

Health and Disability

The role of dark-side of motivation and intention to continue in exercise: A self-determination theory approach

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Motivation plays an important role when it comes to regular physical exercise. Hence, low levels of intentions to continue exercising in the future may ultimately lead to higher rates of exercise dropout. The first objective of the present research was to test a theoretical model considering the dark side of motivational determinants on intentions towards exercising in the future. The second objective consisted in comparing groups with different characteristics, as a way to identify individuals with weaker intention, which is believed to be an indicator of a higher dropout risk. In total, 544 (294 female; 250 male) gym exercisers aged between 18 and 58 years ($M = 35.00$; $SD = 11.57$) partook in the present research. Participants were engaged in fitness group classes ($n = 273$) or in cardio/resistance workouts ($n = 271$), and their exercise experience ranged from 3 to 120 months ($M = 47.41$; $SD = 7.54$). Results showed that the measurement and the structural model had an excellent fit. In addition, the structural model was invariant between gender, fitness activities, and exercise experience. Each group displayed different explained variance in intention to continue exercising. Overall, male, young adults and more experienced exercisers had stronger intentions towards exercising. Fitness instructors should be aware of their own thwarting behaviors, especially when interacting with female, young and less experienced exercisers, since they have weaker intentions to exercise in the future, possibly representing an increased risk of withdrawal.

Key words: Thwarting behaviors, need frustration, controlled motivation, intentions, gym exercise.

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INTRODUCTION

The importance of exercise for physical and psychological health

Regular physical exercise plays an important role on both physical and psychological factors such as weight management, physical fitness, well-being, and enjoyment (Mandolesi, Polverino, Montuori *et al.*, 2018). Hence, individuals engage in physical exercise for different motives, motivations, and needs (Ingledeu & Markland, 2008). However, according to recent studies (Dumith, Hallal, Reis & Kohl, 2011; Eurobarometer, 2018; Physical Activity Council (PAC), 2019), most of the adults reported not participating in regular physical exercise. In fact, the number of physical inactive individuals has been increasing during the last years, resulting in higher rates of reported non-communicable diseases (e.g., obesity, diabetes mellitus II, hypertension, cardiovascular diseases), ultimately leading to an increase in public health expenditure (Andersen, Mota & Di Pietro, 2016; Carlson, Fulton, Pratt, Yang & Adams, 2015). Given the importance of health enhancing behaviors to individuals' well-being and overall health, rigorous study of intention to perform such behaviors seems crucial not only to promote quality of life, but also to contribute to the increase on life expectancy (Patrick & Williams, 2012). Several theoretical frameworks have been studied in an attempt to explain, predict, and consequently change physical inactivity and sedentary behaviors (Hagger, Chatzisarantis & Biddle, 2002). In this regard, most of the current research has focused on

motivational determinants, since individuals have pointed out the "lack of motivation" as the main reason for physical inactive behaviors (Eurobarometer, 2018; Teixeira, Carraca, Markland, Silva & Ryan, 2012).

Theoretical framework

Self-Determination Theory (SDT; Ryan & Deci, 2017) is a macro theory of human motivation that highlights the extent to which individuals regulate their behavior as relatively autonomous or as controlled. The behavior regulations behind autonomous and controlled motivation are assumed to lie on a self-determination continuum, in which amotivation (i.e., acting on the behavior without intent) stands as the least and intrinsic motivation (i.e., inherent interest and pleasure in the activity) as the most self-determined regulations (Deci & Ryan, 1985; Howard, Gagne & Bureau, 2017). As we progress end to end the continuum, external regulation (i.e., individual acts out of the desire for external rewards) arises followed by introjected regulation (i.e., acting as a way to seek approval and/or avoid shame). These two regulations stand as controlled motivation, in which they reflect engaging in behaviors for externally referenced reasons. On the other hand, identified (i.e., the behavior is personally important to the individual) and integrated (i.e., intrinsic sources and the desire to be self-aware) regulations, as well as intrinsic motivation (i.e.,

1 self-motivated and driven by interest and satisfaction inherent) are
2 part of autonomous motivation, which reflects a self-determined
3 drive to act on the behavior.

4 One of the defining features of SDT is the assessment of
5 contextual factors that facilitate or hinder different types of
6 motivation. That is, the social context may support or thwart self-
7 determined regulation and the process of internalization in any given
8 domain (Ryan & Deci, 2017). According to SDT, the extent to
9 which one perceives the for need support from the social
10 surrounding (e.g., interpersonal behaviors from exercise instructors)
11 is largely predictive of how autonomously regulated an individual is
12 likely to act on the behavior (Patrick & Williams, 2012).

13 SDT has assessed and defined three Basic Psychological Needs
14 (BPN) critical to supporting (or thwarting) the process of
15 internalization and the development of motivation and other
16 outcomes (Ryan & Deci, 2017, functioning as mediators between
17 social factors and behavioral regulations. According to Deci & Ryan,
18 2000): Autonomy refers to an individual's need to control his/her
19 own behavior while enjoying freedom during interactions with the
20 environment; Competence involves feeling effective and capable to
21 improve and master new skills; and, Relatedness consists of a
22 person's need to develop emotional connections and affective
23 interactions with others. The satisfaction of the three BPNs carries
24 several positive outcomes, namely by contributing to one's physical
25 and psychological development (Deci & Ryan, 2000). On the other
26 hand, when individuals perceive their BPNs to be frustrated, they
27 experience feelings of controlled motivation and/or ill-being (Ryan
28 & Deci, 2017).

31 *Self-determination tenets in the exercise context*

32 In the exercise context, several studies have tested the impact of
33 supportive behaviors on BPN satisfaction, presenting crucial results
34 on assessing human motivation (Rodrigues, Bento, Cid *et al.*, 2018).
35 For example, Ntoumanis, Thogersen-Ntoumani, Quested and
36 Hancox (2017) showed that exercisers perceiving fitness instructors
37 as supportive (e.g., giving rationale and positive feedback) are more
38 likely to experience increased levels of BPN satisfaction and
39 autonomous motivation, predicting higher levels of intentions to
40 continue exercising in the future. Other studies like (Puente &
41 Anshel, 2010) found positive and significant predictions of perceived
42 supportive behaviors on intrinsic motivation, leading to positive
43 outcomes such as enjoyment and exercise frequency.

44 However, most research conducted up until today has solely
45 focused on the supportive role of fitness instructors' behaviors
46 (Edmunds, Ntoumanis & Duda, 2008; Ntoumanis *et al.*, 2017),
47 neglecting the impact of need thwarting behaviors. According to
48 Ryan and Deci (2017), these behaviors may have negative results in
49 terms of health outcomes, such as ill-being, burnout, or boredom.
50 Thus, it is important to measure such behaviors in health-related
51 research, assess their impact on BPN frustration (Ng, Ntoumanis,
52 Thogersen-Ntoumani, Stott & Hindle, 2013), and, as theoretically
53 proposed by Deci, Olafsen & Ryan, 2017), understand how these
54 can result in controlled motivation (or even amotivation). In other
55 similar domains like physical education, research (Moreno-Murcia,
56 Huescar Hernandez & Ruiz, 2018) has shown that these need
57 thwarting behaviors can positively impact controlled forms of
motivation and negatively influence behavior-related outcomes such

as the intention towards exercising. In fact, as proposed by Hagger,
Hardcastle, Chater, Mallett, Pal and Chatzisarantis (2014),
autonomous and controlled forms of motivation reflect distal
influences on health-related outcomes through intention. Therefore, it
seems of relevance to the analysis of intention, as it represents the
degree to which a person has formulated conscious plans to perform
or not some specific behavior in the future (Ajzen, 1991).

Intentions refer to an individual's engagement in future
behavior (Ajzen, 1991) and has been shown to directly predict
actual behavior, specifically participation or dropout (Balish,
McLaren, Rainham & Blanchard, 2014). According to Hagger
and Chatzisarantis (2009), intention towards exercising stands as
the most proximal predictor of acting on the behavior itself. In
other words, stronger intention is related to increased levels of
exercise participation. On the other hand, weaker intention may
have negative implications, such as behavior withdrawal. In a
systematic review, Rodrigues *et al.* (2018) showed a negative
prediction of amotivation and controlled forms of motivation on
intentions towards exercising, explaining the need of further
analyzing the way the social context may be accountable for this
association.

Aim of the study

To the best of our knowledge, no exercise-related research has
investigated the predictive value of each need thwarting behavior on
each BPN frustration, controlled regulations and amotivation
(according to the self-determined continuum). In addition, no study
has measured the impact of BPN frustration constructs individually
on previous mentioned regulations, and how it is related to intentions
towards exercising.

In this regard, the first objective of present research was to test
a theoretical model (see Fig. 1), expanding the dark side of
motivational determinants on intentions towards exercising. The
second objective was to test the hypothesized model in groups
with different characteristics as a way to measure their intention
towards exercising, since literature points personal characteristics
(e.g., age, gender) as variables to consider when assessing
physical exercise participation (Troost, Owen, Bauman, Sallis &
Brown, 2002). For example, Ingledew, Markland and Ferguson
(2009) have shown that female exercisers aspire for social
recognition and appearance when exercising, thus being related to
controlled forms of motivation. This could represent a negative
impact on intentions and possibly put this group of exercisers at
higher risk of withdrawal. In addition, other variables like age
could influence intention towards exercising (Lee, Dunsiger,
Connell Bohlen *et al.*, 2018; Rhodes, Martin, Taunton, Rhodes,
Donnelly & Elliot, 1999). As shown by Antunes, Couto,
Monteiro, Moutão, Marinho and Cid (2017), older adults may
have different motives and motivation towards exercising. Hence,
the analysis of the influence of age in dropout predisposition and
of the variables influencing behavioral regulation in individuals
aged differently seems of particular relevance (Sallis, Hovell &
Hofstetter, 1992). Likewise, gym exercisers with less exercise
experience could display higher dropout risk, as shown by Radel,
Pelletier, Pjevac and Cheval (2017), explaining that individuals
with less than 6-months of exercise experience have a higher risk
of withdrawing from physical exercise participation. Therefore, it

is hypothesized that individuals with greater exercise experience will demonstrate a stronger intention to continue exercising, since the behavior may already have been internalized by the individual as a daily activity (Prochaska & DiClemente, 1982). Results could give fitness instructors important tools on how to approach and adapt their communication to gym exercisers with weaker intention to continue exercising. Findings have implications for understanding exercise participation and preventing dropout.

METHODS

Participants

Exercisers from seven gym and health clubs participated in this study. The total sample ($n = 544$) was formed by 294 female and 250 males, aged 18 and 58 years ($M = 35.00$; $SD = 11.57$). Gym exercisers were engaged in either fitness group classes ($n = 273$) or in cardio/resistance workouts ($n = 271$), and their exercise experience, from registration date till data collection, ranged from 3 to 120 months ($M = 47.41$; $SD = 7.54$).

Procedures

Ethical approval was obtained by the Ethics Committee (registration number: CE-UBI-pJ-2018-044:ID683) and research was carried out in accordance with the Helsinki Declaration. Gym and health club managers were contacted and research objectives were explained. After receiving agreement, potential participants were approached at gym and health clubs reception desks and asked to voluntarily participate in the study. Gym exercisers who complied to participate signed an informed consent form and responded to a multi-section questionnaire that took approximately 14 minutes to complete.

Instruments

The Interpersonal Behavior Questionnaire (Rocchi, Pelletier, Cheung, Baxter & Beaudry, 2017) Portuguese version (Rodrigues, Pelletier, Neiva, Teixeira, Cid & Monteiro, 2019b) was used to measure the way gym exercisers perceive fitness instructors' interpersonal behaviors. Only those assessing perceived thwarting behaviors were considered for this study, namely: autonomy thwarting (four items: e.g., "My fitness professional pressures me to do things his way"), competence thwarting (four items: e.g., "My exercise professional give me negative feedback and tells me that I am unfit"), and relatedness thwarting (four items: e.g., "My fitness professional has "cold" interactions with me"). Participants responded to each item using a 7-point scale anchored from one (*do not agree at all*) to seven (*totally agree*). Past studies support the use of this scale for measuring interpersonal behaviors (Rocchi & Pelletier, 2018; Rocchi, Pelletier & Desmarais, 2016).

The Basic Psychological Needs Satisfaction and Frustration Scale Portuguese version (Rodrigues, Hair, Neiva, Teixeira, Cid, & Monteiro, 2019a) was used for assessing the way individuals experience BPN frustration when exercising, namely: autonomy frustration (four items: e.g. "When I

exercise, I feel pressured towards outcomes"), competence frustration (four items: e.g., "I feel a sense of disappointment with my performance when exercising"), and relatedness frustration (four items: e.g., "I feel distant from other people at the gym or health club"). These items were answered using a 5-point scale ranging from one (*totally disagree*) to five (*totally agree*). Several studies (Chen, Vansteenkiste, Beyers *et al.*, 2015; Teixeira, Silva & Palmeira, 2018) support the use of this scale.

The Behavioral Regulation in Exercise Questionnaire Portuguese version (Cid *et al.*, 2018) was used to measure behavioral regulations, namely: amotivation (three items: e.g., "I do not see why I am still exercising"), external regulation (three items: e.g., "I exercise because of external rewards, such as social recognition"), and introjected regulation (three items: e.g. "I feel ashamed when I skip a training session"). Items were assigned a five-point scale ranging from zero (*totally disagree*) to four (*totally agree*). Past research supports the use of this scale in measuring behavioral regulations in Portuguese exercisers (Cid, Monteiro, Teixeira *et al.*, 2018; Teixeira *et al.*, 2018).

Following Ajzen (2006) recommendations, three items were created to measure exercisers' intention to engage in exercise participation in the future: item 1: "I intent to exercise in the near future as I am practicing nowadays"; item 2: "It is my will to continue exercising in the upcoming as how I attend currently", and; item 3: "I pretend to exercise in the next months at the same frequency as it is practiced today". Individuals responded to each item using a seven-point Likert-type scale ranging from one (*do not agree*) to seven (*totally agree*).

Statistical analysis

In order to test the hypothetical model, we followed Kline (2016) recommendations, firstly performing a confirmatory factor analysis (CFA) and then a structural equation model (SEM), using IBM SPSS AMOS v23 (Arbuckle, 2013). CFA was conducted to test measurement model fit, convergent and discriminant validity and composite reliability, as a means to assess construct validity. Average variance extracted (AVE) scores > 0.50 were considered as acceptable for convergent validity, and squared correlations between constructs below AVE represented discriminant validity (Hair, Black, Babin & Anderson, 1997) composite reliability coefficient was employed and scores ≥ 0.70 displayed acceptable internal consistency (Hair *et al.*, 2019). Afterwards, SEM to test structural model fit, direct effect and indirect effects was performed for all groups. The bias-corrected estimates, p -values, and confidence interval (CI) 95% were considered to assess effects, considering significant $p < 0.05$ and/or CI95% not encompassing zero (Hayes, 2018; Williams & Mackinnon, 2008).

Model adequacy in CFA and SEM was verified by the traditional absolute and incremental indexes: standard mean root square residual (SRMR); root mean square error of approximation (RMSEA, with its respective CI90%; comparative fit index (CFI) and Tucker-Lewis index (TLI), respectively. The absolute and incremental indexes cutoff values suggested by several authors (Byrne, 2016; Marsh, Hau & Wen, 2004) were considered: SRMR and RMSEA ≤ 0.80 , CFI and TLI ≥ 0.90 .

After testing the structural model, a multi-group analysis using IBM SPSS AMOS v23 was performed in order to determine the model invariance (i.e., equivalent) between the following groups: male and female; young adults and middle-aged adults (Spirduso, Francis &

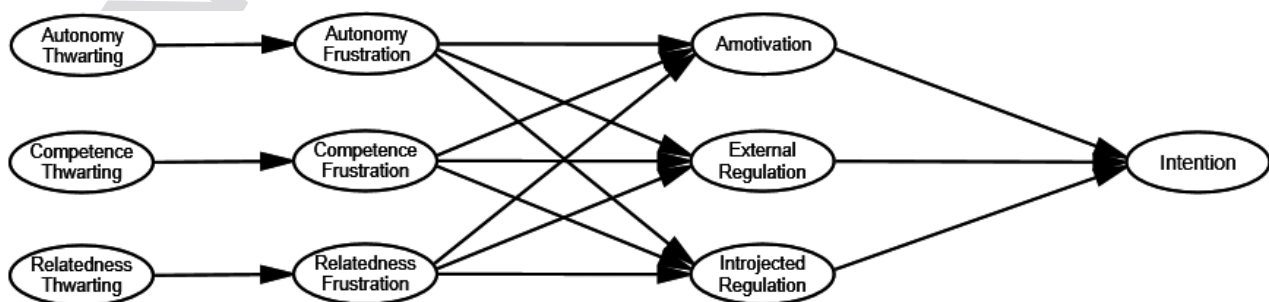


Fig. 1. Xxxx

MacRae, 2005), and < 1-year and \geq 1-years of exercise experience. Experience level stratification was based on the Transtheoretical Model created by Prochaska and DiClemente (1982), specifically the maintenance phase, in which individuals with more than 6-months of physical exercise experience have stronger intention to continue exercising.

First, structural model fit of the data for each group was analyzed, as suggested by several authors (Byrne, 2016; Cheung & Rensvold, 2002; Sass, 2011). Afterwards, multi-group analysis was performed, considering the following criteria: unconstrained model; measurement weights; structural weights; structural covariances; structural residuals; and measurement residuals. Invariance assumptions were verified through the differences in CFI (Δ CFI) using < 0.01 as cutoff values (Byrne, 2016).

RESULTS

Preliminary analysis

Data set was screened for missing values, as well as for univariate and multivariate outliers. Missing values were found in thirteen participants, specifically in items regarding intention. In such cases, data were inserted using multiple imputation procedures (Allison, 2000). Additionally, three cases emerged either as univariate outliers ($z > 3.00$) or multivariate outliers (Mahalanobis' distance = $p^1 < 0.001$; $p^2 < 0.001$). These participants were removed from further analysis as suggested by Byrne (2016). Item-level descriptive statistics indicated no deviation from univariate normality (skewness and kurtosis were contained between -2 and $+2$, -7 and $+7$, respectively). However, Mardia's coefficient of multivariate kurtosis exceeded expected values (>5.0) in all samples under analysis: total sample (281.620), female (246.216), male (236.258), young adults (236.589), middle-aged adults (224.004), <1-year of experience (216.027), and \geq 1-year of experience (203.995). Considering several recommendations (Hair *et al.*, 2019; Nevitt & Hancock, 2001), a Bollen-Stine (B-S) bootstrap of 2,000 samples in CFA and SEM was performed. Descriptive statistics and bivariate correlations are displayed in Table 1.

Confirmatory factor analysis and structural equation modeling

The measurement model in CFA displayed excellent fit. Convergent (AVE > 0.50) and discriminant validity ($r^2 <$ AVE of each factor) were also achieved and composite reliability scores were above 0.70, suggesting adequate internal consistency (see Table 1). The structural model in SEM had good fit in total sample, as well as for all groups under analysis, as shown in Table 2.

Direct effects were found between constructs in all samples (see Table 3, 4, and 5), specifically, positive associations were found between thwarting interpersonal behaviors and their respective BPN frustration in all groups; and autonomy and competence frustration were significant with amotivation in all groups. Significant negative effect of amotivation and external regulation were found on intentions towards exercising in the future. However, introjected regulation had a significant positive effect on intentions towards exercising, except in female, young adults, and individuals with < 1-year experience.

Looking at indirect effects, perceived competence thwarting displayed significant prediction with amotivation and external regulation. However, perceived autonomy and relatedness thwarting behaviors' indirect effect on behavioral regulations vary depending on group (see Tables 3–5). Overall, all three BPN frustration have a

negative indirect effect on intention towards exercising, especially autonomy and competence frustration.

The structural model explained variance was: (1) 12% for female; (2) 15% for male; (3) 18% for young adults; (4) 10% for middle-aged adults; (5) 10% for < 1-year of experience, and; (6) 13% for \geq 1-year of experience. In other words, female exercisers, middle-aged adults, and individuals with less than 1-year of exercise experience have less intention to continue exercising in the future, compared to male exercisers, young adults, and individuals with greater than or equal to 1-year of exercise experience respectively.

Multi-group analysis

Results revealed that the structural model fit the data in each group under analysis (see Table 2). In addition, invariance assumptions were met in multi-group models, since Δ CFI were contained within cutoff values. For more details see Table 6.

DISCUSSION

Based on SDT (Ryan & Deci, 2017), the aim of the present study was to examine a theoretical and motivational model of intention towards exercising. Specifically, the present study tested a theoretical sequence, considering the effect of dark side motivational determinants and its prediction on gym exercisers' intention towards exercising. Afterwards, we compared the proposed model between groups in order to determine which groups had the weakest intention to continue exercising, which probably are the ones with the highest risk of exercise withdrawal.

Current results showed that perceived thwarting behaviors provided by significant others (i.e., fitness instructors) predicted higher levels of BPN frustration. Specifically, each perceived thwarting behavior (i.e., autonomy, competence, and related thwarting) was associated with its respective BPN frustration (i.e., autonomy, competence, and relatedness frustration). This corroborates the SDT framework (Ryan & Deci, 2017) and past research in similar domains (Rocchi & Pelletier, 2018), suggesting that the contextual environment has the ability to predict how someone will experience BPN satisfaction or frustration.

Regarding the estimate path from BPN frustration to behavioral regulations, autonomy and competence frustration positively and significantly predicted amotivation and external regulation. However, only relatedness frustration positively and significantly predicted introjected regulation. Current results bring new insights to the literature since this was the first attempt to measure the relationship between BPN frustration and controlled motivation. Existing literature has focused on the impact of BPN satisfaction on self-determined motivation (Moreno-Murcia, Belando, Huéscar & Torres, 2017). In other words, BPN satisfaction predicts higher levels of autonomous motivation. However, the lack of BPN satisfaction is not representative of high levels of BPN frustration (Bartholomew, Ntoumanis, Ryan, Bosch & Thøgersen-Ntoumani, 2011). Differences between satisfying or frustrating basic needs may result from the interaction between the individual and the social environment and the way the individual perceives these interactions (Vansteenkiste & Ryan, 2013). Thus, BPN satisfaction and BPN frustration should be seen as independent constructs that may co-occur in a given context (Rodrigues *et al.*, 2018). According to Ryan

Table 1. Descriptive statistics, composite reliability, variance inflation factor, average variance extracted, and correlation matrix

	M	SD	S	K	CR	VIF	AVE	Correlation matrix												
								1.	2.	3.	4.	5.	6.	7.	8.	9.	10.			
1. Autonomy Thwarting	3.31	1.38	0.14	-0.55	0.74	1.92	0.69	r ²	1											
2. Competence Thwarting	1.71	0.89	1.31	1.23	0.71	0.81	0.65	r ²	0.42**	1										
3. Relatedness Thwarting	2.02	1.02	0.76	0.02	0.77	1.04	0.72	r ²	0.26**	0.87**	1									
4. Autonomy Frustration	1.78	0.69	0.82	0.32	0.72	0.48	0.67	r ²	0.41**	0.49**	0.42**	1								
5. Competence Frustration	1.58	0.57	0.93	0.51	0.74	0.32	0.69	r ²	0.31**	0.64**	0.63**	0.68**	1							
6. Relatedness Frustration	1.85	0.71	0.88	0.66	0.75	0.50	0.71	r ²	0.27**	0.44**	0.39**	0.73**	0.72**	1						
7. Amotivation	0.24	0.43	1.78	2.66	0.89	0.19	0.87	r ²	0.07	0.19	0.15	0.53	0.52	0.58**	0.43**	1				
8. External Regulation	0.78	0.74	0.64	-0.55	0.70	0.55	0.65	r ²	0.36**	0.43**	0.36**	0.46**	0.43**	0.39**	0.56**	0.56**	1			
9. Introjected Regulation	2.10	0.99	-0.28	-0.55	0.70	0.98	0.63	r ²	0.20**	0.12	0.09	0.28**	0.23**	0.36**	0.00	0.35**	0.35**	1		
10. Intention	4.58	0.62	-1.75	4.20	0.97	0.39	0.95	r ²	-0.06	-0.25**	-0.23**	-0.26**	-0.22**	-0.25**	-0.28**	-0.31**	-0.31**	0.07	0.07	1
								r ²	0.00	0.06	0.05	0.07	0.05	0.06	0.08	0.09	0.09	0.01	0.01	0.01

Note: M = Mean, SD = Standard Deviation, S = Skewness; K = Kurtosis, CR = Composite Reliability; VIF = Variance Inflation Factor; AVE = Average Variance Extracted; r = correlation; r² = squared correlation. *p = 0.05; **p = 0.01.

Table 2. Model fit indexes

	χ^2	df	χ^2/df	B-S p	CFI	TLI	SRMR	RMSEA	90% CI RMSEA	
									Lower	Upper
CFA Total Sample	769.885	450	1.711	<0.001	0.961	0.954	0.041	0.036	0.032	0.040
SEM Total Sample	1269.017	477	2.660	<0.001	0.948	0.939	0.061	0.055	0.052	0.059
SEM Male	963.614	477	2.020	<0.001	0.927	0.924	0.066	0.064	0.058	0.070
SEM Female	1023.665	477	2.146	<0.001	0.924	0.922	0.068	0.060	0.055	0.065
SEM Young adults	1014.475	477	2.126	<0.001	0.917	0.913	0.066	0.064	0.056	0.068
SEM Middle-aged adults	958.521	477	2.009	<0.001	0.916	0.910	0.069	0.067	0.061	0.073
SEM < 1-year experience	943.451	477	1.978	<0.001	0.919	0.911	0.060	0.060	0.054	0.066
SEM \geq 1-year experience	881.755	477	1.849	<0.001	0.925	0.913	0.064	0.056	0.050	0.062

Note: χ^2 = chi-square; df = degrees of freedom; χ^2/df = normative chi-square; B-S = Bollen-Stine significance; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; SRMR = Standardized Root Mean Square Residual; RMSEA = Root Mean Squared Error of Approximation; RMSEA 90% CI = Confidence Interval of RMSEA.

Table 3. Direct and indirect path estimates among constructs in female and male exercisers

Path	Female					Male				
	β	R ²	p	CI95%		β	R ²	p	CI95%	
				Lower	Upper				Lower	Upper
Direct effect										
Autonomy Thwarting \rightarrow Autonomy Frustration	0.44	0.19	<0.001	0.27	0.60	0.56	0.31	<0.001	0.39	0.88
Competence Thwarting \rightarrow Competence Frustration	0.66	0.44	<0.001	0.53	0.75	0.84	0.70	<0.001	0.73	0.94
Relatedness Thwarting \rightarrow Relatedness Frustration	0.36	0.13	<0.001	0.21	0.51	0.67	0.45	<0.001	0.52	0.81
Autonomy Frustration \rightarrow Amotivation	0.24	0.06	0.01	0.09	0.39	-0.06	0.00	0.63	-0.22	0.13
Autonomy Frustration \rightarrow External Regulation	0.36	0.13	0.01	0.13	0.59	0.18	0.03	0.17	-0.03	0.37
Autonomy Frustration \rightarrow Introjected Regulation	0.13	0.02	0.28	-0.07	0.33	0.23	0.05	0.10	-0.01	0.42
Competence Frustration \rightarrow Amotivation	0.45	0.20	<0.001	0.29	0.61	0.62	0.38	0.02	0.29	0.85
Competence Frustration \rightarrow External Regulation	0.25	0.06	0.08	0.03	0.51	0.40	0.16	0.07	0.06	0.70
Competence Frustration \rightarrow Introjected Regulation	-0.07	0.01	0.49	-0.26	0.10	0.01	0.00	0.90	-0.23	0.34
Relatedness Frustration \rightarrow Amotivation	-0.03	0.00	0.72	-0.17	0.13	0.17	0.03	0.30	-0.11	0.49
Relatedness Frustration \rightarrow External Regulation	0.03	0.00	0.80	-0.16	0.26	0.13	0.02	0.46	-0.20	0.52
Relatedness Frustration \rightarrow Introjected Regulation	0.32	0.10	0.01	0.12	0.50	0.14	0.02	0.45	-0.20	0.45
Amotivation \rightarrow Intention	-0.16	0.03	0.05	-0.30	-0.02	-0.17	0.03	0.08	-0.34	-0.01
External Regulation \rightarrow Intention	-0.32	0.10	<0.001	-0.48	-0.17	-0.21	0.04	0.02	-0.40	-0.07
Introjected Regulation \rightarrow Intention	0.08	0.00	0.40	-0.07	0.22	0.19	0.04	0.01	0.07	0.32
Indirect effect										
Autonomy Thwarting \rightarrow Amotivation	0.10	0.01	0.01	0.03	0.21	-0.04	0.00	0.59	-0.15	0.06
Autonomy Thwarting \rightarrow External Regulation	0.16	0.03	<0.001	0.04	0.32	0.10	0.01	0.14	-0.01	0.25
Autonomy Thwarting \rightarrow Introjected Regulation	0.06	0.00	0.24	-0.03	0.17	0.13	0.02	0.01	0.01	0.29
Competence Thwarting \rightarrow Amotivation	0.29	0.08	<0.001	0.17	0.44	0.52	0.27	0.02	0.26	0.78
Competence Thwarting \rightarrow External Regulation	0.17	0.03	0.07	0.02	0.36	0.33	0.11	0.06	0.06	0.63
Competence Thwarting \rightarrow Introjected Regulation	-0.05	0.00	0.48	-0.17	0.07	0.01	0.00	0.90	-0.20	0.28
Relatedness Thwarting \rightarrow Amotivation	-0.01	0.00	0.68	-0.06	0.05	0.11	0.01	0.24	-0.06	0.39
Relatedness Thwarting \rightarrow External Regulation	0.01	0.00	0.78	-0.06	0.11	0.09	0.01	0.41	-0.12	0.41
Relatedness Thwarting \rightarrow Introjected Regulation	0.12	0.01	<0.001	0.05	0.24	0.10	0.01	0.39	-0.12	0.33
Autonomy Thwarting \rightarrow Intention	-0.06	0.00	<0.001	-0.13	-0.02	0.01	0.00	0.75	-0.04	0.07
Competence Thwarting \rightarrow Intention	-0.10	0.01	0.01	-0.19	-0.04	-0.16	0.03	0.03	-0.33	-0.05
Relatedness Thwarting \rightarrow Intention	0.08	0.00	0.63	-0.03	0.04	-0.02	0.00	0.73	-0.12	0.08
Autonomy Frustration \rightarrow Intention	-0.14	0.02	<0.001	-0.25	-0.06	0.02	0.00	0.76	-0.07	0.11
Competence Frustration \rightarrow Intention	-0.16	0.03	0.01	-0.27	-0.06	-0.19	0.04	0.03	-0.37	-0.05
Relatedness Frustration \rightarrow Intention	0.02	0.00	0.68	-0.07	0.10	-0.03	0.00	0.74	-0.17	0.12

Note: β = coefficient; R² = explained variance; p = level of significance; CI95% = Confidence Interval at 95%.

and Deci (2017), autonomy, competence, and relatedness frustration may be related to controlled forms of motivation, since they are more associated with intense experience of negative outcomes.

Results exhibited a significant negative prediction of amotivation and external regulation on intention towards exercising. To the best of

our knowledge, this was the first attempt to examine the effect of each BPN frustration on behavioral regulations. Hence, results will be interpreted based on existing literature. Controlled forms of motivation are less likely to be behaviorally adaptive because the activity tends to be perceived as inconsistent with psychological

Table 4. Direct and indirect path estimates among constructs in young and middle-aged adults

Path	Young adults					Middle-aged adults				
	β	R ²	p	CI95%		β	R ²	p	CI95%	
				Lower	Upper				Lower	Upper
Direct effects										
Autonomy Thwarting → Autonomy Frustration	0.54	0.29	<0.001	0.36	0.71	0.39	0.15	<0.001	0.25	0.53
Competence Thwarting → Competence Frustration	0.76	0.58	<0.001	0.66	0.84	0.70	0.49	<0.001	0.53	0.83
Relatedness Thwarting → Relatedness Frustration	0.48	0.23	<0.001	0.33	0.62	0.48	0.23	<0.001	0.27	0.71
Autonomy Frustration → Amotivation	0.10	0.01	0.24	-0.04	0.26	0.05	0.00	0.64	-0.12	0.24
Autonomy Frustration → External Regulation	0.41	0.17	<0.001	0.24	0.59	0.06	0.00	0.66	-0.15	0.32
Autonomy Frustration → Introjected Regulation	0.27	0.08	0.01	0.10	0.45	0.04	0.00	0.78	-0.20	0.27
Competence Frustration → Amotivation	0.57	0.32	<0.001	0.40	0.71	0.54	0.29	0.01	0.23	0.77
Competence Frustration → External Regulation	0.28	0.08	0.08	0.03	0.51	0.31	0.10	0.14	-0.05	0.61
Competence Frustration → Introjected Regulation	-0.13	0.02	0.25	-0.23	0.05	0.03	0.00	0.77	-0.17	0.26
Relatedness Frustration → Amotivation	0.00	0.00	0.99	-0.15	0.15	0.21	0.04	0.17	-0.04	0.72
Relatedness Frustration → External Regulation	0.06	0.00	0.65	-0.13	0.27	0.21	0.04	0.29	-0.10	0.71
Relatedness Frustration → Introjected Regulation	0.29	0.08	0.01	0.10	0.45	0.25	0.06	0.11	-0.01	0.48
Amotivation → Intention	-0.14	0.02	0.07	-0.29	-0.01	-0.22	0.05	0.03	-0.37	-0.05
External Regulation → Intention	-0.25	0.07	<0.001	-0.38	-0.12	-0.29	0.08	0.01	-0.48	-0.11
Introjected Regulation → Intention	0.11	0.01	0.12	-0.01	0.23	0.18	0.03	0.03	0.04	0.32
Indirect effect										
Autonomy Thwarting → Amotivation	0.05	0.00	0.23	-0.02	0.16	0.02	0.00	0.58	-0.05	0.09
Autonomy Thwarting → External Regulation	0.22	0.05	<0.001	0.11	0.38	0.03	0.00	0.60	-0.05	0.14
Autonomy Thwarting → Introjected Regulation	0.15	0.03	0.01	0.05	0.29	0.02	0.00	0.74	-0.07	0.12
Competence Thwarting → Amotivation	0.43	0.18	0.001	0.29	0.56	0.34	0.12	0.01	0.14	0.63
Competence Thwarting → External Regulation	0.22	0.05	0.07	0.02	0.40	0.21	0.04	0.13	0.03	0.49
Competence Thwarting → Introjected Regulation	-0.01	0.00	0.25	-0.25	0.04	0.02	0.00	0.74	-0.12	0.17
Relatedness Thwarting → Amotivation	0.00	0.00	0.99	-0.07	0.08	0.01	0.00	0.13	-0.01	0.54
Relatedness Thwarting → External Regulation	0.03	0.00	0.60	-0.06	0.15	0.10	0.01	0.24	-0.03	0.54
Relatedness Thwarting → Introjected Regulation	0.14	0.02	0.01	0.05	0.25	0.12	0.01	0.06	0.02	0.27
Autonomy Thwarting → Intention	-0.05	0.00	0.03	-0.21	-0.01	-0.01	0.00	0.74	-0.06	0.03
Competence Thwarting → Intention	-0.12	0.01	<0.001	0.10	-0.06	-0.14	0.02	0.05	-0.30	-0.03
Relatedness Thwarting → Intention	0.01	0.00	0.57	-0.02	0.05	-0.03	0.00	0.46	-0.26	0.03
Autonomy Frustration → Intention	-0.08	0.00	0.03	-0.17	-0.02	-0.02	0.00	0.79	-0.13	0.08
Competence Frustration → Intention	-0.16	0.03	<0.001	-0.27	-0.08	-0.19	0.04	0.05	-0.38	-0.04
Relatedness Frustration → Intention	0.02	0.00	0.60	-0.05	0.09	-0.06	0.00	0.52	-0.35	0.08

Note: β = coefficient; R² = explained variance; p = level of significance; CI95% = Confidence Interval at 95%.

needs and regulated by external contingencies (Ryan & Deci, 2017). As shown in several studies (Bartholomew *et al.*, 2011; Moreno-Murcia *et al.*, 2018), controlled motivation could have a positive association with negative consequences, such as burnout, ill-being and lower intentions towards the behavior.

One somewhat surprising finding was that introjected regulation had a positive and significant association with intentions in male, young adults and individuals with ≥ 1 -year of exercise experience. According to the theoretical framework of SDT, introjected motivation processes that are aimed at promoting feelings of self-worth or social approval are experienced as negative and unpleasant feelings and are more likely to be associated with negative outcomes. One hypothetical explanation of current results is that the type of introjected regulation assessed in current research involves actions that gym exercisers perceive as self-capable and reasonable to perform. This type of behavioral regulation has been defined as introjected approach motivation, which refers to attempts to meet standards to feel worthy and proud of oneself (Assor, Vansteenkiste & Kaplan, 2009). The fact that this regulation explains self-worth striving and self-esteem concerns might be somehow beneficial in promoting positive outcomes

(Assor *et al.*, 2009). Forthcoming studies should assess both sides of introjected regulation in order to better understand its implication on behavioral and cognitive outcomes.

Multi-group analysis

The model was invariant between gender, age and exercise experience, respecting invariance assumptions proposed by several authors (Byrne, 2016; Cheung & Rensvold, 2002), except for the measurement residual criterion. Several authors (Cheung & Rensvold, 2002; Hair, Black, Babin & Anderson, 2014) noted that higher levels of invariance are seldom achieved and recommend moving ahead when structural invariance criteria are confirmed, as was the case in the current study. Overall, multi-group analysis supported the use of the present model to measure motivational determinants on intention among groups with different characteristics. This analysis was important since it represented the equivalence of the relationships between constructs in groups with different characteristics.

Regarding explained variance of intention between gender, females had lower scores compared to male exercisers. This could

Table 5. Direct and indirect path estimates among constructs in < 1-year and ≥ 1 year of exercise experience

Path	<1-year experience					≥1-year experience				
	β	R ²	p	CI95%		β	R ²	p	CI95%	
				Lower	Upper				Lower	Upper
Direct effects										
Autonomy Thwarting → Autonomy Frustration	0.39	0.15	<0.001	0.18	0.60	0.57	0.32	<0.001	0.29	0.83
Competence Thwarting → Competence Frustration	0.75	0.56	<0.001	0.61	0.86	0.84	0.71	<0.001	0.74	0.93
Relatedness Thwarting → Relatedness Frustration	0.42	0.18	<0.001	0.23	0.60	0.66	0.44	<0.001	0.45	0.82
Autonomy Frustration → Amotivation	0.05	0.00	0.50	-0.08	0.20	0.10	0.01	0.40	-0.09	0.34
Autonomy Frustration → External Regulation	0.25	0.06	0.06	0.03	0.52	0.14	0.02	0.35	-0.10	0.43
Autonomy Frustration → Introjected Regulation	0.25	0.06	0.09	0.01	0.48	0.16	0.03	0.31	-0.11	0.41
Competence Frustration → Amotivation	0.61	0.37	<0.001	0.42	0.77	0.40	0.16	0.04	0.10	0.68
Competence Frustration → External Regulation	0.28	0.08	0.10	-0.01	0.54	0.34	0.12	0.12	-0.03	0.64
Competence Frustration → Introjected Regulation	-0.23	0.05	0.09	-0.46	-0.01	0.09	0.01	0.53	-0.18	0.33
Relatedness Frustration → Amotivation	0.14	0.02	0.16	-0.02	0.34	0.13	0.02	0.47	-0.15	0.47
Relatedness Frustration → External Regulation	0.17	0.03	0.26	-0.07	0.42	0.18	0.03	0.38	-0.15	0.61
Relatedness Frustration → Introjected Regulation	0.31	0.10	0.03	0.09	0.54	0.17	0.03	0.37	-0.13	0.43
Amotivation → Intention	-0.19	0.04	0.06	-0.37	0.02	-0.15	0.02	0.12	-0.33	0.01
External Regulation → Intention	-0.20	0.04	0.10	-0.37	0.01	-0.27	0.08	0.06	-0.50	-0.05
Introjected Regulation → Intention	0.00	0.00	0.98	-0.16	0.16	0.19	0.04	0.04	0.04	0.31
Indirect effect										
Autonomy Thwarting → Amotivation	0.02	0.00	0.39	-0.03	0.09	0.06	0.00	0.5	-0.04	0.26
Autonomy Thwarting → External Regulation	0.09	0.01	0.05	0.01	0.28	0.08	0.00	0.34	-0.06	0.32
Autonomy Thwarting → Introjected Regulation	0.09	0.01	0.08	0.01	0.25	0.09	0.01	0.22	-0.04	0.32
Competence Thwarting → Amotivation	0.46	0.21	<0.001	0.29	0.64	0.34	0.12	0.04	0.09	0.61
Competence Thwarting → External Regulation	0.21	0.04	0.10	0.01	0.42	0.29	0.08	0.11	-0.01	0.56
Competence Thwarting → Introjected Regulation	-0.17	0.03	0.09	-0.37	-0.01	0.07	0.00	0.52	-0.15	0.28
Relatedness Thwarting → Amotivation	0.06	0.00	0.12	-0.01	0.18	0.08	0.01	0.44	-0.09	0.37
Relatedness Thwarting → External Regulation	0.07	0.00	0.19	-0.02	0.22	0.12	0.01	0.33	-0.08	0.51
Relatedness Thwarting → Introjected Regulation	0.13	0.02	0.02	0.045	0.31	0.11	0.01	0.31	-0.07	0.31
Autonomy Thwarting → Intention	-0.02	0.00	0.11	-0.09	0.01	-0.01	0.00	0.65	-0.10	0.04
Competence Thwarting → Intention	-0.13	0.02	0.01	-0.24	-0.05	-0.12	0.01	0.07	-0.27	-0.01
Relatedness Thwarting → Intention	-0.03	0.00	0.22	-0.08	0.01	-0.03	0.00	0.61	-0.18	0.05
Autonomy Frustration → Intention	-0.06	0.00	0.15	-0.16	-0.01	-0.02	0.00	0.72	-0.14	-0.07
Competence Frustration → Intention	-0.17	0.03	0.01	-0.31	-0.06	-0.14	0.02	0.08	-0.31	-0.01
Relatedness Frustration → Intention	-0.06	0.00	0.28	-0.16	0.03	-0.04	0.00	0.65	-0.22	0.09

Note: β = coefficient; R² = explained variance; p = level of significance; CI95% = Confidence Interval at 95%.

be related to the aspiration's women have when exercising compared to men. According to several authors (Ingledeu, Markland & Medley, 1998; Markland & Ingledeu, 1997), female exercisers search more for social acceptance and appearance, which are external reasons for acting on the behavior. Contrarily, in a study conducted by Molanorouzi, Khoo and Morris (2015), results showed men to be more intrinsically motivated to exercise when compared to women. This search for "outer recognition" has been associated with controlled motivation, which in turn leads to negative outcomes (Ingledeu & Markland, 2008). Indeed, gym exercisers with a stronger intrinsic motivation have been shown to commit themselves in exercise for longer periods and report higher levels of intention and adherence to exercise (Buckworth, Dishman, O'Connor & Tomporowski, 2013). In contrast, participants engaging in physical exercise for external reasons and motivations are more prone to experience a weakening of their intention towards exercising, ultimately leading to withdrawal (Rodrigues *et al.*, 2018). As stated by Sallis *et al.* (1992), female exercisers may be more sensitive to social cues. Thus, fitness instructors should be attentive on their communication style. As current results showed,

perceived thwarting behaviors from the environment may negatively impact female's intention towards exercising.

Young adults displayed stronger intention to exercise in the future compared to middle-aged adults. Such findings are not surprising as physical exercise declines with age (Alley, Schoeppe, Rebar, Hayman & Vandelanotte, 2018). As shown by several authors (Hickey & Mason, 2017; Spirduso *et al.*, 2005) younger individuals are more engaged in physical activities than to middle-aged and older adults. One reason could rely on the fact that older men with functional limitations, pain or chronic disease believe that they are unable to become more physical active, or that it is too late to engage in physical exercise (Ziegelmann, Lippke & Schwarzer, 2006). Another reason related to the weaker intention towards exercising in middle-aged adults may be due to self-efficacy. Trost *et al.* (2002) reported younger men to have higher rates of self-efficacy when compared to middle-aged and older adults, and consequently display higher levels of reported physical activity. In addition, middle-aged and older adults prefer slow-paced physical activity than younger adults, hence, older men prefer being active at home (e.g., gardening, housekeeping)

Table 6. Model invariance between gender, age and exercise experience

	χ^2	$\Delta \chi^2$	df	Δdf	χ^2/df	<i>p</i>	CFI	ΔCFI
<i>Female - Male</i>								
Unconstrained Model	1928.061	-	954	-	2.021	<0.001	0.904	-
Measurement Weights	1962.800	34.74	977	23	2.009	<0.001	0.903	0.001
Structural Weights	1994.250	66.19	992	38	2.010	<0.001	0.903	0.001
Structural Covariances	2019.244	91.18	998	44	2.023	<0.001	0.902	0.002
Structural Residual	2026.371	98.31	1005	51	2.016	<0.001	0.899	0.005
Measurement Residual	2123.898	195.84	1038	84	2.046	<0.001	0.895	0.009
<i>Young adults - middle-aged adults</i>								
Unconstrained Model	1982.378	-	954	-	2.078	<0.001	0.909	-
Measurement Weights	2018.572	36.19	977	23	2.066	<0.001	0.908	0.001
Structural Weights	2029.935	47.56	992	38	2.046	<0.001	0.905	0.004
Structural Covariances	2045.017	62.64	998	44	2.049	<0.001	0.905	0.004
Structural Residual	2067.829	85.45	1005	51	2.058	<0.001	0.901	0.008
Measurement Residual	2181.155	198.78	1038	84	2.101	<0.001	0.899	0.010
<i><1-year - \geq1-year of experience</i>								
Unconstrained Model	1552.451	-	954	-	1.627	<0.001	0.907	-
Measurement Weights	1585.565	33.11	977	23	1.623	<0.001	0.904	0.001
Structural Weights	1604.449	52.00	992	38	1.617	<0.001	0.901	0.004
Structural Covariances	1611.088	58.64	998	44	1.614	<0.001	0.900	0.004
Structural Residual	1624.160	71.71	1005	51	1.616	<0.001	0.899	0.008
Measurement Residual	1716.038	163.59	1038	84	1.653	<0.001	0.896	0.010

Note: χ^2 = Chi-square; $\Delta \chi^2$ = differences in χ^2 ; df = Degrees of Freedom; Δdf = differences in df; χ^2/df = normative Chi-square; *p* = level of significance; CFI = Comparative Fit Index; ΔCFI = differences in CFI.

than indoor sporting facilities which are predominately used for fast-paced activities (Alley *et al.*, 2018). This could be related with the low reported intention towards exercising in a gym or health club by middle-aged adults, and could represent a risk group of dropout.

In the current study, gym exercisers with <1-year of exercise experience displayed weaker intention to maintain exercise participation compared to those with more than a year of experience. This is in line with past literature, showing that individuals with low exercise participation have higher probability of dropping out during the first six months (Buckworth *et al.*, 2013). In addition, Prochaska and DiClemente (1982) suggested that people with more than 6-months of experience are more likely to maintain exercise participation on the long-term. Therefore, one could suspect that individuals with longer exercise experience compared to those with smaller exercise experience have stronger intention, even when they perceive high thwarting behaviors from fitness instructors.

Present results have implications for SDT-based research on interpersonal behaviors, and possibly, in behavior outcomes. Firstly, this research extends existing literature based on SDT regarding the "dark side" of motivation in the exercise context (Ng *et al.*, 2013) by including measures of thwarting interpersonal behaviors and BPN frustration separately. To the best of our knowledge, past literature has not measured these constructs separately, which could influence the analysis of motivational determinants on behavioral outcomes. Present findings suggest that perceived autonomy, competence, and relatedness thwarting behaviors independently contribute to the prediction of autonomy, competence, and relatedness frustration, respectively.

Limitations

Although the present study contributes to the understanding of the role of the dark side of motivation on intention to continue

exercising in the specific context of gym and health clubs, some limitations should be considered. For instance, results cannot be generalized since they are constrained to gym and health club exercisers. Another limiting aspect of present study is the self-report nature of motivational determinants and intention towards exercising in the future. Measuring intention towards behavior enactment is not representative of acting on the behavior itself. Therefore, forthcoming studies should assess not only self-reported indicators, but also employ observable measures (e.g., exercise frequency) both for the present and other contextual settings and cultural backgrounds.

Present cross-sectional findings only provide a single "picture" in time, therefore preventing any causal-inference conclusions. Forthcoming studies with a longitudinal design would be helpful in examining the prediction of thwarting interpersonal behaviors on changes in physical exercise participation or withdrawal. The proposed model in this study should be tested in other samples using experimental methodology.

Lastly, data from the bright side of motivation constructs (i.e., perceived supportive behaviors, BPN satisfaction, and autonomous motivation) were not collected. It is hypothesized that these could buffer the effect of thwarting behaviors on BPN frustration and controlled motivation. Forthcoming studies should consider the possible interactions of both sides of motivation, based on SDT framework.

CONCLUSION

Current study offers a unique insight into the motivational determinants and consequences of perceived thwarting behaviors among gym exercisers. These findings extend the knowledge on how the social context (e.g., fitness professionals) not only supports, but also hinders BPN. For instance, results evidence the fact that fitness instructors' thwarting behaviors might lead to

exercisers' weaker intentions to continue exercising. Current research also provides a basis for forthcoming research designs that test the prediction of both sides of interpersonal behaviors (support vs. thwarting), basic psychological needs, behavior regulations and indicators of several outcomes (i.e., intentions, exercise frequency).

Current findings may have implications for developing communication programs and targeting interventions to specific gym exerciser groups. Fitness professionals should constrain as much as possible thwarting behaviors, since they predict BPN frustration and controlled behavior regulations that have been extensively associated with negative outcomes. Current findings suggest that women, middle-aged adults and individuals with less than 1-year of exercise experience are more susceptible to withdrawal, since they represented weaker intention to continue exercising when compared to men, young adults and exercisers with more than 1-year of experience.

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CONFLICT OF INTEREST

Filipe Rodrigues, Diogo Teixeira, Luis Cid and Diogo Monteiro declare that they have no conflict of interest.

ETHICAL APPROVAL

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

INFORMED CONSENT

Informed consent was obtained from all individual participants included in the study.

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