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## ORIGINAL

### BMI AND PHYSICAL ACTIVITY OF THE COLIMA UNIVERSITY STUDENTS

### IMC Y ACTIVIDAD FÍSICA DE LOS ESTUDIANTES DE LA UNIVERSIDAD DE COLIMA

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#### ABSTRACT

**Objective:** To determine the BMI of Colima university students and its relation to physical activity and sedentary time related to age, gender and university cycle.

**Material and Methods:** 370 students, 51.1% female and 48.9% male. We have had being employed the short version of the IPAQ questionnaire and the BMI was determined taken in consideration the measurement of weight and height. **Results:** The mean BMI was 25.20 ± 4.14. Men have a BMI greater than women (p <.01).

The 50.3% of men have a BMI > 25. Students aged between 21 and 25 years have a significantly higher BMI than those under 21 years ( $p < .01$ ). A body mass index (BMI) is associated with obesity, inactivity (OR 3.47) **Conclusions:** The BMI of men is higher than women. Compared with active subjects, sedentary students are mainly obese than active ones.

**KEYWORDS:** Exercise, Sport, Obesity, University.

## RESUMEN

**Objetivo:** Conocer el IMC de los universitarios de Colima y su relación con la actividad física y el tiempo sedentario en función de la edad, sexo y ciclo universitario. **Material y Métodos:** participaron 370 estudiantes, el 51.1% mujeres y el 48.9% hombres. Se utilizó la versión corta del cuestionario IPAQ y el IMC se determinó a partir de la medición del peso y la altura. **Resultados:** el promedio del IMC fue de  $25.20 \pm 4.14$ . Los hombres tienen un IMC superior a las mujeres, ( $p < .01$ ). El 50.3% de los hombres tiene un IMC > 25. Los estudiantes con edades entre 21 y 25 años tienen un IMC significativamente superior que los menores de 21 años ( $p < .01$ ). Un índice de masa corporal (IMC) con obesidad se asocia con la inactividad (OR 3.47)

**Conclusiones:** El IMC de los varones es mayor que el de las mujeres. Comparados con los sujetos activos, los estudiantes sedentarios son obesos en mayor medida.

**PALABRAS CLAVES:** Ejercicio, Deporte, Obesidad, Universitarios.

## INTRODUCTION

Obesity has been had considerate as the most common metabolic disorder in every country in the world. Mexico is one of the most affected countries by the obesity; it's one of the most serious public health country<sup>1,2</sup>. The availability of energy-dense fast processing and relatively low costs along with a reduction in physical exercise and an alarming increase in obesity that favor sedentary lifestyle is one of the main determinants of health in our society.

This problem is one of the most influence factors on the people's quantity and quality of life<sup>3</sup>, in favor of the emergence of people's disorders in terms of physiological and psychological effects. The physiological level is the one of the main factors for the concurrence of other chronic diseases such as hypertension, type 2 diabetes mellitus and other disease markers cardiovascular disorders<sup>4,5,6</sup>.

To determine obesity or overweight has been had employed as a parameter for measuring the body mass index (BMI)<sup>4,7</sup>. Various institutions and recommend

cutoffs to establish different degrees that are associated with health status and even adapted to infancia percentiles<sup>8</sup>. A measure of classification of subjects according to BMI is done with the following system categories: Poor (BMI <18.5), normal ( $\geq 18.5$  and <25), overweight ( $\geq 25$  and <30) and obesity ( $\geq 30$ )

### *Physical activity and sedentary lifestyle on health*

Some studies have had linked physical inactivity with some major chronic<sup>3</sup>, non transmissible diseases<sup>9,10,11</sup>, and some others studies have had linked physical inactivity with mortality for some others non transferable chronic diseases<sup>12,13</sup>.

At the contrary, the regular physical activity (PA) reduces the risk of cardiovascular disease, stroke, and some ones cancer's types<sup>14</sup>. It was found that physical activity promotes general health improvement<sup>13,15,16</sup>, bringing us benefits in the three dimensions that make up the term health: biological, psychological and social.

An active lifestyle with PA regularly performing have has positive effects on the control and prevention of chronic diseases such as obesity, hypertension, diabetes mellitus types II<sup>5,9,17-20</sup>. Some studies have found that AF contributes to the decreased corporal fat<sup>21,22</sup>.

Furthermore, the PA can also bring us psychological benefits<sup>23</sup>, improving self consideration<sup>24</sup>, corporal hedonism<sup>25,26</sup> and mood in general<sup>15,27,28</sup>, and decreasing anxiety and depressive states<sup>29,30</sup>. The third dimension of health is related to the social activity that provides by sports and physical activities connecting the people among them<sup>31,32</sup>.

In recent times it has been had paying attention to another possible determinants on the performance of PA, such as the educational level and the practices of parent's PA to come in overweight, the type of residence, the perceived health, the dietary pattern and the idea of a healthy general lifestyle<sup>33</sup>. Less a decade ago the obesity problem was associated with high or low socioeconomic status and sex, however, the pandemic has reached equally all levels and no longer a unique problem associated to women or socials classes<sup>34</sup>. Among university students, risk behaviors are common in a lifestyle characterized by bad eating habits, poor sleep, physical inactivity, excessive consumption of both alcohol and snuff and high levels exposure of stress during the study years; all these circumstances identified to them as a risk's population<sup>13</sup>. This figure is worrying enough to be alert about the PA levels and the inactivity of young Americans and more especially in Mexico. This study aimed to know the BMI of Colima university students and the impact of physical activity and sedentary time related to age, gender and university cycle.

## MATERIAL AND METHOD

The study evaluates the BMI, PA levels and sedentary habits at university's students from Colima from the perspective of age, gender and university cycle.

*Population:* The population to study was undergraduate students at the Colima State- México of, N = 9975. We conducted a random cluster sampling, respecting gender quotas, populations of each semester and graduate degrees in. We assumed a 5.1% of error margin with a 95% confidence level. The study involved 356 students, 51.1% female and 48.9% male. The population has a mean age of  $20.98 \pm 2.24$  years.

*Variables:* The study analyzes the BMI and its association with physical activity variables, regular physical activity and sport in leisure time, self-perception of fitness and health. We also used the age, sex and the cycle attends college students (= junior students of the second and fourth semester and second cycle = students of sixth and eighth). The latter variable is justified because homogenizes the educational demands of students and the same measurements were made in the second half of the academic year coinciding with the half pairs.

*Instrument:* We have had employed items from the International Physical Activity Questionnaire (IPAQ) to measure the taken time to move in moderate and vigorous intensity activities and sedentary activities<sup>35</sup>. The BMI is determined by measuring height and weight and subsequently was classified<sup>36</sup>. It also was introduced three questions that were answered on a Likert scale. The one on the frequency of physical and sporting activities in leisure time and the two on the state self perceived physical condition (How you consider your state of fitness level?) And health status (how you consider your health status?).

*Statistical analysis:* The association between BMI and sex-university and university cycle was studied through a contingency table, and its associated statistical analyzing corrected residuals (RTC). We studied the BMI and physical activity level, original taken as a continuous variable, depending on the age range, gender and university cycle. A nonparametric test for the study of data normality and homoscedasticity was employed. Finally we implemented a multinomial logistic regression model, calculating odds ratios and their confidence intervals at 95% to establish the degree of association between BMI and the other variables, taking as covariates gender, age range and cycle university. The analysis was performed with SPSS 17.0 software.

## RESULTS

### *BMI analysis depending on age, sex and university cycle*

The results of BMI according to the classification of OMS<sup>37</sup> (Table 1) indicate that 52.7% of college students are within the normal weight (BMI <25), 33.3% in overweight (BMI ≥ 25 and <30), and 9.1% in securities of obesity (BMI ≥ 30), Table 2. The 54.4% of men in the first cycle and 41.7% in the second cycle has a BMI within the normal weight. The 33.3% of the men in the first cycle is overweight and 8.9% obese, while 42.9% of men in the second cycle are overweight and 14.3% are obese

On the other hand, 65.3% of women in the first cycle and 64.2% in the second cycle is within the normal weight. The 19.8% of the women in the first cycle and the second 23.5% are overweight.

By using nominal variables was decided to conduct a contingency table to study the association between sex, and BMI university cycle (Table 1). Statisticians ( $X^2$  (df = 3) = 18.43,  $p < .01$ ) indicate that in the second cycle there are a significant association between the variables, while the first cycle is not ( $X^2$  (df = 3) = 6.24,  $p > .05$ ). The residuals corrected indicate that there are more cases of overweight (RTC = 2.1) than expected in the junior boys and more cases of overweight (RTC = 2.6) and obesity (RTC = 2.4) than expected in men of second cycle. It is also noted that there are fewer cases than expected in the normal weight men in the second cycle (RTC = -2.9).

**Table 1.** Cross tabulation between BMI classified, sex and the cycle university students.

Course	Sex		Classification of BMI				Total
			Underweight <18.5	Normal weight <25	Overweight 25 a 30	Obese > 30	
2 & 4 semesters	Man	Count	3	49	30	8	90
		% within sex	3.3%	54.4%	33.3%	8.9%	100.0%
		% Classification of BMI within	27.3%	42.6%	60.0%	53.3%	47.1%
		% total	1.6%	25.7%	15.7%	4.2%	47.1%
		<i>RTC</i>	-1.4	-1.5	2.1	.5	
	Woman	Count	8	66	20	7	101
		% within sex	7.9%	65.3%	19.8%	6.9%	100.0%
		% Classification of BMI within	72.7%	57.4%	40.0%	46.7%	52.9%
		% total	4.2%	34.6%	10.5%	3.7%	52.9%
		<i>RTC</i>	1.4	1.5	-2.1	-.5	
Total	Count	11	115	50	15	191	
	% within sex	5.8%	60.2%	26.2%	7.9%	100.0%	
	% Classification of BMI within	100.0%	100.0%	100.0%	100.0%	100.0%	
	% total	5.8%	60.2%	26.2%	7.9%	100.0%	
6 & 8 semesters	Man	Count	1	35	36	12	84
		% within sex	1.2%	41.7%	42.9%	14.3%	100.0%
		% Classification of BMI within	12.5%	40.2%	65.5%	80.0%	50.9%
		% total	.6%	21.2%	21.8%	7.3%	50.9%
		<i>RTC</i>	-2.2	-2.9	2.6	2.4	
	Woman	Count	7	52	19	3	81
		% within sex	8.6%	64.2%	23.5%	3.7%	100.0%
		% Classification of BMI within	87.5%	59.8%	34.5%	20.0%	49.1%
		% total	4.2%	31.5%	11.5%	1.8%	49.1%
		<i>RTC</i>	2.2	2.9	-2.6	-2.4	
Total	Count	8	87	55	15	165	
	% within sex	4.8%	52.7%	33.3%	9.1%	100.0%	
	% Classification of BMI within	100.0%	100.0%	100.0%	100.0%	100.0%	
	% total	4.8%	52.7%	33.3%	9.1%	100.0%	

Taking BMI classified variables and physical activity level as ordinal variables differential analysis was performed according to sex, age and cycle (Table 2). Significant differences in BMI classified according to sex and age ( $p < .01$ ). Students who were between 21 and 25 years had a significantly higher BMI than those under 21 years ( $p < .01$ ). Men had a higher BMI ( $p < .01$ ).

**Table 2.** Differential analysis of BMI by gender and students cycle and correlation function of age

	Sex		Cycle		Age	
	<i>U</i>	<i>p</i>	<i>U</i>	<i>p</i>	<i>U</i>	<i>p</i>
BMI classified	11817,00	.000**	14454.00	.130	14.96	.001**
Physical activity	14491,00	.142	15610.50	.872	1.083	.582

\*\* $p < .01$

We studied the body mass index classifying the participants in terms of physical activity, physical activity in leisure time and the level of self-perceived physical condition through a multinomial logistic regression. To facilitate interpretation of the

data is merged the categories "Underweight" and "Normal weight" in BMI and "very inactive" and "Inactive" on physical activity levels.

Of the total, 62.1% were classified within the normal weight, while 29.5% were overweight and 8.4% obese (Table 3). Also offered are percentages of BMI levels depending on the variables of sex, age group, cycle and physical activity, physical activity in leisure time, and self-perceived fitness level. The 78.4% of respondents stated that having a good physical condition although only 26.1% frequently physically active in their time while 51.1% do so sporadically. A 40.2% perceive that they have a bad health condition and 39.9% as good.

**Table 3.** Descriptive use of the variables used in the multinomial logistic regression.

	<i>N (%)</i>	Normal weight	Over weight	Obese
<b>Total</b>	356	62.1%	29.5%	8.4%
<b>Sex</b>				
Man	174 (48.9%)	24.7%	18.5%	5.6%
Woman	182 (51.1%)	37.4%	11.0%	2.8%
<b>Age group</b>				
0 – 20 yo	169 (47.5%)	34.0%	11.2%	2.2%
21 – 25 yo	177 (49.7%)	26.4%	18.0%	5.3%
Más de 25 yo	10 (2.8%)	1.7%	.3%	5.3%
<b>Cycle</b>				
2 – 4	191 (53.7%)	35.4%	14.0%	4.2%
6 – 8	165 (46.3%)	26.7%	15.4%	4.2%
<b>Physical Activity</b>				
Inactive	192 (53.9%)	32.3%	15.7%	5.9%
Moderately active	42 (11.8%)	22.2%	10.7%	1.4%
Active	122 (34.3%)	62.1%	29.5%	8.4%
<b>Physical activity in leisure time</b>				
No	81 (22.8%)	14.6%	5.6%	2.5%
Sporadically	182 (51.1%)	30.6%	16.6%	3.9%
Frequently	93 (26.1%)	16.9%	7.3%	2.0%
<b>State perceived fitness</b>				
Bad	6 (1.7%)	.6%	.8%	.3%
Not too bad	71 (19.9%)	9.6%	6.7%	3.7%
Good	279 (78.4%)	52.0%	21.9%	4.5%
<b>Perceived health</b>				
Bad	143 (40.2%)	22.8%	13.8%	3.7%
Not too bad	71 (19.9%)	11.8%	5.6%	2.5%
Good / very good	142 (39.9%)	27.5%	10.1%	2.2%

We have had implemented an analysis of those classified "overweight" and "obesity" respect to the reference category of "normal weight" and with a multinomial logistic regression model, have had calculated odds ratios and their intervals confidence at 95 % to establish the association degree with physical activity, frequency of physical activity in leisure time, the perceived state of health and fitness. The results indicate at Table 4 show us that the inactive (OR 3.37) are more near to became obese than those who are classified as assets with respect to the reference category of "Normal weight". No association was found between physical activities in leisure time.

Furthermore, associations were found between the perceived state of fitness in both, overweight and obesity, related to the reference group "Normal weight". Self-reported student with regular physical fitness were more likely to be classified as overweight (OR 1.86) and obesity (OR 5.55) than these self perceived like in good physical condition. No association with the group of poor physical condition although descriptive indicate that a very small group, 1.7% of participants. At the end, we haven't had not found significant association between overweight and obesity related to the perceived health status.

**Table 4.** Results of the multinomial logistic regression model (OR and 95% CI) in Colima college examining the association between BMI and physical activity level.

	Sobrepeso	Obesidad
<b>Physical Activity Levels (daily expenditure. Mets)</b>		
Active ( $\geq 40$ )	1	1
Inactive ( $< 37$ mets)	1.12 (.67 - 1.89)	3.37 (1.19 - 9.55) *
Moderately actives (37 - 39.99 mets)	.89 (.39 - 2.04)	2.88 (.69 - 12.03)
<b>Physical activity in leisure time</b>		
Frequently	1	1
No	1.06 (.518 - 2.158)	1.88 (.629 - 5.631)
Sporadically	1.41 (.792 - 2.515)	1.27 (.473 - 3.435)
<b>State perceived fitness</b>		
Good / very good	1	1
Bad	4.82 (.73 - 31.93)	6.87 (.47 - 100.70)
Not too bad	1.86 (1.03 - 3.41) *	5.55 (2.318- 13.31) *
<b>Perceived health</b>		
Good / very good	1	1
Bad	1.64 (.95 - 2.81)	1.97 (.75 - 5.13)
Not too bad	1.09 (.550 - 2.14)	2.02 (.70 - 5.82)

Odds ratio adjusted for age, gender and university cycle. The comparison group is the "Normal weight". \*  $p < .05$

## DISCUSSION

In contemporary societies, obesity has become a health problem<sup>2</sup>. However, in a general analysis, the results indicate that the average Colima college students with a BMI below the level of overweight (BMI  $<25$ ). Similar results were found in studies at other countries universities, Argentina<sup>38</sup> and Chile<sup>39</sup>. These results differ when had been had observed from a gender perspective, males have a higher BMI than women. This sex difference has been shown in several college studies Chile<sup>39</sup>, Colombia<sup>40</sup>, Germany<sup>43</sup> and Spain<sup>41,42</sup>.

For Colima college men they have has a similar average BMI of 25.2, to those of Chile universities<sup>39</sup>. Opposite results are obtained in Colombian university studies<sup>44</sup> and Spanish from Madrid and Valencia 25.37 where the average BMI is within the normal weight ( $<25$ )<sup>41</sup>. For Colima university women was found a similar BMI



average in the normal weight, 25.41, as in Chile University<sup>39</sup> and Latin American countries including Colombia and Europe like Spain<sup>40</sup>.

The average value is not a very reliable for assessing a complete population therefore was used to make a distribution of the population (%) within the BMI classification proposed by WHO. The results indicated that the Colima student population is not stranger to the problem of overweight and obesity, the 38.7% of students are above normal weight (BMI  $\geq$  25). These results are similar to other Latin American university in Chile (32.8%)<sup>39</sup> and Colombia (35.1%)<sup>40</sup>, high relative to university of Guadalajara, Mexico (25.9%)<sup>45</sup>, and very high related to Argentine university student<sup>38</sup> where only 18% of college students had a BMI >24. Also have had found that 5.1% of students had a low weight (BMI <18.5).

In a deeper analysis, Colima's male university population shows alarming results for the average age of college students (21.22  $\pm$  2.25) and that 50.3% have a BMI above the normal weight, above women 27.5%. Similar results were found in the Chile university with 45.5% of overweight or obesity<sup>39</sup>. These results have has a clear contrast with a study of Bolivian university where 27% of men is above normal weight<sup>46</sup>. Regarding Spain, BMI>25 of Colima college is almost double of males Alfonso X Madrid University (28.5%)<sup>25</sup> and the universities from Valencia (24.3%)<sup>41</sup>. In the case of Colima university the overweight percentage or obese is 27.5% less than the Bolivian university (35%)<sup>46</sup> and the Spanish University of Valencia (37%)<sup>41</sup>.

The results of Colima males are superior to both developing countries such as Bolivia, as developed countries such as Spain. It appears that in countries with emerging economies such as Mexico, Colombia and Chile the male college develop a lifestyle oriented to became overweight or obese. They are also superior in the case of Colima college women. Obesity is a pandemic affecting all socioeconomic levels and it is not a problem unique to women.<sup>34</sup> In studies of college Latin America students have had found that students were overweight or obese have has a higher prevalence of risk factors in order to have a metabolic syndrome<sup>37,38</sup>. The problem of overweight and obesity in adults persists with university worsen in the male case<sup>7</sup>. These results mirror those found in the survey ENSANUT 2006 for the Mexican population range from 20 to 29<sup>7</sup>. This indicates related to the cultural level, remember us that there be in the university is, not a good reason for to have has a good health status and that the education authorities were negligent in their policies towards this sector of the population or before.

The results at the BMI classification in men particularly high suggesting the possibility of more deep studies, taking into account another variables: nutritional habits of other substances, other tasks collated with the study, multi-vendor environment (rural or urban), dig deeper into the kind of gentle movements that the

students ... you will also need to assess body composition through other more accurate methods such as bioimpedance.

### *Physical activity and BMI*

The 53.9% of participants was classified as inactive. According to several studies and international organizations, is recommended at least performing 30 minutes of moderate-intensity physical preferably all, days of the week<sup>48-51</sup>. The study found that only 26.1% of the participants are physically active in their leisure time on a regular basis.

The results indicate that inactive are more likely to be obese than active (OR 3.37), although the study found no associations with regular physical activity at the leisure time, as seen before in other studies<sup>52</sup>. Currently there is no doubt that exercise accompanied by a healthy diet is the best treatment to body weight control, and provided there are no other endocrine diseases. However, it is necessary to determine the most appropriate values of physical activity, frequency, duration and intensity to cause beneficial effects on health. A frequency at least three times per week regularly distributed along the week may be a minimum for the health care<sup>53</sup>. Some studies recommend at least 30 minutes of moderate physical activity every day of the week<sup>49,54</sup>, whereas others recommend at least 150 minutes of week physical activity<sup>50,51</sup>. This activity can be continuous or intermittent with duration of at least 10 minutes in each period<sup>55</sup>. As there is no a general consensus<sup>15</sup>, however seems to be an agreement on the usefulness of moderate physical activity daily care of health<sup>49</sup>. The ACSM recommends intensity between 50% and 85% of oxygen consumption reserve<sup>16</sup>.

On the other hand, found that subjects who self perceived with regular physical condition are more likely to be classified as overweight and obesity (OR 1.86 and 5.55 respectively) than those classified with a good physical condition. However, this does not happen with self-perceived health. Subjects ranked outside the normal weight feel with lower fitness, probably in their day to day, though not perceive their health as well. Overweight and obesity are conditions that cause diseases in the medium and long term among the young, and the danger is that they are not perceived as a risk at present.

## **CONCLUSIONS**

The study concluded that more than one third of the student population of Colima, Mexico, presents problems of overweight and obesity. For males these problems are more pronounced with respect to women, being necessary to study the causes in future studies from a broad perspective encompassing analysis lifestyles, the socio-economic conditions and social support environment .

College students are overweight or obese are placed in a situation of risk for a metabolic syndrome in the future and therefore must be implemented solutions to promote a healthy lifestyle. Among the related variables to lifestyle, be concluded that the inactive classified students as are more likely to be obese than assets and have has a poor perception of one's physical condition and it is too a risk factor for overweight and obesity seem

The arrival to college coincides with a decline in the practice of PA. Today the regular practice of physical activity has become one of the main objectives for improving public health<sup>56</sup>, from academic institutions should have had being considered institutional programs in order to reduce the overweight and obesity through a healthy lifestyle. It is necessary to provide coaching on healthy lifestyles, orientation programs so that students go to the practice of AF that best suits their interests and needs, and strategies to improve nutritional habits and consumption. Finally, students must have has facilities for free and individual AF and organized programs aimed at improving health too.

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