Research Article

Anthropometric Characteristics, Diettic Intake and Chronotype in Ecuadorian Adults

Características antropométricas, ingesta dietética y cronotipo de adultos ecuatorianos.

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Abstract

Anthropometric characteristics in a subject are a good indication of their body-weight status and diagnosis of overweight and obesity. O and O multifactorial, so today the curiosity arises to investigate new risk factors that predispose to increased body weight, including chronotype. The objective of this study is to evaluate the anthropometric characteristics and caloric intake according to the chronotype in sick Ecuadorian adults. This cross-sectional study consisted of 400 men and women aged between 18 and 63 years, who were hospitalized at the Enrique Garcés General Hospital in the city of Quito. Anthropometric measurements were taken using ISAK techniques. Calorie intake was measured by a 24-hour recall and food frequency, and the Horne and Osttberg questionnaire was applied to measure the chronotype of the subjects. Statistical analyses were performed in R and R studio software. The study subjects were classified into 4 groups depending on their chronotype: moderate morning, extreme morning, intermediate, and moderate evening. It was observed that moderate evening subjects had higher values of body weight, high waist circumference, high triceps skinfold, high percentage of fat mass, visceral fat, and caloric intake than the other groups ($p < 0.05$). Evening chronotype appears to be related to overweight and obesity and caloric intake.

Keywords: chronotype, overweight, anthropometry.

Resumen

Las características antropométricas en un sujeto son una buena indicación de su estado de peso corporal y diagnóstico de sobrepeso y obesidad. O y O multifactoriales, por lo que en la actualidad surge la curiosidad de investigar nuevos factores de riesgo que predispongan al aumento de peso corporal, entre ellos el cronotipo. El objetivo de este estudio es evaluar las características antropométricas y el consumo calórico según el cronotipo en adultos ecuatorianos enfermos. En este estudio transversal. La muestra estuvo conformada por 400 hombres y mujeres entre 18 y 63 años de edad que se encontraban hospitalizados en el Hospital General Enrique Garcés de la ciudad de Quito. Las medidas antropométricas se tomaron mediante técnicas ISAK. La ingesta de calorías se midió mediante un recordatorio de 24 horas y la frecuencia de los alimentos. Y se aplicó el cuestionario de Horne y Osttberg para medir el cronotipo de los sujetos.

Los análisis estadísticos se realizaron en el software R y R studio. Los sujetos de estudio se clasificaron en 4 grupos según su cronotipo: Moderado matutino, extremo matutino, intermedio y moderado vespertino. Se observó que los sujetos vespertinos moderados tenían valores más altos de peso corporal, circunferencia de cintura alta, pliegue cutáneo tricipital alto, porcentaje alto de masa grasa, grasa visceral e ingesta calórica que los demás grupos (p<0,05). El cronotipo vespertino parece estar relacionado con el sobrepeso y la obesidad y la ingesta calórica.

Palabras Clave: *cronotipo, sobrepeso, antropometría.*

1. Introduction

Prevalence of obesity worldwide is alarmingly high with a worldwide trend, so it has been baptized with the term "globesity" (1). Today, there are approximately 2.2 billion people who are overweight or obese worldwide, that is, almost 30% of the world's population (2).

According to national data, in Ecuador 65.5% of women and 60% of men aged 17 to 51 are overweight or obese. (3). Overweight / obesity, as well as chronic noncommunicable diseases (ECNT) are public health problems that significantly increase the expenditure of health resources in Ecuador and in the world. Reason why it is essential to look for new strategies that point to the causes of the problem or its associated factors.

Within the search for these associated factors, it has been described that chronobiology could be part of the etiological factors of overweight and obesity. (4). Chronobiology is a relatively new science that is responsible for studying more thoroughly the biological rhythms of human beings and their implications with normal physiological and biochemical processes related to disease health processes (5). Biological rhythms may be affected by several external reasons, such as physical activity (6), meal times (7), excessive use of artificial light at night (8, 9), or even proven that subjects follow chronobiological trends by established genetic patterns (10).

On the other hand, biological rhythms can be measured in various ways (11), however there is a technique of relative simplicity, low cost and minimal discomfort for the subject called "chronotype" which helps characterize the variations that occur in circadian cycles endogenous and classifies subjects according to their tendency: morning or evening and the combination of both: intermediate. The chronotype measurement was developed by Horne & Ötsberg who developed a validated form and translated into Spanish (12). Previous studies have shown that the tendency to be evening is more damaging than the tendency to be morning, observing that evening subjects tend to have worse diet habits that have an impact on their state of health and body weight, as

well as the tendency to be evening It has been related to pathologies such as diabetes mellitus 2, heart disease among others. (13).

Based on the aforementioned background, this research work has been proposed in order to establish the relationship between the chronotype of a group of subjects, Ecuadorian adults and their anthropometric measurements and caloric intake, the hypothesis that we have raised shows that the subjects Afternoons will have higher caloric intake, higher body weight and higher anthropometric measurements.

2. Materials and methods

2.1. Design and participants

Cross-sectional, observational, non-experimental design. Sample: Men and women between the ages of 18 and 63 who were hospitalized at the Enrique Garcés General Hospital in the city of Quito were recruited. Inclusion criteria: Hospitalized patients of different hospitalization services. Patients between 18 and 63 years. Patients who sign the informed consent. Exclusion criteria: Women during pregnancy, women who are breastfeeding, patients with mobility or edema problems, minors.

Sample size calculation: To calculate the sample, the number of patients treated monthly in the outpatient service of the Enrique Garcés Hospital in the city of Quito-Ecuador was taken, with the data obtained, a calculation was made using the proportion of 30% risk of overweight and obesity, 2% of error and with a 95% confidence interval of which an additional 10% was also added due to possible data loss. The Epidat 3.1 program was used to calculate the sample. A final value of 400 patients was obtained.

2.2. Anthropometric evaluation:

The following measurements and calculations were evaluated in the participants: weight, height, (BMI), waist circumference, hip circumference, hip waist index, tricipital fold, percentage of fat mass, percentage of muscle mass, percentage of visceral mass We used: an SECA model 201 anthropometric tape to measure body circumferences, Seca 220 Telescopic Height Rod to measure the height of the participants, a Slim Guide caliper to measure the adipose panicle, an OMRON brand HBF-514C body control scale for body composition measurements. The measurement techniques applied were based on the international protocol for anthropometric assessment "ISAK".

2.3. Cronotype

The questionnaire used to determine the chronotype was the one designed by Horne & Ötsberg tool translated and validated in the Ecuadorian population, the chronotype of the participants was classified as follows: 16-30 extreme evening, 31-41 moderate evening, 42 -58 intermediate, 59- 69 moderate morning and 70-86 extreme morning. (12).

2.4. Caloric intake

To evaluate the caloric intake of the participants, the 24-hour Recall model was applied, which included a weekday of their normal diet "out of the hospital", to more than one recall of food frequency. For the analysis of the dietary information of the patients, the food composition tables were used: from the Institute of Nutrition of Central America and Panama (INCAP) and the food composition table of Ecuador.

2.5. Statistical analysis

The descriptive analysis was performed using means and standard deviation, since the variables followed a normal distribution (Kolmogorov-Smirnov $p = 0.478$). For inferential analysis, statistical tests such as ANOVA and CHI SQUARE were used and statistical significance was determined when the test value was <0.05.

The R and R Studio software was used for the statistical analysis.

2.6. Ethical considerations:

The investigation was executed after complying with the guidelines required by the teaching and research department of the Enrique Garcés General Hospital, which includes the written informed consent of all participants and a confidentiality letter. All data were collected by trained and qualified personnel.

3. Results

General characteristics and chronotype diagnosis of the study population: The sample included 400 men and women (43.1% and 56.9%, respectively). The average age of the sample was 38.24 years (SD 12, 49), 37% of the population is married, according to the classification in the chronotypes, subjects with a tendency to maturity predominate, 40%

are moderate morning followed by 36% corresponding to the intermediate chronotype and in a lower percentage 11 % are located moderate evening.

Anthropometric and caloric intake characteristics of the population: Several analyzes were carried out on the anthropometric characteristics of the population, highlighting an average body weight of 67.11 Kg, 1.57 cm tall; 16.48 mm tricipital fold and 27.17 kg / m2 body mass index and 90.04 cm waist circumference. With respect to body composition, an average fat mass of 33.81%, 28.61% muscle mass and 8.63% visceral fat was found. With respect to dietary intake, an average of 2986 Kcal / day was found. Regarding the diagnoses made of the anthropometric measurements, it was found that 40% of the population presented a low tricipital fold, 40% were overweight, 36% presented high metabolic cardio risk according to the diagnosis of waist circumference, while the 56% of the subjects presented high metabolic cardio risk according to the diagnosis of hip waist index. Finally, 45% of the population presented obesity diagnosed by bioimpedance (fat mass) and 65% of the population had a very high diagnosis of visceral fat.

Analysis of the chronotype and anthropometric and food intake values: Differences were observed between anthropometric measurements and caloric intake and the different groups of chronotype (moderate morning, extreme morning, intermediate and moderate evening, finding the highest means in body weight (69.13 kg; p

= 0.035), Body mass index (29.32 kg / m2; p = 0.042), waist circumference (97.8 cm; p = 0.034), tricipital fold (20.12 mm; p = 0.038), percentage of fat mass (31.56 %; p = 0.027) percentage of visceral fat (0.034; p = 0.031) in moderate evening subjects compared to the other groups.

4. Discussion

The present study shows for the first time an association between chronotype, anthropometric characteristics and caloric intake in Ecuadorian adults through a pilot sample of 400 adult subjects.

In this study it was found that the evening chronotype of the population studied is associated with higher values of body weight, a result that coincides with those obtained by Maukonen et al., 2019 [15], where the evening ones are more predisposed to weight gain and an increase in BMI compared to people in the morning chronotype, the authors explain that this process may be related to a higher nocturnal food intake, which may play an important role in the development of obesity.

In this sense, changes in body composition related to excess body weight and poor lifestyle habits determine the development of complications such as cardio-metabolic

diseases and diabetes (16, 17). In addition, overweight and obesity increase the risk of mortality due to different causes (18).

In this study, in addition to the analysis of the Body Mass Index, a more exhaustive analysis was carried out using other nutritional evaluation techniques such as anthropometric and body composition techniques, through the use of specialized bioimpedance balances (BIA), as well as the waist circumference, which today is an important anthropometric measurement, as well as the percentage of visceral fat, since they have been shown to be important in predicting cardiovascular risk (19).

We found that individuals with evening chronotype had higher waist circumferences compared to subjects with morning chronotype or indifferent chronotype (p<0.05), which is related to the study by Valladares et al., 2010, (20) where statistically significant associations were found in relation to abdominal fat, which was higher in the evening chronotype, in this same study a significant association was observed with higher values of visceral fat and evening chronotype, which also agrees with the results of our study.

In addition, according to Schuber and Randler, 2008 (21), the late night being is related to unhealthy dietary habits and greater BMI, in our study we also found that the evening subjects presented anthropometric measures such as tricipital fold and high visceral fat compared to other groups, in addition to BMI, which complements the theory that the tendency to be evening could worsen the control of both body weight and body composition.

Finally, our study found that evening subjects had a higher caloric intake compared to the other groups, which is consistent with the research of Sato et el., 2011 (22) who also studied the influence of sleep habits in the population.

The aforementioned is consistent with the conclusion made by Valladares et al., 2016 (20), which states that aspects of the regulation of circadian cycles such as quantity and quality of sleep or the chronotype are associated with the development of metabolic diseases because they could alter brain functions involved in appetite control, which would lead to an increase in caloric intake. Therefore, and according to the results found, the chronotype can be considered as a risk factor predisposing to weight gain, increased risk in anthropometric and body composition measures and increased dietary intake. Nutritional treatments should adjust the recommendations of the diet according to the chronotype of the patients since it seems to be more effective than the traditional hypocaloric dietary treatment (23), so the results obtained in this research mark the beginning for future research in Ecuador.

Clinical implications: The results of this study may contribute to a better understanding of overweight and obesity, considering that there are also factors such as the chronotype that can be included in the lifestyle recommendations of Ecuadorian adults.

Limitations of the study: it is highlighted that this is one of the first works on the relationship of the chronotype and anthropometric measurements in Ecuadorian adults, however, it should be noted that the level or amount of physical activity that the adults carried out could not be evaluated with precision. It is recommended to continue with deeper analyzes using confounding variables in the analyzes of the relationships between chronotype, overweight and other health components.

5. Conclusions

It is concluded that the subjects' evening chronotype is related to anthropometric measurements such as weight, height, waist circumference and body composition such as percentage of fat mass, percentage of lean mass and percentage of visceral fat, it was also found relationship with dietary intake with statistically significant differences. The evening chronotype seems to be the largest.

Acknowledgments

Interest Conflict

The authors have no conflicts of interest.

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Tabla 1

General characteristics and chronotype diagnosis of the study population.

General Characteristics		n=400 (100,0%)
Sex		
Male		185 (43.1%)
Female		215 (56.9%)
Age (y) Mínimum Maximum	Mean	Standar Desviation
18 63	*38.24*	*12.49*
Marital Status		
Single		140 (35%)
Married		148 (37%)
Free union		75 (19%)
Divorced		37 (9%)
Chronotype		
Intermediate		*144 (36%)*
Moderate morning		*158 (40%)*
Extreme morning		*52 (13%)*
Moderate evening		*46 (11%)*

Tabla 2

Anthropometric and caloric intake characteristics of the population.

Variables		Number (%)	Mean ± Estándar desviation (Minimum-Maximum) N=400
Body weight (kg)			67,11± 12,55 (39.5-126)
Height (m)			1,57± 0,08 (1.30-1,83)
Tricipital Skinfold (mm)			16,84± 8,11 (3.00-39,0)
BMI (Kg/m2)			27,17±4,76 (18.52-43,7)
Waist Circumference (cm)			90.04± 11,34 (61-149,5)
Hip Circumference (cm)			97,44± 10,80 (70-137)
ICC (hip waist index)			0,93± 0,085 (0.7-1,25)
Fat mass (%)			33,81± 10,60 (5.6-59,2)
Muscle Mass (%)			28,61± 6,49 (16.3-47,8)
Visceral Fat (%)			8,36± 3,51 (5-24)
Dietary intake (Kcal / day),			2986± 1678 (1234-4589)
Tricipital Skinfold High (mm)		98 (25)	
(Diagnosis)	Normal	140 (35)	
	Low	162 (40)	
	Normo	139 (35)	
	Weight		
BMI (Diagnosis)	Overweigh	159 (40)	
	Obesity	102 (25)	

Tabla 3

Cardio Metabolic Risk according to Cir. Waist and Index Waist Hip.

High risk	142 (36)*
	223 (56)**
Moderate risk	93 (23)*
	141 (35)**
Low risk	165 (41)*
	36 (9)**
Body composition	
Obese	182 (45)
% Fat mass High (Diagnosis)	110 (28)
Normal	94 (24)
Low fat	14 (3)
Very high	19 (5)
% Muscular mass High (Diagnosis)	44 (11)
Normal	170 (43)
Low	167 (41)
Very high	258 (65)
High	120 (30)
Normal	22 (5)

% Visceral fat (Diagnosis)
*Waist Circumference (cm) **Waist hip index

Tabla 4

Relationship between: chronotype and anthropometric and food intake values of the study population.

	Matutino		Vespertino		
	moderado	extremo	Intermedio	moderado	P valor
N=400	158	52	144	46	
Body weight,	67.69	65.93	68.76	69.13	0.035
Mean (SD)	(13.12)	(10.11)	(12.28)	(16.95)	
Body mass	27.15	26.79	28.13	29.32	0.042
index, mean	(4.35)	(3.42)	(3.45)	(2.56)	
(SD)					
Waist circumference,	78.2	82.4	95.6 (4.12)	97.8 (3.57)	0.034
Mean (SD)	(11.23)	(14.5)			
Tricipital	15.32	16.7	18.9 (6.78)	20.12	0.038
skinfold (mm),	(4.35)	(4.56)		(5.78)	
Fat mass(%),	27.65	28.7	29.31	31.56	0.027
Mean (SD)	(4.56)	(5.67)	(6.78)	(5.66)	
Visceral fat (%), Mean (SD)	5.6 (2.3)	6.2(3.5)	6.4 (3.4)	7.4(4.3)	0.031
Dietary intake	1678	1895	2768	3569	0.021
(Kcal/day),	(985)	(896)	(1040)	(1276)	

Abbreviations

(ECNT): Enfermedades crónicas no transmisibles.

(INCAP): Instituto de Nutrición de Centro América y Panamá. (BMI): Indice de masa corporal.

(BIA): Bioimpedancia eléctrica.

(EFRICA-EC): Estudio de Factores de Riesgo Cardio-Metabólico en Adultos Ecuatorianos.