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ORIGINAL ARTICLE

Levels of physical activity, motivation and barriers to participation in university students

Javier SEVIL ¹*, Alba PRÁXEDES ², Alberto ABARCA-SOS ³, Fernando DEL VILLAR ²,
Luis GARCÍA-GONZÁLEZ ¹

¹Faculty of Health and Sport Sciences, University of Zaragoza, Huesca, Spain; ²Faculty of Sport Sciences, University of Extremadura, Cáceres, Spain; ³Faculty of Social Sciences and Humanities, University of Zaragoza, Teruel, Spain

*Corresponding author: Javier Sevil, Faculty of Health and Sport Sciences, University of Zaragoza, Plaza Universidad 3, 22001, Huesca, Spain. E-mail: javier.sevil@gmail.com

ABSTRACT

BACKGROUND: Grounded in self-determination theory and trans-theoretical model applied to exercise, the aim of this study was to analyse the existing relationships between physical activity (PA) carried out by university students, perceived barriers to PA, motivation to PA and stages of change.

METHODS: 901 Spanish students took part in the study (408 men, 493 women; mean age 22.59±3.59), who completed the Behavioural Regulation in Exercise Questionnaire (BREQ-3), Scale of Barriers to PA, Stages of Change and the International Physical Activity Questionnaire - Short Form (IPAQ-SF).

RESULTS: Noteworthy among the findings is the positive relationship between the more autonomous regulation forms, especially integrated regulation, and the moderate to vigorous PA (MVPA) levels. However, barriers to participation are negatively related to PA levels and the more self-determined forms of motivation. Finally, students in action and maintenance stages, and those who comply with the recommendations on PA present higher values in the more self-determined motivation forms and lower values in barriers to participation in PA.

CONCLUSIONS: The study shows the importance of addressing the analysis of variables associated with engagement in PA in the university population to develop healthy policies and intervention programmes that can establish a series of healthy and more active habits in the youth-adult stage. The appropriateness of promoting more self-determined motivation forms is highlighted, especially integrated regulation, to have an impact on higher levels of MVPA.

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Engagement in regular physical activity (PA) with moderate to vigorous intensity (MVPA) reports numerous benefits in a person's integral development, personal well-being and quality of life. However, MVPA levels decrease drastically from childhood to adolescence, especially in females,¹ and this tendency is maintained until the more adult stage is reached.² Consequently, the promotion of PA becomes one of the priority lines in health and education policies of many countries for all population groups.³

A recent study in Spain on youth-adult population points out that university students are the least active, compared with children and adolescents, and less than 40% of the sample comply with PA recommendations (*i.e.*, 30 minutes' MVPA).⁴ These results are in agreement with other previous studies in the same country that indicated that only 27.4% of university students could be considered as sufficiently active. Most studies have shown the MVPA levels were higher in university males than in females.⁵ This fact is especially signifi-

cant as, despite the fact that international organisations³ recommend lower levels in PA levels in youths-adults (*i.e.*, 30 minutes' MVPA) than in children and adolescents (*i.e.*, 60 minutes' MVPA), the degree of compliance with these levels by the university population is extremely low. In this sense, the start of university studies coincides with the abandonment of PE classes, a context that may contribute to compliance with MVPA levels and to the promotion of more active and healthy lifestyles.⁶ Likewise, changes in lifestyle can be appreciated in this university stage (*e.g.*, diet, smoking, alcohol, tobacco, illicit drug/s use) and in other psychosocial factors (*e.g.*, stress, lack of family support, study hours), which may alter behaviour in terms of PA levels.⁷ Hence, this transition period, between secondary school and the start of the university stage, is considered to be a critical stage for the promotion and maintenance of engagement in PA.⁸

Given this prevalence of physical inactivity, there are a large number of studies that have analysed some of the theories, models and factors that may impact upon youth PA behaviour. Previous research⁹ has shown the importance of integrating the psycho-social variables proposed in the self-determination theory (SDT)¹⁰ and the trans-theoretical model (TTM)¹¹ applied to exercise, permitting the use of social-ecological models to further complement and justify engagement in PA.¹²

Thus, the SDT¹⁰ becomes a theoretical framework that permits examining the relationship between motivational regulation and engagement in PA in the university population.¹³ In this sense, the Organismic Integration Theory,¹⁴ which forms part of the SDT,¹⁰ postulates that there are different levels of motivation, and that the reasons for engagement vary in agreement with the locus of causality. Therefore, a more internal, external or impersonal regulation may appear. Thus, university students may engage in PA for the enjoyment and satisfaction they obtain, it being an end in itself (intrinsic regulation). This continuum of self-determination is followed by the forms of extrinsic motivation, where human behaviour depends on external factors that do not relate to the actual activity. Thus, university students may engage in PA because it is present in their lifestyles (integrated regulation), know the importance and benefits it has in their personal development (identified regulation), seek to feel satisfied, avoiding feelings of responsibility and unease (introjected regulation) or

feel an external pressure or obligation (external regulation).¹⁰ The intrinsic, integrated and identified regulation types would form the more autonomous motivation type, whilst the introjected and external regulation types would form the more controlled regulation.¹⁴ Finally, the least self-determined regulation of this continuum is amotivation, defined by a lack of internal and external intention to engage voluntarily in PA. A university student who is amotivated does not understand the meaning and value of engaging in PA, and considers this behaviour to be a waste of time.¹⁰

Different studies have shown, in youth-adult population, that the more self-determined profiles towards physical exercise are associated with positive consequences that follow a more adaptive behavioural pattern (*e.g.*, enjoyment, high MVPA levels, intention to be physically active).¹⁵ However, some longitudinal studies point to a continuous decrease of the more self-determined forms of motivation from childhood to adolescence¹⁶ until the adult stage,¹⁷ indicating that, in many cases, motivation is associated with a decrease in MVPA levels.

Similarly, the TTM,¹¹ applied in the exercise context, appears in scientific literature as a complementary model to the SDT¹⁰ that helps explain the behaviour and intention of change in behaviour of an individual related to engagement in PA. Thus, the TTM¹¹ is set up as a series of stages of change: pre-contemplation (*i.e.*, "I do not exercise and have no interest in it"), contemplation (*i.e.*, "I do not exercise, but I want to"), preparation (*i.e.*, "I exercise from time to time"), action (*i.e.*, "I have been exercising regularly, several times a week, for at least the last 6 months") and maintenance (*i.e.*, "I have been exercising regularly for longer than 6 months"). Thus, this model permits situating the behaviour shown by students in a series of stages, helping develop and adjust intervention programmes.¹⁸

However, there are barriers to PA that may represent a decrease in the levels of PA¹⁹ and less intention of change in behaviour in terms of engagement in PA.²⁰ Likewise, other authors have pointed out that lack of motivation is shown as a barrier perceived by university students to engage in PA.²¹ In this sense, sedentary individuals usually present a greater number of barriers, whilst active individuals present a lower number of barriers.²² However, the lack of PA in the youth-adult population can also be justified by the barriers that they

themselves perceive (*e.g.*, lack of time, laziness, work and exams).²³

Due to the lack of studies that associate the variables set out in the university population, the objective of this study was to analyse the existing relationships between the PA carried out by university students, perceived barriers to participation, motivation and stages of change. All of this will help understand factors that can be targeted in behavioural interventions to increase MVPA levels. Based on the theoretic review carried out, the first hypothesis indicates that the more self-determined forms of motivation will be associated with and will positively predict the levels of MVPA, as well as compliance with the recommendations on PA, and they will be negatively associated with all the barriers to PA. Likewise, it is sustained that these barriers to participation will be negatively associated with the levels of MVPA and compliance with the recommendations on PA in university students. The second hypothesis sustains that individuals who satisfy the recommendations on PA will present higher values in the more self-determined forms of motivation and lower values in the more controlled forms of motivation and amotivation, as well as in all the barriers to PA, compared with individuals who do not satisfy these recommendations. Finally, the third hypothesis indicates that the stages of change of action and maintenance will present higher values in the more self-determined forms of motivation and lower values in perceived barriers. Contrary to this, the stages of pre-contemplation, contemplation and preparation will present lower values in the more self-determined forms of motivation and higher scores in all barriers to PA.

Materials and methods

A cross-sectional descriptive-correlational study was performed, by means of a quantitative research methodology.

A total of 901 university students (408 men and 493 women), aged between 18 and 49 years old (mean age 22.59 ± 3.59), from different faculties at a Spanish University participated in the study. The selection of the sample was non-probabilistic, selected by accessibility. Following approval by the University's Ethics Committee, the decanal team of the different faculties involved were contacted, obtaining consent to conduct the study.

Participation by the students in the study was completely voluntary and anonymous, and they expressed their consent in writing.

Variables and instruments

MOTIVATIONAL REGULATIONS IN EXERCISE

The Behavioural Regulation in Exercise Questionnaire (BREQ-3) by Wilson, Rodgers, Loitz and Scime²⁴ was used to measure the students' motivation to PA, in its version validated in the Spanish context by González-Cutre, Sicilia and Fernández.²⁵ The scale, headed by the sentence "I exercise because...", is comprised of 23 items, grouped into six factors (four items per factor, except for identified regulation that is comprised of three items), which measure intrinsic regulation (*e.g.*, "I get pleasure/satisfaction from exercise"), integrated regulation (*e.g.*, "I exercise because it is consistent with life goals"), identified regulation (*e.g.*, "I value the benefits of exercise"), introjected regulation (*e.g.*, "I feel guilty when I do not exercise"), external regulation (*e.g.*, "I feel under pressure from others") and amotivation (*e.g.*, "I do not see why I should exercise"). The response format used was evaluated on a Likert scale of 0 to 4, where 0 corresponded to total disagreement, and 4 to total agreement. Cronbach's α values were 0.87 for intrinsic regulation, 0.93 for integrated regulation, 0.72 for identified regulation, 0.69 for introjected regulation, 0.79 for external regulation, and 0.75 for amotivation.

PA LEVELS AND COMPLIANCE WITH RECOMMENDATIONS ON PA

The International Physical Activity Questionnaire-Short Form (IPAQ-SF)²⁶ was used to quantify PA levels by university students, validated in Spanish population (Roman *et al.*).²⁷ This questionnaire has been validated in 12 countries, showing acceptable psychometric properties to measures on individual's PA levels in one week.²⁸ To this end, the first four questions, of the seven that make up this questionnaire, were chosen to quantify the MVPA levels (*i.e.*, frequency, duration and intensity) and evaluate compliance with recommendations (*i.e.*, 30 minutes of MVPA). The questions include a short description about the characteristics of the type of activities that fit into each section.

BARRIERS TO PHYSICAL ACTIVITY

The Scale of Barriers by Chinn, White, Harland, Drinkwater and Raybould,²⁹ previously used in young population,³⁰ was used to measure the barriers to PA. This instrument is comprised of 17 items that measure perceived barriers to PA in several factors: eight items measure disliking of PA (*e.g.*, “Do not enjoy physical activity”), four items measure time constraints (*e.g.*, “I do not have enough time”), one item measures safety reasons (*e.g.*, “Physical activity outdoors is not safe”) and three items measure environmental reasons (*e.g.*, “No place to do physical activity”). The item “I am not allowed to go out”, referring to typical behaviour of the child or adolescent stage, was eliminated. Likewise, the item “I have too much school work” was changed into “I have too much university work”. The answers correspond to a Likert scale that varies from 0 (“It is not a problem at all”) to 6 (“It is a serious problem”). Due to the fact that this version has not been used before in the university population, the validity of the instrument was verified. Following the confirmatory factor analysis (CFA), it was decided to include the item related to “safety reasons” in the “environmental reasons” factor, making a total of 4 items in this factor (*i.e.*, barriers relating to environmental and safety reasons). Thus, the three factors obtained accounted for 60% of the total variance. The barriers relating to disliking of PA, with a factorial weight of between 0.420 and 0.865, accounted for 14% of the variance. On the other hand, the barriers relating to time constraints, with a factorial weight of between 0.784 and 0.860, accounted for 19% of the variance. Finally, the barriers relating to environmental and safety reasons, with a factorial weight of between 0.650 and 0.754 accounted for 14% of the variance. Cronbach’s α coefficients of 0.87 were obtained for the disliking barriers in PA, 0.87 for the time constraint barriers and 0.81 for the environmental and safety reasons barriers in terms of engagement in PA.

STAGES OF CHANGE

The stages established in the TTM¹¹ were used to measure the stages of change, used in young people in the Spanish context.³¹ The scale is comprised of one single question³¹ and individuals have to select, from the 5 options presented, the stage where he or she is at with respect to their behaviour in terms of exercise: pre-

contemplation, contemplation, preparation, action and maintenance.

Procedure

The study took place in the month of March 2014, during the class period and far away from the exam period. First of all, the informed consent to perform the study was obtained and then the different university professors were contacted, establishing several dates and classrooms to give out the data collect. Before giving the instruments to the students the objectives of the study were explained and some terms that might have been confusing were clarified. In this sense, the concepts of “moderate” and “vigorous” PA concepts were explained with several practical examples, in order for the students to be able to differentiate the activities they carry out, adapting them to one intensity or the other. In addition, it was highlighted that they had to set out in this questionnaire the activities they had carried out during the previous week. Students completed the questionnaires individually, in an adequate working climate, and in the presence of the researcher, allocating approximately 15 to 20 minutes.

Statistical analysis

Firstly, the Kolmogorov-Smirnov test of normality was performed, indicating the need to use the parametric statistic ($P > 0.05$), and the internal consistency was calculated using Cronbach’s α coefficient. Indices of over 0.70 were obtained. Later on, a descriptive analysis (mean and standard deviation) was conducted of the different study variables. In addition, a CFA was carried out of the barriers to PA in order to discover the factorial structure of the items. Likewise, a bivariate correlation analysis was carried out by means of the Pearson correlation coefficient except for the variable “Compliance with recommendations on PA”. In this case, as the variable is dichotomous, Spearman’s rho correlation coefficient was used. Later on, a stepwise regression analysis was performed (considering MVPA as a dependent variable and the motivational regulation types as independent variables). Finally, a two-factor multivariate analysis of variance (MANOVA) was carried out (compliance with recommendations and stages of change) in motivational regulation and barriers to PA. Bonferroni’s

TABLE I.—*Correlations between the different study variables.*

Study variables	1	2	3	4	5	6	7	8	9	10	11
1. Intrinsic regulation		0.80**	0.68**	0.35**	-0.24**	-0.37**	-0.20**	-0.26**	-0.55**	0.34**	0.43**
2. Integrated regulation			0.64**	0.40**	-0.23**	-0.30**	-0.23**	-0.39**	-0.56**	0.43**	0.52**
3. Identified regulation				0.41**	-0.17**	-0.38**	-0.20**	-0.21**	-0.42**	0.26**	0.30**
4. Introjected regulation					0.19**	-0.00	-0.02	-0.13**	-0.12**	0.18**	0.13**
5. External regulation						0.39**	0.22**	0.16**	0.40**	-0.15**	-0.21**
6. Amotivation							0.25**	0.15**	0.51**	-0.15**	-0.18**
7. Environment and safety barriers								0.37**	0.42**	-0.17**	-0.18**
8. Time constraints barriers									0.37**	-0.27**	-0.34**
9. Disliking of PA barriers										-0.34**	-0.44**
10. MVPA											0.87**
11. Compliance with recommendations on PA (yes/no) ^a											
Mean	2.82	2.37	3.07	1.46	0.44	0.37	1.27	3.34	1.07	39.66	48.3% ^b
Standard deviation	0.98	1.28	0.81	0.88	0.68	0.62	1.22	1.64	1.07	49.14	
Cronbach's α	0.87	0.93	0.71	0.69	0.79	0.75	0.71	0.87	0.87		

^a Since the variable "Compliance with recommendations on PA", is dichotomous, the existing correlations have been carried out using Spearman's rho correlation coefficient; ^b the values that appear in the Mean of Compliance with PA refers to university students who satisfy the recommendations.

TABLE II.—*Regression analysis of the MVPA.*

Variables	B	SEB	β	ΔR^2
MVPA				0.192**
Step 1 Integrated regulation	17.026	1.161	0.439	

post-hoc was used to determine between which stages of change there were significant differences. The effect size was also calculated through the partial eta squared statistic (η_p^2), which allows to learn the magnitude of the differences found on eliminating the influence of the sample size. All these calculations were carried out using the SPSS v.21.0 statistical programme.

Results

Table I indicates the results of the correlations, showing that intrinsic regulation, integrated regulation and introjected regulation are positively and significantly related to the levels of MVPA and to compliance with recommendations on PA, whilst external regulation and amotivation are negatively associated. On the other hand, as seen in Table II, the results of the stepwise linear regression analysis for the MVPA levels indicated that integrated regulation predicted 19% of the explained

variance. Along lines, the same more self-determined forms of motivation, as well as introjected regulation, negatively and significantly correlate to all the barriers to PA, whilst external regulation and amotivation do so in the opposite direction. Likewise, all the barriers to participation are negatively and significantly associated with the levels of MVPA and with compliance with the MVPA recommendations for university students.

The results of the MANOVA (tables 3 and 4) indicate a significant main effect of the stages of change, where the effect size has a mean magnitude (Wilks's lambda = 0.434; $F_{(18,262)}=23.101$; $P<0.001$; $\eta_p^2=0.189$). In subsequent univariate contrasts, the differences obtained between the different groups are analysed for each one of the variable studies. With respect to compliance with engagement in PA (Table III) it can be observed how individuals who satisfy the recommendations on PA present significantly higher values in intrinsic regulation, integrated regulation, identified regulation and introjected regulation. On the other hand, individuals who do not comply recommendations on PA present significantly higher values in external regulation, amotivation and in all barriers to PA, referring to environmental and safety reasons, time constraints and disliking of PA.

In connection with the stages of change (Table IV), it is noteworthy that those individuals who are in the

TABLE III.—*MANOVA and descriptive statistics in the different study variables, among individuals who comply and do not comply with the recommendations on PA.*

	Comply with recommendations (N.=435; 48.3%)		Do not comply with recommendations (N.=466; 51.6%)			Contrast between groups	
	Mean	SD	Mean	SD	SE	F _(18, 262)	P value
1. Intrinsic regulation	3.26	0.76	2.42	1.00	0.03	197.265	<0.001
2. Integrated regulation	3.05	1.03	1.74	1.13	0.04	327.30	<0.001
3. Identified regulation	3.33	0.65	2.83	0.88	0.02	91.85	<0.001
4. Introjected regulation	1.58	0.90	1.35	0.84	0.02	16.18	<0.001
5. External regulation	0.30	0.55	0.57	0.76	0.02	37.96	<0.001
6. Amotivation	0.25	0.47	0.48	0.72	0.02	32.22	<0.001
7. Environment and safety barriers	1.01	1.06	1.50	1.31	0.04	37.35	<0.001
8. Time constraints barriers	2.78	1.52	3.86	1.58	0.05	107.36	<0.001
9. Disliking of PA barriers	0.59	0.72	1.52	1.15	0.03	204.56	<0.001

TABLE IV.—*MANOVA and descriptive statistics on the different study variables, in the different stages of change.*

Study variables	Pre-contemplation (PC) (N.=39)		Contemplation (C) (N.=130)		Preparation (P) (N.=285)		Action (A) (N.=84)		Maintenance (M) (N.=363)		Contrast between groups		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	SE	F _(18, 262)	P value
1. Intrinsic regulation ¹	1.63	1.17	1.95	0.91	2.59	0.86	2.97	0.88	3.41	0.62	2.76	115.71	<0.001
2. Integrated regulation ²	1.03	1.14	1.14	0.89	1.84	1.02	2.43	1.07	3.36	0.74	2.29	212.55	<0.001
3. Identified regulation ³	2.19	1.22	2.56	0.89	2.87	0.74	3.23	0.65	3.46	0.57	3.01	62.57	<0.001
4. Introjected regulation ⁴	0.88	0.75	1.17	0.82	1.31	0.80	1.62	0.91	1.70	0.88	1.40	18.56	<0.001
5. External regulation ⁵	0.53	0.74	0.67	0.87	0.55	0.73	0.44	0.62	0.26	0.49	0.40	12.74	<0.001
6. Amotivation ⁶	0.76	1.18	0.66	0.80	0.38	0.58	0.33	0.50	0.23	0.46	0.33	16.05	<0.001
7. Environment and safety barriers ⁷	1.41	1.22	1.72	1.29	1.49	1.27	1.12	1.16	0.95	1.07	1.19	14.24	<0.001
8. Time constraints barriers ⁸	4.31	1.42	4.21	1.54	3.90	1.41	3.16	1.43	2.52	1.51	3.23	54.30	<0.001
9. Disliking of PA barriers ⁹	1.98	1.53	2.01	1.08	1.30	1.00	0.89	0.88	0.51	0.68	1.00	81.98	<0.001

¹ a) M>PC, C, P, A; b) A>PC, C, P; c) P>PC, C; ² a) M>PC, C, P, A; b) A>PC, C, P; c) P>PC, C; ³ a) M>PC, C, P; b) A>PC, C, P; c) P>PC, C; ⁴ a) M>PC, C, P; b) A>PC, C, P; c) P>PC, C; ⁵ a) M<PC, C, P; b) A<PC, C, P; c) P<PC, C; ⁶ a) M<PC, C, P; b) A<PC, C, P; c) P<PC, C; ⁷ a) M<C, P; b) A<C, C; c) P<PC, C; ⁸ a) M<PC, C, P, A; b) A<PC, C, P; c) P<PC, C; ⁹ a) M<PC, C, P, A; b) A<PC, C, P; c) P<PC, C.

stages of change of maintenance, action and preparation present significantly higher values in intrinsic regulation, integrated regulation and identified regulation than those in the stages. In addition, in the stages of change of action and maintenance, significantly lower values can be seen in the barriers referring to time and to disliking of PA with respect to the other stages of change.

Discussion

The objective of this study was to analyse the existing relationships between the PA carried out by university students, the perceived barriers to PA, motivation to PA and stages of change. The first hypothesis pos-

tulated that the more self-determined forms of motivation would be associated with and would positively predict the levels of MVPA, as well as compliance with the MVPA recommendations, and would be negatively associated with all barriers to PA. In addition, it was postulated that barriers to participation would be negatively associated with the levels of MVPA and compliance with the MVPA recommendations for university students.

The findings of this study support this first hypothesis. Therefore, the more self-determined forms of motivation (*i.e.*, intrinsic regulation, integrated regulation and identified regulation) showed a positive and significant correlation with the MVPA levels, as well as with

compliance with MVPA recommendations for university students. These results are in keeping with the findings of a recent systematic review by Teixeira, Carraça, Markland, Silva and Ryan³² who highlight the importance of fostering more self-determined forms of motivation to improve the levels of MVPA in youth-adults. Moreover, as occurs in other studies on the university population, of all the forms of motivational regulation, integrated regulation is associated with and further predicts the levels of MVPA.²⁶ This fact may be due to the fact that university students are able to establish their own lifestyles with time, reflecting the maintenance of the behavioural pattern, especially when coping with obstacles or barriers that are so frequent in this stage, such as lack of time or academic stress. Thus, those students who understand that PA forms part of their lifestyles may consider that they are not held back by active engagement, whereas other students, who may have a more intrinsic interest in the activity, may consider that it interferes with other obligations or preferences.³³ Based on this, it appears that motivation is closely related to the PA levels of university students, so encouraging the development of intervention programmes that have an impact on these more self-determined forms of motivation seems a suitable aspect to achieve a more active population.

On the other hand, the more self-determined forms of motivation and the levels of PA were negatively and significantly correlated to all barriers to PA. Consistent with these results, different studies have identified lack of motivation as one of the main barriers to PA.³⁴ Likewise, these results are in line with other studies that found that barriers to PA were reversely correlated to exercise in the university population.¹⁹ Barriers referring to disliking of PA obtained higher negative correlations. Thus university students who perceive this type of barriers to PA seem to be less motivated and appear to be less active. Some descriptive studies in Spanish university students point out that this type of intrapersonal barriers have a high prevalence,²³ and may cause the abandonment of PA.³⁵ This may be due to the fact that some studies on the university population point out that the pleasure of participation in PA is related to continuity in engagement in PA.³⁶ Therefore, the implementation of intervention programmes, which promote the development of motivational processes and emotional consequences such as enjoyment, seems to be important

in this group of students to increase the levels of PA, favouring the decrease of this type of barriers.

On the other hand, the second hypothesis sustained that students who comply with the recommendations on PA would present higher values in the more self-determined forms of motivation and lower values in the more controlled motivation and amotivation types, as well as in all barriers to PA, with respect to individuals that did not comply with these recommendations. The findings point out that the hypothesis is fulfilled. In this study, students who comply with recommendations of PA, presented significantly higher values in intrinsic regulation, integrated regulation, identified regulation and introjected regulation. Similarly, other studies have shown a high association between the more self-determined forms of motivation and compliance with PA levels in the university environment.³⁷ This may be due to the fact that individuals who have a more internal locus of coincidence with respect to engagement in exercise prove to be physically more active.³⁸ To the contrary, students who do not comply with recommendations on PA presented significantly higher values in external regulation and amotivation. These findings are consistent with those from a recent study, in which it was showed that more active behaviours are negatively associated with amotivation.³⁹

On the other hand, students who do not satisfy the recommendations presented more barriers to PA. In this sense, a substantial body of research indicates that barriers are considered to be one of the main predictors of PA levels. More specifically, of the three types of barriers, time constraints accounted for the highest values in the university population. This may be due to the fact that entering into the university stage represents a larger number of academic tasks and responsibilities that might obstruct the reconciliation and organisation of leisure time.⁴⁰ These results are in keeping with the barriers to PA identified in other studies on the university population.²⁰

Finally, the third hypothesis indicates that the stages of change of action and maintenance will present higher values in the more self-determined forms of motivation and lower values in perceived barriers to PA. To the contrary, the stages of pre-contemplation, contemplation and preparation will present lower values in the more self-determined forms of motivation and higher scores in all barriers to PA.

The findings indicate that the hypothesis is partially satisfied due to the fact that the stage of change of action, maintenance and preparation present significantly higher values in the more autonomous motivational regulation types, as well as in introjected regulation, with respect to the other stages of change. Contrary to what could be expected, no significant differences are observed in external regulation between the different stages of change. Regarding to the stages of change of pre-contemplation and contemplation, it is observed that amotivation presents significantly higher values with respect to the stages of change of action and maintenance. Similarly, authors such as Daley and Duda⁴¹ indicated that university students in the first stages of change felt less motivated to engage in PA than those who were in the last stages of action and maintenance. These results are in line with the study by Salter *et al.*⁴² on the university population, who found that the maintenance stage was positively associated with integrated regulation and intrinsic regulation. In this sense, if a university student engages with certain regularity or frequency in PA, the motivational regulation may be a variable that explains this pattern of behaviour.

On the other hand, it can be observed in this study that the stages of change of action and maintenance present significantly lower values in the barriers referring to time and disliking of PA with respect to the other stages of change. Along this line, a recent study by Abarca-Sos *et al.*⁴³ indicates that the barriers to engagement decrease progressively throughout the stages of change, showing higher values in the stages of precontemplation and contemplation. Furthermore, different scientific evidence has shown that the barriers to PA prove to be a negative predictor of the stages of change.^{34, 44} Thus, as indicated by Marshall and Biddle⁴⁵ in a meta-analysis, the stages of change show a high association with the different levels of PA and with the perceived barriers to engagement. In this regard, the elimination of perceived barriers could bring university students closer to stages of change such as preparation or even action, predisposing them to engagement as they do not encounter so many barriers.

Hence, the psychological variables used in these two theoretic frameworks appear as complementary factors that may help explain the engagement in PA of university students. In this way, the identification of specific barriers in university students associated with higher

levels of MVPA, as well as the implementation of intervention programmes, focused on developing the more self-determined forms of motivation could favour compliance with the recommendations on PA for health and achieving a stage of change that is closer to action and to maintenance.

In terms of study limitations, it seems important to highlight that this is a cross-sectional study so its conclusions must be interpreted with caution. Therefore, this precludes determining causality between the variables. Likewise, the levels of MVPA were taken with the IPAQ instrument, so the findings could have been overestimated. However, the use of the IPAQ is justified in this study due to the number of individuals selected and due to the validity and reliability shown at national and international studies. Future studies should contemplate measuring the levels of MVPA with an accelerometer or using Global Positioning Systems (GPS) in order to improve the objectivity and precision in the measurements made. Likewise, it is advisable to include other study variables that exist in the SDT^{1,0} which could provide a broader vision of the university students' engagement in PA (*e.g.*, enjoyment, academic performance, intention of being physically active). As a result of this study, it also seems appropriate to develop intervention programmes in university students that have an impact on the more self-determined forms of motivation, especially integrated regulation, to overcome the barriers to PA, mainly those related to enjoyment. Specifically in university students with low levels of motivation and enjoyment, the social context is relevant to support autonomy (*e.g.*, providing different on-campus sports activities), competence (*e.g.*, adapting activities to each student's individual needs whilst being accessible for beginners) and relatedness (*e.g.*, proposing different activities and social tournaments on campus), according to SDT. Moreover, some students suggested the importance of being informed through various media tools, such as Facebook the different activities and events.⁴⁶

Conclusions

Noteworthy among the findings is the positive relationship between the more autonomous forms of regulation, especially integrated regulation, and the levels of MVPA. However, the barriers to engagement are negatively related to PA levels and the more self-determined

forms of motivation. Finally, students in the stages of action and maintenance, and students who comply with the recommendations on PA present higher values in the more self-determined forms of motivation and lower values in barriers to participation.

All of this shows patterns for the development of intervention programmes that will have an impact on the more volitive profiles of university students, being able to achieve a greater increase in MVPA levels. Thus, it is important to reduce the barriers to PA, especially those related to disliking of PA, given its relationship with the levels of MVPA and compliance with recommendations on engagement. The creation of environments to promote PA in university students is a fundamental aspect, in order to adopt and establish a series of healthy and more active habits that can continue until the adult stage.

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