Anthropometric evaluation and physical activity in college students during COVID-19 confinement

Anthropometry and physical activity in lockdown

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***Abstract*— The contingency caused by COVID-19 heavily impacted day-to-day activities in college students. Thus, the objective of this study was to evaluate the anthropometric characteristics, body composition and physical abilities of college students in lockdown. The present was an analytical, observational, cross-sectional and prospective study of 51 students from the State University of Valle de Ecatepec, from 20 to 30 years old. Anthropometric measurements (BMI, MM and MG), physical tests of strength, flexibility and Maximum Oxygenation Volume were performed. The international physical activity test was applied, then means and standard deviations, frequencies and percentages were determined, significant differences were considered if p<0.05. Of 51 participants, 64.7% (33) were female, and 35.3% (18) male. Ages fluctuated between 19 to 28, with an average of 21.82±1.86. There were no differences in age or sex (p>0.05). Differences between females and males were observed in BMI; 22.79±2.41 in women and 24.84±1.99 in men (p =0.003), muscle mass was 6.18±1.28 in women and 8.22±1.34 in men (p=0.0001), strength tests 24.42±2.70 in women and 31.61±6.45 in men (p = 0.0001). The data of the present study shows the lack of activity of students during the pandemic, with higher anthropometric differences, BMI and MM in men, showing greater strength capacity in the former, preferring weight activities and repetitions over cardiovascular activity. The values of inactivity are high, related to the increase in class hours, the reduction of schedules and spaces for physical activity.**

***Keywords:* Keywords: COVID-19, anthropometry, physical activity, sedentary lifestyle, university students, physical tests, physical activity test.**

I.- INTRODUCTION

Derived from the SARS-CoV-2 pandemic, physical activity has been altered worldwide, these changes have transformed several aspects of the individual's health. In line with this, Mexico has an approximated population of 126.2 million inhabitants and has been classified by the World Health Organization (WHO) as a country with high obesity at childhood and adulthood, thus, it has been declared a country in health emergency.(1) According to WHO, more than 1.6 billion adults are overweight, and of these, at least 400 million are obese. Obesity contributes to increased morbidity and mortality rates by being associated with chronic non-contagious diseases such as diabetes, hypertension or cardiovascular problems. This causes an increase in premature deaths and the loss of quality of life, thus, raising healthcare costs. Some even consider it as a sociopathology based on unequal distribution of resources, since in industrialized societies or developing countries, it affects populations with fewer socioeconomic resources and, depending on which places and groups of age, more women than men. (2,3) Based on this epidemiological data, we can gauge the severity of obesity in Mexico. The obesity rate in Mexican women is 37.5% and in men 26.8%, while overweight is higher in men with 42.5% and in women it is 35.9%. It was also observed that from 1988 to 2012, overweight in women aged 20 to 49 years increased from 25% to 35.3% and obesity from 9.5% to 35.2%.2. Consequently, the most common diseases in the population with these characteristics are hypertension and diabetes, plus, the lack of mobility causes eating-disorders to appear, which is reflected in the body with different associated pathologies. (4)

On the other hand, students, regardless of age or academic stage, tend to live under a sedentary lifestyle, they carry a load of at least 6 to 8 hours a day sitting, and if we add the time they invest in their homework or a working day, we could say that they are inactive for more than 12 hours. Considering all of the above, this segment of students has a greater probability of developing overweight, generating different types of obesity. (5,6)

In the same line, the conditions caused by the quarantine have reduced the physical activities of students even more, which ultimately has led them to be more exposed to the consequences of a sedentary lifestyle, such as in cardiovascular diseases, oxygenation levels or eating habits, impacting in key factors of school performance. Recognizing the population characteristics linked to physical activity and its relationship with body composition and anthropometric values during this period of isolation, will allow us to identify aspects of health in the college population and to design strategies physical activity through appropriate methodologies. For this reason, the objective of this study is to evaluate the anthropometric characteristics and body composition of college students during the confinement caused by the COVID-19 pandemic and their relationship with physical abilities.

II.- MATERIAL AND METHODS

An analytical, observational, cross-sectional and prospective study was carried out. The population was formed by 51 students enrolled at the Universidad Estatal del Valle de Ecatepec, without clinical signs of disease. The procedures were carried out under the ethical standards for research with human beings, according to the Declaration of Helsinki of 1975. They were granted the letter of informed consent for adults and the letter of confidentiality based on country legislation.

Physical and anthropometric measurements were carried out using standardized instruments by the ISAK (International Society for the Advancement of Kineanthropometry). Skinfold measurements (caliper), circumferences (tape measure) and perimeters (pachymeter) were performed following the protocol of the SATA (Accreditation System for Anthropometric Techniques) manual, by trained personnel for data collection. To calculate muscle mass, the formulas of Martín and Lee were used, considering MM: muscle mass in (gr); Ga: Forearm perimeter-skinfolds (cm); Gb: leg-skinfold perimeter (cm); Gc: Arm circumference and skinfolds

(biceps+triceps) (cm); and finally, Gd: thigh perimeter - skinfold (cm) (7-9).

The Body Mass Index (BMI) was determined by dividing the body mass in kilograms by the square of the height expressed in meters. To calculate fat mass in this study, the Faulkner equation was used, for men: 5.783 + (∑4pan) * 0.153, women: 7.9 + (∑4pan) * 0.213. Making the sum of 4 skinfolds (t: triceps, se: subscapular si: suprailiac a: abdominal) (10).

Physical capacities were evaluated by oxygen consumption test, strength, distance covered in 5 minutes and flexibility. Field tests were applied; the participants received instructions for specific exercises for each measurement, after warming up directed by personnel trained in physical activity.

The Vo2max was recorded by the maximum oxygen consumption (VO2 max) of each student according to the Howald equation, based on the Cooper test (continuous running for 12 minutes) (11). After finishing the test, the metric distance obtained was multiplied by 0.02 and 5.4 was subtracted from the result. The figure obtained from the equation expresses the student's maximum oxygen consumption milliliters. To conclude the evaluation, it is multiplied by the kilograms of the subject's weight and by the number of minutes run.

On the other hand, a strength test was applied, where the participant performs a maximum vertical jump (VJ) starting with the knees flexed at 90º of knee flexion, with the trunk straight and the hands on the waist. The total number of repetitions was measured. The distance traveled in 5 minutes was performed on a flat field of 400 meters and the total distance traveled was recorded with a chronometer.

Finally, the flexibility test (fingers-floor distance) was performed, where the participant was asked to flex the trunk, barefoot on a firm surface and on a step, bringing the fingers closer to the feet. Measuring the distance from the floor to the tips of the fingers in centimeters (12).

Through the application of a digital test, physical activity was evaluated. The US version in Spanish, available on the IPAQ website (www.ipaq.ki.se) (13), was used and the recommendations of experts were followed to carry out a format that could be sent by email to each participant. The perception of sedentary lifestyle was evaluated by estimating the number of hours in front of a desk in class, work or academic

activities, related to the days and times of physical activities, where the person who performs less than 15 minutes of daily physical activity is considered sedentary; moderate: those who carry out activities at least two days per week; and mild: those who carry out more than 4 days of activity per week.

Statistical Analysis:

Means, standard deviations, frequencies and percentages were determined. The Kolmogorov-Smirnov test, Student Chi-square T-test and Spearman's correlation were applied. The statistical analysis of the data was carried out with the SPSS v 23 program. A value of $p<0.05$ was taken as statistical significance.

III.- RESULTS

A total of 51 participants were included in the study, 64.7% (33 cases) were female and 35.3% (18 cases) were male. Age ranged from 19 to 28 years, with an average of 21.82±1.86 years. No differences were observed in relation to the average age and sex ($p>0.05$).

The results of the anthropometric measurements, capacities and physical activity of the study participants in relation to gender are shown in Table 1. Differences between genders were only observed in BMI, MM and between strength.

No correlation was found between the perception of sedentary lifestyle and the type of physical activity with the anthropometric measurements and physical capacities evaluated ($p>0.05$ in all the evaluations). The degree of physical activity was positively correlated to the degree of cardiovascular resistance (rho=0.48, p=0.001) and flexibility (rho=0.32, p=0.03). The type of physical activity was not related to any anthropometric parameter or to any physical capacity ($p>0.05$).

Regarding anthropometric measurements, BMI was negatively correlated to the degree of cardiovascular resistance (rho= -0.30, p=0.02) and flexibility (rho= -0.27, p=0.05); body fat percentage was not correlated to any of the physical capacities evaluated ($p>0.05$); muscle mass was positively correlated to strength (rho= 0.33, p=0.01).

Tabla 1. Características antropométricas, capacidades y actividad físicas de los participantes en el estudio

	Femenino n=33	Masculino n=18	Valor p
Medidas antropométricas			
IMC (kg/m^2)	22.79±2.41	24.84±1.99	**0.003**
MM (kg)	6.18±1.28	8.22±1.34	**0.0001**
GC (%)	22.04±5.55	19.41±4.61	0.07
Capacidades físicas			
Vo2mx	46.32±1.26	46.61±1.39	0.46
Fuerza	24.42±2.70	31.61±6.45	**0.0001**
Distancia	2205.82±407.07	2315.28±430.75	0.37
Flexibilidad	8.69±3.59	8.38±4.73	0.79
Resistencia CV			
● Optima	18.2% (6)	44.5% (8)	0.11
● Regular	39.4% (13)	33.3% (6)	
● Insuficiente	42.4% (14)	22.2% (4)	
Actividad física			
	n=22	n=27	
Tipo de Actividad			
● Cardiovascular	27.3% (6)	41.2% (7)	0.40
● Fuerza	36.4% (8)	17.6% (3)	
● Mixta	36.4% (8)	41.2% (7)	
Grado de Actividad			
● Intensa	20.8% (5)	11.8% (2)	0.73
● Moderada	29.2% (7)	29.4% (5)	
● Leve	50% (12)	58.8% (10)	
Percepción de Sedentarismo	57.6% (19)	88.9% (16)	0.06
● Alto	33.3% (11)	5.6% (1)	
● Moderado	9.1% (3)	5.6% (1)	
● Leve			

IMC=índice de masa corporal, MM=masa muscular, GC=grasa corporal, CV=cardiovascular

IV.- DISCUSSION

The present study shows differences between genders regarding the performance of physical activities, with men carrying out more physical activities. In relation to physical capacities, males maintaining slightly higher levels than women. Plus, 30% of the participants declared themselves as inactive or with a degree of slight physical activity.

Our results are similar to those reported in other studies carried out in college students, where the populations evaluated presented a decrease of physical activities due to confinement caused by the current pandemic. Lara et al. (14), showed that there is a high incidence of physical inactivity, a 51.40% of students evaluated did not performed physical activity corresponding to the recommendations of international organizations, 31.40% perform moderate physical activity and 17.10% vigorous physical activity.

The factors that are associated with low activity are a large amount of work with 65.71% and lacking the necessary time for exercise with 51.14% (14). Another study regarding the practice of physical activity highlights a significant decrease in intensity and quantity, plus, a change in the type of physical activity performed, going from cardiovascular sports and muscular fitness to gentle gymnastics and flexibility. The total percentage of people who did not practice any physical activity increased. Even with more free time, people in isolation significantly decreased their amount of physical activity. These results allow us to conclude that confinement led to a change in physical activity habits, a decrease in the values recommended as healthy, which has implications for health and quality of life (15). Studies in this regard highlight that the practice of physical activity favors stress reduction and lightens work and academic loads, within motivational exercise programs to control overweight and obesity (16). Among the main reasons to carry out physical-sports practices are the health benefits, to release energy and tension, and improve self-image. The main reason for not doing physical activity is that some people do not consider themselves skilled in sports, and thus, abandon the practice, plus, the lack of free time is also reported (17). Azofeifa (18) found that the perception of physical or sports competence is positively associated with the physical activity practiced by people, especially in college students.

The fact that levels of physical exercise decrease as the students get older (19) allow us to understand that

the college students present the highest rates of inactivity. Adding the time of confinement due to the current pandemic, result in a permanent stage of inactivity. Mexico is, generally, an inactive country, and its student population is in a sedentary state, an association is reported between a greater study load and hours attending classes, reducing activities (20). Specifically, several studies propose physical activity monitoring methods, in which progressive exercise plans, supervision by trained personnel and periodic measurements are given continuity can lead to a healthy lifestyle such as the one proposed by several authors. (21)

The data of the present study shows that the anthropometric measurements maintain a significant difference in respect to gender, where men have a greater tendency to be overweight, with a higher BMI and muscle mass than women, while there was no difference in the percentage of fat. In physical capacity tests, an important difference is reported, mainly in strength exercises, where the male gender in the tests performed higher repetitions, while both groups presented low values of flexibility and VO2Max compared to other studies. Regarding the type of physical activity, a greater preference of women for mixed and strength exercises is reported, while men perform cardiovascular and strength exercises.

It was also observed that in the perception of sedentary lifestyle, the levels are higher in women than in men, giving way to the consideration that women perform less physical activity, which is reflected in significant differences with respect to weight with men. The trend is that after a period of inactivity related to the pandemic, physical abilities are gradually diminished, to the point of limiting basic actions of daily life.

This study could propose some methods for measuring physical capacities applicable to university students, as well as testing validated tests and periodic surveys that show the behavior of these study groups, as well as a distribution of groups, to be compared with other more active communities, such as sports groups or special populations.

Future studies could propose programs to reduce student stress, through permanent physical activation campaigns, guidance on nutritional habits and

prevention programs for chronic degenerative diseases.

V.- CONCLUSIÓN

In conclusion, this study demonstrates the increase in student inactivity during the pandemic, as well as higher anthropometric differences between BMI and MM in men and physical capacities between men and women, showing greater strength capacity in the former, preferring weight activities or repetitions over cardiovascular activity.

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