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Physical activity recommendations for health: knowledge and perceptions among college students

Recomendaciones de actividad física para la salud: conocimiento y percepciones entre estudiantes universitarios

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Abstract. Every population subgroup should know the physical activity (PA) recommendations to benefit their health. The present study sought to examine the knowledge and explore the perceptions of PA recommendations for adults among Portuguese college students, by gender and fields of study. A total of 255 bachelor students (55.3% women; Mage = 21.0±2.2 years) from sport sciences, health sciences and other fields, from four colleges in Portugal, answered to an online questionnaire. College students' answers about knowledge of PA recommendations were submitted to an inductive thematic analysis. The chi-square test was used to assess if knowledge of PA recommendations was independent of gender and fields of study. The majority of students (51.0%) assumed not knowing the PA recommendations. From those that assumed to know the PA recommendations, only 9.8% got them right, 42% overestimated, 10.7% underestimated and 37.5% did not know them for other reasons, with no differences found by gender and field of study. Overall, these students fail to identify the minutes per week and the intensity of PA dimensions of the PA recommendations. Portuguese students do not know the PA recommendations for health, including the sports and health sciences students. Implications for the development of national PA recommendations and public health campaigns to improve knowledge of college students are discussed.
Keywords: physical activity recommendations; college students; young adults; public health; health promotion.

Resumen. Cada subgrupo de población debe conocer las recomendaciones de actividad física (AF) para beneficiar su salud. El presente estudio buscó examinar el conocimiento y explorar las percepciones de las recomendaciones de AF para adultos entre los estudiantes universitarios portugueses, por género y áreas de estudio. Un total de 255 estudiantes de licenciatura (55.3% mujeres; Medad = 21.0 ± 2.2 años) de ciencias del deporte, ciencias de la salud y otras áreas, de cuatro universidades en Portugal, respondieron a un cuestionario online. Las respuestas de los estudiantes universitarios sobre el conocimiento de las recomendaciones de AF fueron sometidas a un análisis temático inductivo. La prueba de qui-cuadrado se usó para evaluar si el conocimiento de las recomendaciones de AF era independiente del género y de las áreas de estudio. La mayoría de los estudiantes (51.0%) asumieron no conocer las recomendaciones de AF. De aquellos que supuestamente conocían las recomendaciones de AF, solo el 9.8% las acertó, el 42% se sobreestimó, el 10.7% se subestimó y el 37.5% no las conoció por otras razones, sin diferencias por género y área de estudio. En general, estos estudiantes no identifican los minutos por semana y la intensidad de las dimensiones de las recomendaciones de AF. Los estudiantes portugueses no conocen las recomendaciones de AF para la salud, incluidos los estudiantes de deportes y ciencias de la salud. Se discuten las implicaciones para el desarrollo de recomendaciones nacionales de AF y campañas de salud pública para mejorar el conocimiento de los estudiantes universitarios.
Palabras clave: recomendaciones de actividad física; estudiantes universitarios; adultos jóvenes; salud pública; promoción de la salud.

Introduction

The practice of regular physical activity (PA) is associated with various health benefits, including a reduction in the risk of coronary heart disease and stroke, diabetes, high blood pressure, breast and colon cancer, depression and weight management (USDHHS, 2018; Kyu et al., 2016). However, worldwide about 23% of adults do not meet the physical activity recommendations (Organization, 2015b; Sallis et al., 2016).

To benefit health, the recommendations state that adults should do at least 150 minutes of PA a week with moderate intensity, or 75 minutes with vigorous intensity, or an equivalent combination of both (WHO, 2010). Despite the mixed findings regarding the associations of PA recommendations knowledge with PA (Abula, Gröpel, Chen, & Beckmann, 2018; Hunter, Tully, Donnelly, Stevenson, & Kee, 2014; Knox, Musson, & Adams, 2015), it is expected that adults know the PA recommendations (USDHHS, 2018; Marcus & Forsyth, 2009; WHO, 2010). Indeed, implementing community-wide public education and awareness campaigns for PA has been recommended as a 'best buy' strategy for the prevention and control of non-communicable diseases (WHO, 2017). Based on communication models and behaviour change theories (Marcus & Forsyth, 2009; McGuire, 1984; WHO, 2012), knowledge per se might not be sufficient to induce a behaviour change but it plays an important role in facilitating the development of intentions and preparation stages of PA. Moreover, the misperception of personal PA and lack of knowledge might function as a barrier to behaviour change (Marques, Martins, Ramos, Yazigi, & Carreiro da Costa, 2014; McGuire, 1984; WHO, 2012).

Research has shown that the prevalence of knowledge about PA recommendations is low between adults varying from 1% to 36% in the USA (Kay, Carrol, Carlson, & Fulton, 2014; Moore, Fulton, Kruger, & McDivitt, 2010), 10% in Canada (LeBlanc et al., 2015), 15% to 18% in United Kingdom (Knox, Esliger, Biddle, & Sherar, 2013; Knox et al., 2015), and reaching 47% in North Ireland (Hunter et al., 2014). Having low education, being a student or unemployed, physically inactive and men are factors associated with not knowing PA recommendations between adults (Hunter et al., 2014; Knox et al., 2013; Moore et al., 2010). From a public health perspective, these differences suggest that governments and society can inform and educate their citizens towards an active lifestyle, and that targeted interventions might be needed for different population subgroups.

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The transition from high school to college has been identified as an important life change event where PA levels tend to decline (Enberg et al., 2012; Keating, Guan, Piñero, & Bridges, 2005; Pengpid et al., 2015; Telama et al., 2014). Only a few studies have examined the knowledge of PA recommendations among college students (Abula et al., 2018; Harris, 2014). It was found that only 4.4% of Chinese college students (Abula et al., 2018) and none of the future physical education teachers in the UK (Harris, 2014) accurately knew the PA recommendations. In Portugal, only 4% of Portuguese adolescents (Marques, Martins, Sarmento, Rocha, & Carreiro da Costa, 2015) and 52% of physical education master students (Alves, 2016) knew the PA recommendations.

The college students are an understudied population group (Abula et al., 2018; Da Cuña Carrera, Lantarón Caeiro, González González & Gutiérrez Nieto, 2017; Harris, 2014). Being inserted in an accessible and organized context composed of various agents (e.g. universities, student associations) is an advantage for intervening and promoting healthy lifestyles (Corbí, Palmero-Cámara & Jiménez-Palmero, 2019; Plotnikoff et al., 2015; WHO, 2017). The investigation of the factors associated with knowing or not knowing the PA recommendations is also important for designing targeted campaigns (Knox et al., 2013; WHO, 2012). In this respect, considering the existing differences in PA levels among men and women (Keating et al., 2005; Muñoz & Fernández-Luna, 2019; Pengpid et al., 2015; Sallis et al., 2016), the students' gender is worthy of further investigation. Moreover, comparisons among students from different fields of study are also needed (Harris, 2014; Morton, Thompson, Wheeler, Easton, & Majeed, 2016), especially because these students will be in professional positions responsible for promoting PA.

Previous research has also highlighted the need to further understand the proportion of people and factors associated with adults that know, underestimate and overestimate the PA recommendations (Abula et al., 2018; Hunter et al., 2014; Knox et al., 2015). In this respect, the use of open-ended questions might be an important advantage for gaining new insights into participants' knowledge and perceptions and for improving health promotion campaigns (McGuire, 1984; WHO, 2012).

Many studies about the knowledge of PA recommendations have taken place where national/local PA recommendations exist (Kay et al., 2014; Knox et al., 2015). Nevertheless, several countries are now developing national PA recommendations for the population based on the WHO recommendations, such as Portugal (Kalhmeier et al., 2015; WHO, 2015a). Thus, a better understanding of the knowledge of PA recommendations is fundamental to provide guidance to public health authorities for developing PA guidelines, designing campaigns and promoting PA. Therefore, the present study sought to examine the knowledge and explore the perspectives of PA recommendations among Portuguese college students, by gender and fields of study.

Methods

Participants and procedures

This is an observational cross-sectional study that involved bachelor degree students from two Portuguese universities (one public and another private) and two polytechnics (i.e. non-university higher educational institutions aiming to provide more practical training and to be profession-oriented; one public and another private). The institutions were located in Lisbon, Coimbra (centre of Portugal), Porto and Viseu (north of Portugal). The institutions were selected because researchers had close contacts with professors working there and in order to ensure that participants were from specific fields of study, namely: sports sciences (physical education, sport), health sciences (nursery, physiotherapy) and others (social communication, psychology).

In each institution one professor was contacted in order to ensure the participation of their students. This professor sent an electronic message (e-mail) to students from his classes. The e-mail comprised information about the conditions of participation and a link to access the online questionnaire. Students were informed about the research team, research purposes and conditions to participate. Students were also told that their participation was voluntary, anonymous and the data collected confidentially.

The online questionnaire was made available for participation during a 3-week period (May/June of 2017). At the beginning of each week, a reminder e-mail was sent in an effort to achieve higher participation rates. Participation rates were approximately of 10%, and 49% of those provided full answers. The mean completion time of the questionnaire was 9 minutes. The final sample was 255 college students. The study protocol was approved by the Ethics Commission of the Faculty of Medicine of the University of Lisbon.

Instrument

The data was collected through a survey, using a structured questionnaire in an online format. For its development Limesurvey GmbH (Castern Schmitz, Germany) was used, hosted in a private server. As it is shown in table 1, the questionnaire was composed by 26 questions distributed in four dimensions: PA behaviour, PA recommendations, psychological factors and socio-

Table 1.
Dimensions and questions of the online questionnaire

Dimension	Questions
I. Physical activity and sedentary behaviour	1a. Vigorous PA: days per week
	1b. Total time in vigorous PA per day
	2a. Moderate PA: days per week
	2b. Total time in moderate PA per day
	3.a. Walking: days per week
	3.b. Total time walking per day
	4a. Total sitting time (week day)
	4b Total sitting time (weekend day)
	5a. Formal and regular PA in University context
	5b. If yes, activity, sessions per week, time per week
II. Physical activity recommendations	6a. Knowledge of PA recommendations
	6b. If yes, what are the PA recommendations
III. Psychological factors	7. Perceived lifestyle related to PA
	8. Perceived lifestyle changes after entering university
	9. Attitude towards PA
	10. Strategies to increase PA in university context
	11. Perceived physical fitness
	12. Perceived health
	13. Health condition preventing PA involvement
IV. Demographic data	14. Nationality
	15. Sex
	16. Age
	17. Height
	18. Weight
	19. Marital status
	20. Residential status
	21. Professional status
	22. University name
	23. Faculty name
	24. Course
	25. Type and locality of the university
	26. Grade for accessing university

demographics.

The questions about the knowledge of PA recommendations were based on an international study (Knox et al., 2013), which was already applied in the Portuguese setting (Alves, 2016). The first question asked was: 'Do you know the international physical activity recommendations available for adults (18-64 years) that benefit their health?' The answer options were 'yes' and 'no'. This question provides the proportion of college students who self-perceived to know the PA recommendations. If the answer was 'yes', the students were asked the following open-ended question: 'What are the international physical activity recommendations for adults (18-64 years)?'. This question allowed obtaining answers in order to examine the knowledge and explore the perceptions of college students about the PA recommendations.

The socio-demographic data questions used in this study collected information about students' gender, age, type and locality of the educational institution, and attended field of study.

Once all data was gathered, the college students' answers were exported from the Limesurvey GmbH software to an excel file and, then, to an IBM SPSS 24.0 (New York city, New York, USA) database.

College students' answers about knowledge of PA recommendations were submitted to an inductive thematic analysis (Braun, Clarke, & Weate, 2016; Corbin & Strauss, 2008). First, two researchers read all answers independently, several times, to identify the main characteristics and possible emerging themes. Second, these researchers met to discuss their ideas. Third, all answers were independently examined and classified by the two researchers. Based on the constant comparative method (Corbin & Strauss, 2008), key elements of the answers were identified, constantly compared and then coded according to its thematic emphasis. When data did not fit into an already existing category, a new category was created and the data re-examined (Corbin & Strauss, 2008). Fourth, the researchers re-examined data together, themes were compared, contrasted and identified by consensus. If there was disagreement among researchers regarding the coding or the classification of certain answers, the final decision was left to a third researcher, blinded to the previous classifications.

Six main themes were identified in participant's answers: i) Frequency – days/sessions per week; ii) Time – minutes per session; iii) Time – minutes per week; iv) Intensity; v) Type of activity; vi) General PA aspects or other related areas. Afterwards, based on these themes, each student was classified into one of the following subgroups of knowledge: I) knows the PA recommendations; II) does not know – underestimates; III) does not know – overestimates; and IV) does not know – others. The WHO PA recommendations (2010) were taken into account to identify correct/incorrect answers (e.g. 150 minutes of PA with moderate intensity a week, or 75 minutes of vigorous PA a week, or an equivalent combination of both). Typical answers for each theme and subgroup are presented in the results section.

Data analysis

In order to analyse if the self-perceived knowledge (assume to know, assume not to know), knowledge of PA recommendations (knows, does not know) and subgroups of knowledge (knows, underestimates, overestimates, other) were independent of gender and fields of study, the chi-square test was used. 95% confidence intervals were calculated and presented. The statistical analyses were done on IBM SPSS Statistics 24.0 (New York city, New York, USA). The significance level was set at $p < 0.05$.

Results

The socio-demographic data of participants are presented in table 1. College students were mainly women (55.3%), from university (65.1%) and sport science courses (46.7%).

Table 2 shows that 51.0% (95% CI = 44.8-57.1) of students assumed that they did not know the PA recommendations for adults, with no differences found between sexes (X^2 = 0.713; p = 0.448). However, a larger proportion (61.1%, 95% CI = 49.6-71.5) of students from health sciences significantly considered that they were knowledgeable of the PA recommendations when compared to students from other courses (31.3%, 95% CI = 20.9-43.6) (X^2 = 12.243; p = 0.002).

Table 2.
Socio-demographic characteristics of college students (n = 255).

	Total
Sex, n (%)	
Men	112 (43.9)
Women	141 (55.3)
Non-responses	2 (0.8)
Age, mean ± standard deviation	21.0±2.2
Characteristics of educational institution, n (%)	
Public	118 (46.3)
Particular/Private	137 (53.7)
Type of educational institution	
Polytechnic	89 (34.9)
University	166 (65.1)
Locality of the educational institution, n (%)	
Viseu	43 (16.9)
Coimbra	46 (18.0)
Lisboa	137 (53.7)
Porto	29 (11.4)
Fields of study, n (%)	
Sport sciences	119 (46.7)
Health sciences	72 (28.2)
Other	61 (23.9)
Non-responses	3 (1.2)

Table 3.
College students' self-perceived knowledge of physical activity recommendations for adults, by sex and field of study (n = 255).

Self-perceived knowledge of PA recommendations	Sex[a]			Fields of study[b]				Total
	Men	Women	p	Sport Sciences	Health Sciences	Others	p	
	n (%) [95% CI]	n (%) [95% CI]		n (%) [95% CI]	n (%) [95% CI]	n (%) [95% CI]		n (%) [95% CI]
Assume not to know	60 (53.6) [44.4-62.5]	68 (48.2) [40.1-56.4]	0.448	58 (48.7) [35.1-52.6]	28 (38.9) [28.5-50.4]	42 (68.9) [56.4-79.1]	0.002	130 (51.0) [44.8-57.1]
Assume to know	52 (46.4) [37.5-55.6]	73 (51.8) [43.6-59.9]		61 (51.3) [42.4-60.0]	44 (61.1) [49.6-71.5]	19 (31.1) [20.9-43.6]		125 (49.0) [42.9-55.1]

Tested with Chi-Square test of independence; PA, physical activity; CI, confidence interval.
[a] n = 253, two missing cases; [b] n = 252, three missing cases.

Table 4.
Knowledge classification of college students' that assumed to know the PA recommendations, by sex and fields of study (n = 112).

Knowledge of PA recommendations	Sex			Fields of study				Total[a]
	Men	Women	p	Sports sciences	Health sciences	Others	p	
	n (%) [95% CI]	n (%) [95% CI]		n (%) [95% CI]	n (%) [95% CI]	n (%) [95% CI]		n (%) [95% CI]
Knows	4 (8.7) [3.4-20.3]	7 (10.4) [5.2-20.0]	0.758	9 (15.8) [8.5-27.4]	2 (4.5) [1.3-15.1]	0 (0) [0-25.8]	0.087	11 (9.8) [5.6-16.7]
Does not know	42 (91.3) [79.7-96.7]	60 (89.6) [80.0-94.9]		48 (84.2) [72.6-91.5]	42 (95.5) [84.7-98.7]	11 (100.0) [74.1-100]		101 (90.2) [83.8-94.4]
Knows	4 (8.7) [3.4-20.3]	7 (10.4) [5.2-20.0]		9 (15.8) [8.5-27.4]	2 (4.5) [1.3-15.1]	0 (0) [0-25.8]		11 (9.8) [5.6-16.7]
Does not know - underestimate	5(10.9) [4.7-23.0]	7 (10.4) [5.2-20.0]	0.884	7 (12.3) [6.0-23.3]	5 (11.4) [5.0-24.0]	0 (0) [0-25.8]	0.331	12 (10.7) [6.3-17.8]
Does not know - overestimate	18 (39.1) [26.4-53.5]	30 (44.8) [33.5-56.7]		22 (38.6) [27.1-51.6]	19 (43.2) [29.7-57.8]	6 (54.5) [28.0-78.7]		47 (42.0) [33.2-51.2]
Does not know - other	19 (41.3) [28.3-55.7]	23 (34.3) [24.1-46.3]		19 (33.3) [22.5-46.3]	18 (40.9) [27.7-55.6]	5 (45.5) [21.3-71.2]		42 (37.5) [29.1-46.7]

Tested with Chi-Square test of independence; PA, physical activity; CI, confidence interval.
[a] n = 112 students instead of 125 due to 13 non-responses to the question 'If yes, point out the PA recommendations'.

Only a minority (9.8%; 95% CI = 5.6-16.7) of students that reported to know the PA recommendations really know them (table 3). No differences were identified in the knowledge about recommendations based on sex ($X^2 = 0.095$; $p = 0.758$) and fields of study ($X^2 = 4.873$; $p = 0.087$). When also considering the subgroups of knowledge classification (knows, underestimates, overestimates, other), also no differences were found considering sex ($X^2 = 0.652$; $p = 0.884$) and fields of study ($X^2 = 6.891$; $p = 0.331$) variables. However, it is possible to observe that most students fail to know the PA recommendations due to overestimating (42.0%; 95% CI = 33.2-51.2) and considering other general aspects related to PA (37.5%; 95% CI = 29.1-46.7) rather than underestimating (10.7%; 95% CI = 6.3-17.8).

Table 4 provides evidence that students who knew the PA recommendations (n = 11) talked mainly about two dimensions: minutes per week (150 min and/or 75) and PA intensity (moderate and/or vigorous). A typical answer was: 'To do a minimum of 150 minutes per week of physical activity with moderate intensity, or 75 minutes of vigorous intensity, or a combination of both'. Some of these students (n = 4) have not mentioned the intensity dimension, but their answer was considered partially correct (e.g. '150 minutes of physical activity per week'). With some degree of flexibility, the researchers classified these students as knowing the PA recommendations.

As for students that underestimated the PA recommendations (n = 12), the content analysis provided evidence that their perceptions were mainly related to the number of sessions per week and minutes per session. The more frequent answer was: 'Three times per week, 30 minutes each'.

A total of 42% of college students who assumed to know the PA recommendations overestimated them. Their thoughts were mainly about daily PA, for periods of 30 or 60 minutes. They frequently mentioned one type of activity or a combination of both. For example: '60 minutes of daily PA, by running or walking».

A total of 38% of college students did not knew the PA recommendations due to other reasons. Their answers were focused, essentially, on two dimensions: types of activities (e.g. 'We should walk, run or going to the gym') and PA general aspects or related areas (e.g. PA benefits or nutrition). Typical answers were: 'PA is good for health, such as to prevent obesity' and 'Have a healthy diet and drink water regularly'.

Table 5.
Perceptions of knowledge classification subgroups about PA recommendations (n = 112).

Themes	Knows (n=11) n (%)	Does not know underestimate (n=12) n (%)	Does not know overestimate (n=47) n (%)	Does not know other (n=42) n (%)	Total (n=112) n (%)
Frequency – days/sessions per week					
1-2	0	2(16.7)	0	1 (2.4)	3 (2.7)
3	1 (9.1)	8 (66.7)	5 (10.4)	5 (11.9)	19 (16.8)
4-6	2 (18.2)	0	1 (2.1)	1 (2.4)	4 (3.5)
7	0	2 (16.7)	41 (85.4)	0	43 (38.1)
No references this dimension	8 (72.7)	0	1 (2.1)	35 (83.3)	44 (38.9)
Time – minutes per session					
15	0	1 (8.3)	0	0	1 (0.9)
30	3 (27.3)	10 (83.3)	26 (54.2)	1 (2.4)	40 (35.4)
60	0	1 (8.3)	14 (29.2)	1 (2.4)	16 (14.2)
90	0	0	1 (2.1)	0	1 (0.9)
No references to this dimension	8 (72.7)	0	7 (14.6)	40 (95.2)	55 (48.7)
Time – minutes per week					
150	5 (45.5)	0	0	0	5 (4.4)
150 and/or 75	4 (36.4)	0	0	0	4 (3.6)
Other (e.g. 200 minutes)	0	1 (8.3)	1 (2.1)	0	2 (1.8)
No references to this dimension	2 (18.2)	11 (91.7)	47 (97.9)	42 (100.0)	102 (90.2)
Intensity					
Moderate	0	1 (8.3)	0	2 (4.8)	3 (2.7)
Moderate to vigorous	7 (63.3)	0	7 (14.6)	1 (2.4)	15 (13,3)
Vigorous	0	0	2 (4.2)	0	2 (1.8)
No references to this dimension	4 (36.7)	11 (91.7)	39 (81.3)	39 (92.9)	93 (83.0)
Type of activity					
Walking	0	3 (25.0)	14 (29.2)	5 (11.9)	22 (19.5)
Running	0	0	2 (4.2)	0	2 (1.8)
Health club (individual/group classes)	0	0	1 (2.1)	1 (2.4)	2 (1.8)
Physical fitness	0	0	1 (2.1)	3 (7.1)	4 (3.5)
Swimming	0	0	0	1 (2.4)	1 (0.9)
Combination of previous activities	1 (9.1)	0	1 (2.1)	9 (47.4)	11 (9.7)
No references to this dimension	10 (90.9)	9 (75.0)	29 (60.4)	23 (54.8)	71 (62.8)
General PA aspects or other related areas					
Benefits of PA	0	0	0	6 (14.3)	6 (5.3)
Nutrition	0	0	1 (2.1)	2 (4.8)	3 (2.7)
Sedentariness/Sedentary behaviour	0	0	1 (2.1)	3 (7.1)	4 (3.5)
Just "doing physical activity"	0	0	1 (2.1)	4 (9.5)	5 (4.4)
Just "doing exercise"	0	0	1 (2.1)	2. (4.8)	3 (2.7)
Combination of previous categories	0	0	0	3 (7.1)	4 (3.5)
No references to this dimension	11 (100)	12 (100)	43 (89.6)	22 (52.4)	88 (77.9)
Number of mentioned themes					
1	3 (27.3)	0	1 (2.1)	19 (45.2)	23 (20.4)
2	6 (54.5)	10 (83.3)	22 (45.8)	13 (31.0)	51 (45.1)
3	1 (9.1)	2 (16.7)	23 (47.9)	10 (23.8)	36 (31.9)
4 or 5	1 (9.1)	0	2 (4.2)	0	3 (2.7)

PA, physical activity; MPA, moderate physical activity; VPA, vigorous physical activity

Discussion

The purpose of the present study was to examine the knowledge and explore the perceptions of PA recommendations of college students. Results highlight that the majority of college students assume not knowing the PA recommendations to benefit health. Moreover, only a minority of students that assumed to know the PA recommendations were classified as accurately knowing them. The majority of students did not know the PA recommendations due to overestimating or focusing on general aspects of PA.

A major finding was that only 9.8% of Portuguese college students knew the PA recommendations. This prevalence is lower when compared to most international European studies (Hunter et al., 2014; Knox et al., 2013; Knox et al., 2015). Two major factors can explain this difference. First, in the United Kingdom there have been national PA recommendations for several years and numerous PA recommendations knowledge campaigns, which is not the case in Portugal (Department of Health, 2011; Kalhmeier et al., 2015). Second, this might be due to the fact that the population subgroups of adults included in the studies are different. With this in mind, it is possible that some college students of the present study might know the recommendations for people aged 5-17 years of age and think that these still apply since they crossed this age threshold recently. This could help to understand the high prevalence of college students that overestimated PA recommendations, mainly due to considering the daily need of PA and the 30/60 minutes per session.

Considering the national context, the prevalence of 9.8% is relatively close to the 4% of the Portuguese adolescents who knew the PA recommendations for children and adolescents (Marques et al., 2015), namely 60 minutes of daily MVPA (WHO, 2010). When reaching 18 years, college students should take into account the PA recommendations for adults. However, if schools and society are not having success in promoting PA recommendations for people below 18 years of age (Marques et al., 2015), it is plausible that they are also not promoting the PA recommendations for adults. At least, this message should be strongly promoted by

physical education teachers targeting students at the 12th grade, before finishing school, as previously highlighted in other studies (Martins, Marques & Carreiro da Costa, 2015; Martins et al., 2017). Thus, the current study suggests that during the transition from adolescence to adulthood, PA recommendations for youth and adults might be confounded. This information should be taken into account by public health and education authorities when designing campaigns and promoting PA.

There were no differences in PA recommendations knowledge between genders. This corroborates previous Portuguese and international studies (Knox et al., 2015; Marques et al., 2015). Thus, data from the present study suggests that campaigns for promoting PA recommendations should be targeted to both men and women college students.

The other aim of this study was to compare PA recommendations knowledge of students from different fields of study. In the sport science group only 15.8% of students that assumed to know the PA recommendations really knew them. In a study conducted in England with 124 physical education teacher education students', none correctly knew the PA recommendations (Harris, 2014). However, the 15.8% is by far lower compared with the 55% of Portuguese physical education master's students that knew the PA recommendations (Alves, 2016). This difference could be explained by the fact that the students in the present study are taking bachelor degrees. It is plausible that PA and health education contents, as with those related to PA recommendations and PA promotion, are further developed in the advanced levels of education.

Regarding health sciences students, a majority said they knew the PA recommendations (61.0%) but only a minority accurately knew them (4.5%). The misperception of PA recommendations among health sciences students might function as a barrier for changing their knowledge and behaviour (Marques et al., 2014), as well as of those that will be 'educated' by this group of professionals.

Not a single student from «other» fields knew the PA recommendations. Considering that only 24% of students that participated in this study were from «other» fields, it is essential that future studies focus on students from degrees that are not closely related to PA and health promotion.

The use of an open-ended question to characterize the PA recommendations knowledge allowed identifying various levels of knowledge. This is a major strength of the present study. It was shown that 42.0% of the students that said they knew the recommendations overestimated them. This number is higher than the one found in other studies involving adults in the UK: 13.8% (Knox et al., 2015) and 24.2% (Hunter et al., 2014). It is important to note that the prevalence in these studies was calculated by using all the people that participated, including those that assumed they did not know and those that did not answer. In the present study this number was calculated using only the participants that said they knew the PA recommendations. However, if the prevalence were calculated considering the entire sample the values would be similar.

The content analysis showed that overestimation of the PA recommendations was majorly due to answers that showed that people think they need to practice every day, for 30 or 60 minutes per day or session. However, in a context where physical inactivity is one of the leading causes of chronic diseases (Lee et al., 2012), it is not ethically correct promoting a campaign where the focus is to emphasise that people do not have to do PA daily. Although, this might be an obstacle for PA practice since people might think they need to exercise a specific amount without knowing the other options (e.g. 75 minutes of vigorous PA, separated between 3-week sessions). In regard to that, future studies should further understand if overestimating PA recommendations could be a PA barrier.

A major finding is that college students who think they know the PA recommendation but do not. In order to promote the knowledge of PA recommendations it might be important to emphasise the following dimensions: minutes per week, PA intensities, PA recommendations as a minimum that could be reached in several ways, in terms of time, days, activity types and intensity. Thus, the open-ended question approach allowed further understanding of college students' perceptions about PA recommendations and for highlighting possible communication messages to promote PA knowledge. Future studies can measure PA levels and factors associated with the various degrees of knowledge about PA recommendations.

This study has some limitations. Firstly, it was a small and convenient sample. In a future study it would be beneficial to get a representative sample of college students. A future study should also include colleges from more diverse fields to guarantee that future health education campaigns have representative information about the national panorama. With regard to the questionnaire format, and assuming that this study wanted to evaluate theoretical knowledge, it is possible that some participants consulted the World Wide Web to answer the questions about the PA recommendations. Although, this probably has not occurred due to the answers obtained. The anonymity of this approach seems to promote honest answers, showing that this method might be both an efficient and an effective alternative solution to face-to-face studies about this subject.

Findings from the present study might be of particular relevance for the National Strategy for Promoting PA of the Portuguese General Health Direction (DGS), which defines the college students as a priority subgroup for PA interventions.

Conclusion

The majority of Portuguese college students that participated in the present study do not know the PA recommendations for adults. Even though half of the college students said they did not know the PA recommendations, of those that said they knew, only 9.8% actually did know. A deeper understanding of the characteristics and perceptions of those who misperceived and do not know the PA recommendations due to overestimating, underestimating and other reasons, has important implications for developing national PA guidelines and for designing effective PA and PA knowledge promotion campaigns.

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