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Psychometric properties of Turkish version of The Behavioural Regulation in Exercise Questionnaire (BREQ-3)

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The aim of this study was to examine the validity and reliability of the Turkish version of Behavioural Regulation in Exercise Questionnaire-3 (BREQ-3). Four hundred-one male and 299 female exercisers participated in this study. The Behavioural Regulation in Exercise Questionnaire-3 BREQ-3, Basic Psychological Needs in Exercise Scale and Goal Orientation in Exercise Measure were administered with personal information form to all participants. The psychometric properties of the scale were investigated using confirmatory factor analysis, internal consistency, convergent and discriminant validity. Findings regarding the construct validity of the scale demonstrated that six-factor model showed acceptable fit to the data. The results demonstrated an adequate internal consistency. Furthermore, correlations of the behavioral regulations with goal orientations and basic needs satisfactions in exercise provided the evidence for the convergent and discriminant validity of the measure. In sum, results indicated that BREQ-3 is a reliable and valid scale in within the context of exercise in Turkey.

KEY WORDS: Exercise motivation, Reliability, Self-Determination theory, Valıdıty.

Introduction

The benefits of exercise such as improving physical fitness, reducing the risk of metabolic diseases (i.e., high blood pressure, coronary heart disease, diabetes) and alleviating psychological diseases (i.e., anxiety and depression) have been clealry documented in the literature. Although the benefits of regular exercise are well known, western cultures insufficiently engage in exercise in order to gain its benefits (WHO, 2016). It is then important to examine the exercise motivation to ensure exercise adherence and help others achieve its benefits (Weman-Josefsson, Fröberg, Karlsson, & Lindwall, 2017).

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Numerous motivation theories such as Self-Determination Theory (SDT), Achievement Goal Theory (AGT) and Theory of Planned Behavior (TPB) (Jones, Sinclair, Rhodes, & Courneya, 2004; Petherick & Markland, 2008; Teixeira, Carraça, Markland, Silva, & Ryan, 2012) proposed to explain why individuals may initiate and maintain exercise behaviors. SDT, is one of the popular and most studied theroies in exercise psychology for explaining exercise motivation. SDT consists of of six types of motivational regulations (intrinsic, integrated, identified, introjected, external, amotivation) varying in degree of self-determination underlying the behavioral engagement (Ryan & Deci, 2017). The behaviors that occur with completely autonomous (self-determinated) reasons are defined as intrinsic motivation, behavioral regulations that are realized with more controlled with external reasons are expressed as extrinsic motivation. Intrinsic motivation comprises attending exercise behavior because of its inherent reasons (i.e., for enjoyment and interest) (Deci & Ryan, 2000). On the other hand, extrinsic motivation focus on consequences that themselves differ in terms of their autonomy that includes external, introjected, identified, and integrated regulations. External regulation refers to being motivated to exercise in order to achieve external gains (e.g., I exercise because other people say I should). Introjected regulation refers to being motivated to exercise to avoid aversive feelings (e.g., I exercise because I feel guilty if I don't). Identified regulation refers to exercise motivation stemming from personal values and endorsement of a exercise behaviour or its outcomes (e.g., I value the benefits of exercise). Integrated regulation relavants to engaging in exercise because they are integrated within the individual's sense of self, goals and values (e.g., I consider exercise to be part of my identity). Intrinsic, integrated and identified regulations are all considered autonomous forms of motivation, whereas external and introjected behavioural regulations are associated with controlled forms of motivation. Finally, amotivation is identified a diminished or lack of motivation to exercise (Deci & Ryan, 1985).

Various instruments have been developed to measure exercise motivation from an SDT perspective. These include Exercise Motivations Inventory (EMI; Markland & Ingledew, 1997), Exercise Motives and Gains Inventory (EMGI; Strömmer, Ingledew, & Markland, 2015), Basic Psychological Needs in Exercise Scale (BPNES; Vlachopoulos & Michailidou, 2006), Perceived Environmental Supportiveness Scale (PESS; Markland & Tobin, 2010) and Behavioural Regulation in Exercise Questionnaire (BREQ; Mullan, Markland & Ingledew, 1997). EMI is a scale that considers exercise motivation from a broad perspective with 14 subscales and also evaluates those who do not exercise (Markland & Ingledew, 1997). On the other hand

EMGI addresses the gains from exercise in addition to exercise motivation (Strömmer, Ingledew, & Markland, 2015). Moreover, while BPNES states that the satisfaction of three basic psychological needs (autonomy, competence and relatedness) is effective in individuals' participation in exercise (Vlachopoulos & Michailidou, 2006), PESS attempts to assess the presence of a supportive social environment in exercise settings in order to satisfy these basic psychological needs (Markland & Tobin, 2010). The third version of BREQ was selected in this study because it deals with exercise motivation with a hierarchical and multidimensional approach and is a highly preferred tool and theoretical perspective in this field (Farmanbar, Niknami, Hidarnia, & Lubans, 2011). The first version of the BREQ includes 15-item with four factors (external, introjected, identified and intrinsic regulations) and has been validated by Mullan et al. (1997). Another study conducted by Wilson, Rodgers and Fraser (2002) investigated the psychometric properties of the BREQ without the amotivation items and found good construct validity that supported the psychometric integrity of the BREQ as a four-factor model of exercise motivation. Markland and Tobin (2004) revised BREQ by adding amotivation subscale and renamed the scale as BREQ-2. The validity and reliability of BREQ-2 were tested across different cultures such as Turkey (Ersöz, A çı, & Altıparmak, 2012), Greece (Moustaka, Vlachopoulos, Vazou, Kaperoni, & Markland, 2010), Portugal (Palmeira, Teixeira, Silva, & Markland, 2007) and Spain (Murcia, Gimeno, & Camacho, 2007). BREQ-2 only measures the four motivational regulation which is proposed by SDT, it does not measure the integrated regulation and one item of introjected regulation is also missing. Therefore, to address the limitations of the BREQ-2, an integration subscale and a new additional introjected items were included to produce the BREQ-3 (Markland & Tobin, 2004; Wilson et al., 2006). The new version of the scale was called BREQ-3 with 24 items divided into six subscales. Previous research has supported the BREQ-3's factor structure and subscales' reliability in different languages including Spanish (González-Cutre, Sicilia, & Fernández, 2010), Portuguese (Cid et al., 2018), Brazil (Guedes & Sofiati, 2015) and Mexican (Zamarripa, Castillo, Baños, Delgado, & Álvarez, 2018).

González-Cutre et al. (2010) in a sample of 524 exercisers from Spain found that BREQ-3 had good psychometric qualities including acceptable factorial validity and strong internal consistency. In addition, the factor structure was invariant across gender and age and for the criterion validity integrated regulation predicted by competence and autonomy needs satisfaction. On the other hand, the fit indices of 24-item model was not acceptable for the Portuguese sample (Cid et al., 2018). In the Portuguese version of

BREQ-3, after eliminating six items (one item for each factor), 18 items with a six-factor structure obtained satisfactory fit index values. In another study, the Mexican version of the BREQ-3 has been shown to exibit an acceptable six-factor model and internal consistency (Zamarripa et al., 2018). Additionally, Guedes and Sofiati (2015) found that Brazilian version of BREQ-3 confirmed the original six-factor structure, and Cronbach's alpha reliability coefficients revealed a good internal consistency for all subscales.

Over the last two decades, there has been an increasing interest to investigate the psychometric properties of the original questionnaires in different cultures and languages since the linguistic features may influence the way the questionnaire is presented and interpreted in different cultures. Ersöz, Asci and Altiparmak (2012) have tested the validity and reliability of BREQ-2 and found that 4 factor structures of BREQ-2 (intrinsic, introjected, external regulations and amotivation) make it a valid and reliable scale. Identified regulation subscale did not work in the Turkish sample. Since the identified and integrated regulations subscales are not present in the Turkish BREQ-2 scale, it was important to translate and validate the BREQ-3 in Turkish language to improve the usability of BREQ-3 in various cultures. Thus, the aim of this study was to investigate the validity and reliability of the BREQ-3 for a Turkish sample.

Empirical studies in the exercise context have shown that individuals with autonomous or more self-determined motivational profiles (i.e., identified and integrated regulation, and intrinsic motivation) tend to have higher levels of basic psychological needs satisfaction (autonomy, competence and relatedness) and task-oriented exercise participation. On the other hand, individuals with controlled or less self-determined motivational orientations (introjected and external regulation, and amotivation) were shown to possess lower levels of basic needs satisfactions and ego-oriented exercise participation (Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011; Cid et al., 2021; Dyrlund, 2008; Ersöz, Müftüler, Lapa, & Tümer, 2017; Sebire, Jago, Fox, Edwards, & Thompson, 2013; Vansteenkiste & Ryan, 2013). Based on these emprical evidence, for convergent and discriminant validty, it was hypothesized that autonomous (i.e., identified, integrated, intrinsic regulations) motivation are positively correlated with autonomy, competence and relatedness psychological needs and task orientation in exercise. On the other hand, a negative correlation was expected between controlled (i.e., external, introjected regulations) motivation and autonomy, competence and relatedness psychological needs and ego orientation in exercise. For factorial validity and relaibility, we hypothesized that the CFA would provide support for the six-factor structure of the BREQ-3, and its factors would show adequate reliability.

Materials and Methods

PARTICIPANTS

The present study used a cross sectional design and convenient sampling. Based on this sampling, 401 male (M_{age} = 31.24, *SD*= 12.42) and 299 female (M_{age} = 27.28, *SD*= 13.84) therefore a total of 700 (M_{age} = 28.98, *SD*= 13.21) exercise participants from private fitness centers voluntarily participated in this study. The ages of the participants ranged from 17 to 61 years. In this study, the participant to item ratio (20:1) was used as a criteria for determining sample size as suggested by MacCallum, Widaman, Preacher and Hong (2001). The length of exercise participation was approximately three years (*M* = 34.03 month, *SD* = 41.73) and the weekly frequency was between 1 and 11 times per week (*M* =3.93, *SD*= 1.55). Most of the participants reported moderate intensity of physical activity (*n* = 375; 53,6 %).

INSTRUMENTS

The Personal information form was used to asess demographic characteritics of participants. The Basic Psychological Needs in Exercise Scale and Goal Orientation in Exercise Measure were used to test convergent and discriminant validity of BREQ-3.

Personal Information Form

Participants were asked to report sex, age, exercise intensity, exercise frequency, and the length of exercise. The exercise intensity was determined by asking the question of "How would you describe your exercise intensity?" and they were asked to select one of the following options: Vigorous (heartbeat fast, can't speak), Moderate (non-tiring, I speak but with difficulty), Mild (I can speak).

The Behavioural Regulations in Exercise Questionnaire-3 (BREQ-3)

The BREQ-3 (Markland & Tobin, 2004; Wilson et al., 2006) consists of 24 items and measures six types of behavioral regulations in exercise, that is, amotivation (4 items: e.g., "I don't see why I should have to exercise"), external regulation (4 items: e.g., "I exercise because other people say I should"), introjected regulation (4 items: e.g., "I feel guilty when I don't exercise"), identified regulation (4 items: e.g., "It's important to me to exercise regularly"), integrated regulation (4 items: e.g., "I exercise because it is consistent with my life goals") and intrinsic regulation (4 items: e.g., "I exercise because it's fun"). Each item was answered on a five-point Likert-scale, ranging from 0 ('Not true for me') to 4 ('Very true to me').

The Basic Psychological Needs in Exercise Scale (BPNES)

The Basic Psychological Needs in Exercise Scale (Vlachopoulos & Michailidou, 2006) was used to assess participants' need satisfaction in exercise. The BPNES consists of 12 items and 3 subscales (autonomy, competence and relatedness). Responses were provided on a 5-

point Likert-type scale ranging from 1 (Totally Disagree) to 5 (Totally Agree). The Turkish version of the BPNES was tested by Vlachopoulos et al. (2013) in a cross-cultural study. Cronbach's alpha reliability values of scale were 0.78 for autonomy, 0.73 for competence and 0.80 for relatedness (Vlachopoulos et al., 2013).

The Goal Orientation in Exercise Measure (GOEM)

The Goal Orientation in Exercise Measure (Petherick & Markland, 2008) assesses the perceptions of achievement orientations in the physical activity setting. GOEM consists of 10 items and two subscales: task and ego orientation. Responses were provided on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). This scale was adapted to Turkish by Ersöz, Müftüler, Lapa and Tümer (2017). Cronbach's alpha reliability values of the scale were 0.87 for task orientation and 0.90 for ego orientation (Ersöz et al., 2017).

PROCEDURES

Prior to data collection, ethical approval was obtained from Marmara University Institute of Health Sciences Ethics Commitee (Ethical approval code: l3.01.2020-16). The data were collected from exercise participants in private sports enterprises. All participants completed the questionnaire voluntarily and anonymously. For each particants, it took approximately 10 minutes to complete the survey. The informed consent form was obtained from the participants.

TRANSLATION OF SCALE

Behavioural Regulations in Exercise Questionnaire-3, with permission of the copyright owner was first translated to Turkish by using the back-translation technique (Beaton, Bombardier, Guillemin, & Ferraz, 2000; Brislin, 1986). The original items were translated to Turkish separately by three bilingual researchers. Then, discrepancies between the three translated forms were discussed in order to develop an initial Turkish version of the inventory. Thereafter, bilingual translator was not involved in the first steps but then back-translated this initial Turkish version to the original language. In the next stage, all translations and the original questionnaire were handed to a expert in order to consolidate all the versions of the questionnaire and achieve equivalence between the original and target versions.

DATA ANALYSIS

Data were assessed for multivariate outliers by using the boxplot analysis. One hundrend- thirty outliers were removed from data set. To verify the normality of the distribution, skewness and kurtosis values were used. According to George and Mallery (2016) skewness and kurtosis values between -2 to +2 indicate a normal distribution. The factor structure of The Behavioural Regulations in Exercise Questionnaire-3 was examined by confirmatory factor analysis (CFA) through maximum likelihood estimation using LISREL 8.80 program. In this study, relative chi-squared (2/df), comparative fit index (CFI), normed fit index (NFI),

nonnormed fit index (NNFI), standardized root mean square residual (SRMR) and root mean square error of approximation (RMSEA) were used as absolute fit measures for determining the model fit. If the value of (2/df) is less than 5, it means that there is an acceptable fit (Bollen, 1989; Kline, 2015). If the RMSEA and SRMR are less than 0.05, it shows an acceptable fit, 0.05< RMSEA <0.1 is good fit (Schermelleh-Engel, Moosbrugger, & Mühler, 2003). In addition, NFI, NNFI, and CFI values above 0.90 are acceptable, and 0.95 to 1.00 means that the model fit is perfect (Bentler, 1990; Hu & Bentler, 1999).
To test convergent and discriminant validity, the relationship of BREQ-3 with BPNES and GOEM subscales were tested by using Pearson Product Moments Correlation Analysis. The convergent and discriminant validity of BREQ-3 were also examined by means of Average Variance Explained (AVE), Composite Reliability (CR), Maximum Shared Variance (MSV), and Average Shared Variance (ASV) coefficient. The following criteria must be satisfied to ensure convergent validity: CR > 0.70, CR > AVE, and AVE > 0.50 (Hair, Black, Babin, & Anderson, 2014; Kline, 2015). If the AVE is less than 0.50, CR values must be greater than 0.70 to ensure convergent validity (Fornell & Larcker, 1981). The criteria for ensuring discriminant validity are MSV < AVE and ASV < MSV (Gefen, Straub, & Boudreau, 2000). The reliability of the scale was calculated by using CR.

Results

DESCRIPTIVE STATISTICS

Means, standard deviations, skewness and kurtosis values for BREQ-3, BPNES and GOEM subscales were displayed in Table I. The univariate normality scores obtained for each subscale demonstrated a normal distribution with all subscales scores ranging from 2.25 to -1.49 for skewness and from -1.41 to 2.45 for kurtosis (Table I).

Table I
Descriptive Statistics for the BREQ-3, BPNES and GOEM subscales.

	Min	Max	Mean	SD	Skewness	Kurtosis
Intrinsic regulation	1	5	4.43	0.68	-1.49	2.45
Integrated regulation	1	5	4.01	0.90	-1.10	0.68
Identified regulation	1	5	4.33	0.65	-1.16	-1.41
Introjected regulation	1	5	3.54	1.05	-0.62	-0.27
External regulation	1	5	1.65	0.85	1.61	2.33
Amotivation	1	5	1.40	0.74	2.25	2.47
Autonomy	1	5	4.05	0.78	-0.97	1.22
Competence	1	5	4.10	0.76	-0.79	-0.64
Relatedness	1	5	4.06	0.76	-0.87	0.83
Task Orientation	1	5	4.24	0.80	-1.03	0.46
Ego Orientation	1	5	3.76	1.09	-0.85	-0.06

CONFIRMATORY FACTOR ANALYSIS

The 24-item structure of BREQ-3 was examined via CFA. The six-factor model showed an acceptable fit to the data (x^2/df= 4.51, RMSEA=0.07, NFI=0.95, NNFI=0.95, CFI=0.96, SRMR=0.06). However, the item 3 in the intrinsic regulation subscale showed low loading so it was removed from the model and 23 items were re-examined. The fit indices of the confirmatory factor analysis for the 23-item scale were acceptable: x^2/df= 4.48, RMSEA=0.07, NFI=0.95, NNFI=0.96, CFI=0.96, SRMR=0.06.

The six factor model is presented Fig. 1. The standardized factor loadings of items ranged between 0.63-0.82 for intrinsic regulation, 0.67-0.83

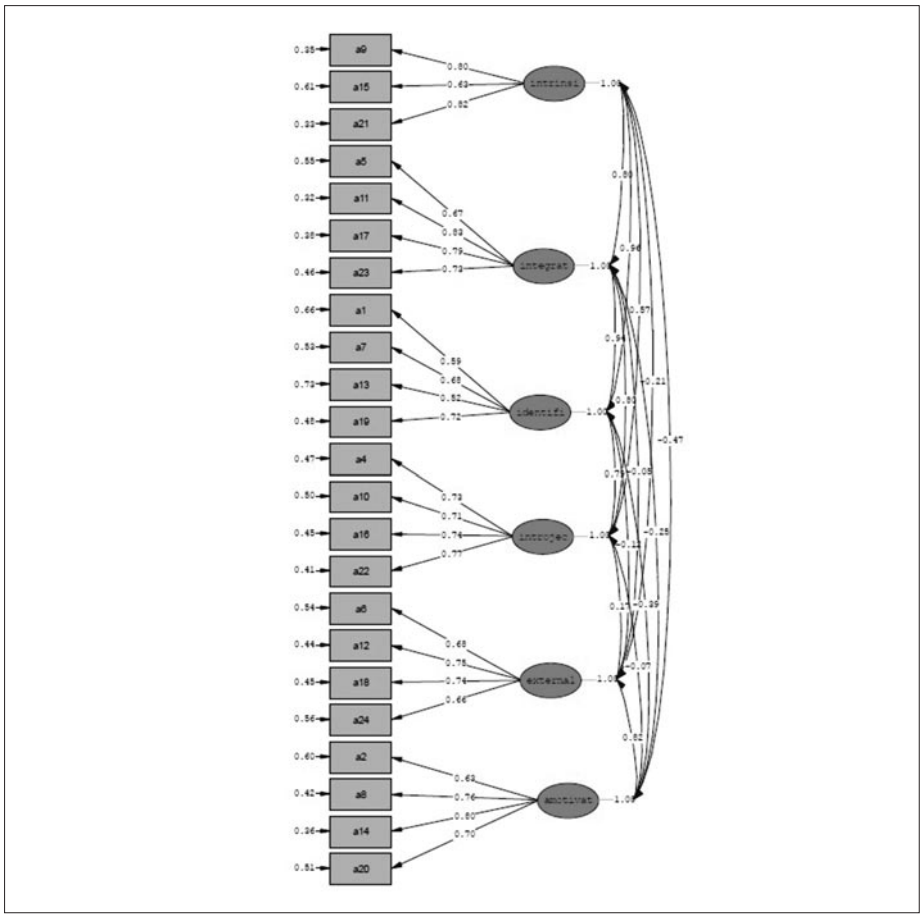

Fig. 1. - Factor Structure of BREQ-3.

for integrated regulation, 0.52-0.72 for identified regulation, 0.71-0.77 for introjected regulation, 0.66-0.75 for external regulation, and 0.63.-0.80 for amotivation (see Fig.1).

CONVERGENT, DISCRIMINANT VALIDITY AND RELIABILITY

Convergent validity was determined by assessing the AVE in conjunction with CR. The discriminant validity was analyzed by comparing AVE with MSV and ASV. Results of convergent and discriminant validity were summarized in the Table II.

For convergent validity, results show that, CR values were much higher than 0.70 and greater than AVE values. AVE was above 0.50 except for the dimension "identified regulation" (Table II).

Regarding the discriminant validity, the MSV values were lower than the AVE and ASV values lower than the MSV values.

Furthermore, the relationship among BREQ-3, BPNES and GOEM were examined with Pearson correlation coefficient (Table II) in order to determine the convergent and discriminant validity of BREQ-3.

The findings indicated positive correlation of autonomy, competence and relatedness subscales with intrinsic regulation, integrated regulation, identified regulation, introjected regulation ($p<.01$). The intrinsic regulation, integrated, identified and introjected regulation were moderately correlated with autonomy, competence and relatedness. The integrated regulation was

Table II
Pearson's Correlations Among BREQ-3, BPNES And GOEM Subscales And The Result Of Convergent, Discriminant Validity And Reliability Scores For BREQ-3

	Intrinsic regulation	**Integrated regulation**	**Identified regulation**	**Introjected regulation**	**External regulation**	**Amotivation**
Autonomy	.425**	.451**	.371**	.283**	-.112**	-.211**
Competence	.493**	.585**	.493**	.382**	-.146**	-.265**
Relatedness	.478**	.497**	.447**	.352**	-.098**	-.178**
Task Orientation	.264**	.258**	.264**	.130**	-.058	-.202**
Ego Orientation	.185**	.256**	.244**	.210**	-.007	-.082*
AVE	0.57	0.57	0.40	0.54	0.50	0.52
CR	0.80	0.86	0.73	0.82	0.80	0.81
MSV	0.16	0.30	0.12	0.30	0.19	0.19
ASV	0.08	0.12	0.07	0.10	0.05	0.05

$^{**}p < .01$, $^{*}p<.05$

highly correlated with competence. On the other hand, a weak correlation was found between introjected regulation and autonomy (Table II).

The autonomy, competence and relatedness subscales were found to be negatively correlated with external regulation and amotivation ($p<.01$). Task and ego orientation were positively correlated with intrinsic regulation, integrated regulation, identified regulation, introjected regulation ($p<.01$). On the other hand, task and ego orientation subscales were negatively correlated with amotivation ($p<.01$, $p<.05$). A weak correlation was found between all types of regulations (except for external regulation) and task and ego orientation (Table II).

Reliabiltiy analysis

In order to assess the internal consistency of the BREQ-3, CR was calculated. CR ranged between 0.73 and 0.86, which were much higher than 0.70 (Table II).

Discussion and Conclusions

The aim of the present study was to examine the factorial validity and reliability of BREQ-3 for Turkish exercise participants. The validity findings provided initial evidence in support of the hypothesized structure of the scale. Specifically, the six factor model of the BREQ-3 was supported through CFA with satisfactory fit indexes (Kline, 2015). The six-factor model showed adequate fit indexes and all the factorial loadings remained above 0.50 except item 3. The CFA results were similar to previously reported findings such as Spanish (González-Cutre et al., 2010), Brazilian (Guedes & Sofiati, 2015) and Mexican versions (Zamarripa et al., 2018). On the other hand, Portuguese (Cid et a., 2018) version of BREQ-3 showed adeaquate fit after the elimination of six items.

Specifically, item 3 in intrinsic regulation subscale was removed because of low loading. Similarly to the this finding, Cid et al. (2018) also reported low factor loading of item 3 in the Portuguese sample. The low loading of item 3 could be explained by cultural bias. Item 3 ("I exercise because it's fun") for Turkish exercise participants more likely refers to enthusiastic fun rather than pleasure.

The convergent and discriminant validity of the BREQ-3 was assessed with AVE, CR, MSV, and ASV. The results demonstrated that the BREQ-3

has adequate discriminant and convergent validity. Convergent and discriminant validity were also assessed by examining the relationship between the subscales of the BREQ-3 and BPNES and GOEM. Considering the correlation analysis, three psychological needs were positively correlated with introjected, identified, integrated regulation and intrinsic regulation, but negatively correlated with external regulation and amotivation. Similarly with the earlier studies (Deci & Ryan, 2008; Edmunds, Ntoumanis, & Duda, 2006; Farholm, Sørensen, Halvari, & Hynnekleiv, 2017; Ryan & Deci, 2017), these findings partially support our hypothesis. Only the positive correlation between the introjected regulation and Basic Psychological Needs in Exercise (BPNE) was unexpected. This result may be due to the internalization of the exercise behavior (Gillison, Osborn, Standage, & Skevington, 2009). Basic psychological need satisfaction will promote internalization of motivational regulations into more autonomous forms of motivation (Deci & Ryan, 2000; Ryan & Deci, 2002).

In addition, the correlations between the subscales of BREQ-3 and GOEM showed that introjected, identified, integrated and intrinsic regulation were positively correlated with ego and task orientations and amotivation was negatively correlated with them. Based on previous studies (Petherick & Markland, 2008; Standage & Treasure, 2002; Wang et al., 2002), ego orientation was expected to be positively related to less self-determined behavioral regulations (external and introjected regulations) and amotivation. The positive correlation of task orientation with more self-determined types of behavioral regulations and introjected regulation were consistent with the previous research (Ersöz et al., 2017; Georgiadis, Biddle, & Chatzisarantis, 2001; Petherick & Markland, 2008). Similarly, the negative corelations of task orientation with extrinsic regulation and amotivation (Ersöz et al., 2017; Petherick & Markland, 2008) were reported in the previous studies. Unlike previous studies (Ersöz et al., 2017; Petherick & Markland, 2008; Wang et al., 2010) and the principles of Achievement Goal Theory (Nicholls, 1989), ego orientation was positively correlated with identified, integrated and intrinsic regulation in the present study. Finally, consistent with previous studies, the positive relationship of ego orientation with introjected regulation and amotivation was expected (Ersöz et al., 2017; Petherick & Markland, 2008; Wang et al., 2010). Overall, these findings demonstrate good convergent and discriminant validity of the BREQ-3.

The CR demonstrated that the Turkish version of BREQ-3 had good internal consistency. CR values were above 0.70. The present results show that the questionnaire presents acceptable reliability with regard to the criteria reported by Kline (2015). The CR values were also consistent with the

Portuguese (Cid et al., 2018) and Mexican (Zamarripa et al., 2018) versions of the scale.

In conclusion, The Turkish version of the BREQ-3 is a reliable and valid instrument for studying motivational regulations in exercise contexts. The present research is limited by the classical test theory. In addition, the development and validation of a measure, future research should be examined across a diverse range of analysis methods (e.g.,item response theory, multi trait multi method analysis). Finally, cross-cultural validity of the Turkish scale could be investigated by examining whether measurement invariance of the BREQ-3 will be observed across samples of exercise participants in different countries, gender and exercise types through multi-group CFA.

Disclosure

No financial interest or benefit has arisen from the direct application of this research.

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