higher in rural adolescents than in urban areas ($p = 0.009$), a

lower HAZ was found among adolescents in rural areas than in urban areas. ($p < 0.001$). No statistically significant differences were found in BAZ in urban and rural areas. (Table 1)

Physical activity level:

The study found 58% of adolescents to be sedentary according to the IPAQ-A survey applied (95% CI 49.3-66.3). No adolescents with “active” or “very active” levels of physical activity were found. Statistically significant differences were found between the levels of physical activity of adolescents in urban areas (less activity) compared

TABLE I
ANTHROPOMETRIC AND PHYSICAL ACTIVITY CHARACTERISTICS OF RURAL AND URBAN.

Mean	Urban		Rural		P-value	
	SD	Mean	SD			
Age. Years	14.6	0.67	14.3	0.69	0.563	
Weight. Kg	53.6	12.18	44.7	8.58	0.000	
Height. Cm	157.1	11.90	148.2	8.27	0.000	
BMI. kg/m ²	20.2	4.05	21.8	2.59	0.009	
BMI/age z-score	0.5	1.14	0.2	0.81	0.034	
Height/Age z-score	0.6	0.67	1.9	2.09	0.036	
HEIGHT / AGE Z-SCORE						
Geographical area	Very Low Height (%)	Low Height (%)	Low height alert (%)	Normal (%)	P-value	
Rural	83.3	80.0	55.6	35.5	<0.001	
Urban	16.7	20.0	44.4	64.5		
BMI/ AGE Z-SCORE						
Geographical area	Low weight alert (%)	Normal (%)	Overweight risk (%)	High weight alert (%)	High weight (%)	P- value
Rural	40.0	58.3	34.8	16.7	0.0	0.072
Urban	60.0	41.7	65.2	83.3	100.0	
Physical activity level	Mean	SD	IC 95%	Rural (%)	Urban (%)	P-value
Very sedentary	32.1	0.04	(24.55-40.63)	33.3	66.7	0.000
Sedentary	58.0	0.43	(49.29-66.26)	40.4	59.6	
Moderately Active	9.9	0.03	(5.80-16.44)	82.4	17.7	

Food consumption:

The average consumption of the entire population was 239.4g of carbohydrates 52.7 gr of proteins and 55.7 gr fat. The average energy consumption was 1670 Kcal with a minimum of 704 Kcal and a maximum of 2918 Kcal. A comparison between energy

and macronutrient consumption was performed in the urban and rural areas, with statistically significant differences between protein ($p = 0.012$), fats ($p < 0.001$), carbohydrates ($p = 0.013$), and energy ($p < 0.001$) according to the zones; (higher consumption, always in the urban area compared to the rural). There were no statistically significant

differences in energy intake ($p = 0.698$), carbohydrates ($p = 0.621$), fats ($p = 0.542$) and proteins ($p = 0.297$) among boys and girls. The participants were asked about the type of product used to sweeten their food and drinks from the following options: white sugar, brown sugar, panela (cane sugar) and artificial sweetener. White sugar was reported by 79.4% (IC95% 71.85.5).

There are statistically significant differences in the consumption of sweeteners with respect to the zones: in the rural areas, no artificial sweeteners are consumed, and there is a greater consumption of

brown sugar and cane sugar with respect to the urban area ($p=0,005$). The 83.2% of adolescents reported that they drink water every day (95% CI 75.7-88.7), however, 61.8% reported that they drink less than three glasses per day and only 3.1% drink 7-8 glasses per day.

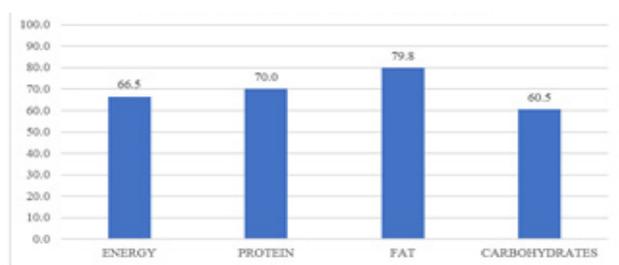
No statistically significant differences were found between the habit of drinking water between both zones. The 25.9% of adolescents reported having breakfast every day "Always", while 71.8% had breakfast "sometimes". 82.4% of adolescents in rural areas always have breakfast ($p<0.001$) (Table 2).

TABLE 2.
FOOD CONSUMPTION, FEEDING PRACTICES AND PHYSICAL ACTIVITY OF THE POPULATION.

Food Consumption (g)	Mean	SD	Minimum	Maximum
Carbohydrates	239.4	82.2	40.7	481.3
Protein	52.8	27.8	16.4	293.0
Fat	55.7	28.2	14.6	230.0
Energy	1670.2	496.9	704.4	2918.4
Macronutrient consumption	Rural	Urban	P-value	
	Mean (IC 95%)	Mean (IC 95%)		
Carbohydrates (gr)	222.2 (200.98 - 243.50)	257.5(239.23 - 275.69)	0,013	
Fats (gr)	48.5 (42.82 - 54.14)	63.3(55.49 - 71.020)	0,001	
Proteins (gr)	46.8 (42.10 - 51.46)	59.0(50.63 - 67.45)	0,012	
Energy (Kcal)	1512.4 (396.23 - 1628.63)	1835.3(1718.73- 1951.88)	<0,001	
Food practices	% (IC 95%)	Rural (%)	Urban (%)	P-value
A) Use of sweeteners				
White sugar	79.4(71.50-85.54)	43.3	56.7	0.005
Brown sugar	12.9(8.17-19.99)	82.4	17.7	
Cane sugar	6.1(3.05-1.18)	75.0	25.0	
Artificial sweeteners	1.5(0.37-6.00)	0.0	100.0	
b) Drinkin water				
No	16.8(11.26-24.30)	40.9	59.1	0.292
Yes	83.2(75.70-88.74)	53.2	46.8	
c) Have breakfast				
Never	2.3(0.73-6.96)	33.3	66.7	0.000
Sometimes	71.8(63.34-78.88)	40.4	59.6	
Always	25.9(19.09-34.24)	82.3	17.65	

A percentage of adequacy was also calculated between the energy and macronutrient values found in the diets of adolescents in this study and the recommended values for the population between 10 and 18 years according to the Institute of Medicine

of the United States, was deficient for all of them: For the energy (kcal), the percentage of adequacy was 67.8%, for proteins 70.4%, fat 79.8%, and carbohydrates 60.5%. (Figure 1).



*Data presented in percentages of adequacy (observed value / expected value * 100) based on the recommendations of the National Institute of Medicine of the United States

Figure 1. Percentage of adolescent energy and macronutrient adequacy compared to recommended values. *

Risk Assessment of Eating Disorder:

According to the SCOFF questionnaire, 32.3% of the adolescents were classified as presenting an Eating Disorder Risk. Clinical differences were found by sex, it was greater among girls than boys. However, differences between sex and rural/urban area were not statistically significant (see Table 3).

TABLE 3.
RISK OF EATING DISORDER IN ADOLESCENTS MEASURED BY THE SCOFF QUESTIONNAIRE

Risk of eating disorder in the total number of adolescents	Yes	No		
	% (IC 95%)			
Do you have the feeling of being sick or because you feel so full that you feel uncomfortable?	21.5 (15.23-29.55)		78.5(70.45-85.77)	
Are you worried because you feel you have to control how much you eat?	32.3(24.75-40.92)		67.7(59.07-75.25)	
Have you recently lost more than 6Kgs over a period of three months?	28.5(21.29-36.92)		71.5(63.08-78.71)	
Do you think you are fat or even though others say you are too thin?	15.4(10.08-22.76)		84.61(77.24-89.91)	
Would you say that food dominates your life?	26.2(19.24-34.49)		73.85(65.51-80.76)	
Risk of eating disorder (Total)	32.3 (24.75- 40.92)		67.7 (59.07- 75.25)	
Risk of Eating Disorder by Sex	Yes (%)	No (%)	P-value	
Mens	34.9	65.1	0.353	
Women	27.0	72.9		
Risk of Eating Disorder by Geographic zone	Yes (%)	No (%)	P-value	
Rural	59.5	47.2	0.188	
Urban	40.5	52.8		

IV. DISCUSSION

The data reported in this study show that there are differences between geographic areas and nutritional status, food consumption, physical activity and food disorders. Adolescents in rural areas have a poorer diet according to Aguilar (2011). The better nutritional status among students from an urban area could be explained by the higher cultural and socioeconomic level of the families in these areas. Nutritional habits in humans greatly condition their quality of life, in the case of adolescents or children, these predispose the individual to long-term effects either as protective agents or as risk factors of many pathologies especially obesity (Freire, 2013).

A lower percentage of adequacy can be seen in the normal intervals (90%-110%) with respect to the values recommended by the National Institute of Medicine of the United States the National Health and Nutrition Survey of Ecuador (Freire, 2013) They also reported an energy deficit of more than 200 kcal in adolescents between 13 to 18 years. According to Berti (2014) the diet in the Central Andes region (Bolivia, Colombia, Ecuador and Peru), in general terms lacks fat and energy. No statistically significant differences were found with regard to energy intake and sex, unlike other investigations in adolescents (González-Jiménez , 2013; Velasco, 2009).

In Ecuador, the main source of protein is rice, fol-

lowed by chicken and meat to a lesser extent. According to ENSANUT-ECU (2013) around 6% of Ecuadorian adolescents do not consume the protein requirement per day. In this study a percentage of protein adequacy of 70.04% was found. As adolescents are constantly growing, their protein requirements increase. A deficient consumption of protein can therefore contribute to inappropriate development in adolescents resulting in for example a delay in sexual maturation, reduction of linear growth and decrease in muscle mass formation Akseer (2017).

Akseer (2017) evaluated the disability rate for protein-energy malnutrition in many regions of the world. The lowest was in Europe with less than 10 per 100,000 people and the highest was found in sub-Saharan Africa at approximately 150 per 100,000 people. Latin America presented rates approximately 50 per 100,000 especially in men from 10 to 14 years old in 2015, a remarkable reduction since 1990. In this investigation height-age z-score was 1.89 (SD 2.09) which represents a higher risk for adolescents living in rural areas. Excessive consumption of carbohydrates is one of the causes of overweight and obesity in Ecuador, especially since simple carbohydrates mainly from sugary drinks, rice and white bread are consumed (ENSANUT-ECU, 2013). Zazpe (2014) stated that the consumption of complex carbohydrates is associated with a better adaptation of micronutrients. While simple carbohydrates contain less vitamins and minerals. That is, by reducing the consumption of simple carbohydrates we are improving the intake of micronutrients. Despite the many recommendations on appropriate consumption of fruits and vegetables, a low consumption among the adolescents in this study was found. Ochoa-Avilés (2014) showed low consumption of fruit, vegetables and fish in adolescents, while the consumption of processed products with added sugar and

refined grains constituted most of their diet Ochoa-Avilés (2014). Daly (2017) found that 13-year-old children from rural areas consume less than one serving of fruit (0.60) and vegetables (0.40) a day. While in a study developed in 33 countries in Europe and North America on the trend of consumption of fruit and vegetables in adolescents between 2002 and 2010, Vereecken (2015) observed a significant increase in consumption after the implementation of national policies. at the beginning of the year 2000 education and subsidy. Likewise, in Finland or Switzerland, low prevalence of fruit consumption are maintained, while Spain or Italy show low prevalence in the consumption of vegetables.

Another of the factors to evaluate within a healthy lifestyle is physical activity, since sedentarism is a predisposing factor for the appearance or worsening of other cardiovascular risk factors especially of obesity (Rivera, 2009). In this study there were no adolescents with “active” or “very active” levels of physical activity, most being sedentary (58%). Encouraging the practice of regular physical activity is very important. Of the sixth grade students residing in a rural low income areas, 79.2% were sedentary. However, this percentage was lower than that found by Rivera (2010) (92.5%) in his study on adolescents in Brazil.

Eating behaviour disorders are a complex pathological picture accentuated during adolescence. Treatment requires a multidisciplinary team where the doctor, psychologist / psychiatrist, nutritionist, dietitian and nurse must work together with the adolescent and family. The prevalence of this condition has historically been higher in the female population. However, in our study sample these differences were not statistically significant. The SCOFF questionnaire which has been used in several publications, including the AVENA (Estecha,

2016) study conducted in adolescents in Spain, is an initial guide to the risk of eating disorders that should be re-evaluated and applied by the respective professionals.

V. CONCLUSIONS

19.1% of the population had low stature by age and 17.6% of risk of overweight according to the BMI / age. The percentages of adequacy of macronutrients in the entire population were low. Statistically significant differences were found between the levels of physical activity of adolescents in urban areas (less activity) compared to adolescents in rural areas (greater activity). 32.3% of the adolescents were classified as presenting an Eating Disorder Risk. Differences between sex and rural/urban area were not statistically significant.

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