motricidade

ORIGINAL ARTICLE

https://doi.org/10.6063/motricidade.38881

The PAFMUP Project - Physical Activity, Fitness, Motor Competence and Mental Health of Portuguese University Students: results from a pilot study

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ABSTRACT

The role of physical health in enhancing mental well-being is well known. This pilot study examines how different aspects of physical activity and motor skills correlate with mental health outcomes in this demographic. Using a combination of self-reported questionnaires and objective fitness tests, data were collected from a sample of 206 students at the Coimbra School of Education in Portugal. Key metrics included accelerometry-based physical activity levels, aerobic and muscular fitness, agility and balance, motor competence, and mental health indicators such as general wellbeing, stress perception, sleep quality and quality of life. Despite low levels of motor competence, physical activity and fitness, preliminary findings suggest a significant positive relationship between regular physical activity and improved mental health, with higher fitness levels and better motor competence also associated with reduced stress perception. These results underline the importance of integrating physical health initiatives into university settings to promote overall student well-being. The study highlights potential areas for further research, including longitudinal analyses and targeted interventions to enhance physical and mental health.

KEYWORDS: physical activity; fitness; motor competence; mental health; university students.

INTRODUCTION

Motor competence, physical activity, and physical fitness can be understood through Stodden's conceptual model (Stodden et al., 2008), which posits that these domains are interrelated and collectively contribute to an individual's health trajectory. According to this model, individuals with higher motor competence are more likely to engage in physical activity, which in turn enhances physical fitness and promotes overall health.

In line with this conceptual framework, a study by Barnett et al. (2016) found that higher motor competence in childhood was associated with greater physical activity levels in adolescence. This relationship was mediated by perceived competence and enjoyment of physical activity. Robinson et al. (2015) conducted a systematic review and meta-analysis that confirmed the positive association between motor competence and physical activity across different age groups. The study highlighted that motor competence is a significant predictor of physical activity levels.

The study by Cattuzzo et al. (2016) explored the relationship between motor competence and physical fitness in children and adolescents. They found that higher motor competence was associated with better performance in fitness tests, including aerobic capacity and muscular strength. Logan et al. (2018) also found that motor competence was a significant predictor of physical fitness in young adults. They emphasised the importance of developing motor skills early in life to support lifelong physical fitness.

The interrelationships between motor competence, physical activity, and physical fitness have significant implications for the well-being of university students. It is during adolescence that bad habits of physical inactivity are acquired

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Conflict of interests: nothing to declare. Funding: nothing to declare.
Received: 11th November 2024. Accepted: 20th October 2025.

(Magalhães, 2020), often persisting into higher education. As students transition to this stage of education, they often face new challenges, including increased academic workload, social pressures, and lifestyle changes. These challenges can impact their physical and mental health, making it crucial to promote strategies that support overall well-being.

Beyond the physical, mental, and social benefits, this same practice also brings other advantages for the general population, and for the university student population in particular, namely a strong positive correlation with academic success (Al-Drees et al., 2016; Leung et al., 2025), as well as a negative correlation with academic procrastination (Jiang et al., 2021). Despite this, the already high levels of sedentarism in the age group between 15 and 24 years have been increasing in Portugal (INE, 2021).

Kljajević et al. (2021) systematically reviewed 21 studies assessing the levels of physical activity and physical fitness among university students. Despite some cultural differences, the authors found low levels of physical activity and fitness among this population. As previously mentioned, this is a new phase that involves several lifestyle changes. Such changes often lead to poor management of study and leisure time, a lack of interest or motivation in engaging in physical activity, resulting in a sedentary lifestyle and, consequently, unsatisfactory levels of physical fitness (Fotynyuk, 2017).

There is also a tendency for these values to decline over the academic course of students (Jiang et al., 2021) and when comparing students over a longer time span (Pribis et al., 2010). Physical fitness is declining, and body fat is increasing, which may be alarming, as associations between cardiorespiratory fitness and academic performance have been found throughout the educational journey of students (Marques et al., 2018; Rodriguez et al., 2020), and even in university students (Yang & Tsao, 2019).

Regular physical activity and high levels of physical fitness are associated with reduced risk of chronic diseases, such as cardiovascular disease, diabetes, and obesity (Warburton & Bredin, 2017). It is also associated with mental health benefits such as reduced symptoms of depression and anxiety, improved mood, and enhanced cognitive function (Penedo & Dahn, 2005; Warburton & Bredin, 2017). Higher physical fitness levels are also associated with numerous health benefits, including reduced risk of chronic diseases, better mental health, and improved quality of life (Marques et al., 2021; Ortega et al., 2008). These benefits underscore the importance of promoting physical activity among university students, who often experience high levels of stress and mental health challenges.

In addition to the benefits of physical activity, a robust body of evidence supports its role as a protective factor for mental health, including lower depressive symptomatology, reduced stress, and improved psychological well-being. A scoping review of intervention studies in young people concluded that physical activity and exercise are good strategies for mental health promotion and early intervention, although more high-quality studies are still needed (Pascoe et al., 2020). Evidence suggests that higher baseline physical activity is associated with a reduced risk of developing depression across populations (Schuch et al., 2018). Importantly for higher education contexts, university-focused work also highlights that structured physical activity and exercise initiatives may buffer perceived stress and strengthen mental well-being among young adults (Herbert, 2022).

Higher motor competence facilitates engagement in physical activities, promoting physical fitness and reducing sedentary behaviour. This is particularly important in a university setting where students may spend long hours sitting for lectures and studying.

Lubans et al. (2016) reviewed the mechanisms by which physical activity influences cognitive and mental health in youth, noting that physical fitness acts as a mediator in these relationships. They found that physical activity interventions that improve fitness also enhance cognitive function and mental health.

In this regard, physical activity has been shown to have positive effects on various aspects of mental health, including reducing symptoms of depression and anxiety, improving mood, and enhancing cognitive function (Bailey et al., 2018; Herbert, 2022; Pascoe et al., 2020). For students who often experience high levels of stress, regular physical activity can be a valuable tool for managing mental health. Higher motor competence is associated with increased self-efficacy and enjoyment of physical activity, which can enhance psychological well-being and reduce stress (Lubans et al., 2010). This highlights the importance of developing motor skills to support mental health.

Engaging in physical activities, such as sports and exercise, provides opportunities for social interaction and the development of social support networks. This can enhance social well-being and create a sense of community among students (Eime et al., 2013). Higher motor competence can facilitate participation in social physical activities, promoting social inclusion and reducing feelings of isolation (Stodden et al., 2008).

The PAFMUP Project aims to monitor and characterise physical activity, fitness, motor competence and mental health of university students in Portugal. By characterising students' habits throughout their academic journey, it will be possible to provide higher education institutions with information that may help them create programs that offer students opportunities to engage in regular physical activity through sports facilities, fitness programs, or recreational

activities. The present study is the result of a pilot study conducted at a Portuguese higher institution, in which students from various courses were analysed.

METHODS

This study is a cross-sectional pilot observational study integrated in the PAFMUP project. Data was collected in a single assessment session, to test feasibility. A convenience sample of 206 Portuguese students (117 female and 89 male) from four different undergraduate programmes was used, based on class availability and voluntary participation. Table 1 presents descriptive data regarding the sample.

Inclusion criteria were active enrolment in the course and absence of medical contraindications for physical testing. All participants provided informed consent.

Measures

Motor competence was assessed through the Motor Competence Assessment (Rodrigues et al., 2019). This test comprises 6 tasks, divided into 3 categories: locomotor, manipulative, and stabilising skills. Locomotor skills were evaluated using the shuttle run and the standing long jump. To evaluate the domain of stabilising skills, we used the plate-tapping test and lateral jumps. Manipulative skills were evaluated using the soccer ball kick and the tennis ball throw.

Cardiorrespiratory fitness was assessed with the Queen's College Step Test, following the procedures defined in the literature (McArdle et al., 1972). The modified agility T test was used to assess participants' agility and Change of Direction (COD). Flexibility was assessed through sit and reach, and the Countermovement Jump was used to measure Vertical jump power. The Optojump® system (Microgate, Bolzano, Italy) was used to assess the participants' performance in this test. Finally, handgrip strength was also assessed using a handheld dynamometer (Takey dynamometer – TKK5410, Japan).

Physical activity levels were assessed with accelerometry (Actigraph wGT3X-BT®) and followed the protocol described by Clemente et al. (2016).

A questionnaire was also used to investigate the students' physical activity, behavioural change and wellbeing.

Statistical procedures

Descriptive data on participants' motor competence and physical fitness levels are shown. The ANOVA one-way test was used to compare levels of physical activity across groups, after checking the normality and homogeneity assumptions, as outlined by Pallant (2022). Effect sizes (ETA2) were reported along with p-values. Significance level was set at $p < .05$. This procedure was repeated for the questionnaire data.

RESULTS

This section aims to present descriptive data for each group of students for each physical assessment. Preliminary results from this pilot study point to a significantly low level of motor competence among all students. It is noteworthy that all groups were below the 50th percentile for total motor competence (Table 2), with particularly low values among ASE, GS, and EB students. Sport Sciences students show comparatively higher scores across all MCA domains, although they still do not reach high percentile ranges.

Regarding physical fitness, Sport students presented higher mean values in cardiorespiratory fitness, strength and power, as expected given the course profile and gender distribution. Table 3 presents the fitness levels of all groups.

Table 1. Sample characterisation.

	AGE		BMI	
	F	M	F	M
SPORT (*n* = 104)	20.62 ± 1.60	20.70 ± 2.22	22.81 ± 2.56	23.30 ± 2.79
ASE (*n* = 15)	20.70 ± 1.23		26.59 ± 6.59	
EB (*n* = 62)	20.56 ± 5.75	28.36 ± 11.46	23.87 ± 3.72	25.18 ± 4.40
GS (*n* = 25)	21.85 ± 7.67	19.52 ± 1.21	23.24 ± 4.19	26.70 ± 1.67

Table 2. Motor Competence of university students according to the course.

	ASE	GS	EB	Sport
MCA STABILITY	11.06 ± 16.65	24.17 ± 20.91	25.79 ± 21.94	50.58 ± 22.55
MCA LOCOMOTOR	8.98 ± 7.28	11.83 ± 14.95	18.41 ± 17.52	54.26± 22.35
MCA MANIPULATIVE	16.83 ± 14.06	25.22 ± 22.80	22.78 ± 20.16	38.40 ± 20.31
MCA TOTAL	12.29 ± 9.79	20.41 ± 16.71	22.33 ± 15.48	47.74 ± 14.95

Accelerometry data, as seen in Table 4, showed very high sedentary time across all courses (> 87%), with moderate to vigorous physical activity accounting for around 3% of total daily time. Group differences were statistically significant with small to moderate effect sizes, indicating that although Sport students were more active, sedentarism remained the dominant behaviour.

Regarding participants' attitudes and perceptions of a healthy lifestyle, Table 5 shows that, apart from Sport students, there is low engagement in weekly physical activity, consistent with accelerometry data. It is noteworthy that ASE students perceive themselves as having poorer eating habits, particularly compared to Sport students, and as having lower overall health quality.

Quality-of-life indicators related to health and well-being were assessed using a validated questionnaire (Table 6).

DISCUSSION

The present pilot study confirms a pattern described in the previous literature: university students tend to exhibit low physical activity levels and moderate physical fitness,

Table 3. Fitness levels of university students according to course.

	Step Test VO2Max (ml/kg/min)	Vertical Jump Power (watt)	Handgrip Strength (kg)	Agility T-test (seg)	Flexibility Sit&Reach (cm)
ASE	40.17 ± 4.66	608.54 ± 162.83	31.62 ± 3.83	8.50 ± 0.82	3.77 ± 7.99
GS	42.77 ± 6.27	643.67 ± 231.16	24.91 ± 7.60	8.27 ± 1.07	5.51 ± 9.21
EB	41.86 ± 6.36	630.62 ± 137.14	24.65 ± 5.27	7.95 ± 0.71	5.58 ± 6.92
Sport	54.04 ± 8.51	861.30 ± 190.76	36.28 ± 8.84	6.26 ± 0.83	4.91 ± 8.34

Table 4. Physical Activity levels of university students according to course*.

	SPORT	EB	ASE	GS	Z	Sig	ETA²
Sedentary Time	87.18 ± 7.46[a,b]	87.46 ± 3.69[a]	87.49 ± 3.89	93.23 ± 4.07[b]	9.075	< .001	.119
Light PA	9.25 ± 5.85[c]	9.76 ± 2.78[c,d]	9.82 ± 3.23[e]	5.09 ± 3.26[d,e]	18.124	< .001	.212
Moderate PA	3.18 ± 1.73[f]	2.73 ± 1.23[g]	2.59 ± .96	1.62 ± 1.00[f,g]	4.711	.003	.065
Vigorous PA	.39 ± .72[h,i,j]	.04 ± .04[h]	.10 ± .12[i]	.06 ± .07[j]	12.321	< .001	.155

*Significant differences found between: a) Sport and EB Students (p = .002); b) Sport and GS Students (p < .001); c) Sport and EB Students (p < .001); d) EB and GS Students (p < .001); e) ASE and GS Students (p =. 005); f) Sport and GS Students (p = .007); g) EB and GS Students (p = .002); h) Sport and EB Students (p < .001); i) Sport and ASE Students (p = .001); j) Sport and GS Students (p < .001).

Table 5. Self-perceptions of a healthy lifestyle*.

	SPORT	EB	ASE	GS	Z	Sig	ETA²
On a scale of 1 to 10 what value do you attribute to your eating habits?	6.45 ± 1.53[a]	5.88 ± 1.56	5.00 ± 3.30[a]	5.88 ± 2.11	3.205	.24	.45
On a scale of 1 to 10, what value do you attribute to the overall quality of your health?	7.25 ± 1.65	7.03 ± 1.91	5.92 ± 3.75	6.81 ± 2.16	1.826	.144	.26
"How frequently do you engage in physical exercise weekly?"	3.11 ± 1.1[b,c]	1.05 ± 1.07[b]	1.00 ± 1.13	1.66 ± 1.31[c]	15.055	.001	.18

*Significant differences found between: a) Sport and ASE Students (p < .05); b) Sport and EB Students (p < .05); c) Sport and GS Students (p < .05).

Table 6. Descriptive data from the Quality of Life Related to Health and Well-Being Questionnaire*.

	SPORT N = 104	EB N = 58	ASE N = 12	GS N = 32	Z	Sig	ETA²
General Wellbeing	14.92 ± 4.70	14.30 ± 4.09	16.00 ± 4.69	14.94 ± 6.40	1.953	.122	.03
Stress perception	29.45 ± 4.47[a]	32.15 ± 3.89[a]	28.92 ± 4.16	30.44 ± 4.54	5.419	.001	.07
Quality of Life	29.34 ± 5.08	27.84 ± 5.39	26.50 ± 5.13	29.41 ± 4.23	1.185	.317	.02
Sleep quality	19.52 ± 5.63	19.88 ± 5.35	17.50 ± 7.34	20.06 ± 4.72	.707	.549	.01
Eating habits	69.35 ± 10.05	67.17 ± 8.99	66.00 ± 10.75	67.53 ± 10.24	.929	.428	.01

*a: Significant differences found between Sport and EB (p < .05).

with high levels of sedentary behaviour (Kljajević et al., 2021). It is worth noting that, even among Sport Sciences students, the level of Total Motor Competence is below the 50th percentile. These values are especially low for students in Sociocultural Animation (ASE), Gerontology (GS), and Teacher Training (EB). Particularly for Sport Sciences students, these values are consistent with reports that motor skill proficiency is not automatically preserved in adulthood without continued practice (Logan et al., 2018).

The strong predominance of sedentary time aligns with national and international surveillance data and reinforces concerns about behavioural risk patterns emerging in the early years of adulthood. Given the established links between physical activity and mental health (Herbert, 2022; Pascoe et al., 2020), this behavioural profile is a relevant public health concern.

One factor that may influence these values is the lack of accelerometer use during sports activities, particularly among Sport Sciences students. Another reason for such low numbers may be low adherence to device use during the intervention period. Nonetheless, the percentage values refer to the time it was used.

Although not statistically significant, ASE students reported better general well-being, feeling more cheerful, active, and energetic than the other groups, particularly contrasting with the EB students. In terms of stress perception, EB students felt more nervous and stressed when compared with their Sport Students counterparts. In this regard, it is also interesting to note that ASE students felt less confident in their ability to deal with personal problems when compared with the Sport and EB students. Preliminary data suggest that Sport and ASE students are less stressed than the other groups of students, particularly when compared with EB students.

Regarding the perception of quality of life, no differences between groups were found. All were relatively happy with their life. Sleep quality did not differ between groups, with all groups showing relatively average values.

Finally, in the eating habits section of the questionnaire, we found that sports students eat more whole grains and fatty proteins, including meat or fish, and consume more alcoholic beverages. This fact is noteworthy, as it may imply a relationship between sports involvement and the use of more protein-rich macronutrients on the one hand, but also more dangerous behaviours related to alcohol consumption.

Group differences in stress perception, with higher stress in EB students and, conversely, in sport students, are consistent with evidence that more active people tend to be better stress-regulated and report better psychological well-being. Although effect sizes were small, the direction of results supports previously described associations between physical activity and mental health indicators.

Contrary to expectations, overall well-being and quality-of-life scores did not differ significantly between groups. This may reflect compensatory psychosocial factors or limitations of cross-sectional measurement sensitivity. It also reinforces the idea that physical indicators and perceived well-being do not always vary in parallel among young adults.

Alcohol intake patterns observed in Sport students deserve attention, as prior studies noted the coexistence of heathy and risky behaviours in physically active groups.

This pilot study has several limitations. Data were collected from a convenience sample, resulting in an unequal gender distribution and small subsamples in some groups. The physical tests were difficult to implement with some subjects, as they required a certain level of motor proficiency, and some participants struggled to perform them. which may have influenced performance outcomes. Thirdly, some lack of motivation, particularly among the more sedentary participants, may have amplified the results at the lower end of motor competence and physical fitness.

CONCLUSION

In conclusion, the interplay between motor competence, physical activity, and physical fitness is critical for the overall well-being of university students. This pilot study portrays university students as physically sedentary, with average physical capacity and low motor competence. This does not seem to limit their overall well-being. Although they recognise that physical activity is important for their health, this recognition is not enough to compel them into more active lifestyles. Higher motor competence facilitates engagement in physical activities, which in turn enhances physical fitness and promotes both physical and mental health. These findings support the need for institution-level strategies to promote physical activity and motor competence in higher education settings. Future research within the PAFMUP project should adopt longitudinal designs and intervention approaches to clarify causal pathways and program effectiveness.

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