ASSESSMENT OF THE LEVEL OF PHYSICAL ACTIVITY AND PHYSICAL FITNESS IN A SAMPLE OF UNIVERSITY STUDENTS. Comparison after the Covid-19 pandemic.

VALORACIÓN DEL NIVEL DE ACTIVIDAD FÍSICA Y APTITUD FÍSICA EN UNA MUESTRA DE UNIVERSITARIOS. Comparativa tras la pandemia de covid-19.

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ABSTRACT

The transition from secondary education to university education has become a critical moment for the lifestyle of young people, especially for the practice of physical activity. Therefore, the main objective of the present study was to assess the levels of physical activity in university students, by correlating the results of the IPAQ-SF and the different physical fitness variables (Eurofit). The sample consisted of 194 students of the Primary Education Degree, with a mean age of 21.37 ± 2.66 years. The main results obtained reflect the direct relationship between the practice of physical activity in general, and vigorous physical activity in particular, and optimal physical fitness of university students, linked above all to the strength component. As for the comparison between pre-pandemic (18/19) and post-pandemic (21/22) university students, the increase in physical activity after the pandemic did not show substantial differences in the physical fitness components. In conclusion, these results should lead us to reflect on the influence of an active lifestyle on physical fitness, which has an impact on overall health status and quality of life.

KEY WORDS: physical activity, physical fitness, university students, covid-19

RESUMEN

El tránsito de la educación secundaria a la enseñanza universitaria se ha convertido en un momento crítico para el estilo de vida de los jóvenes, especialmente para la práctica de actividad física. Por ello, el principal objetivo del presente estudio fue valorar los niveles de actividad física en universitarios, mediante la correlación entre los resultados del IPAQ-SF y las distintas variables de condición física (Eurofit). La muestra estuvo conformada por 194 estudiantes del Grado de Educación Primaria, con una edad media de 21,37 ± 2,66 años. Los principales resultados obtenidos reflejan la relación directa entre la práctica de actividad física en general, y la actividad física vigorosa en particular y una óptima aptitud física de los estudiantes universitarios, vinculada sobre todo con el componente fuerza. En cuanto a la comparación entre los universitarios del curso prepandémico (18/19) y el curso postpandémico (21/22), el aumento de la actividad física tras la pandemia no reportó diferencias sustanciales en los componentes de la condición física. A modo de conclusión, estos resultados deben conducirnos a una reflexión sobre la influencia de un estilo de vida activo en la aptitud física, la cual tiene repercusión en el estado de salud general y la calidad de vida.

PALABRAS CLAVE: actividad física, condición física, universitarios, covid-19

INTRODUCTION

The transitional stage from secondary education to university education, coinciding with the end of adolescence and the onset of adulthood, has become a decisive and critical period for the consolidation of lifestyle (1-3). It is at this time that many young people are forced to modify their lifestyle habits in order to adapt to the demands of a new educational stage (4-7).

In this sense, the regular practice of physical activity is considered to be one of the essential and indispensable aspects for achieving a healthy lifestyle (2,8,9). Moreover, as is well known, there is consistent evidence that regular physical activity (PA) has multiple benefits on physical, physiological and psychosocial aspects in both adults and young people (10-14). Even so, the greatest decline in physical activity practice occurs at this time of life transition, with significant negative repercussions on the health status, quality of life and physical condition of these young people (1,15).

Based on these data, the decrease in physical activity levels in the university population could also lead to a decrease in physical fitness or physical condition (7,15,16), understood as the set of capabilities that allow a person to perform daily tasks or physical sports activities, including qualities such as strength, speed, aerobic capacity or range of motion, among others (17,18). In recent times, physical fitness has been considered a good biological predictor of health status, especially among children and young people (11,18-20), since the different qualities that make it up reflect the functional status of the subject, which is related to the ability to carry out daily activities, actively enjoy leisure time or physical-sporting activities without limitations.

This physical fitness or physical condition, as well as its components, is strongly determined by a genetic component, but even so the practice of physical activity, especially exercise of vigorous intensity, constitutes an important factor in increasing and maintaining a healthy level of physical condition (16,20-23). Therefore, the relationship between regular physical activity and the level of performance in the different components of physical fitness seems clear.

In 2020, the world's population was faced with an unexpected situation due to the COVID-19 pandemic, which resulted in the need for social distancing, isolation and quarantine measures to prevent the spread of the disease. Although the effectiveness of these measures with respect to the virus is unquestionable, they led to other problems such as a decrease in physical activity, an increase in sedentary activities and the impact on the psychological level, which could have a considerable impact on public health (24-26).

Along these lines, there are numerous studies that analyse the practice of physical activity and its benefits during the period of confinement (25,27-29), but there are few studies that make a comparison between the levels before and after (26), as well as their relationship with physical fitness in a specific population, especially among university students.

Taking all this into account, the main objective of this research is to assess the levels of physical activity practice in university students, through the correlation between the IPAQ-SF results and the different physical fitness variables (strength, flexibility, speed, balance...). In addition, we seek to establish possible differences between students in the year immediately prior to the pandemic (2018-2019) and those in the year after (2021-2022) who are studying for a degree in primary education with respect to the level of physical activity and physical fitness.

MATERIAL AND METHODS

Sample

The study sample is made up of 194 first-year undergraduate students of the Degree in Primary Education at the University of Malaga, belonging to the 2018-2019 and 2021-2022 academic years. They correspond to a total of 91 girls and 103 boys, with a mean age of 21.37 ± 2.66 years (Table 1). The sample was stratified according to the academic year to which the students belonged, corresponding to the years before and after the COVID-19 pandemic, obtaining a total of 93 students in the 2018-2019 academic year and 101 students in the 2021-2022 academic year.

Table 1. Characteristics of the sample

Sex (%)	
Woman: 46,9	Man: 53,1
Grade (%)	
2018-2019: 47,9	2021-2022: 52,1
Woman r: 46,2 Man: 53,8	Woman: 47,5 Man: 52,5

After the initial selection, the nature of the study was informed, indicating that their anonymity would be maintained at all times, following the ethical considerations of the Sport and Exercise Science Research (30), and with the principles included in the Declaration of Helsinki (31), which define the ethical guidelines for research on people. During the study, we acted under the provisions of Organic Law 3/2018, of 5 December, on the Protection of Personal Data and Guarantee of Digital Rights, with respect to the protection of personal data under Spanish law.

Instruments

For the evaluation of physical condition, the Eurofit Test battery was used (32,33), which is intended to measure endurance, strength (upper and lower limbs), flexibility and speed, and also included the Squat Jump (SJ) and the Countermovement Jump (CMJ). The tests performed were as follows:

Horizontal jump.

The horizontal jump test is used to measure explosive leg strength. To perform this test, the subject must stand with feet slightly apart behind the starting line. With the help of the impulse of the arms and the bending of the legs, the jump is executed forward without any previous running, it must be with both feet

at the same time. The measurement is made from the starting line to the nearest footprint left. Three attempts shall be made, the best of them being the final score.

Manual Dynamometry.

This is used to measure the maximum isometric strength of the hand and forearm muscles (34). Measurements are taken while standing upright and holding the dynamometer with one hand, with the arm extended and close to the trunk, after adjusting the grip area according to the length of the hand. This consists of exerting maximum force (for 3 to 5 seconds) on the grip of the dynamometer. It shall be performed three times with each hand alternately, with an interval of one minute between each measurement, the best of them being the final score.

Flamenco Balance.

This test measures general body balance. The subject stands on one foot, holding the leg bent behind with the hand on the same side of the body, on a piece of wood about 3 cm high. The test consists of reaching the minute while maintaining balance in the described position. The result of this test is the number of attempts the subject needs to maintain balance for one minute. Each attempt is one point, the higher the number of points the worse the performance in this test.

Tapping Test.

With the Tapping Test we seek to evaluate the segmental speed of the upper limbs. Two circles of 20 cm in diameter are placed on a table about 80 cm apart measured from their centres, between the two circles there will be a rectangle of 20x10 cm. The subject, standing upright in front of the table, shall place the non-dominant hand on the rectangle and the other hand on the corresponding circle. The test consists of touching alternately with the dominant hand the two circles a total of 25 times each as fast as possible without moving the non-dominant hand from the rectangle. When you reach 50 contacts, the stopwatch is stopped.

Seated trunk flexion.

This is used as a general flexibility test, assessing the flexibility of the hip and the posterior musculature of the lower limbs. The subject sits on the floor, barefoot, with the knees extended and the feet at 90º resting on a box built specifically for this test. The test consists of flexing the hips and moving forward

with both hands a bar that is on the box, the subject must maintain the position of maximum reach. The score is the furthest point reached and maintained. If the hands reach unevenly, the hand that reaches the shortest distance determines the score. The best value of two observations is taken into account.

Abdominals.

With this test we evaluate the strength-resistance of the abdominal muscles. The subject is placed in the supine position on a mat with legs bent and feet supported. The hands are placed crossed on the chest. In 30 seconds, the subject will try to perform the maximum number of flexion-extensions of the trunk. This is performed only once.

Speed 5x10.

This test measures agility and speed of movement over a distance of 5 metres marked by two lines. On a signal, the subject must run from the starting line to the opposite line and return to the starting line. This route shall be repeated until 5 round trips have been completed. The stopwatch shall be stopped after stepping on the starting line after the 5th trip.

Sustained arm flexion.

This test evaluates the strength and endurance of the upper limbs. The subject must hold on to a horizontal bar placed 2.5 metres from the ground, placing the fingers forward and flexing the arms until the chin is above the bar but without touching it. You should hold this position for as long as possible. Once the chin passes under or touches the bar, the stopwatch is stopped.

Squat Jump (SJ).

This test measures the maximum dynamic strength of the lower limbs. It consists of performing a vertical jump starting from a squat position, i.e. with the knees bent at a 90º angle and keeping the trunk upright. The hands must be placed on the waist and must not be released during the entire jump. From this position, the subject must propel himself/herself to jump upwards with maximum extension of the knees, the feet at the moment of contact must be supported firstly by the metatarsal area and then by the back of the foot. Two measurements are taken, the result is the highest height reached.

Countermovement Jump (CMJ).

This test measures explosive strength and elastic strength in the lower limbs. It consists of performing a vertical jump, starting from an upright position and with the hands on the hips, with a previous countermovement of bending the knees to an angle of 90º, preventing the trunk from bending in order to eliminate any influence on the jump that does not come from the lower limbs, followed quickly by an extension and a jump upwards. The legs during the flight phase shall be extended and the feet at the moment of contact shall be supported first by the metatarsal area and then by the back of the foot. Two measurements shall be made with the "My jump" application for mobile devices (35,36), the result will be the highest height reached.

The short version of the International Physical Activity Questionnaire (IPAQ-Short Form) was used to measure the level of physical activity (37). This questionnaire consists of seven questions with acceptable measurement properties to monitor physical activity levels for adults aged 18-65 years in various settings. Several studies have validated the reliability of using this questionnaire to report the number of METS (38-41). In addition, it allows us to establish different levels of physical activity practice:

- High level of practice: accumulating a total of at least 3000 METs/week.
- Medium level of practice: exceeding 600 METs/week.
- Low level of practice: not reaching 600 METs/week.

Statistical analysis

All statistical analyses were performed with the IBM SPSS Statistics 25 statistical package. The level of significance was set at $p < 0.05$. The fit of the different variables to the normal distribution was assessed by both graphical procedures and the Kolmogorov-Smirnov test.

A descriptive analysis of the study variables was carried out in general and dividing the sample according to the year to which they belonged. As the study variables did not conform to the normal distribution, non-parametric tests such as correlation analysis (Spearman's rho) were carried out to determine the existence of significant relationships between the study variables, as this allows us to measure the degree of association between related quantitative variables. The Mann-Whitney U test was also performed to determine the heterogeneity of two independent samples, in this case, the students of the 2018-2019 academic year and those of the 2021-2022 academic year.

RESULTS

First, a descriptive analysis of the study variables was carried out: general data of the participants, results of the different Eurofit tests and the levels of physical activity determined by the IPAQ-SF questionnaire. For this analysis, a distinction was also made between the group analysed before the pandemic (2018-2019) and the group analysed after the pandemic (2021-2022) (Table 2).

Table 2. Descriptive analyses of the study variables.

	TOTAL (Mean ± SD)	**PRE-COVID (Mean ± SD)**	**POST-COVID (Mean ± SD)**
	Variables Generales		
Age (years)	21,37 ± 2,66	21,29 ± 2,85	21,44 ± 2,48
Height (cm)	170,12 ± 9,87	169,76 ± 10,20	170,45 ± 9,60
Weight (kg)	67,03 ±13,10	67,05 ± 13,23	67,01 ± 13,04
BMI (kg/m2)	22,73 ± 4,42	23,01 ± 3,05	22,42 ± 5,59
	Fitness Variables (EuroFit))		
Horizontal jump (cm)	173,66 ± 40,61	175,88 ± 32,49	171,66 ± 46,80
Dynamometry right (kgf)	36,65 ± 13,57	35,74 ± 10,72	37,51 ± 15,76
Dynamometry Left (kgf)	34,31 ± 13,61	33,23 ± 10,45	35,30 ± 15,96
Flamingo Balance (pts)	3,17 ± 3,44	2,84 ± 3,04	3,47 ± 3,75
Tapping Test (s)	9,82 ± 1,98	9,53 ± 1,39	10,08 ± 2,38
Trunk Flexion (cm)	11,39 ± 12,63	5,05 ± 9,73	17,94 ± 11,96
Abdominals (rep)	23,59 ± 5,55	25,05 ± 5,24	22,29 ± 5,52
Speed 10x5 (s)	20,21 ± 2,80	19,39 ± 1,70	20,94 ± 3,35
Maintained arm flexion (s)	22,50 ± 18,82	15,39 ± 13,06	28,96 ± 20,88
SJ (cm)	29,41 ± 8,65	29,31 ± 8,96	29,51 ± 8,41
CMJ (cm)	31,05 ± 7,93	30,61 ± 6,97	31,44 ± 8,73
	Variables Actividad Física (IPAQ-SF)		
IPAQ Vig (Mets)	1878,68 ± 2273,77	1517,68 ± 1858,61	2211,09 ± 2562,67
IPAQ Mod (Mets)	650,21 ± 759,12	458,06 ± 372,70	827,13 ± 958,35
IPAQ Leve (Mets)	1207,44 ± 1728,29	849,75 ± 1047,79	1539,83 ± 2130,71
IPAQ Total (Mets)	3734,58 ± 3480,91	2839,14± 2161,96	4566,70 ± 4207,04

**Note: BMI = Body Mass Index; SJ = Squat Jump; CMJ = Countermovement Jump; METS = Metabolic Equivalent of Task.*

For the level of physical activity practice assessed through the IPAQ-SF questionnaire and following the WHO criteria, the analyses showed the following results (Table 3):

Table 3. Physical Activity Levels by grades.

	Level of Physical Activity (%)		
	Low	Medium	High
All	3,6	47,9	46,9
2018-2019	3,2	64,5	31,2
2021-2022	4,0	32,7	61,4

After this, an analysis of the correlations (Spearman's rho) existing between the different physical fitness tests and the different levels of Physical Activity was carried out. Highlighting the most significant relationships of the study, we can find a direct relationship of vigorous physical activity with the following physical fitness tests: right (rho = 0.252; p = 0.000 < 0.01) and left (rho = 0.230; p = 0.001 < 0.01) dynamometry (Figure 1), abdominals (rho = 0.180; p = 0.014 < 0.05), maintained arm flexion (rho = 0.308; p = 0.000 < 0.01), SJ (rho = 0.195; p = 0.008 < 0.01) and CMJ (rho = 0.167; p = 0.023 < 0.05) (Figure 2).

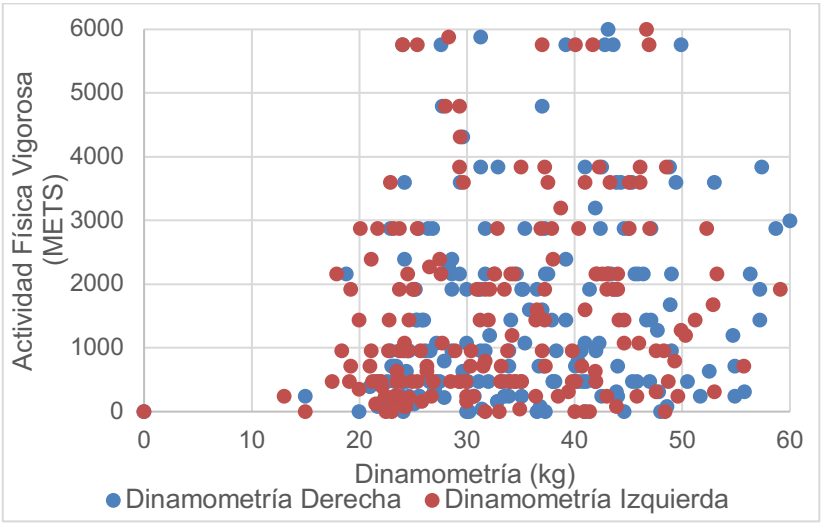

Figure 1. Relationship between Vigorous Physical Activity and Dynamometry.

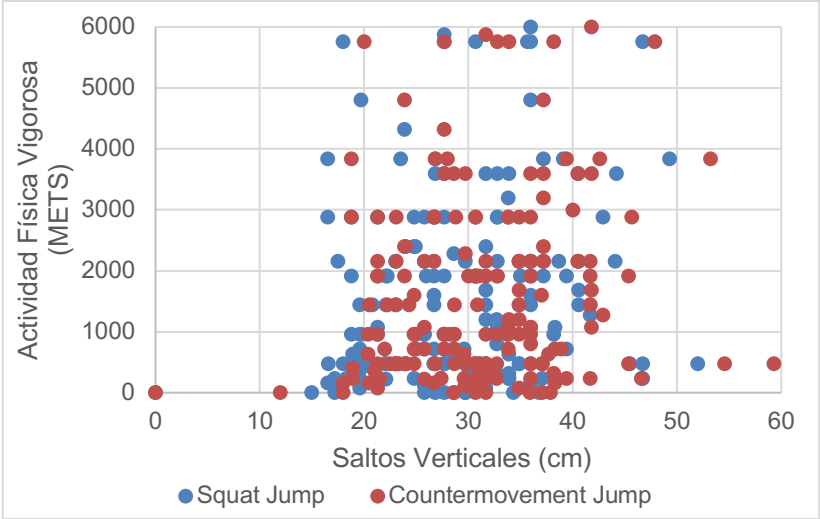

Figura 1. Correlación entre la Actividad Física Vigorosa y los Saltos Verticales.

En cuanto a la actividad física total se encontraron relaciones significativas de manera directa con las pruebas: Salto Horizontal (rho = 0,167; p = 0,023 < 0,05), Dinamometría Derecha (rho = 0,256; p = 0,000 < 0,01) e Izquierda (rho = 0,240; p = 0,001 < 0,01) (Figura 3), Flexión Tronco (rho = 0,177; p = 0,019 < 0,05), Flexión mantenida de brazos (rho = 0,295; p = 0,000 < 0,01), SJ (rho = 0,196; p = 0,008 < 0,01) y CMJ (rho = 0,174; p = 0,018 < 0,05) (Figura 4).

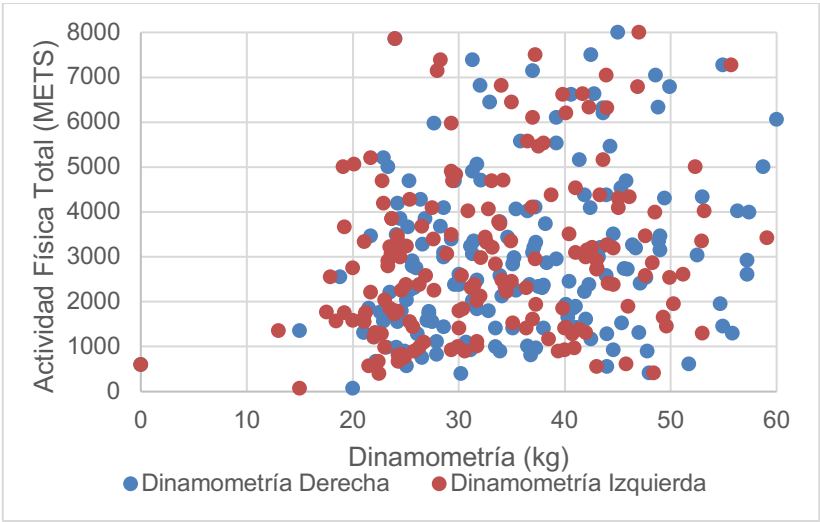

Figure 2. Correlation between Vigorous Physical Activity and Vertical Jumps

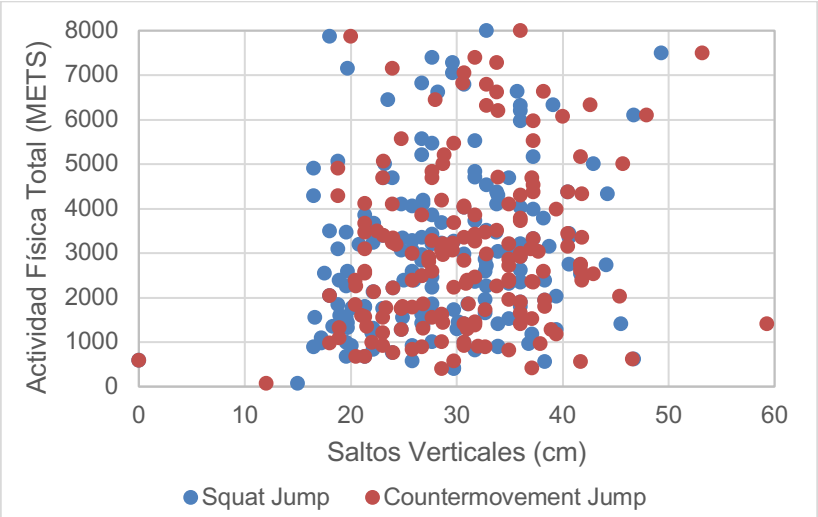

Figure 4. Correlation between Total Physical Activity and Vertical Jumping.

Finally, moderate physical activity was directly related to the Left Dynamometry test (rho = 0.155; p = 0.033 < 0.05) and light physical activity was directly related to the Trunk Flexion test (rho = 0.184; p = 0.015 < 0.05) and inversely related to the Abdominals test (rho = - 0.171; p = 0.020 < 0.05).

On the other hand, differences between the group analysed before the pandemic and the group analysed after the pandemic were analysed using the Mann-Whitney U analysis. Firstly, we studied the significant differences in the results achieved in the physical fitness tests (Table 5).

Table 5. Differences in the Physical Fitness tests by grades.

	Mdn (18-19)	**Mdn (21-22)**	**U de Mann-Whitney**	**Z**	**Sign. Asint. (bil)**
Horizontal jump (cm)	175,00	176,00	4346,50	-0,158	0,874
Dynamometry right (kgf)	33,90	37,10	4265,00	-0,757	0,449
Dynamometry Left (kgf)	31,70	34,00	4127,50	-0,996	0,319
Flamingo Balance (pts)	2,00	3,00	3764,50	-1,979	0,048
Tapping Test (s)	9,51	9,83	3915,50	-1,437	0,151
Trunk Flexion (cm)	5,00	18,00	1602,50	-6,789	0,000
Abdominals (rep)	25,00	23,00	3151,50	-3,268	0,001
Speed 10x5 (s)	19,45	20,70	2594,00	-4,945	0,000
Maintained arm flexion (s)	11,12	26,30	2596,50	-4,774	0,000
SJ (cm)	29,60	27,70	4142,50	-0,448	0,654
CMJ (cm)	30,70	30,70	4129,50	-0,627	0,531

*Note: Mdn = Median

The main significant results that we can extract from this analysis are that university students in the 21-22 year achieved better results than those in the 18-

19 year in the trunk flexion tests (U (5,00; 18.00)= 1602.50; z = -6.789, p = 0.000 < 0.01) and arm suspension (U (11.12; 26.30)= 2596.50; z = -4.774, p = 0.000 < 0.01) and worse results in the Flamingo Balance tests (U (2.00; 3.00)= 3764.50; z = -1.979, p = 0.048 < 0.05), as they need more attempts to reach the target; Abdominals (U (25.00; 23.00)= 3151.50; z = -3.268, p = 0.001 < 0.01), as they performed fewer repetitions and the 5x10 Speed test (U (19.45; 20.70) = 2594.00; z = -4.945, p = 0.000 < 0.01), as they needed more time to finish the course.

After this, the differences found in the physical activity levels reported by the IPAQ questionnaire were also analysed (Table 6).

Table 6. Differences in the level of physical activity by grade.

	Mdn (18-19)	**Mdn (21-22)**	**U de Mann-Whitney**	**Z**	**Sign. Asint. (bil)**
IPAQ Vigorous (METS)	960,00	1680,00	3770,00	-2,377	0,017
IPAQ Moderate (METS)	360,00	480,00	3843,00	-2,198	0,028
IPAQ Level (METS)	577,50	742,50	3095,00	-3,829	0,000
IPAQ Total (METS)	2374,00	3390,00	3090,00	-3,835	0,000

In this case, the results obtained show that university students in the 21-22 academic year obtain significantly higher values for vigorous physical activity (U (960;1680) = 3770; z = - 2.377, p = 0.017 < 0.05), moderate (U (360;480) = 3843; z = - 2.198, p = 0.028 < 0.05), mild (U (5770.50; 742.50) = 3095; z = - 3.835, p = 0.000 < 0.01) and total physical activity (U (2374; 3390) = 3090; z = - 3.835, p = 0.000 < 0.01).

DISCUSION

The aim of this study focused, firstly, on assessing the level of physical activity of a sample of university students studying for a degree in Primary Education and its possible correlations with respect to physical fitness variables.

In general, the results obtained regarding the level of physical activity show that 46.9% of the students belong to the high level of physical activity, 47.9% belong to the medium level, and only 3.6% to the low level of physical activity. If we take into account that the university students in the present study are students related to Physical Education, the results are similar to other studies carried out with this type of population (21). But on the other hand, it contrasts with the results obtained in other studies with the university population in general (3,14), where the majority of university students do not meet the minimum requirements for physical activity.

These differences are associated with the characteristics of the population included in the present study, given that, as they are primary education students specialising in Physical Education, physical activity is generally an inherent part of their education. We should highlight these results as a quite positive aspect, since as future teachers they should serve as role models in terms of regular physical exercise due to the fundamental role they play in the education and promotion of physical activity in children.

As for the relationship between levels of physical activity and the different components of physical fitness, clear relationships were found between vigorous physical activity and performance in the manual dynamometry tests, abdominal crunches, sustained arm flexion and vertical jumps (squat jump and countermovement jump). Therefore, those university students who reported a higher level of vigorous physical activity showed higher values in the strength components, both in isometric strength of upper limbs, strength-resistance of abdominal muscles and upper limbs and in maximum dynamic, explosive and elastic strength of lower limbs, compared to those whose level of physical activity was moderate or light.

On the other hand, total physical activity was related to the results of the horizontal and vertical jump tests (squat jump and countermovement jump), manual dynamometry, trunk flexion and maintained arm flexion. In other words, the university students who reported greater physical activity in general, regardless of level, showed higher levels in the following physical fitness components: explosive, elastic and maximum dynamic strength in the lower limbs, isometric strength and strength-endurance in the upper limbs, and flexibility of the hips and posterior leg muscles.

All these results suggest the existence of a direct relationship between the practice of physical activity in general, and vigorous physical activity in particular, and the physical condition of university students, especially with the strength component. These results are similar to those of other studies in which physical activity was associated with improved physical fitness (16,20-22). In addition, other studies further substantiated these results by associating higher levels of physical activity with greater hand press strength and greater lower limb power (20,42).

As for the comparison between the different courses, we can highlight that after the pandemic, university students were more active than during the pre-pandemic course, in contrast to the data obtained in other studies (43,44) where subjects decreased their physical activity after the pandemic. In terms of physical fitness components, students in the 2021-2022 academic year performed better

in the components of Flexibility and Upper limb strength-endurance and worse in Balance, Upper limb strength-endurance and Speed. These results do not show a clear difference in the different components of physical fitness of university students in the academic year before and after the pandemic confinement, as also shown in other studies (44,45).

Therefore, by way of conclusion, the main results obtained allow us to affirm that regular physical activity is associated with better physical fitness, especially in those tests linked to the performance of the physical capacity of strength. As for the differences between pre-pandemic and post-pandemic university students, although the level of physical activity has increased among university students after the pandemic, this has not led to a substantial improvement in the components of physical fitness.

The present study should serve to generate reflection on the increasingly sedentary lifestyles that are being adopted among the youth population, with negative repercussions on their health status, quality of life and physical fitness. The university, as a training institution at a critical stage of life for the development of healthy lifestyle habits, should promote policies that favour the practice of physical activity among its students.

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