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Predicting strenuous, moderate, and mild exercise frequency and subjective vitality by exercise behavioral regulations among older adults

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Abstract

The purpose of this study was to examine the contribution of types of exercise behavioral regulations in predicting weekly frequency of strenuous, moderate, and mild exercise and subjective vitality within self-determination theory among Greek older adults. Participants were 445 older adults participating in either individual exercise activities or group-based indoor exercise programs. Data were collected using the Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2: Markland & Tobin, 2004), the Subjective Vitality Scale (Ryan & Frederick, 1997) and the Godin Leisure Time Exercise Questionnaire (GLTEQ: Godin & Shephard, 1985). Linear regression analyses revealed that strenuous and mild exercise frequency were negatively predicted by external regulation while moderate exercise frequency was not predicted by any type of regulation; subjective vitality was positively predicted by external regulation to a small extent with stronger prediction by introjected regulation and intrinsic motivation. The present findings support to a large extent self-determination theory predictions regarding exercise behavior among Greek older adults.

Keywords: self-determination theory; motivational regulations; elderly; physical activity

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1 Introduction

Population aging has emerged as an important demographic trend worldwide. A decline in fertility and improvement of quality of life, health, and longevity have led to an increase in life expectancy among the elderly population (Bloom & Luca, 2016; Inhorn & Patrizio, 2015; Ribeiro et al., 2020). Research has shown that systematic exercise involvement among older adults is important for enhancing quality of life and is associated with prevention of cardiovascular diseases, type-2 diabetes, osteoporosis, and depression (Pedersen & Saltin, 2015; Valenzuela et al., 2018). However, despite the benefits of physical activity, proportions of physical inactivity have been increasing dramatically across all age and population groups (Cavill, Kahlmeier, & Racioppi, 2006). Almost one in four older adults does not achieve minimum recommendations for physical activity participation (WHO, 2015), as older adults have largely adopted a sedentary lifestyle spending more than 9.4 hours a day sitting (Harvey, Chastin, & Skelton, 2015).

Recommendations of the World Health Organization for older adults dictate either engagement in moderate intensity aerobic exercise for more than 150 minutes, or more than 75 minutes in strenuous aerobic exercise per week, or a combination equivalent of the two. In addition to aerobic activity, WHO recommends participation in muscle strengthening activities for all major muscle groups, at least two days per week and balance-improving exercises to prevent falls, at least three days per week (WHO 2010). Therefore, systematic participation in organized exercise programs is important because it contributes positively to the physical and mental health of the elderly, improving their physical condition and body posture, self-esteem, sociability, and psychological health and well-being (Keogh, Rice, Taylor, & Kilding, 2014; Liposcki et al., 2019; Mason, Horvat, & Nocera, 2016; Tulloch et al., 2018). Studies among older adults have substantiated the important role of self-motivation as a precursor of exercise participation in this age group (Hannan, 2013; Pelssers et al., 2018; Stephan, Boiché, & Le Scanff, 2010).

Self-determination theory (SDT: Deci & Ryan, 1985, 1991) provides an appropriate theoretical framework for the study of motivation and distinguishes between different qualities of reasons that prompt individuals to participate in physical activity, that is, intrinsic motivation, extrinsic motivation, and amotivation (Deci & Ryan, 1985, 2000, 2008). Individuals are intrinsically motivated when they exercise out of the enjoyment derived from the activity (Deci & Ryan, 1985; Ryan & Deci, 2000). A state of amotivation denotes a lack of intention to exercise (Deci & Ryan, 1985) while extrinsic motivation refers to reasons for participation different than the enjoyment derived from the activity. According to Deci and Ryan (1985), extrinsic motivation further consists of different sub-types of behavioral regulations which represent the degree to which an individual has internalized the behavior. These types of extrinsic motivation from the least self-determined to the most self-determined are external regulation (i.e., pressure to exercise is applied by an external source to the individual), introjected regulation (individuals force themselves to exercise to avoid experiencing negative emotions such as guilt or shame if they did not), identified regulation (individuals exercise because they consider exercising important for themselves), and integrated regulation (exercise behavior is enacted because the importance attached to exercise aligns with individuals' goals and values). All types of behavioral regulations in SDT are theoretically situated on a self-determination continuum (or continuum of relative autonomy) including the following regulatory styles with this particular order of amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic motivation. Amotivation is placed at the lower end of the continuum while intrinsic motivation at the highest end of the self-determination continuum (Deci & Ryan, 1985).

Many research studies have supported predictions grounded in SDT that more self-determined exercise regulations correspond to more systematic and longer-term exercise involvement, greater exercise commitment, and more positive attitudes toward exercise (Edmunds, Ntoumanis, & Duda, 2006; Vlachopoulos, 2007; Vlachopoulos & Michailidou, 2006; Wilson & Rodgers, 2004). For instance, Zafeiridou, Sarafi and Vlachopoulos (2014) found that among adults, strenuous weekly exercise frequency was predicted by integrated regulation while moderate exercise was positively predicted to a small extent by external regulation and to a greater extent by intrinsic motivation. No prediction was found for mild exercise by any type of regulation. Edmunds et al. (2006) found that strenuous exercise among adults was negatively predicted by external regulation and positively predicted by introjected regulation and identified regulation. No links were found for moderate and mild exercise with behavioral regulations. Among overweight and obese adults, introjected regulation and integrated regulation were found to positively predict total exercise behavior examined via the GLTEQ (Edmunds, Ntoumanis, & Duda, 2007). Brunet and Sabiston (2011) found that autonomous motivation (a composite of identified regulation and intrinsic motivation) positively predicted total exercise based on the GLTEQ among young adults (18-24 yrs.), adults (25-44 yrs.), and middle-aged adults (45-64 yrs.) while external regulation was a negative correlate and introjected regulation was a positive correlate of total exercise only for young adults. No links emerged to total exercise either for adults or middle-aged adults. Among young adult regular exercisers, Duncan, Hall, Wilson and Jenny (2010) found identified regulation and integrated regulation to positively predict total exercise frequency using the GLTEQ.

Subjective vitality is another key variable in the self-determination theory framework that reflects subjective well-being and is assumed to be a consequence of self-determined types of behavioral regulations (Deci & Ryan, 2000). Applying SDT in an exercise context among Greek middle-age women it was found that identified regulation and intrinsic motivation were positively correlated with subjective vitality but this was not the case for external regulation and introjected regulation (Moustaka, Vlachopoulos, Kabitsis, & Theodorakis, 2012). In a similar vein, Vlachopoulos, Ntoumanis, and Smith (2010) found among English exercise participants positive correlations of subjective vitality with identified regulation and intrinsic motivation, a negative correlation with external regulation, and an absence of correlation with introjected regulation.

Given that subjective vitality reflects psychological health and well-being, makes it an important element to be enhanced among elderly exercise participants (Couto, Antunes, Monteiro, Moutão, Marinho, & Cid, 2017). Exercise participation may be viewed as a valuable approach to increasing subjective vitality (Ryan & Frederick, 1997; Ryan et al., 2009; Park et al., 2017; Solberg, Hopkins, Ommundsen, & Halvari, 2012). In line with self-determination theory, actions taken by choice are expected to be accompanied by higher subjective vitality while those stemming from behavioral control are expected to result in lower subjective vitality (Deci & Ryan, 2008).

Considering that the exercise-related literature concerning elderly people is limited in relation to information about the conditions maximizing exercise participation and related psychological benefits, the present study was designed to examine whether types of exercise behavioral regulations would predict weekly frequency of strenuous, moderate, and mild exercise as well as levels of subjective vitality among Greek older adults participating in exercise.

Based on theory and the extant literature, it was hypothesized that strenuous, moderate, and mild weekly exercise frequency would be positively predicted by autonomous forms of exercise regulations while they would be negatively predicted by external regulation. Regarding introjected regulation, and despite its non-autonomous nature and based on past research findings, it was expected to emerge as a weak but positive predictor of strenuous, moderate, and mild exercise frequency. Concerning subjective vitality, a positive prediction was expected by autonomous forms of exercise regulations and a negative prediction by controlling forms of regulations.

2 Method

2.1 *Participants*

The sample consisted of 445 Greek older adults aged between 64 and 81 years (*M* = 70.6 yrs., *SD* = 4.53), 110 of which were men (24.7%), and 335 were women (75.3%). Of the total sample, 100 participants exercised in private fitness centers (22.5%), 132 in community fitness centers (29.7%), and 213 (47.8%) in community nonresidential senior centers offering exercise programs for older adults. Finally, 88 of the participants, (19.8%) were involved in individual exercise activities and 357 (80.2%) in group-based indoor exercise programs.

2.2 Instruments

Three questionnaires were presently used. The Greek version of Markland and Tobin's (2004) Behavioral Regulation in Exercise Questionnaire-2 (Moustaka, Vlachopoulos, Vazou, Kaperoni, & Markland, 2010) was used to assess levels of exercise behavioral regulations of the exercise participants. The BREQ-2 includes 19 self-report items to measure 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 (3 items e.g., I feel guilty when I don't exercise), identified regulation (3 items e.g., I value the benefits of exercise) (the fourth identified regulation items "I get restless if I don't exercise regularly" was removed in line with suggestions by Markland and Tobin, 2004) and intrinsic motivation (4 items e.g., I exercise because it's fun). Participants provided their responses following the question «Why do you exercise» on a 5-point Likert type response scale ranging from 0 (*definitely no*) to 4 (*definitely yes*).

Levels of subjective vitality, an outcome of a sense of self-determination in behavior, were measured using the subjective vitality scale (Ryan & Frederick, 1997). The scale consists of seven items and was developed to examine whether a person feels alive and full of energy in their life in general. A sample item is «At this moment, I feel alive and vital». According to Bostic, McGartland Rubio and Hood (2000), item #2 «I don't feel very energetic» should be removed from the scale. Responses to this scale were given on a 7-point Likert scale ranging from 1 (*not at all true*) to 7 (*very true*). Initial favorable psychometric evidence has emerged for the subjective vitality scale among Greek exercise participants (Vlachopoulos & Karavani, 2009).

The Godin Leisure Time Exercise Questionnaire (GLTEQ, Godin & Shephard, 1985) was used to measure weekly frequency of exercise participation. Participants indicated how often they participated in mild, moderate, and strenuous exercise for a minimum of 15 min during the past week. Strenuous exercise involved activities where the heart beats rapidly (e.g., running); moderate exercise includes activities where exercise is not strenuous (e.g., volleyball); and mild exercise involved activities corresponding to a minimum effort (e.g., fishing). The structural validity and reliability of scale scores has

been supported in related studies (Godin & Shephard, 1985). The scale has been successfully adapted and used with Greek exercise participants (Moustaka et al., 2010).

2.3 Procedure

Initially, the directors of the community nonresidential senior centers were informed about the purpose of the study and verbal permission was granted to distribute the questionnaires to the elderly attending the exercise programs. The same procedure was followed regarding the community and private fitness centers. A convenience sample of elderly exercise participants was presently used. Completion of the questionnaires was voluntary, anonymous, and took place before the exercise session of that particular day to achieve measurement of the study variables at the contextual level of generality in measurement (Vallerand, 1997). Data collection took place all days of the week both at morning and evening times.

2.4 Statistics

Linear regressions were performed to examine the contribution of each type of exercise behavioral regulation in predicting strenuous, moderate, and mild weekly frequency of exercise participation as well as subjective vitality. The level of statistical significance was set at $p \leq .05$.

3 Results

Internal consistency reliability analyses revealed satisfactory levels of internal reliability with indices of Cronbach's α of .72 for amotivation, .73 for external regulation, .84 for introjected regulation, .76 for identified regulation (three items), .75 for intrinsic motivation, and .91 for subjective vitality (six items).

For the prediction of frequency of strenuous, moderate, and mild exercise, linear regression showed that strenuous exercise was negatively predicted by external regulation (R^2 =.064, AdjR^2 = .054, F_{change} = $6.041_{(5, 439)}$, p < .001) (Table 1). Moderate exercise frequency was not statistically significantly predicted by any type of exercise behavioral regulation (R^2 =.016, AdjR^2=.00, F_{change}=$1.39_{(5, 439)}$, p = .22) (Table 2). Mild exercise frequency was negatively predicted by external regulation (R^2 =.071, AdjR^2=.060, F_{change}=$6.687_{(5, 439)}$, p < .001) (Table 3).

Table 1. Linear regression predicting strenuous exercise frequency by types of behavioral regulations

Predictor variables	Beta	t	Part	*p*
Amotivation	.05	1.06	.04	.28
External regulation	-.26**	-5.21	-.24	.00
Introjected regulation	.06	1.00	.04	.31
Identified Regulation	.01	0.17	.00	.86
Intrinsic motivation	-.08	-1.17	-.05	.24

Note. ** p < .01. Part = Part correlation.

Table 2. Linear regression predicting moderate exercise frequency by types of behavioral regulations

Predictor variables	Beta	*t*	Part	*p*
Amotivation	-.03	-0.71	-.03	.47
External regulation	-.09	-1.78	-.08	.07
Introjected regulation	.10	1.72	.08	.08
Identified Regulation	-.10	-1.42	-.06	.15
Intrinsic motivation	.01	0.17	.00	.86

Note. * $p < .05$. Part = Part correlation.

Table 3. Linear regression predicting mild exercise frequency by types of behavioral regulations

Predictor variables	Beta	t	Part	p
Amotivation	.05	0.94	.04	.34
External regulation	-.18**	-3.66	-.16	.00
Introjected regulation	-.10	-1.81	-.08	.07
Identified Regulation	.08	1.14	.05	.25
Intrinsic motivation	-.13	-1.93	-.08	.05

Note. **$p < .01$. Part = Part correlation.

Linear regressions revealed that subjective vitality was positively predicted to a small extent by external regulation and to a greater extent by introjected regulation and intrinsic motivation ($R^2 = .27$, $AdjR^2 = .264$, $F_{change} = 32.92_{(5, 439)}$, $p < .001$) (Table 4).

Table 4. Linear regression predicting subjective vitality by types of behavioral regulations

Predictor variables	Beta	*t*	Part	*p*
Amotivation	.03	0.72	.03	.46
External regulation	.16**	3.70	.15	.00
Introjected regulation	.25**	4.89	.19	.00
Identified Regulation	.05	0.87	.03	.38
Intrinsic motivation	.24**	3.96	.16	.00

Note. ** $p < .01$. Part = Part correlation.

4 Discussion

The purpose of this study was to examine the efficacy of types of exercise behavioral regulations in predicting weekly frequency of participation in strenuous, moderate, and mild exercise and subjective vitality among Greek elderly individuals. In terms of exercise behavior, it was found that participation in strenuous exercise and mild exercise were negatively predicted by external regulation while no prediction emerged for moderate intensity exercise. The present findings are in line with self-determination theory where more psychologically pressuring reasons to exercise are expected to correspond with less frequent exercise behavior. Put differently, absence of pressuring

reasons to exercise may correspond with more frequent weekly exercise participation. Engaging in an activity to avoid negative consequences or some form of punishment corresponds with higher levels of external regulation (Standage, Duda, Treasure, & Prusak, 2003) and once the threat of punishment is removed, individuals are likely to disengage from the activity (Deci & Ryan, 2000). Hence, feelings of self-determination should be enhanced to lead to greater exercise participation while feelings of pressure corresponding to less self-determination should be reduced. Autonomy supportive practices that may be used by the exercise instructor to enhance self-determined behavioral regulations may correspond with increased frequency of exercise behavior. Indeed, various studies have demonstrated positive links between perceptions of autonomy support provided by the exercise instructor and self-determined types of behavioral regulations in both correlational (Moustaka et al., 2010; Vlachopoulos et al., 2010) and experimental studies (Edmunds, Ntoumanis, & Duda, 2008; Moustaka et al., 2012).

It was found that among elderly exercise participants, subjective vitality was positively predicted to a small extent by external regulation and to a greater extent by introjected regulation and intrinsic motivation. These results partially support predictions grounded in self-determination theory where vitality is theorized to stem from self-determined types of behavioral regulations (i.e., identified regulation, intrinsic motivation) and to a lesser extent from non-self-determined types of regulation (i.e., external regulation and introjected regulation). Indeed, the present findings support such a pattern as introjected regulation represents a less pressuring type of extrinsic behavioral regulation compared to external regulation. Additionally, and following the same line of argument, intrinsic motivation also represents a fully self-determined type of exercise behavioral regulation. A number of studies have also found introjected regulation to positively correlate with positive motivational consequences (Brunet & Sabiston, 2011; Edmunds et al., 2006, 2007) while other studies found a neutral and nonsignificant role of introjected regulation among Greek (Moustaka et al., 2012) and English exercise participants (Vlachopoulos et al., 2010).

Limitations of the present study include that the sample was not representative of the Greek elderly exercise population as it was a convenience sample. Further, links between exercise behavioral regulations and exercise behavior should not be treated as cause-and-effect relationships as such a conclusion would necessitate an experimental design to be used. Of benefit for this area of study might be that future research measures exercise participation using objective indices of exercise involvement rather than using self-report methodology. Also, experimental research testing the efficacy of autonomy-supportive practices to enhance self-determined motivation and exercise behavior would shed more light on the motivational dynamics of exercise behavior among the elderly. Clearly, the systematic participation of elderly individuals in exercise is necessary to promote physical fitness, health, quality of life, and to reduce all-cause mortality (Brown et al., 2012; Samitz, Egger, & Zwahlen, 2011), and continued motivational research informed by self-determination theory might contribute to such a goal.

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