Bridging the gap in physical activity and sport among women university students: motivational and practical insights for effective promotion

Abstract. Women's participation in physical activity (PA) and sport remains lower than that of men, with specific challenges persisting into young adulthood. This study aims to better understand the diverse engagement patterns and motivations of women university students in order to inform targeted, gender-sensitive approaches to PA and sport promotion. A survey was conducted among 2,071 women students aged 18-25 years (M = 20.01, SD = 1.33) from 16 European universities. Principal component analysis (PCA) and clustering techniques revealed two main participation styles: 'free' (C1 and C2) and 'organised' (C3 and C4). The 'free' group preferred low-intensity, flexible activities, often self-directed and supported by digital tools, while the 'organised' group thrived in structured, socially supportive environments such as clubs or team sports with coaching. Motivational factors varied considerably: C1 participants did not prioritise a single motivational factor, C2 were primarily motivated by physical condition and appearance, while a combination of enjoyment, affiliation and psychological well-being drove C3 and C4 participants. The study highlights the need for universities to offer diverse, flexible PA options that cater to different preferences, from autonomous activities facilitated by digital innovations to structured programmes that promote social belonging and accountability. Universities can create supportive environments that encourage sustained PA and sport engagement by tailoring interventions to individual motivations and using inclusive communication strategies. These findings provide valuable insights for promoting active lifestyles among women university students and for advancing gender-sensitive approaches to PA and sport promotion.

Keywords: Physical Activity, Motivation, Sport, Women student, University.

Key Points:

1. Women university student's participation in PA and sport varies widely, with a preference for either flexible, autonomous activities or structured, club-based sport.
2. Digital platforms and structured programmes tailored to social and individual motivations can increase women university students' engagement in PA and sport.

3. To better meet the diverse needs of women students, universities should provide diverse, flexible and inclusive PA and sport opportunities.

Introduction

The historical context of women's participation in sport and PA is one of discrimination and social division, shaped by a complex interplay of cultural norms and beliefs (Moreno-Llamas et al., 2022). Globally, women face significant barriers to accessing sport and participating in PA (Peng et al., 2023). As a result, women's opportunities to lead active lifestyles are disproportionately hindered compared to men, resulting in higher levels of physical inactivity. This stark gender imbalance has been highlighted in World Health Organization (WHO) reports on non-communicable diseases (NCDs), which clearly show that men around the world participate in higher levels of PA and sport than women. A study by Guthold et al. in 2020 further highlighted this issue, showing that in almost every country in the world, the prevalence of physical inactivity is higher among girls (85%) than boys (78%). Worryingly, these trends have not changed for girls over the past decade.

Despite global efforts to promote gender equality in PA and sport, significant barriers remain. Women face limited access to PA and sport opportunities, higher costs and negative social attitudes (Corr et al., 2019; Duffey et al., 2021). Structural challenges such as male dominance in sport, fear of judgement, and inadequate facilities further exacerbate these inequalities and disproportionately hinder women's ability to lead active lifestyles compared to men (Cowley et al., 2021). While these barriers are often experienced during adolescence, they can persist into young adulthood (Martínez-Sánchez et al., 2024; Peng et al., 2023). This transition to adulthood is a pivotal period marked by life changes such as moving to university, entering the workforce, or starting a family. Such transitions can present both opportunities and challenges, often disrupting PA and sport routines and affecting overall well-being (Gropper et al., 2020; Oftedal et al., 2023). These life transitions highlight the need for tailored interventions that take into account the unique circumstances of young women.

Motivation plays a central role in shaping engagement in PA and sport. Self-determination theory (SDT) provides a comprehensive framework for understanding these variations in motivation, postulating that the regulation of PA and sport behaviour occurs along a continuum of motivational states, ranging from intrinsic motivation (engaging in PA for pleasure or satisfaction), to extrinsic

motivation (motivated by external rewards or pressures), to amotivation (lack of intention to act) (Ryan & Deci, 2007). Autonomous forms of regulation, such as intrinsic motivation, have traditionally been associated with sustained engagement in PA and sport in both the general population (Teixeira et al., 2012) and adolescents (Owen et al., 2017), but few have focused on university students (Valjent & Flemr, 2012), particularly women. This may be explained by the fact that studies consistently highlight gender differences in motivational drivers: men are often motivated by competition and affiliation, whereas women tend to focus on appearance and general well-being (Lauderdale et al., 2015). However, the existing literature often oversimplifies these differences and fails to capture the diversity of motivational drivers within the female population (Ryan & Deci, 2000; Teixeira et al., 2012). Emerging evidence shows that women's motivations are highly context dependent and vary according to social support, accessibility and individual life circumstances (Elmose-Østerlund et al., 2023; Flemr, 2022 ; Hoare et al., 2017). For example, while some women prioritise social belonging, others may focus on psychological well-being, mastery or health benefits. This diversity highlights a critical gap in the literature, which often treats women as a homogeneous group or compares them directly with men. By exploring the nuanced motivational profiles of young women students, this study seeks to provide insights into the complex factors influencing their PA and sport engagement. Specifically, it aims to profile preferences, PA and sport settings to provide a framework for designing tailored and effective PA promotion programmes for women in university settings.

This approach requires a broadening of the traditional definition of PA, which typically focuses on movement associated with energy expenditure (World Health Organization, 2010). Piggin's (2020) perspective offers a more expansive view of PA, encompassing *'people moving, acting and performing in culturally specific spaces and contexts, influenced by a unique set of interests, emotions, ideas, instructions and relationships'* (Piggin, 2020, p.05). Such a definition is consistent with the Socio-Ecological Model (SEM), a comprehensive framework for understanding women' PA

holistically by considering four interrelated domains: intrapersonal, perceived environment, behavior, policy and environment (Sallis et al., 2015).

Numerous reviews have examined the factors that influence girls' PA and sport behaviours, highlighting the complex interplay of these influences (Duffey et al., 2021; Fowlie et al., 2021; Peng et al., 2023). At the European level, a clear regional effect on PA and sport participation among boys and girls has been observed (Frömel et al., 2022; Groffik et al., 2023; Lera-López & Marco, 2018, 2022), as suggested by the SEM. PA encompasses a wide range of social practices involving the body in different contexts (structured or informal), within different organisations (sport, social, health, medico-social, family, etc.) and with different purposes (utilitarian, hygienic, health-related, professional, recreational, etc.). Within this broad framework, sport activities are considered a subset reflecting a more specific type of PA. From Eichberg's (1998) perspective, sporting activities are shaped by their cultural and anthropological roots, resulting in a plurality of sports, each reflecting specific social and cultural dynamics. Whether running or swimming for health, competition, relaxation or socialisation, these activities are expressions of physical movement that are influenced by social contexts and allow the sharing of a common identity: being a swimmer or a runner. Understanding the types of sport and PA preferred by young women can therefore help us to better tailor spaces and training profiles to meet their diverse cultural and personal needs. These activities, whether occasional, organised or unorganised, have the potential to improve motivation (Cocca et al., 2025).

The aim of this exploratory study was therefore to understand women's PA and sport holistically, taking into account the various interrelated determinants that influence participation. This involved examining the PA choices of women university student, including settings, timing, social interactions, motivations and preferences for different types of PA and sport at university. By identifying the most appealing forms of PA and sport, and the underlying motivations, this framework aims to improve our understanding of how women students engage in PA, and thereby improve the effectiveness of PA promotion programmes.

The two main research objectives of this study were:

1. To explore the PA and sport participation preferences of women university students in different European countries, taking into account individual and socio-cultural factors.
2. To identify the motivations for women university students' participation in PA and sport in order to improve PA promotion strategies.

Materials and Methods

This quantitative study was conducted between April 2021 and October 2023 and was approved by the Ethics Committee of the [Anonymous version].

Participants

A total of 2,071 women university students met the inclusion criteria at the end of the survey. These criteria included completing the questionnaire in full, being a woman university student and aged between 18 and 25 years, providing truthful answers, and not having any health problems that prevented participation in PA. The mean age at completion of the questionnaire was 20.01 (SD = 1.33) years. Table 1 and Figure 1 show the distribution of respondents by field of study and university. The majority of the student sample reported studying Arts, Literature, Languages, Humanities and Social Sciences (n = 768, 37.1%), Health (i.e. Medicine, Sports Science, Paramedical Science; n = 628, 30.3%), Life and Earth Sciences, Basic Sciences (n = 382, 18.4%). Smaller groups are represented by law and political science (n = 122, 5.9%) and communication, economics, management and marketing (n = 107, 5.2%).

The category 'other' includes 64 respondents (3.1% of the total).

[Insert Table 1]

The research was undertaken in sixteen European universities to provide a sample of undergraduate students from countries in Northern, Eastern, Western and Southern Europe (Figure 1).

[Insert Figure 1]

Data collection procedure

A comprehensive questionnaire was designed to collect the data, consisting of four distinct sections that took approximately 15 minutes to complete. The first part of the questionnaire was designed to collect general individual characteristics of the respondents. This section included demographic information such as age, gender, level of education, university of origin and health status at the time of the study for participation in PA. The second part of the questionnaire, which focuses on identifying preferred PA and sport environments, includes targeted questions aimed at understanding the types of PA individuals are most likely to engage in. For example, respondents are asked whether their PA or sport activities fall into specific categories, such as running, cycling, racquet sports or water sports. This section is designed to gather detailed information on patterns of participation in these activities and to provide insights into the most popular types within these categories. Part 3 was inspired by a French national survey (Croutte & Müller, 2018) and explores how and when sports and physical activities are practised, regardless of the individual's skill level or the time devoted to these activities. Part 4 was designed to assess adults' PA motivations using the 40-item PA and Leisure Motivation Scale (PALMS) (Molanorouzi et al., 2014). The PALMS assesses eight motives for PA participation based on SDT: affiliation, appearance, competition/ego, enjoyment, others' expectations, and physical and psychological condition. The questionnaire is a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), or a 5-point frequency scale where 1 is “never” and 5 is “always”.

To ensure linguistic and cultural accessibility, the questionnaire was translated into the national languages of the partner universities : Czech, Danish, Dutch, English, German, Italian, Norwegian, Polish, Portuguese and Spanish. In the case of the PALMS, an instrument already scientifically validated in the target languages, the validated version was used. For the other parts of the questionnaire, a rigorous intercultural translation procedure was applied, following the seven-step framework (Cha et al., 2007; Chapman & Carter, 1979). This approach ensured conceptual, semantic,

linguistic, communicative and functional equivalence, while maximising the relevance and cultural appropriateness of the translated questionnaire.

We worked closely with the partner universities (Figure 1) and asked them to help us invite all their students to take part in the study. Invitations were sent via the students' institutional email addresses, containing a link to access the study and an embedded consent form. This link took participants to the multilingual website, where the questionnaire was hosted using LimeSurvey: (link[Anonymous version]).

Analysis

First, descriptive statistics (frequencies, means, SDs) were calculated for the whole sample and for each classification (age, field of study, university). Next, we combined three types of methods - principal component analysis (PCA), hierarchical clustering and partitional clustering - to better highlight and describe the similarities between individual and detect typologies (Husson et al., 2010). By using PCA, we reduced the dimensionality of our data while retaining the most informative aspects, making it easier to visualise and interpret complex relationships. The KMO (Kaiser-Mayer-Olkin) index measuring the adequacy of the sample shows that our sample is quite good (KMO = 0.88). To further refine the clustering results, we used the K-means algorithm, a partitional clustering method that divides the dataset into a predetermined number of clusters by minimising the within-cluster variance. A 4-cluster solution produced four different pattern profiles in the sample of women university students. The interpretation of the clusters in the partition is based on the comparison of the overall mean with the category mean of the data to be classified (Lebart et al., 2006). The category mean represents the average value of a particular variable within a specific cluster, highlighting the characteristic behaviour or attributes of respondents in that cluster relative to the overall population. To select the most representative variables for each cluster, we measured the difference between the class values and the dataset values. This difference is converted into a criterion known as the test value (v-test), which is used to rank variables and identify the most distinctive variables in each cluster (Morineau, 1984). The v-test corresponds to the quantile of the normal distribution associated

with the p-value, with the sign indicating over- or under-representation (Lebart et al., 2006). Each cluster is described using quantitative variables, presented with the v-test, mean in category (*M*), standard deviation (*SD*) and p-value ($p<0.001$). These variables highlight the distinctive characteristics and preferences of respondents within each cluster. The interpretation took into account spatial, temporal, social, motivational, intensity-related and equipment-related aspects. The combination of these methods provided a robust framework for understanding the similarities and differences between individuals in our dataset.

Statistical analyses were performed using R studio software (version 4.3.0) along with several packages including rstatix, FactoMineR, Factoshiny, FactoInvestigate, psych and outliers (Husson et al., 2016). No outliers were detected in the analysis of the graphs and the data were screened for normality and homogeneity. The significance level was set at 5% ($p<0.05$).

Results

The results are presented below, outlining four distinct profiles of women based on their preferences for PA and sport participation, categorised by their motivations and modalities of practice.

PCA results: motivation, activity, environment, time are keys variables for profiling students

The eigenvalues and the variance explained by the first dimensions of the PCA are presented in Table 2. The first five dimensions of the PCA explained 36.82% of the total variance in the dataset, indicating a moderate but significant representation of the variability in the data.

[Insert Table 2]

The first dimension (Dim 1) is significantly correlated with variables indicating structured and regular sports practice ($p<0.001$). Variables such as season of practice: autumn (r = 0.73), spring (r = 0.73), winter (r = 0.71), as well as regular engagement (r = 0.71) and club structures (r = 0.66) show high positive correlations with Dim 1. Motivations are also correlated with Dim 1, such as enjoyment (r = 0.73), mastery (r = 0.66) and affiliation (r = 0.55). An inverse trend is indicated by negative correlations with Dim 1 ($p<0.001$), such as practice in autonomy (r = -0.22), low intensity effort (r =

-0.27) home practice (r = -0.27), practice duration (less than 30 minutes, r = -0.49). These negatively correlated variables indicate a preference for practices that are less structured, less intensive and often carried out alone. Dimension 2 (Dim 2) is correlated significantly with ICT use (Information and Communication Technologies, r = 0.56), sport environment (running & walking, r = 0.55), practising at home (r = 0.54), autonomy (r = 0.52), practising outdoors & in nature (r = 0.52), practising alone (r = 0.50), practising duration (less than 30 minutes, r = 0.47). Motivations showed moderate positive correlations with Dim 2 ($p<0.001$), such as physical condition (r = 0.35) and appearance (r = 0.29). Coaching (r = -0.26), club structures (r = -0.28) and schedules (r = -0.37) showed significant negative correlations with Dim 2.

Four clusters of women engaged in PA and sports

The dendrogram carried out on the individuals highlighted 4 clusters (figure 2). Cluster 1, 2, 3 and 4 consisted of 611 (29.53%), 381 (18.38%), 554 (26.75%) and 525 (25.34%) participants respectively. The four clusters and their statistically significant effects on the results of the clustering variables are presented in Table 3.

[Insert Figure 2]

[Insert Table 3]

Cluster 1 (C1, 29.53%) is characterised by a high level of variable engagement in activities (v-test = 15.23, *M* = 4.06, *SD* = 0.82, $p<0.001$). Students in this cluster tend to participate in activities lasting less than 30 minutes (v-test = 14.61, *M* = 2.29, *SD* = 1.03, $p<0.001$). They prefer unstructured, free activities that do not require set times or payment (v-test = 11.79, *M* = 3.15, *SD* = 1.12, $p<0.001$). These women student primarly engage in low intensity activities (v-test = 9.80, *M* = 2.00, *SD* = 1.02, $p<0.001$) with flexible scheduling (v-test = 7.10, *M* = 3.77, *SD* = 0.95, $p<0.001$). Other notable characteristics of C1 include practising alone (v-test = 4.55, *M* = 3.43, *SD* = 1.23, $p<0.001$), autonomously (v-test = 3.57, *M* = 3.07, *SD* = 1.34, $p<0.001$) and mainly at home (v-test = 3.43, *M* = 3.29, *SD* = 1.29, $p<0.001$). Cluster 2 (C2, 18.38%) is characterised by a strong preference for practising alone (v-test = 15.99, *M* = 4.02, *SD* = 1.02, $p<0.001$) and at home (v-test = 15.18, *M* =

3.90, *SD* = 1.20, p<0.001). Students in C2 often use online programmes for coaching and training (v-test = 14.49, *M* = 3.14, *SD* = 1.44, p<0.001) and do exercises between 31 minutes and 1 hour (v-test = 13.45, *M* = 3.31, *SD* = 1.10, p<0.001). They also prefer a flexible schedule (v-test = 12.03, *M* = 4.01, *SD* = 0.99, p<0.001). Significant motivators include physical condition (v-test = 11.02, *M* = 4.45, *SD* = 0.50, p<0.001) and appearance (v-test = 10.94, *M* = 4.18, *SD* = 0.80, p<0.001). Other key characteristics of this cluster include the use of ICT (v-test = 10.68, *M* = 2.92, *SD* = 0.96, p<0.001) and a preference for practising in the summer (v-test = 10.46, *M* = 4.17, *SD* = 0.90, p<0.001).

Cluster 3 (C3, 26.74%) is mainly motivated by affiliation (v-test = 19.10, *M* = 3.77, *SD* = 0.77, p<0.001). The respondents are often involved in different sports, including athletics (v-test = 19.08, *M* = 2.11, *SD* = 1.18, p<0.001), team sports (v-test = 17.13, *M* = 2.61, *SD* = 1.09, p<0.001), urban sport (v-test = 14.69, *M* = 2.01, *SD* = 0.99, p<0.001) and winter or mountain sports (v-test = 14.35, *M* = 1.90, *SD* = 0.71, *p*<0.001). They prefer to practise at university (v-test = 18.04, *M* = 2.27, *SD* = 1.29, p<0.001) and with friends (v-test = 14.57, *M* = 3.34, *SD* = 1.10, p<0.001). In addition to affiliation, their other motivations include competition/ego (v-test = 17.22, *M* = 2.70, *SD* = 1.00, p<0.001), mastery (v-test = 14.72, *M* = 4.27, *SD* = 0.55, p<0.001) and enjoyment (v-test = 12.29, *M* = 4.44, *SD* = 0.48, p<0.001). Cluster 4 (C4, 25.34%) is characterised by a preference for structured and precise schedules (v-test = 23.76, *M* = 4.31, *SD* = 1.05, p<0.001). These students typically practice in clubs (v-test = 22.40, *M* = 3.77, *SD* = 1.45, p<0.001) and having a coach is a key factor for their commitment (v-test = 19.36, *M* = 2.93, *SD* = 1.58, p<0.001). They do not express any seasonal preferences, as they report participating in autumn (v-test = 18.48, *M* = 4.69, *SD* = 0.61, p<0.001), spring (v-test = 17.53, *M* = 4.72, *SD* = 0.55, p<0.001) and winter (v-test = 19.41, *M* = 4.59, *SD* = 0.73, p<0.001). Their training sessions last between 1 and 2 hours (v-test = 16.94, *M* = 3.99, *SD* = 1.12, p<0.001) and they exercise regularly (v-test = 14.86, *M* = 4.21, *SD* = 0.88, p<0.001), often training in the early evening (v-test = 11.99, *M* = 3.72, *SD* = 1.21, p<0.001). Team sports are a common choice for this group (v-test = 6.00, *M* = 2.1, *SD* = 1.20, p<0.001). Their main motivations for participating in PA are enjoyment (v-test = 12.170, *M* = 4.12, *SD* = 0.52, p<0.001), affiliation (v-

test = 9.13, *M* = 3.25, *SD* = 0.92, p<0.001) and psychological well-being (v-test = 5.84, *M* = 4.23, *SD* = 0.60, p<0.001).

Discussion

This study aimed to provide a comprehensive analysis of women university students' engagement in PA and sport, categorising them into distinct profiles based on their motivations and preferred modalities of practice.

Different types of engagement in PA and sport among women university students

Recent research has highlighted the importance of physiological factors such as intensity, type and amount of PA in differentiating between students (Carballo-Fazanes et al., 2020). However, the results of our study highlight additional critical factors in understanding how women students prefer to engage in PA and sport. These factors include timing, location, specific times of day or year, regularity of participation, motivations and whether students train with a coach or supervisor or use ICT for guidance. Cluster 1 represents students who prefer low-intensity, flexible activities that are often done autonomously or at home. This is consistent with previous research suggesting that women, particularly women students, tend to prefer unstructured and flexible forms of PA due to constraints such as academic workload, financial limitations, family responsibilities, or male gaze and fear of judgement (Müller, 2018; Peng et al., 2023). This flexibility allows students to fit PA into their busy schedules without the pressure of adhering to a rigid timetable (Rossi et al., 2021). In contrast, Cluster 4 represents students who prefer structured, club-based sports with specific schedules, demonstrating a commitment to organised sport. These findings support previous research suggesting that structured environments, such as sports clubs, provide valuable social and motivational support, fostering long-term commitment and regular engagement in PA (Cocca et al., 2025; Smith et al., 2019). This contrast highlights that while some women students seek flexibility,

others thrive in formalised, structured sport, highlighting the need for diverse opportunities to cater for different preferences.

Diversity of motivations for women students to participate in sport and PA

Our findings highlight the importance of considering the various motivational factors that influence women students' participation in sport and PA, while numerous studies have highlighted motivational differences between girls/women and boys/men (Molanorouzi et al., 2015; Portela-Pino et al., 2019). However, by treating the women group as a homogeneous entity, such gender-focused analysis overlooks the nuanced and diverse motivations that drive girls to participate in PA and sport. This approach limits a deeper understanding of the factors that influence women engagement in these areas. Our results show that motivations varied between clusters, with each cluster having different primary drivers associated with different modalities of practice. Women in Cluster 1 did not prioritise a single motivational factor for engaging in low-intensity, unstructured free practice. In contrast, Cluster 2 students participated in PA primarily for reasons related to appearance, physical condition and psychological well-being. Their preference for unstructured activities, sometimes guided by an online program, and the use of ICT to encourage longer sessions is consistent with previous research. Studies have shown that body image concerns and the desire to improve physical appearance are important drivers of PA participation among women (Elmose-Østerlund et al., 2023; Hoare et al., 2017; Molanorouzi et al., 2015) and that digital platforms are increasingly shaping exercise habits (Sultoni et al., 2021). Women students in Cluster 3 were primarily motivated by social affiliation, consistent with previous findings (Van Luchene & Delens, 2021; Wang et al., 2024). In contrast, Cluster 4 students were driven by a combination of enjoyment, affiliation and psychological well-being as key motivators for PA and sport participation. While the existing literature often highlights gender differences in the relative importance of PA motives, particularly in studies using the PALMS framework, our study does not focus on these differences. Previous studies have shown that

competition and ego-related motives are generally more important for men, whereas appearance-related motives are more important for women (Elmose-Østerlund et al., 2023; Espada et al., 2023; Hoare et al., 2017; Molanorouzi et al., 2015). Furthermore, some studies suggest that men place a greater emphasis on a sense of belonging in their PA and sport participation compared to women (e.g., Peng et al., 2023). However, our study focuses specifically on women and examines the diversity and complexity of their motivational drivers without comparing them to men. These findings show that female students do not form a homogeneous group; rather, their motivations for engaging in PA are diverse and context-specific, shaped by a range of personal, social and environmental factors. By focusing on these differences, this study highlights the importance of tailoring interventions to women's different and evolving needs, rather than relying on generalised assumptions about gendered motivations.

Strategies to improve the promotion of PA and sport among women students in European universities.

The results of this study provide important insights into the promotion of PA and sport among female university students, highlighting the need for tailored strategies that take into account their different preferences and motivations. Although the clustering results did not reveal significant country or regional effects, this finding should be interpreted with caution due to the uneven distribution of participants across countries. Previous research highlights that cultural, environmental and geographical factors play a crucial role in shaping PA behaviours (Frömel et al., 2022; Groffik et al., 2023; Lera-López & Marco, 2018, 2022). This is consistent with the SEM, which highlights the importance of considering interrelated influences at the individual, interpersonal, organisational, environmental and policy levels when designing interventions (Sallis et al., 2015). Although regional differences may not have been apparent in this dataset, the SEM suggests that localised interventions tailored to specific institutional and cultural contexts remain essential. For example, universities could

use institutional policies and environmental resources to create supportive ecosystems that encourage PA engagement. By adopting a multi-level approach, strategies can address both individual motivations and broader contextual factors, ensuring a more inclusive and effective promotion of PA among women at university.

Cluster analysis revealed two distinct profiles of engagement: students who prefer flexibility and autonomy, and those who thrive in structured, socially supportive environments. This distinction highlights the need for universities to offer a diverse range of opportunities. For students who prefer autonomy, flexibility in accessibility can be achieved by extending facility hours, allowing drop-in access without pre-registration, and offering remote options such as virtual fitness classes, workout tutorials and app-based coaching. In addition, open-air sports and fitness facilities, possibly in parks and natural areas around universities, could be considered. This is in line with Sallis' theory and the structural framework, which emphasises the importance of accessible, diverse environments for PA (Sallis et al., 2015). Digital platforms have proven effective in promoting engagement by accommodating irregular schedules and addressing barriers to accessing formal sports facilities (Johannes et al., 2024; Segar et al., 2017; Sultoni et al., 2021). In addition, the integration of on-demand content and hybrid models that combine face-to-face and digital options can further improve accessibility for this group. In contrast, students who benefit from structure and social support are likely to respond positively to initiatives such as team sports, organised competitions and club-based activities. These programmes foster a sense of belonging, accountability and shared commitment, which are critical to sustaining engagement (Smith et al., 2019). By adopting a dual approach that combines flexible accessibility for autonomous participants with structured opportunities for those seeking social connections, universities can better meet the diverse needs of their students and encourage sustained PA engagement.

Communication is another critical factor in promoting PA. The observed variation in motivation across clusters highlights the importance of clear, targeted messages that are tailored to students' needs. For example, promoting mental health benefits or improvements in physical appearance may appeal to students motivated by psychological well-being or appearance-related goals (Molanorouzi et al., 2015). Conversely, emphasising enjoyment, social connectedness or skill development may appeal to students driven by affiliation and intrinsic motivation (Ryan & Deci, 2000; Teixeira et al., 2012). Research has shown that communication strategies tailored to specific motivational profiles can increase engagement by addressing the diverse needs of participants and fostering a sense of relevance and connection to the activity (Segar et al., 2017). By utilising these findings, universities can design more effective and inclusive interventions that maximise women student participation in PA.

One of the most vulnerable groups identified in this study is Cluster 1, characterised by low-intensity, short-duration PA sessions. This group requires special attention, as their sporadic engagement poses a challenge to achieving sustained improvements in PA. Strategies for this group could include promoting small, manageable and home-based activities that emphasise enjoyment and relaxation, alongside interventions that build confidence and reduce perceived barriers to participation (Griffiths et al., 2022; Peng et al., 2023). In addition, gamification and app-based feedback systems could provide extrinsic motivation to support initial engagement, which could later develop into intrinsic motivation as students experience the benefits of regular activity (Ryan & Deci, 2000). Finally, the creation of inclusive and adaptable programmes is essential to meet the diverse needs of women students. By embracing a broader definition of PA, such as that proposed by Piggin (2020), universities can move beyond traditional notions of sport to include informal, recreational and culturally relevant activities. This inclusive approach ensures that programmes cater for students with different cultural backgrounds, time constraints and motivations, thus fostering a supportive

environment for all. These findings therefore highlight the importance of a nuanced and inclusive approach to promoting PA and sport among women university students. By addressing individual and contextual differences, universities could implement strategies that not only increase participation, but also create environments that support sustained engagement.

Research limitation and future research direction

This study has several limitations that need to be considered. While the focus on women university students is intentional, the findings may not be generalisable to other women populations, such as working women or those in different educational settings. The uneven distribution of respondents, with certain countries and fields of study over-represented, may limit the generalisability of the findings to the wider student population across Europe. The use of self-reported data introduces potential biases, including social desirability, which may affect the accuracy of reported PA preferences and motivations. The research also placed more emphasis on personal factors such as motivation and personal preferences, with less exploration of external factors such as institutional policies, financial constraints and cultural aspects. Finally, psychosocial barriers such as body image concerns, cultural attitudes and social pressures faced by women in sport were acknowledged but not explored in depth. These factors are critical to understanding the full range of challenges women students face in engaging in PA and should be a focus for future research.

Conclusion

The research looks at the participation of European women students in physical and sport activities and examines their motivations. The findings emphasise that women approach PA in different ways: some prefer flexible, autonomous activities, while others thrive in structured, organised sporting environments. This variation leads us to suggest that universities should offer a wide range of PA

options to cater to these different preferences, including self-directed activities facilitated by digital tools, self-organized activities in open, easily accessible sports facilities (possibly outdoors), as well as structured, club-based sports with coaching. Overall, this study highlights the importance of recognising and responding to the diverse needs of women students to encourage their sustained engagement in PA and to create more inclusive, active university cultures.

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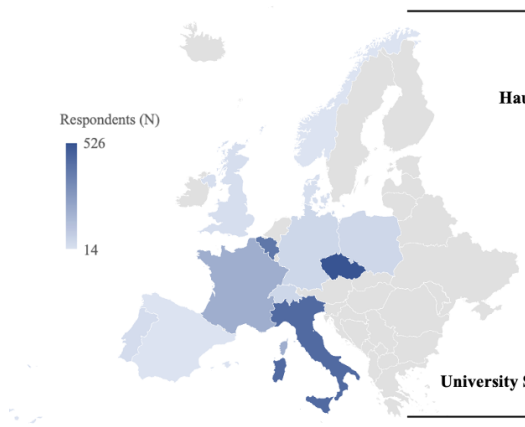
Tables and figures

Table 1. Distribution of the respondents according to the fields of study

Fields of study	*N*	*%*
Arts, literature, languages, humanities and social sciences	768	37.1
Communication, economics, management and marketing	107	5.2
Health	628	30.3
Law and political science	122	5.9
Life and earth sciences, fundamental sciences	382	18.4
Others	64	3.1

Note. *N*=Number of respondents, *%*=percentage; for each field.

Figure 1. Distribution of respondents by university



University	*Country*	*N*	*%*
Adam Mickiewicz University in Poznan	Poland	57	2,8
Charles University in Prague	Czech Republic	526	25,4
Haute école pédagogique du canton de Vaud	Switzerland	58	2,8
Norwegian School of Sport Sciences	Norway	14	0,7
Sapienza University of Roma	Italy	445	21,4
University of Huelva	Spain	15	0,7
University of Porto	Portugal	38	1,8
University of Liège	Belgium	401	19,3
University of Lille	France	202	9,8
University of Teramo	Italy	68	3,3
University of Kent	United Kingdom	32	1,6
University of Southern Denmark	Denmark	30	1,4
University of Stirling	Scotland	43	2,1
University of Urbino Carlo Bo	Italy	23	1,1
University School of Physical Education of Wroclaw	Poland	60	3
Other/No answer	N/A	59	2,8

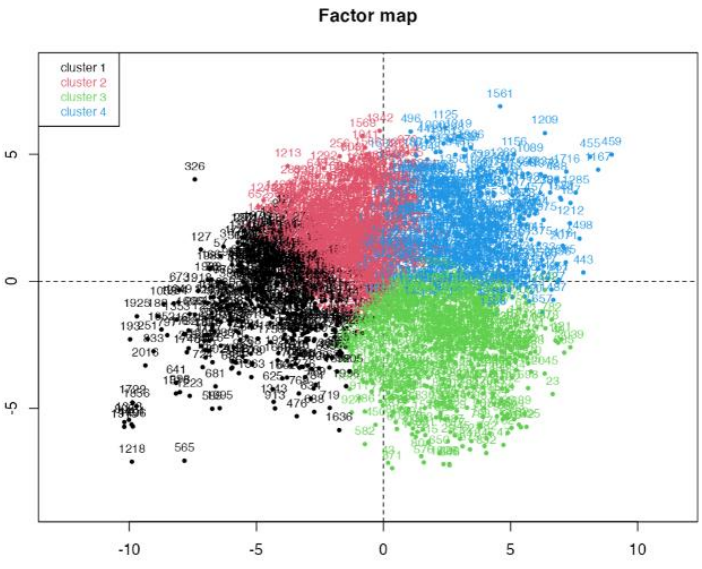
Note. *N*=Number of respondents, *%*=percentage, N/A = Not Available.

Table 2. Eigenvalues and explained variance by the first dimensions of PCA

	Dim 1	*Dim 2*	*Dim 3*	*Dim 4*	*Dim 5*
Eigenvalues	9.86	5.07	3.38	2.70	1.59
% of Variance	15.60	8.44	5.63	4.50	2.70
Cumulative of % variance explained	15.60	24.05	29.67	34.17	36.82

Note. % = Pourcentage, Dim = Dimension, the results of the PCA show that the five first dimensions give a cumulative percentage of 36.82%.

Figure 2. Two-dimensional factorial design distribution of the 4-clusters



Note. This factor map shows the distribution of different students in a two-dimensional space. The colours indicate the groups or clusters identified in the analysis. Black dots represent cluster 1, red dots represent cluster 2, green dots represent

cluster 3 and blue dots represent cluster 4. The numbers next to the points correspond to specific identifiers or observations within each cluster. These clusters illustrate the segmentation of students based on common characteristics observed in the survey.

Table 3. Presentation of clusters according to significant variables

Cluster 1					Cluster 2				
Variable	**v-test**	**M**	**SD**	***p***	**Variable**	**v-test**	**M**	**SD**	***p***
Variable engagement	15.23	4.06	0.82		Practice alone	15.99	4.02	1.02	
Duration of exercise < 30 minutes	14.61	2.29	1.03		Practise at home	15.18	3.90	1.20	
Free activity	11.79	3.15	1.12		Program online	14.49	3.14	1.44	
Low intensity	9.80	2.00	1.02		Duration of exercise 30 minutes to 1 hour	13.45	3.31	1.10	
Free schedule	7.10	3.77	0.95	<0.001	Free schedule	12.03	4.01	0.99	<0.001
Practise alone	4.55	3.43	1.23		Appearance*	11.47	4.18	0.80	
Autonomy	3.57	3.07	1.34		Physical condition*	11.06	4.45	0.50	
Practice at home	3.43	3.29	1.29		Using ICT	10.68	2.92	0.96	
Practice outdoor in city	2.16	2.36	1.30		Practice during summer	10.46	4.17	0.89	
					Free activity	9.58	3.08	1.22	
					Fitness and well-being sport	9.03	3.17	1.21	

Cluster 3					Cluster 4				
Variable	**v-test**	**M**	**SD**	***p***	**Variable**	**v-test**	**M**	**SD**	***p***
Affiliation*	19.10	3.77	0.77		Precise schedule	23.76	4.31	1.05	
Athletics^	19.08	2.11	1.18		Practice in club	22.40	3.77	1.45	
Practice at university	18.04	2.27	1.29		Practice during winter	19.41	4.59	0.73	
Competition/Ego*	17.22	2.70	1.00		Coaching	19.36	2.93	1.58	
Team sport	17.13	2.61	1.09		Practice during autumn	19.09	3.71	0.58	
Mastery*	14.72	4.27	0.55	<0.001	Practice during spring	18.19	4.74	0.52	<0.001
Practice with friend	14.57	3.34	1.10		Duration of exercise 1 hour to 2 hours	16.94	3.99	1.12	
Running and walking	13.15	4.04	0.93		Regular engagement	14.86	4.21	0.88	
Practice during holidays	12.49	4.28	0.82		Enjoyment*	12.70	4.12	0.52	
Enjoyment*	12.29	4.44	0.48		Affiliation*	9.13	3.25	0.92	
Practice during summer	11.19	4.28	0.89		Team sport	6.00	2.1	1.20	
Using ICT	11.18	3.01	0.91		Psychological condition*	5.84	4.23	0.60	

Note. The description of each cluster is based on quantitative variables, presented with v-test (test value), mean in category (*M*), standard deviation (*SD*) and p-value (p<0.001). *Motivation for PA participation from the PALMS (Molanorouzi et al., 2015). These variables highlight the different characteristics and preferences of the respondents within each cluster. ^ Athletics mean here: track and field, running, jumping and throwing.