Application of Stages of Change Model to Adolescents' Physical Activity in Relation to Psychological Variables

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Physical activity (PA) has been related to various health benefits in adolescents[1]. It is important to examine PA behaviour and its correlates, because adolescence is a critical period of life during which PA levels decrease[2].

Social cognitive models of health behaviour have driven most of the studies that have analyzed PA correlates [3]. The Transtheoretical Model (TTM)[4] is the only one who enables to the health promotion professionals to track an individual's progression through a series of stages towards maintenance of different health behaviours[5]. PA participation has been the focus of many studies published on TTM in adults, but there is a dearth of empirical literature examining TTM in adolescents[6].

The first two stages are motivational stages without actual performance of the behaviour: a) pre-contemplation: no intention of becoming physically active; b) contemplation: thinking about starting to become physically active within the next 6 months. The next two stages bring a crucial shift in behavioural manifestation: c) preparation: making small changes in behaviour but still not meeting a criterion for PA; d) action: meeting a criterion of PA, but only recently – usually within the past 6 months – (active group). Finally, the last stage represents the establishment of sustained behaviour: e) maintenance: meeting a criterion for PA for 6 months or longer[7]. Therefore, pre-contemplation, contemplation and preparation belong to passive group, whilst action and maintenance belongs to active group in PA behaviour.

Understanding the distribution of individuals across the stages of change enables stage-matched interventions to be developed for the entire population, not only for those ready to change. There is no consensus in reviewed literature about the distribution of adolescents in different stages of change (SoC)[6]. Silva, Smith-Menezes, Almeida-Gomes and Ferreira de Sousa[8] indicated that 65.8% of adolescents were in inactive stages: pre-contemplation 6.7%, contemplation 13,5% and preparation 45.6%. Only

34.2% were in active stages: action 13.5% and maintenance 23.5%. In other studies, authors found higher proportions in active stages[7,9,10]. In a study developed in Europe[7], adolescents in SoC active groups showed higher levels of PA differences. Concerning gender differences, the same authors[7] pointed that girls were more prevalent in passive groups.

TTM hypothesizes three factors to mediate the change process: individuals' self-efficacy for change, decisional balance and perceived advantages and disadvantages of change, as well as the strategies and techniques individuals use to modify their thoughts, feelings and behaviours[11]. Progression through the stages is assumed to be associated with these factors, but adolescent PA behaviour is influenced by different personal, social and environmental determinants[12]. Therefore, including other PA correlates, such as self-efficacy: perceived barriers, physical self-concept and gender, contributes to understanding the intention of change in PA behaviour.

Self-efficacy beliefs related with PA have been found to be associated with SoC, with pre-contemplators having the lowest self-efficacy levels and individuals in the maintenance stage presenting the highest level of self-efficacy[13]. Different studies in adolescents confirm a consistent positive link between self-efficacy and the stages[7,14], because people in different stages of change have different perceived self-efficacy, benefits and barriers to exercise[13].

Barriers in PA refer to the obstacles in undertaking, maintaining or increasing PA behaviour, and the fact that it is the individual's evaluation of the potential obstacles that hold him or her back from engaging in healthy behaviour[15]. Perceived barriers have been reported as the most consistent negative correlate of children's actual PA[1]. According to an ecological model[12], barriers to PA may be categorized by continuing to focus on both personal (i.e. intrapersonal barriers) as well as environmental/contextual

barriers (i.e. interpersonal, institutional community, public policy, and physical environment). More specifically, studies examining the TTM model in adolescents have shown that self-efficacy, and barriers were the strongest discriminators of exercise stage readiness[16].

Spence and Lee[12] have suggested that a combination of demographic, psychosocial and environmental variables would do better in explaining PA behaviour than any of these classes of predictors on their own. Therefore, we have included two variables in our study: gender at the personal level and physical self-concept at the psychosocial level. In contrast, we did not study variables at the environmental level. However Spence and Lee[12] emphasized that a change at an intra-individual level might include improving attitudes toward PA, thereby increasing the probability that PA behaviour might occur. Gender has been reported as the strongest correlate at the personal level[1,2,12]. Self-concept is a multi-dimensional and hierarchical model[17,18] that incorporates specific sub-domains of self-concept, including a dimension termed physical self-concept. This construct is a multidimensional mental representation of the physical appearance, including perceptive, cognitive, affective and emotional elements, formed through experience and interpretations of his or her environment related to the PA behaviour[18]. A multidimensional model of physical self-concept was developed by Marsh, et al.[17] and consists of nine components: strength, body fat, physical condition, endurance, perceived sports competence, coordination, health, appearance and flexibility.

Therefore, it is necessary to address the SoC model from a broader perspective to understand the psychosocial variables associated with each SoC group. The aims of this study were: (1) to identify the proportion of adolescents in each SoC group; (2) to assess the proportion of adolescents in active and passive SoC groups as a function of gender;

(3) to analyse differences in psychological factors across the SoC; (4) to create psychological cluster profiles to compare and analyse their relationships with SoC groups.

On the basis of the SoC model and previous research related to PA behaviour shown in the introduction section[6,7,19], it was hypothesized that: (a) The proportion of girls in action/maintenance stages would be less than boys; (b) Physical activity levels would increase across the stages of change; (c) Self-efficacy and physical self-concept were hypothesized to increase across the stages of change, and perceived barriers were hypothesized to decrease across the stages of change; (d) Cluster profiles created as a function of psychological variables would be similar to SoC groups.

Materials and methods

Participants

A representative sample of adolescent students (from public and private schools) between the ages of 12 and 18 from the region of Aragon (Spain) participated in this study. Aragon is located in the north-eastern part of Spain, and is the fourth largest region in Spain (~ 48,000 km2), with 1.2 million inhabitants. It is made up of three different provinces. The inclusion criterion was that the participans should all be secondary school students from the region of Aragon, who had lived in this area for at least 3 years. The exclusion criteria were serious disease, and incomplete and missing data. Out of a total of 1704, 86 subjects were excluded from the study after applying the exclusion criteria. 1618 adolescents participated in this study, with a mean age of 14.46 (1.28) years, 884 males with a mean age of 14.45 (1.27) years and 734 females with a mean age of 14.47 (1.30) years. The different strata were selected according to the geographical region, environment, type of school, age and gender.

Measurements

STAGES OF CHANGE

Stages of change[4]: based on the study by Kearney, De Graaf, Damkjaer and Engstrom[20], participants have to select one of the following 5 options regarding their intention to engage in sports or PA in the future. *"I'm not sufficiently sporting or being physically active, and I have no intention to start with it"* (pre-contemplation); *"I'm not sufficiently sporting or being physically active, but I intend to start witin the next 6 months"* (contemplation), *"I'm not sufficiently sporting or being physically active, but I intend to start with it in the next month"* (preparation), *"I'm currently doing enough, and I started in the past month"* (action) and *"I'm currently doing enough, and I have been for more than 6 months"* (maintenance). Each of the stages of change groups was given a score, used in other studies[20]. The scoring system was as follows: 1 = pre-contemplation; 2 = contemplation; 3 = preparation; 4 = action; 5 = maintenance. The construct validity of the SoC model for PA in adolescents was supported by De Bourdeaudhuij, et al.[6]. For some of the analysis, the mean of stages of change was calculated, as used in an earlier study[20].

PHYSICAL ACTIVITY

PA levels were assessed by means of a self-administered questionnaire adapted by Ledent, Cloes and Pieron[21] called "Assessment of Physical Activity Levels questionnaire" (APALQ) developed in Finland[22]. To ensure accuracy of the translation, double-checking (translation and back-translation) procedures were carried out according to Sperber, Devellis and Boehlecke[23]. The questionnaire contained 5 questions, with 4 specific options for each (4-point scale)[22]: (1) Outside school, do you

take part in organised sport?; (2) Outside school, do you take part in non-organised sport?; (3) In Physical Education classes, how many times a week do you take part in sport or physical activity for at least 20 minutes?; (4) Outside school, how many hours a week do you usually take part in physical activity to the extent where you get out of breath or sweat?; (5) Do you take part in competitive sport?. The answers were coded in a Likert scale from 1 to 4, 1 being the lowest value and 4 the highest. Responses were added up in order to calculate a PA Index (PAI), with low scores indicating low activity and high scores representing high level of PA. Cronbach's alpha for this scale was satisfactory, α = .91. In a pre-test study[24], the validity of the PAI questionnaire was tested with a sample of 97 adolescents, 60 males and 37 females, aged 13.63 ± 1.14 years-old. The Pearson correlation between MTI Actigraph accelerometer counts was assessed (r= .40, p< .001) with the PAI. The test-retest reliability of the PAI questionnaire was carried out within a one-week interval, across 150 adolescent subjects (r= .74; p< .001)[24].

SELF-EFFICACY

Self–efficacy was assessed through one question developed by Aznar[25] used in Spanish adolescents in different studies[26,27]. We developed a reliability pre-study that obtained a significant correlation (r= 896 p< .001). Participants were able to choose one of five options about self-efficacy in physical activity compared with their peers, answering the following question: "How do you consider your ability to perform physical activity and sports?" Comparison with other colleagues is key to assess own self–efficacy.

PHYSICAL SELF-CONCEPT

Physical self-concept was assessed via the Physical Self-Description Questionnaire (PSDQ)[17], validated with Spanish young people[28]. PSDQ is a multidimensional

instrument designed to measure physical self-concept across 11 scales: Strength, Body Fat, PA, Endurance/Fitness, Sports Competence, Coordination, Health, Appearance, Flexibility and Physical Self-concept. The scales were comprised of 6 items (e.g., "*I am good at most sports*"). The PSDQ has been demonstrated to have good reliability (alpha was .82-.96), and a well-defined replicable factor structure as shown by confirmatory factor analysis[17].

PERCEIVED BARRIERS TO PA

Participants completed the Scale of Barriers[29] developed to assess perception of barriers to their PA. This scale includes 17 items/barriers, and the young people had to choose a response on a 7-point scale (e.g. not at all a problem (0) to a serious problem (6). Adolescents, who responded with barriers greater than or equal to 1, were identified as having a barrier to PA. Participants, who responded with barriers equal to 0, were identified as not having a barrier to PA. The perceived barriers were divided into two categories: intrapersonal barriers (reflecting traits of the individual such as a negative attitude, etc.) and environmental/contextual barriers. The questionnaire has indicated suitable reliability and construct validity in the Spanish population[15].

Procedures

The University of Zaragoza (Spain) provided ethical approval for this research protocol. The headmasters of the different schools were contacted to inform them about the objectives and to request permission to conduct the study. Participation in the study was voluntary, and adolescents were asked for written authorization from their parents to take part in the study. All ethical data collection procedures were respected. The administration of the questionnaires was conducted following a standard protocol, distributed by the researchers, with the cooperation of the physical education teachers,

who gave the instructions required to fill them in and who stressed that the replies were anonymous and should be sincere.

Statistical analysis

Descriptive statistics, specifically frequencies, were used to calculate the distribution of adolescents across stages by sex and PAI. Differences in SoC, active and passive stages, and between boys and girls were examined with a chi-square test.

We carried out a Multivariate Analysis of Variance (MANOVA) to test the relationship between SoC groups and gender, and the dependent measures (e.g., physical self-concept) followed by Scheffe´s tests. Here, the five stage groups and gender served as the independent variables. Partial η^2 was calculated as the effect size.

An exploratory cluster analysis with K-means algorithm was conducted in order to examine if psychological profiles could be identified. We have created five profiles using physical self-efficacy, physical self-concept and intra and extra-barriers to PA. We used an ANOVA to test the relationships between the cluster profiles and the psychological variables (physical self-concept, self-efficacy, intrapersonal and extrapersonal barriers) and show descriptive statistics for each variable by cluster profiles, followed by Scheffe´s tests. Finally, a comparative analysis between stages of change groups and psychological profiles were developed with a chi-square test and Pearson correlation.

Results

The distribution of the participants across the stages of change is presented in Table 1. Analyses revealed gender [$\chi^2(1) = 110.17$, $p < .001$] and PAI [$\chi^2(8) = 955.978$,

$p < .001$] differences across the SoC when adolescents were grouped into active or passive categories: boys and very active adolescents were more prevalent in the action and maintenance groups.

Table I: Distribution (%) of adolescents into stages of change according to PAI by gender

A MANOVA was used to identify the differences in psychosocial variables by SoC and gender (Table 2). There was a significant main effect of SoC in multivariate analysis (Wilks's $\lambda = 0.807$, $F(4, 1618) = 62.65$ $p < .001$, $\eta^2 = .193$). There was also a significant main effect of gender (Wilks's $\lambda = 0.916$, $F(4, 1618) = 23.90$ $p < .001$,$\eta^2 = .084$). Finally, there was a significant interaction between gender and SoC (Wilks's $\lambda = 0.530$, $F(4, 1618) = 232.26$ $p < .001$,$\eta^2 = .470$). The effects of gender and SoC for each dependent variable were all statistically significant: self-efficacy ($F(1, 1618) = 324.34$ $p < .001$,$\eta^2 = ,236$), self-concept ($F(1, 1618) = 313.82$ $p < .001$,$\eta^2 = ,230$), intrapersonal barriers ($F(1, 1618) = 179.73$ $p < .001$,$\eta^2 = ,146$) and extrapersonal barriers ($F(1, 1618) = 189.42$ $p < .001$,$\eta^2 = .153$).

Scheffe´s tests in SoC indicated that scores in PAI, self-efficacy and physical self-concept increased significantly across the stages. Intrapersonal and extrapersonal barrier decreased significantly across SoC. Gender differences for each SoC group are shown in table number 2. Boys scored higher in PAI, physical self-efficacy and physical self-concept, whereas girls showed higher values in extrapersonal and intrapersonal barriers.

Table II: MANOVA and descriptive statistics for PAI, self-efficacy, physical self-concept and barriers by SoC and gender

Cluster analyses were performed in order to create five psychological profiles using physical self concept, self-efficacy, intrapersonal and extrapersonal barriers to compare with SoC groups. Table 3 shows an ANOVA and descriptive statistics of self-

efficacy, self-concept and intrapersonal and extrapersonal barriers by cluster profiles. We found significant differences between groups in each variable.

The five-cluster solution created for adolescents in relation to psychological variables have different features:

Cluster 1: The first cluster was characterized by the highest levels of intrapersonal and extrapersonal barriers. Furthermore, in this group, the adolescents' scores in self-efficacy and self-concept were the lowest.

Cluster 2: Adolescents in the second cluster obtained low scores in extrapersonal and intrapersonal barriers and high scores in self-efficacy and self-concept.

Cluster 3: Adolescents in the third cluster scored a slightly higher average for extrapersonal barriers than adolescents in cluster number 2. Nevertheless, the scores of intrapersonal barriers were lower, and those of self-efficacy and self-concept were higher than the scores of adolescents in cluster number 2.

Cluster 4: The fourth cluster contained adolescents who scored a higher average in self-efficacy and self-concept than the other groups, and lower averages in extrapersonal and intrapersonal barriers.

Cluster 5: Finally, in the last cluster group, number 5, adolescents obtained the highest scores in self-efficacy and self-concept and the lowest average scores in extrapersonal and intrapersonal barriers.

Relationships between SoC groups and cluster created profiles were examined with chi-square analysis. Results are shown in figure 1. A significant relationship between the created psychological profiles and the SoC groups was found [$\chi^2(1) = 162,76$, $p < .001$; Pearson $R = .359$ $p < .001$].

Table III: ANOVA and descriptive statistics for PAI, self-efficacy, physical self-concept and barriers by cluster analysis

Figure I: Distribution of adolescent population into psychological cluster profiles across SoC groups (%)

Discussion

This study has examined psychological variables and PA, and their relationships with SoC model by gender. It was hypothesized that: (a) the proportion of girls in action/maintenance stages would be less than boys, and as age increases, the proportion of adolescents in action/maintenance stages would decrease; (b) physical activity levels would increase across the stages of change; (c) self-efficacy and physical self-concept were hypothesized to increase across the stages of change and perceived barriers were hypothesized to decrease across the stages of change; (d) cluster profiles created as a function of psychological variables would be similar to SoC groups.

With respect to the first hypothesis, different studies[7,13] confirm our results regarding the variation of SoC as a function of age and gender. In the categories that include PA practice, action and maintenance, a higher percentage of male than female participants was found. Moreover, in passive categories, pre-contemplation, contemplation and preparation, percentages are higher for female adolescents. One possible explanation for this distribution is that the SoC model differentiated vigorous PA more than light and moderate PA[14]. Vigorous PA is associated with sporting participation that is closely linked to adolescent boys' PA participation. In the same line, Schumann, Nigg, Rossi, Jordan, Norman and Garber[30] pointed out that the only intensity of PA distinguished clearly by SoC was strenuous exercise, linked to sports

competition. In contrast, Haas and Nigg[31] added moderate PA as a differentiator between SoC groups.

The distribution of the adolescents into stages of change (2.6% in pre-contemplation, 7.2% in contemplation, 26,3% in preparation, 12.3 in action and 51,7% in maintenance) was similar to other studies[7,16]. Nevertheless, the distribution was slightly different in other studies on adolescents in the maintenance stage: less[10,32] or high[6]. One possible explanation is the difference in assessment methods of stages of change[6,13].

The second hypothesis, PA levels would increase across the stages of change, is supported because SoC are strongly associated with PAI. PA levels increase across SoC, with a large increase during the action and maintenance stages. In contrast, in our study, we found adolescents categorized in active groups using PAI but in a passive SoC group (Table 1). One possible explanation could be that PAI studied different dimensions of PA, whilst the SoC scale focuses on the intention to change in general PA. In this sense, Suminski and Petosa[5] found that 50% of adolescents categorized as sedentary and 16% as active were included in the wrong SoC group. Furthermore, in a study developed in the US, the questionnaire used to assess PA failed to differentiate PA levels across SoC[32].

The third hypothesis, self-efficacy and physical self-concept were hypothesized to increase across the SoC, and perceived barriers were hypothesized to decrease across the stages of change, is supported by the assessed evolution of psychological variables across SoC. Firstly, self-efficacy scores differentiated subjects at different stages, with a positive linear relationship between self-efficacy through stages of change. These findings were confirmed by the work conducted by Marcus and Simpkin[13], who found that pre-contemplators and contemplators had the lowest scores and those in

maintenance had the highest scores for self-efficacy. Furthermore, Nigg and Courneya[16] emphasized that self-efficacy increased across advancing SoC groups. On the other hand, other studies reported less consistent results, because self-efficacy did not discriminate between contemplation, action and maintenance[14,19]. These data regarding self-efficacy could be explained, according to Bandura´s theory[3], because adolescents in active SoC can be expected to feel confidence and more readiness for PA than individuals in passive SoC groups. This fact could be explained because the level of confidence to engage in a specific behaviour is significantly related to actual behaviour[9].

Parker, Martin, Martínez, Marsh and Jackson[33] suggested that different factors outside the TTM model may be relevant for progression across the SoC and increase participation in PA. The same authors pointed that one of these factors, physical self-concept, has been linked to higher levels of PA and has shown an increase across SoC, because self-concept has an effect on persistence and task choice. Our results are in the same vein, because scores in self-concept are likely to increase from pre-contemplation to maintenance SoC[13].

Nevertheless, unlike self-efficacy and self-concept, barriers for PA for adolescents in active SoC groups have scored lower than adolescents who did not adopt an active lifestyle. Barriers are a very important correlate to adolescents' PA because they impede individuals' efforts to be active[14]. In a study developed with different population in Europe[20], similar results were found, because barriers of adolescents and young adults to PA declines across SoC, obtaining lower scores in maintenance groups, except for work/study commitments, because it is similar for all SoC groups. Other studies also observed a decrease in score in barriers to PA[9,14,15]. Furthermore, Prochaska and

DiClemente[4] propose in their model that individuals progress across SoC in different cognitive process, like negatively perceived barriers[4].

Perceived barriers and physical self-efficacy are strongly related. Different authors emphasize this relationship. Kearney, et al.[20] pointed out that the maintenance of PA behaviour consists mainly of the benefits and barriers for taking up PA and dropping out. Moreover, interventions toward adolescents in passive SoC should be tailored, trying to increase self-efficacy, more specifically, in overcoming perceived barriers related to PA[7].

The analysis between gender and SoC showed that girls had higher scores in intrapersonal and extrapersonal barriers and lower scores in self-concept and self-efficacy in all SoC groups, regardless of whether they were included in an active or passive group. This fact means that health problems and life situations of adolescent females presented more hindrances for being active and with less influence than adolescent males[34]. All these variables are very important determinants of PA behaviour and adolescents, mainly females, must learn time management strategies in order to schedule PA, because this stage in time is when individuals begin to assert autonomy in their decision-making and make life decisions[29].

Finally, the fourth hypothesis, cluster profiles created as a function of psychological variables would be similar to SoC groups, was enunciated in order to establish new relationships between strong studied correlates of PA and SoC. It was supported because psychosocial profiles were significantly related to the SoC groups created by the scale. Adolescents from the study population were distributed into five psychological profiles in order to compare them with the five SoC groups. Several authors have recently paid attention to creating cluster groups related to different PA research focuses: PA levels or sedentary behaviour profiles[35], patterns of health

behaviours[36] or motivational profiles[37]. To our knowledge, no specific study has carried out a comparative analysis between SoC groups and psychologically created cluster profiles explicitly in youth population, so comparisons are difficult.

A correspondence between passive groups of SoC with high scores in intrapersonal and extrapersonal barriers and low scores in self-concept and self-efficacy was hypothesized, instead of between active groups. The five-cluster solution created for adolescents with respect to psychological variables presents the following correspondence with SoC groups: Cluster 1: pre-contemplation. Cluster 2: contemplation. Cluster 3: preparation. Cluster 4: action. Cluster 5: maintenance. One possible explanation regarding significant relationships between psychological cluster profiles and SoC groups could be that adolescents in clusters numbers 4 and 5 obtained higher average scores in self-efficacy and self-concept than the other previous groups, and lower averages in extrapersonal and intrapersonal barriers, so participants were mainly distributed into active groups, action and maintenance. Furthermore, we observed significant differences in the cluster profiles for all the psychological variables, only finding similarities in groups 2, 3 and 4 in analysis of variance and in the score at the last school in intrapersonal barriers for the intermediate clusters. These psychological variables could predict the distribution of adolescents into SoC groups, confirming broad approaches to understand PA behaviour in adolescents[12].

As limitations of the study, firstly, the data relied on self-reports of physical activity, and psychosocial variables have limitations; for example, adolescents' answers may misrepresent the reality. Secondly, due to the cross-sectional nature of the study, causal relationship cannot be inferred and the direction of relationship between variables must be interpreted cautiously. Thirdly, the SoC scale did not include information about frequency, duration or intensity of PA. Finally, in this study, only the

stages of change concept in relation to psychosocial variables was tested, not the TTM as a whole.

Conclusion

In this study we found that higher levels of PA and more favourable psychological determinants for an active lifestyle, higher self-efficacy and physical self-concept and lower intrapersonal and extrapersonal barriers, were found in active SoC groups, and mainly in adolescent boys. Furthermore, there was a significant interaction between gender and SoC, showing higher scores in active groups for physical self-concept and self-efficacy and lower scores in passive groups for intrapersonal and extrapersonal barriers. Psychological cluster profiles created with respect to self-efficacy, self-concept, intrapersonal barriers and extrapersonal barriers were related to SoC groups created by the scale.

SoC groups have been used in several exercise interventions[6], because there are three advantages to understand PA behaviour: a) develop interventions in each stages of change; b) allow PA and exercise professionals to guide adolescents who are least likely to engage in PA (passive stages); c) an individual's readiness to change can predict the likelihood of that person successfully adopting and maintaining the targeted exercise behaviour. Nevertheless, the SoC model is an organizational construct and it only has an explanatory power when it is combined with other variables or dimensions[38]. In addition, the same authors agree that not all four elements of the TTM are required for effective interventions, because in their systematic review they found that different studies were shown to be effective with one dimension. Our study pointed to the need to assess SoC groups and the TTM model in relation to other PA determinants in order to establish clear relationships for each group with different variables. The findings of the research suggest the importance of the study, showing strong determinants of PA in

relation to the intention to change behaviour, not only TTM variables. Finally, this study can be relevant for policymakers to develop and evaluate interventions in order to improve variables related to SoC, to increase PA in adolescents, and to start the process of change towards active SoC groups.

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Table 1: distribution (%) of adolescents in stages of change in function of PAI by gender

		Precontemplation	Contemplation	Preparation	Action	Maintenance
Sample (*n* = 1606)		2.6%	7.2%	26.3%	12.3	51.7
Males (*n* = 734)		1.1%	3.8%	19.6%	12.6%	62.9%
Females (*n* = 872)		4.2%	11.2%	34.3%	12%	38.3%
Sedentary	Male	19.4%	25%	50.0%	5.6%	0%
	Female	21.9%	37.7%	35.1%	3.5%	1.8%
Moderate active	Male	.9%	5.3%	39.6%	20.7%	33.4%
	Female	1.4%	8.9%	45.9%	15.7%	28.0%
Very active	Male	0 %	1.2%	3.9%	8.1 %	86.8%
	Female	0%	0%	6.5%	10.3%	83.2%

Table 2: MANOVA and descriptive statistics for PAI, self-efficacy, physical self-concept and barriers by SoC and gender

		1. PC	2. C	3. P	4. A	5. M	F-value	p-value	η^2	Order of effect
	Sample	8.78 (1.57)	10.44 (2.73)	11.99 (2.37)	14.26 (2.34)	16.55 (2.30)	415.77	.000	.524	1 < 2 < 3 < 4 < 5
PAI	Male	8.83 (.91) a	12.24 (.44)b	12.49 (.18)b	14.64 (.22)d	17.00 (.10)b	112.27	.000	.439	1 < 3 < 4 < 5; 2 < 4 < 5
	Female	8.82 (.41) a	9.76 (.25)b	11.64 (.15)b	13.83 (.24)d	15.77 (.14)b	131.31	.000	.528	1 < 3 < 4 < 5; 2 < 3 < 4 < 5
	Sample	2.59 (1.17)	2.64 (1.03)	2.82 (.82)	3.07 (.85)	3.55 (.86)	70.86	.000	.146	1 < 3 < 4 < 5
Self-efficacy	Male	3.16 (.35) a	2.80 (.17) a	2.77 (.07) a	3.12 (.08) a	3.63 (.03) b	26.33	.000	.160	2 < 5; 3 < 5; 4 <5
	Female	2.51 (.16) a	2.56 (.10) a	2.86 (.05) a	3.04 (.09) a	3.39 (.05) b	15.80	.000	.119	1 < 5; 2 < 5; 3 < 5
	Sample	52.90 (24.71)	51.68 (26.00)	61.66 (24.73)	69.32 (21.66)	78.41 (19.44)	64.84	.000	.142	1 < 3; 2 < 3 < 4 < 5
Physical self-concept	Male	69.66 (8.79) a	56.84 (4.30) d	66.71 (1.73) c	72.08 (2.14) c	82.73 (.96) b	23.87	.000	.147	2 < 5; 3 < 5; 4 <5
	Female	48.17 (4.00) a	50.61 (2.48) d	58.90 (1.44) c	64.29 (2.33) c	69.40 (1.34) b	11.17	.000	.087	1 < 5; 2 < 5; 3 < 5
	Sample	2.20 (1.35)	1.15 (1.15)	.85 (1.05)	.52 (.86)	.30 (.66)	80.12	.000	.158	1 < 2 < 3 < 4 < 5
Intrapersonal barriers	Male	1.96 (1.35) a	1.01 (1.14) a	.67 (.089) c	.51 (.88) a	.24 (.53) b	14.85	.000	.097	1 < 5; 2 < 5;
	Female	2.28 (1.37) a	1.21 (1.15) a	.97 (1.14) c	.53 (.84) a	.41 (.86) b	18.89	.000	.139	1 < 2; 1< 3; 1< 4; 1 < 2 < 3< 5;
	Sample	1.36 (1.08)	1.51 (1.05)	1.41 (.95)	1.26 (.93)	1.04 (.89)	14.38	.000	.036	2 < 3 < 5
Extrapersonal barriers	Male	1.22 (.38) a	1.37 (.18) a	1.41 (.07) a	1.15 (.09) a	1.02 (.04) d	5.86	.000	.041	3 < 5
	Female	1.49 (.17) a	1.57 (.10) a	1.44 (.06) a	1.35 (.10) a	1.14 (.05) d	2.70	.030	.023	n.s.

Note: Abbreviations PC=precontemplation; C=contemplation; P=preparation; A=action; M=maintenance. Detailed differences between genders for each SoC groups are given below:

a) No significant differences by gender in this SoC group.

b) Significant differences by gender in this SoC group: ($p < .001$).

c) Significant differences by gender in this SoC group: ($p < .01$).

d) Significant differences by gender in this SoC group: ($p < .05$).

Table 3: ANOVA and descriptive statistics for PAI, self-efficacy, physical self-concept and barriers by cluster analysis

	1 (n= 82)	2(n= 154)	3(n= 309)	4(n= 430)	5(n= 582)	F-value	p-value	η^2	Order of effect
Self-efficacy	2.20 (.96)	2.57 (.89)	2.89 (.80)	3.26 (.79)	3.66 (.86)	104.44	.000	.184	1<2<3<4<5
Physical self-concept	12.54 (7.06)	34.85 (6.30)	54.54 (5.38)	74.55 (5.38)	92.79 (4.86)	7257.15	.000	.942	1<2<3<4<5
Intrapersonal barriers	1.58 (1.34)	.97 (1.08)	.73 (.99)	.50 (.84)	.29(.68)	52.61	.000	.087	1 > 2 > 4 > 5; 2 >3 > 4> 5
Extrapersonal barriers	1. 68 (.93)	1.29 (1.01)	1.35 (.94)	1.26 (.97)	.99 (.85)	17.15	.000	.025	1 >2; 2 > 3; 2 > 4; 2 > 5; 4 > 5

Figure 1: Distribution of adolescent population in cluster psychological profiles across SoC groups (%)