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La régulation du comportement d'exercice et les raisons de l'activité physique : La validation italienne des questionnaires BREQ et MPAM-R

Regulation of exercise behaviour and motives for physical activities: The Italian validation of BREQ and MPAM-R questionnaires

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Résumé

Sur la base de la théorie de l'auto-détermination, le but de cette étude est de proposer la validation de deux instruments différents pour l'évaluation du comportement d'exercice : le BREQ de Mullan et a. (1997), qui mesure les formes externe, introjectée, identifiée, et intrinsèque de la régulation, et le MPAM-R de Ryan et al. (1997), qui évalue cinq raisons distingués de l'activité physique (apparence, santé et forme physique, sociale, compétence, et amusement). L'analyse factorielle confirmatoire, conduite auprès de 1995 étudiants inscrits à trois lycées différents, a soutenu empiriquement la structure à quatre facteurs de la régulation du comportement ainsi que la structure à cinq facteurs des raisons de l'activité physique. De plus, l'analyse confirmatoire multi-groupe a montré l'invariance des structures factorielles, des paramètres structuraux, et des corrélations des deux échelles en relation au genre sexuel. La validité critériée des échelles a aussi reçu un soutien empirique partiel. Enfin, la structure factorielle de la régulation du comportement et des raisons de l'activité physique a été soutenue empiriquement lorsque les deux construits ont été inclus dans le même modèle de mesure.

Mots clés: régulation comportementale; raisons de l'activité physique; comportement d'exercice; validation; invariance.

Abstract

Based on self-determination theory, the purpose of the present study was to provide the first Italian validation of two different instrument to assess the exercise behaviour: the Mullan et al.'s (1997) BREQ, which measures external, introjected, identified and intrinsic forms of regulation and Ryan et al.'s (1997) MPAM-R, which assesses five distinct motives for physical activity (appearance, health and fitness, social, competence, and enjoyment). Confirmatory factor analysis conducted on data collected from 1995 students attending three different Secondary Schools empirically supported respectively the four-factor structure of behavioural regulation and the five-factor structure of motives for physical activity, supporting convergent and discriminant validity of both scales. Furthermore, multi-group confirmatory factor analysis showed the invariance of the factor structures, structural parameters and correlations of the two scales across gender. Criterion-related validity of the scales also received partial empirical support. Finally, the factor structure of behavioural regulation and motives for physical activity was empirically supported when both constructs were included in a single measurement model.

Keywords: behavioural regulation; motives for physical activities; exercise behaviour; validation; invariance.

1. Introduction

The investigation of motivation for exercise and physical activity has gained progressive attention of scholars over the last three decades, and several instruments for assessing motivational constructs have been developed, based on the self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2000, 2002). According to this theoretical perspective: a) individual's motivation to engage and persist in an activity can vary in the degree to which it is controlled rather than self-determined, and b) the occurrence of the most autonomous, or self-determined, forms of motivation essentially depends on the satisfaction of three innate psychological needs: competence, autonomy and relatedness. Specifically, if people engage in an activity because it is interesting, enjoyable and pleasing, then they will be expected to be intrinsically motivated, whereas if they get involved in an activity in order to get tangible rewards or to avoid personal punishments they will be more likely to be extrinsically motivated. However, consistent with a self-determination approach, extrinsic motives vary across a continuum according to their degree of internalization and integration with the self, moving from external to introjected, identified and integrated regulation.

In physical exercise domains, numerous empirical surveys, building on self-determination theory (SDT), have examined the influence of different forms of regulatory motivational styles on several behavioural outcomes, such as attendance, persistence, or maintained participation in exercise or physical activity, showing positive and significant associations between autonomous forms of motivation (i.e., identified regulation) and such outcomes e.g., Chatzisarantis, Hagger, Biddle, & Karageorghis, 2002; Vallerand, 1997; Edmunds, Ntoumanis, & Duda, 2006; Brickell & Chatzisarantis, 2007; Lutz, Karoly, & Okun, 2008; Landry & Solomon, 2004). In order to test the hypothesized influence of motivational

antecedents on exercise behaviours, several motivation-related constructs have been considered, with some researchers being more focused on analysing the regulation of exercise behaviour and other scholars being more focused on investigating motives underlying individual's participation in exercise and physical activity. As Caspersen, Powell & Christenson (1985) stated, physical activity, and exercise are terms often used interchangeably. Nevertheless, while physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure, exercise is a subset of physical activity that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness.

The present work provides the Italian validation of two different measures of motivational constructs, respectively Mullan et al.'s (1997) BREQ (Behavioural Regulation in Exercise Questionnaire) and Ryan et al.'s (1997) MPAM-R (Motives for Physical Activity Measure-Revised). To the extent that out study will support the validity and reliability of the two questionnaires, these may represent valuable instruments that practitioners in the field of sport psychology can use, as long as their mother tongue is Italian. Additionally, the validation of the BREQ and the MPAM-R questionnaires will allow scholars and practitioners evaluating how core motivational processes may stimulate individual engagement in physical exercise.

Both instruments share some common premises: a) were initially developed on the basis of the SDT; b) assessed both extrinsic and intrinsic motives for exercise; c) included exercise as the focal reference point for item content and d) were used primarily as an index for exercise motivation rather than motivation for sport or rehabilitation (Wilson, 2012). Therefore, a description on the two constructs is needed in order to clarify core theoretical differences between them.

1.2 Behavioural regulation and exercise

Originally, self-determination theory provided a dichotomous approach to motivation, assuming that only two unidimensional constructs of motivation could be distinguished: extrinsic motivation, which occurs when behaviour is oriented towards instrumental outcomes (such as receiving a reward or avoiding a punishment); and intrinsic motivation, which occurs when people tend to engage in an activity because of the interest, enjoyment and pleasure derived from the activity itself. However, later developments of self-determination theory (Deci & Ryan, 2000; 2002) have suggested an alternative theoretical conceptualization of motivation that goes beyond the dichotomous difference between intrinsic and extrinsic motivation and that distinguishes different forms of motivation. In particular, extrinsic motivation has been conceived as varying in the degree of internalization and integration with the self of a required behaviour, in such a way that four kinds of motivation can be identified, along a continuum from highly controlling to highly autonomous: external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic motivation.

External regulation: this is the least autonomous form of motivation, which leads people to engage in an activity in order for them to receive a reward or to avoid a punishment. The contextual antecedents that regulate this kind of motivation are defined as controlled.

Introjected regulation: this is a partially internalized form of motivation, in which contingent rewards and punishments are self-imposed, such as, to support self-worth or to avoid negative emotions: in this way that regulation is within the individual, although it is still external.

Identified regulation: this is a more autonomous form of extrinsic motivation, in which people recognize and identify with core values of an action/behaviour, which are considered a

part of one's identity. However, since people do not engage in an activity for the pleasure and satisfaction derived from it, the motivation-related outcomes are still extrinsically driven.

Integrated regulation: this is the most autonomous form of extrinsic motivation, in which people completely accept the importance of behaviour, by fully integrating its values within some aspects of their own identity.

Intrinsic regulation: this is the most self-determined motivational type, in which people perform an activity for the pleasure and satisfaction derived from participation.

Building on this theoretical construct, Mullan et al. (2007) tested the continuum of behavioural regulation in the exercise domain, by identifying four distinct motivational dimensions, precisely: three kinds of extrinsic motivation, which include external regulation, introjected regulation, and identified regulation; and intrinsic motivation. Note, however, that the integrated regulation component was not included by the authors within the forms of extrinsic external motivation, because it is difficult to distinguish between integrated and identified regulation (Brunet, Burke, & Sabiston, 2013). The authors conducted two studies to validate their Behavioural Regulation in Exercise Questionnaire (BREQ): results provided empirical support to both factorial validity and internal consistency of the scale. Additionally, several authors have examined and demonstrated the critical role that behavioural regulation exerts in affecting exercise-related outcomes, such as participation in outdoor activities (Wang, Ang, Teo-Koh, & Kahlid, 2004) and exercise (Edmunds, Ntoumanis, & Duda, 2006; Brickell & Chatzisarantis, 2007; Markland, 2009), intention to exercise (Chatzisarantis, Hagger, Smith, & Sage, 2006; Lim & Wang, 2009), intensity of exercise (Standage, Sebire & Loney, 2008) and physical wellbeing (Thøgersen-Ntoumani & Ntoumanis, 2006). Consistent with self-determination theory and research, we propose that people who find it enjoyable or personally

important to engage in physical exercise would be more likely to participate in physical activities than those whose level of regulation is associated with being controlled by internal or external rewards. This is because, compared to those who involve in exercise out of feelings of guilt or other extrinsic reasons, autonomously regulated individuals would experience less motivational setbacks, higher feelings of personal accomplishment, more positive emotions and stronger persistence, all of which are essential to effective engagement in exercise behaviours (Thøgersen-Ntoumani & Ntoumanis, 2006; Vallerand & Losier, 1999).The first aim of the present work, which represents the first attempt to validate the Italian version of Mullan et al.'s (1997) BREQ (Behavioural Regulation in Exercise Questionnaire), is thus to empirically support both the four-dimensional structure of behavioural regulation and its predictive power in explaining participation in physical activity. Therefore, we hypothesize the following:

H1: Behavioural regulation is a multi-dimensional construct, composed of four distinct dimensions.

H2: The factor structure of behavioural regulation is invariant across gender.

H3: Participation in exercise will be positively related to introjected regulation, identified regulation and intrinsic motivation, but will be unrelated to external regulation.

1.3 Motives for physical activity

Motives for exercise have been conceptualized as motivational foci of physical activities and it has been argued that different types of motives can vary in the degree to which they are intrinsically- or extrinsically-oriented, similarly to behavioural regulation (Markland & Ingledew, 2007). Thus, intrinsic motivation and autonomous forms of extrinsic motivation are likely to be characterized by motives of enjoyment, competence/challenge and social affiliation, whereas controlled motivation is expected to prevail when body-related motives, such as health

and fitness and appearance, occur. However, unlike behavioural regulation, motives for physical activity deal with goal contents, as defined by the self-determination theory, that is to say, *what* exercise-related goals people want to pursue. More specifically, goal contents have been distinguished on the extent to which they represent intrinsic or extrinsic aspirations, consistent with self-determination theoretical framework (Ryan, Sheldon, Kasser, & Deci, 1996; Deci & Ryan, 2000). Conversely, behavioural regulation is more concerned with the *why* of goal pursuit, that is to say, with the autonomous and controlled reasons that direct individuals' efforts to pursue a given goal.

The first systematic analysis of motives for physical activities was carried out by Frederick and Ryan (1993), who identified three core motives: a *body-related factor*, a *competence factor* and an *intrinsic factor* (enjoyment). The authors also investigated differences in adherence between sport participants and participants expected to be engaged in fitness- or exercise-oriented activities; additionally, it was revealed that the former were much more triggered by intrinsically-oriented motives (enjoyment and competence) than the latter, whose foci of physical activity was essentially related to body-related motives. Constructs of motives have been further investigated by Ryan et al. (1997, study 2), who developed and validated a revised measure of motives for physical activities. The authors specifically considered five different motives, including two extrinsically- or controlled-oriented motives (*appearance* and *health and fitness*) and three intrinsically- or autonomously-oriented motives (*social interaction*, *competence/challenge* and *enjoyment*). Additionally, the influence of each motive on subsequent physical activity was examined, and results showed that exercise adherence was positively associated with social interaction, competence and enjoyment motives, whereas it was not

significantly predicted by appearance and fitness motives (Ryan et al. 1997; Sit et al. 2008; Moreno et al. 2008).

Other scholars have investigated the influence of motives on exercise-related outcomes, such as well-being (Maltby & Day, 2004), exercise behaviour (Markland, 1999; Markland et al., 1992; Markland & Hardy, 1993; Frederick-Recascino, 2002; Markland & Ingledew, 1997, 2007; Ingledew & Markland, 2008), and persistence in sport (Pelletier & Sarrazin, 2007; Sarrazin, Boiche, & Pelletier, 2007). Generally, the literature has provided empirical evidences on the positive impact of intrinsic motives on such behavioural and psychological outcomes, whereas extrinsic motives have been shown to be negatively, and sometimes non-significantly, related to physical activity. In line with this stream of research, we therefore suggest that autonomy-oriented motives would be associated with higher participation in physical exercise than controlling motives. In fact, autonomous motives are more likely to satisfy the basic needs for autonomy, competence and relatedness, which are usually associated with more favourable attitudes towards exercise behaviour, as well as with feelings of freedom from pressure (Ingledew & Markland, 2008; Hagger, Chatzisarantis, & Biddle, 2002). In contrast, controlling motives are unlikely to satisfy these needs, and, consequently, may lead to tension, pressure to perform and feelings of obligation, which usually lessen personal engagement in physical activity (Deci & Ryan, 1985; Markland, & Ingledew, 1997).The second aim of this study, which represents the first attempt to validate the Italian version of Ryan et al.'s (1997) MPAM-R (Motives for Physical Activity Measure-Revised), is thus to empirically support both the five-dimensional structure of behavioural regulation and its predictive power in explaining participation in physical activity. Therefore, we hypothesize the following:

H4: Motives for physical activities is a multi-dimensional construct, composed of five distinct dimensions.

H5: The factor structure of motives for physical exercise is invariant across gender.

H6: Participation in physical activity will be positively related to social, competence and enjoyment motives, but will be unrelated to appearance and health and fitness motives.

Finally, we will assess whether it is possible to support the factor structure of the behavioural regulation and motives for physical activities by integrating them in a single measurement model. Indeed, to the extent that the factor structure of both behavioural regulation and motives for physical activities can be reproduced in a single model, it would be possible for both researchers and practitioners to assess the two constructs simultaneously.

H7: The factor structure of behavioural regulation and motives for physical activity will be empirically supported when the two constructs are included in a single measurement model.

2. Method

2.1 Participants and procedure

Data was collected from 1995 students (997 males, 998 females) aged between 13 and 19 (M = 15.6, SD = 1.60) from three different Secondary Schools. The survey was part of a broader project of a Region of Northern Italy, aimed at promoting physical and sport activities among adolescents. Informed consent to conduct the investigation was given by parents. Each participant volunteered to complete a questionnaire. The students were requested to respond anonymously to a multi-section inventory. After explaining the purpose of the survey, the core researcher distributed the questionnaire, which took 20 minutes to complete.

2.2 Measures

Demographic characteristics. Participants were asked to indicate the following background information: age, gender, type of school, school year, sport experience over the last year, and presence of sport facilities in the area where they lived.

Behavioural regulation. We assessed behavioural regulation using Mullan et al.'s (1997) BREQ (Behavioural Regulation in Exercise Questionnaire), which measures four distinct regulatory styles: external regulation, introjected regulation, identified regulation and intrinsic motivation. The stem preceding the items is "Why do you engage in exercise?". Responses were recorded on a five point Likert-type scale ranging from 1 (not at all true for me) to 5 (completely true for me). Sample items included: "I exercise because other people say I should" (external regulation), "I feel ashamed when I miss an exercise session" (introjected regulation), "it's important to me to exercise regularly" (identified regulation), "I enjoy my exercise sessions" (intrinsic motivation). The original scale was translated in Italian by two expert researchers in sport psychology and then back-translated into English by a native English speaker, who spoke excellent Italian and who was an expert in social sciences. The original scale exhibited good psychometric properties, as results from Confirmatory Factor Analysis (χ^2 [84] = 239.28, GFI = .90, NNFI = .91, RMSEA = .07) showed that all the items loaded significantly on their respective latent constructs, all factor loadings were higher than .50 (ranging between .56 and .88), and reliability coefficients of the four subscales were higher than .70 (ranging between .76 and .90).

Motives for physical activity. We assessed motives for physical activities through Ryan et al.'s (1997) MPAM-R (Motives for Physical Activity Measure-Revised), which measures five distinct motives: appearance, health and fitness, social, competence and enjoyment. It is a 30-item instrument that uses a 5 point Likert response format, anchored at the extremes with 1 (not at all true for me) and 7 (very, true for me). The stem is "Why do you exercise?": sample items

included: “to be attractive to others” (appearance), “to have more energy” (health and fitness), “to be with others in activity” (social), “to obtain new skills” (competence), “because it’s fun” (enjoyment). This scale was also translated in Italian and then back-translated into English by the same native English speaker. The original MPAM-R scale yielded good psychometric properties, in that results from Exploratory Factor Analysis showed that all the items loaded significantly on the five hypothesized latent constructs, factors loadings were higher than .50 (ranging between .52 and .87), and reliability coefficients of the four subscales were higher than .70 (ranging between .78 and .88). Additionally, Ryan et al. (1997) found that adherence to sport activity was positively associated with fitness, enjoyment, competence, and social motives, but not with appearance motives.

Participation in physical activity. Participation in physical exercise was assessed with two items that were used to ask students to indicate the frequency with which they participated in moderate- to high-intensity physical exercises during the previous week. Responses were rated on a scale ranging from 1 (never) to 5 (often, 5-7 days a week). Students were requested to answer these questions only if they had previously declared that they regularly performed physical activity. The total score of this scale was computed by averaging the scores of the two items. The two items were: “How often, in the last seven days, have you practiced moderate-intensity sport activities (e.g., playing volleyball with friends, doing thirty abdominals, hiking, or similar activities)”, and “How often, in the last seven days, have you practiced high-intensity sport activities (e.g., swimming, cycling, aerobic gymnastics, spinning, football, participating in a competition or a championship game, or similar activities)”.

3. Results

The psychometric properties of BREQ and MPAM-R questionnaires were investigated by evaluating their construct validity and reliability. We first assessed construct validity (convergent validity, discriminant validity and criterion-related validity) of both scales by conducting two separate confirmatory factor analyses with Mplus, version 6.1 (Muthén & Muthén, 1998-2010) in order to compare alternative models (Hypothesis 1 and 4). Subsequently, we assessed the factorial invariance of the scales across gender (Hypothesis 2 and 5). Finally, criterion-related validity for each construct (Hypothesis 3 and 6) were estimated using SPSS, version 15.0.

3.1 Hypothesis testing for behavioural regulation

With respect to behavioural regulation, we tested Hypothesis 1 by comparing the theoretically derived model involving four distinct factors with three alternative models, which involved, respectively, one, two and three dimensions. We started with Model 1, with all items loading on a single factor. Then, a two-factor model was estimated with items of external and introjected regulation loading on the first factor and items of identified regulation and intrinsic motivation loading on the second factor. Thirdly, a three-factor model was run, with items of external and introjected regulation loading on their respective theoretically derived factors and items of identified regulation and intrinsic motivation loading on one single factor. Finally, the hypothesized four-factor model, consistent with the self-determination approach (Deci & Ryan, 2000), was tested. To test the fit of compared models, we considered model chi-square (the higher the values the worse the model's correspondence to the data) and the following fit indexes: the standardized root mean square residual (SRMR), for which values of less than .10 (Schreiber, Stage, King, Nora, & Barlow, 2006) are favourable; the root-mean-square error of approximation (RMSEA), which should be less than .08 (Browne & Cudeck, 1993); the comparative fit index (CFI), for which values of .90 or greater are recommended (Hu & Bentler,

1999). As expected, the four-factor model had a significantly better fit ($p < .05$) than models 1-3 (see Table I). Additionally, the fit indexes revealed a very good fit: the CFI was .96, RMSEA was .06 and SRMR was .04.

Insert Table I near here

CFA results also indicated that the four factors of behavioural regulation were effectively distinct from each other, since correlations among latent constructs were all less than .85, thus revealing good discriminant validity (Kline, 2005). Furthermore, standardized regression coefficients of items on each factor were all higher than .50 (Hair et al., 2007), thus supporting convergent validity of the factors. However, a modification was made for item "I get restless if I don't exercise regularly", which was associated with identified regulation in the original scale: in the present study, when this item was associated with introjected regulation, the factor loading (.83) was significantly higher than when it was associated with identified regulation (.72). Additionally, when the item was included in the identified regulation subscale, the fit indexes in were significantly lower ($\Delta \chi^2$, Δdf = 426.588, 0, $p < .05$, CFI = .93, RMSEA = .08, SRMR = .05). Therefore, such item was dropped out from the identified regulation subscale and included in the introjected regulation subscale. Table II shows all factor loadings of the scale.

Insert Table II near here

Additionally, we performed a multi-group CFA to check the factorial invariance of the scale across gender (Hypothesis 2). This implied conducting a hierarchical procedure (Mullan et al., 1997). More precisely, the complete model was first examined for males and females separately to establish the adequacy of the baseline model. At the next level of testing the equivalence of the factor loadings across groups was tested. At the third level, equivalence of factor loadings and factor variances and covariances was examined. Finally, equivalence of

factor loadings, factor variances and covariances, and measurement errors was tested. A notable decrease in fit following an increase in equality constraints is evidence of inequality of model parameters across groups. Tests of invariance at each level were evaluated with the parsimony normed fit index (PNFI, James, Mulaik & Brett, 1982; this was calculated by hand) in addition to the fit statistics used previously. A more constrained model should show higher PNFI values, that is, be more parsimonious than one which is less constrained. Therefore, as additional invariance constraints are imposed, PNFI values should increase if factorial invariance is to be demonstrated (Byrne, Shavelson, & Muthén, 1989). In sum, a model with more constraints should not show a notable decrease in goodness-of-fit indices and should have higher PNFI values than its less constrained counterparts.

The models for the two groups indicated good fit with the data: for the female group, χ^2 (998), = 356.163, *df* = 84, CFI = .96, RMSEA = .06, SRMR = .04; for the male group, χ^2 (997), = 415.116, *df* = 84, CFI = .96, RMSEA = .06, SRMR = .04. Subsequent tests of invariance for the CFA models across genders are shown in Table III. As can be seen, the baseline model exhibited adequate fit to the data, which yields support to the invariance of the factor pattern across gender. The introduction of invariance constraints revealed a marginal decrease in the incremental fit indexes (i.e., CFI) and a progressive increase in the PNFI across all the restricted models. This hence provides support for the equivalence of the structural parameters in each model.

Insert Table III near here

Though CFA results revealed the distinctiveness of each factor, the four elements of behavioural regulation were all positively and significantly correlated. Yet, adjacent subscales were more highly correlated than those at the opposite extremities of the continuum, which is in line with Mullan et al.'s (1997) findings. It is also worth remarking the significant positive

relationship between extrinsic motivation and intrinsic motivation. While a negative association could be expected between the two forms of motivation (Deci & Ryan, 1991), our finding is consistent with the concept of extrinsic motivation outlined by Ryan and Deci (2000), who suggested that extrinsic motivation may be internalized to some degree, approximating intrinsic motivation to the extent that it is perceived as enhancing self-determination and intrinsic task interest. Supporting this tenet, and in accordance with our findings, some studies have provided empirical evidence for a positive relationship between extrinsic motivation and intrinsic motivation (i.e., Hoekman, McCormick, & Barnett, 2009; Tikare, 2013). Finally, internal consistency was assessed by the calculation of reliability coefficients (Cronbach's alpha), which were all higher than .70. Table IV shows descriptive statistics and correlations among the study variables.

Insert Table IV near here

Finally, in order to test criterion-related validity of the measure (Hypothesis 3) we assessed the relationship between the four elements of behavioural regulation and participation in physical activity through multiple linear regressions. Hypothesis 3 was supported, since regression analysis provided empirical support to the hypothesized patterns of relationships between three of four forms of motivational regulations and participation in physical exercise: introjected regulation ($\beta = .14$, SE = .02, $p < .001$), identified regulation ($\beta = .15$, SE = .02, $p < .001$) and intrinsic motivation ($\beta = .23$, SE = .02, $p < .001$). Conversely, no significant relationship was found between external regulation and participation in physical activity. The results of these analyses are shown in Table V.

Insert Table V near here

3.2 Hypothesis testing for motives for physical activity

With respect to motives for physical activities, we tested Hypothesis 4 by comparing the expected five-factor model with four alternative models. We first ran Model 1, with all items loading on a single factor. Secondly, a two-factor model was assessed with items of motives for appearance and health and fitness' loading on the first factor and items of motives for social, competence and enjoyment loading on the second factor. Thirdly, a three-factor model was estimated, with items of appearance and health and fitness loading on the first factor, items of competence and enjoyment loading on the second factor, and items of social loading on the theoretically expected factor. Then, we ran a model including four separate factors, with items of social, competence and enjoyment loading on the expected factors and items of health and fitness and appearance loading on one single factor. Finally, the hypothesized five-factor model, involving five distinct motives for physical activity, was tested. To test the fit of compared models, we considered the same indexes as for behavioural regulation models: the standardized root mean square residual (SRMR), the root-mean-square error of approximation (RMSEA), and the comparative fit index (CFI). As hypothesized, the five-factor model had a significantly better fit ($p. < .05$) than models 1-4 (see Table VI). Fit indexes of the expected model showed an acceptable fit: the CFI was .89, RMSEA was .07 and SRMR was .05.

Insert Table VI near here

CFA results also provided evidence that motives for physical activities were five distinct factors, as indicated by correlations among latent constructs, which were all lower than .85 (good discriminant validity). Furthermore, standardized regression coefficients of items on each factor were higher than .50 (except one item of the appearance motives subscale, whose factor loading was .49), thus supporting convergent validity of the factors. Table VII shows all factor loadings of the scale.

Insert Table VII near here

Subsequently, we assessed the factorial invariance across gender (Hypothesis 5) by conducting the same procedure as for behavioural regulation. First, the models for the two groups provided an acceptable fit: χ^2 (998), = 2548.10, *df* = 395, CFI = .89, RMSEA = .07, SRMR = .06; for the male group. Moreover, as can be from Table VIII, the baseline model was a good fit to the data, which was slightly higher than that of more restricted models. These latter, in turn, yielded a progressive increase in PNFI, which supports the equivalence of the structural parameters across gender.

Insert Table VIII near here

Also in this case, motives for physical activity were all significantly and positively correlated with each other. Furthermore, reliability coefficients (Cronbach's alpha) of each construct were higher than .70, thus indicating good internal consistency of the scales (see Table IV). Additionally, criterion-related validity of the five constructs (Hypothesis 6) was tested through multiple linear regressions on motives and participation in physical activity, after controlling for effects of age and gender. Results partially confirmed Hypothesis 6, since participation in physical exercise was strongly positively predicted by motives for social (β = .07, SE = .02, $p < .05$), competence (β = .24, SE = .03, $p < .001$) and enjoyment (β = .19, SE = .03, $p < .001$), and less strongly positively predicted by motives for appearance (β = .06, SE = .02, $p < .05$), but it was not significantly predicted by motives for health and fitness. The results of multiple regression analyses are shown in Table IX.

Finally, we replicated confirmatory factor analyses on behavioural regulation and motives for physical activity through a single measurement model. This allowed testing Hypothesis 7, which predicted that the factor structure of the two constructs would be

empirically supported by a single measurement model encompassing both of them. Consistent with our prediction, the model yielded a good fit to the data (χ^2 (1995), = 6202.63, *df* = 909, CFI = .90, RMSEA = .05, SRMR = .05) and outperformed any simpler representation to the data ($p < .01$, see Table X). Additionally, all the items loaded on the expected factors. Accordingly, Hypothesis 7 was empirically supported.

Insert Table IX near here

Insert Table X near here

4. Discussion

International psychological research on exercise and physical activity has provided valuable results on the crucial role played by motivation in fostering exercise-related outcomes, and the assessment of psychometric properties of scales and instruments used to measure motivational processes has been progressively required in Italian context. Therefore, the core goal of this study was to offer an initial contribution to the Italian validation of two questionnaires, which measure respectively behavioural regulations in physical exercise and motives for physical activity: Mullan et al.'s (1997) BREQ (Behavioural Regulation in Exercise Questionnaire) and Ryan et al.'s (1997) MPAM-R (Motives for Physical Activity Measure-Revised).

With respect to BREQ, results of our research empirically supported the four-factor structure of behavioural regulation construct, which was found to be composed of four distinct, though interrelated factors, consistent with the self-determination theory (Deci & Ryan, 2000): external regulation, introjected regulation, identified regulation, and intrinsic motivation.

Furthermore, we provided empirical evidence for the equivalence of factor structure of behavioural regulation across gender. Finally, the criterion-validity of the scale was empirically supported, with three of four factors positively and significantly predicting participation in physical exercise: introjected regulation, identified regulation, and intrinsic motivation. In accordance with our findings, several studies in psychological literature on exercise have reported non-significant relationships between external regulation and physical activity (e.g., Markland, 2009; Edmunds, Ntoumanis, & Duda, 2006).

With respect to MPAM-R, the five-factor model of motives for physical activity received empirical support, and five distinct and interrelated motives were effectively identified: appearance, health and fitness, social, competence, and enjoyment. Additionally, the test of invariance of the scale across gender was empirically supported. Moreover, as hypothesized, all self-determined motives positively and significantly predicted participation in physical exercise, while one of the two controlling motives – i.e. health and fitness motives – was unrelated to exercise participation. However, contrary to our expectations, appearance motives were positively related to participation in physical activity. Yet, this result can be explained by taking into account the motivational basis for a desired outcome in physical activity (Vansteenkiste, Soenens, & Lens, 2007). Indeed, as Vansteenkiste and colleagues (2007) have suggested, some individuals may pursue physical attractiveness for either extrinsic (i.e. because they want to conform to society's appearance ideals) or self-determined reasons (i.e. because they personally value being attractive). Importantly, research has shown that when the contents of goals (i.e. motives) are framed as autonomous, they lead to higher persistence in physical exercise (Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). Accordingly, for our study participants appearance motives, unlike health and fitness motives, might have represented an autonomous

outcome. As a result, the autonomous framing of appearance-related goals may have caused the positive association between appearance motives and participation in physical exercise.

Finally, our study provided empirical support for the factor structure of behavioural regulation and motives for physical activity when both constructs were included in a single measurement model. This finding is important from both a research and practical standpoint, as it highlights the usefulness of including the two instruments when implementing a specific research design on motivation for sport and physical activity, as well as when assessing distinct regulatory processes and exercise motives in applied contexts. Importantly, as research has suggested that motives for physical activity are conductive to behavioral regulation – and not vice versa (e.g., Ingledew & Markland, 2008; Markland & Ingledew, 2007) – it would be recommended to administer MPAM-R questionnaire prior to the BREQ, either in longitudinal research designs or during health promotion interventions. From a research standpoint, this strategy would help providing stronger evidence for the causal impact of motives on behavioral regulation, whereas from a practical standpoint it would allow examining how interventions aimed at inducting autonomous motives may help developing self-determined forms of motivation among individuals and, consequently, promote higher involvement in physical activity.

Our study has also several limitations. Firstly, although our sample was large enough to test the hypothesized research models, it was composed of students from 13 to 19 years old. Therefore, this study might be replicated with a different age sample, in order to strengthen the invariance of the measure. Secondly, though the influence of both motives and behavioural regulation on participation to physical activity was empirically supported for most of the motivational constructs, a causal effect could not be empirically supported because our research was cross-sectional. Therefore, future longitudinal studies aimed at testing the direct influence of

motives for physical activity and regulatory motivational styles on exercise-related outcomes in the Italian context are recommended, in order to increase the criterion-related validity of the scales. Thirdly, the predictive power of both motives and behavioural regulation was only tested on exercise-related outcomes, thus, future researches might be required that will also be conducted in physical activity domain, in order to further provide empirical evidence on the predictive validity of the constructs in the Italian context. Finally, our study represents one of the few attempts to validate the factor structure of behavioural regulation and motives for physical exercise in a language other than English. Future studies are therefore warranted in order to move a step further toward assessing the meaningfulness of these constructs and the validity of the corresponding scales across nations.

In summary BREQ and MPAR-R may be useful also in the Italian context for measuring respectively the regulation of exercise behaviour and a broad range of motives for physical activity. Both instruments assess intrinsic and extrinsic types of motivation, the latter in a multidimensional fashion. How different types of intrinsic motivation are better than others at predicting a person's intentions to engage in exercise during free time remains a question to be explored.

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Table I

Comparison of Alternative Factor Structures for Behavioural Regulation

Comparaison de Structures Factorielles Alternatives pour la Régulation Comportementale

Model	χ^2	*df*	$\Delta\chi^2$	Δ *df*	CFI	RMSEA	SRMR
Hypothesized four-factor model	671.99*	84	–	–	.96	.06	.04
Three-factor model (combining identified regulation and intrinsic motivation)	1464.81*	87	792.82*	3	.90	.09	.06
Two-factor model (combining external regulation and introjected regulation, and identified regulation and intrinsic motivation)	3219.12*	89	2547.13*	5	.78	.13	.11
One-factor model	4983.18*	90	4311.19*	6	.65	.16	.12

Note. N = 1995; CFI = comparative fit index; RMSEA = root-mean-square error of approximation; SRMR = standardized root mean square residual.

* $p < .01$.

Table II

Results of Confirmatory Factor Analysis of Behavioural Regulation Items

Résultats de l'Analyse Factorielle Confirmatoire des Items de la Régulation Comportementale

Items	Factor loading
External regulation	
I exercise because other people say	.69
I should I take part in exercise because my friends/family/spouse say I should	.75
I exercise because others will not be pleased with me if I don't	.64
I feel under pressure from my friends/family to exercise	.65
Introjected regulation	
I feel guilty when I don't exercise	.71
I feel ashamed when I miss an exercise session	.73
I feel like a failure when I haven't exercised in a while	.79
I get restless if I don't exercise regularly	.81
Identified regulation	
I value the benefits of exercise	.67
It's important to me to exercise regularly	.82
I think it is important to make the effort to exercise regularly	.78
Intrinsic motivation	
I exercise because it's fun	.77
I enjoy my exercise sessions	.64
I find exercise a pleasurable activity	.88
I get pleasure and satisfaction from participating in exercise	.83

Note. N = 1995.

Table III

Goodness-of-Fit Statistics for Multi-Sample Confirmatory Factor Analysis Models Testing for Invariance of Behavioural Regulation across Gender

Indices d'Ajustement pour les Modèles d'Analyse Factorielle Confirmatoire Multi-Groupe pour Evaluer l'Invariance de la Régulation du Comportement en relation au Genre Sexuel

Model	χ^2	*df*	$\Delta\chi^2$	Δ *df*	CFI	NFI	RMSEA	SRMR	PNFI
Baseline	771.28*	168	–	–	.96	.95	.06	.04	.76
Equivalence of factor loadings	784.02*	179	12.74*	11	.96	.95	.06	.04	.77
Equivalence of factor variances and covariances	868.70*	190	97.42*	11	.95	.95	.06	.05	.83
Equivalence of measurement errors	907.65*	203	38.85*	13	.95	.95	.06	.05	.89

Note. N = 1995. PNFI = parsimony normed fit index.

* $p < .01$.

Table IV

Means, Standard Deviations, and Correlations

Moyennes, Déviations Standards, et Corrélations

Variables	Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Gender (1 = male, 2 = female)	---	---	---											
2. Age	---	---	-.01	---										
3. Appearance	3.33	1.06	.04	-.02	*(.83)*									
4. Fitness	3.67	0.91	-.01	-.02	.64**	*(.81)*								
5. Social interaction	3.08	0.97	-.05*	-.11**	.31**	.42**	*(.77)*							
6. Competence	3.33	1.04	-.18**	-.09**	.37**	.62**	.52**	*(.89)*						
7. Enjoyment	3.51	0.97	-.09**	-.07**	.31**	.56*	.63**	.78**	*(.90)*					
8. External regulation	1.94	0.81	-.11**	-.08**	.20*	.14**	.23**	.11**	.07**	*(.78)*				
9. Introjected regulation	2.46	1.08	-.03	-.03	.38**	.44**	.29**	.48**	.45**	.29**	*(.85)*			
10. Identified regulation	3.48	1.00	-.01	-.03	.42**	.67**	.40**	.64**	.65**	.16**	.64**	*(.80)*		
11. Intrinsic motivation	3.63	1.10	-.05*	-.09**	.23**	.49**	.55**	.66**	.82**	.05*	.42**	.66**	*(.85)*	
12. Participation in physical activity	2.28	0.82	-.18**	-.13**	.22**	.31**	.34**	.46**	.44**	.10**	.34**	.40**	.41**	*(.65)*

Note. N = 1995; internal consistency values (Cronbach's Alphas) appear across the diagonal in parentheses.

** p < .05, ** p < .01.*

Note. N = 1995; les Coefficients de cohérence interne (alpha de Cronbach) sont reportés entre parenthèses dans la diagonale.

** p < .05, ** p < .01.*

Table V

Multiple Linear Regressions on Behavioural Regulation and Participation in Physical Activity

Régressions Multiples Linéaires sur la Régulation Comportementale et la Participation dans l'Activité Physique

Dependent Variable	Parameter	β	SE	t
Participation in physical activity	External regulation	-.00	.02	- 0.16
	Introjected regulation	.14	.02	5.51***
	Identified regulation	.15	.02	4.86***
	Intrinsic motivation	.23	.02	8.94***

Note. N = 1995; all parameters are controlled for age and gender.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Note. L'âge et le genre ont été inclus en qualité de variables de contrôle.

Table VI

Comparison of Alternative Factor Structures for Motives for Physical Activity

Comparaison de Structures Factorielles Alternatives pour les Raisons de l'Activité Physique

Model	χ^2	*df*	$\Delta\chi^2$	Δ *df*	CFI	RMSEA	SRMR
Hypothesized five-factor model	4184.35*	395	–	–	.89	.07	.05
Four-factor model (combining appearance and fitness)	5125.81*	399	941.47*	4	.86	.08	.08
Three-factor model (combining appearance and fitness, and competence and enjoyment)	6251.62*	402	2067.27*	7	.83	.08	.07
Two-factor model (combining appearance and fitness, and social interaction, competence and enjoyment)	7100.48*	404	2916.13*	9	.81	.09	.08
One-factor model	12297.65*	405	8113.30*	10	.66	.12	.10

Note. N = 1995.

* $p < .01$.

Table VII

Results of Confirmatory Factor Analysis of Motives for Physical Activity Items

Résultats de l'Analyse Factorielle Confirmatoire des Items des Raisons de l'Activité Physique

Items	Factor loading
Appearance	
To define muscles, look better	.71
To improve my appearance	.86
To lose weight, look better	.76
To be attractive to others	.49
Because I would feel unattractive if I didn't	.51
To improve my body shape	.84
Fitness	
To improve cardiovascular fitness	.66
To maintain strength, live healthy	.79
To have more energy	.53
To maintain physical health, well-being	.81
Because I want to be physically fit	.69
Social interaction	
To be with others in activity	.80
Because I want to be with my friends	.66
To meet new people	.57
Because my friends want me to	.51
Because I enjoy spending time with others doing this	.66
Competence	
Because I like physical challenge	.83
To get better at activity	.75
To keep up current skill level	.73
To obtain new skills	.71

Because I like activities that are challenging	.81
To improve existing skills	.63
Because I like the challenge	.77
Enjoyment	
Because it makes me happy	.79
Because it's fun	.77
Because I like the excitement of participation	.64
Because I enjoy this activity	.84
Because I like to do this activity	.82
Because it's interesting	.74
Because the activity is stimulating	.74

Note. N = 1995.

Table VIII

Goodness-of-Fit Statistics for Multi-Sample Confirmatory Factor Analysis Models Testing for Invariance of Motives for Physical Activity across Gender

Indices d'Ajustement pour les Modèles d'Analyse Factorielle Confirmatoire Multi-Groupe pour Evaluer l'Invariance des Raisons de l'Activité Physique en relation au Genre Sexuel

Model	χ^2	*df*	$\Delta\chi^2$	Δ *df*	CFI	NFI	RMSEA	SRMR	PNFI
Baseline	4916.46*	786	–	–	.89	.88	.07	.06	.90
Equivalence of factor loadings	4954.06*	811	37.60*	25	.89	.88	.07	.06	.93
Equivalence of factor variances and covariances	5581.37*	820	627.31*	9	.87	.86	.07	.07	.94
Equivalence of measurement errors	5773.27*	842	191.9*	22	.87	.86	.08	.07	.97

Note. N = 1995.

* $p < .01$.

Table IX

Multiple Linear Regressions on Motives for Physical Activity and Participation in Physical Activity

Régressions Multiples Linéaires sur les Raisons de l'Activité Physique et la Participation dans l'Activité Physique

Dependent Variable	Parameter	β	SE	t
Participation in physical activity	Appearance	.06*	.02	2.39*
	Fitness	-.01	.03	-0.49
	Social interaction	.07*	.02	2.55*
	Competence	.24***	.03	7.02***
	Enjoyment	.19***	.03	5.48***

Note. N = 1995; all parameters are controlled for age and gender.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Note. L'âge et le genre ont été inclus en qualité de variables de contrôle.

Table X

Comparison of Alternative Factor Structures for Behavioural Regulation and Motives for Physical Activity and Comparaison de Structures Factorielles Alternatives pour la Régulation Comportementale et les Raisons de l'Activité Physique

Model	χ^2	*df*	$\Delta\chi^2$	Δ *df*	CFI	RMSEA	SRMR
Hypothesized nine-factor model	6294.10*	909	–	–	.90	.05	.05
Seven-factor model (combining appearance and fitness, and identified regulation and intrinsic motivation)	8592.78*	924	2298.68*	15	.86	.06	.07
Five-factor model (combining appearance and fitness, competence and enjoyment, external regulation and introjected regulation, and identified regulation and intrinsic motivation)	11795.03*	935	5500.93*	26	.80	.08	.08
Four-factor model (combining appearance and fitness, social interaction, competence and enjoyment, external regulation and introjected regulation, and identified regulation and intrinsic motivation)	12653.13*	939	6359.03*	30	.78	.08	.08
Two-factor model (combing appearance, fitness, social interaction,	19978.61*	944	13684.51*	35	.64	.10	.09

competence and enjoyment, and external regulation, introjected regulation, identified regulation and intrinsic motivation)							
One-factor model	21034.66*	945	8113.30*	36	.62	.10	.10

Note. N = 1995.
* $p < .01$.