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ABSTRACT

The present study explored the mediation role of past exercise adherence, self-reported frequency and intentions in the association between past experience and future exercise adherence. In total, 431 exercisers (female = 216; male = 215) aged 18 and 64 years, engaged in fitness activities such as group fitness classes and resistance training, were included in the analysis. Serial mediation procedures were employed to examine the direct, indirect, and total indirect effects among variables. The predictor variable and all mediators displayed a positive and significant association with future six-month adherence. Past six-month exercise adherence displayed the most significant association with future six-month adherence. The sequential indirect path from exercise experience → past six-months adherence → self-reported frequency → intentions future six-months adherence displayed a positive and significant effect (β = .19 [CI95% = .09, .31]), presenting a partial mediation effect. Past behaviour is the most significant predictor of future adherence, and thus interventions should be based on promoting consistent exercise frequency. Professionals working in the fitness centre context can identify possible dropouts based on their past behaviour and intentions to be physically active in the future.

Introduction

Exercise participation contributes positively to physical and psychological health (Warburton & Bredin, 2017). Additionally, regular physical exercise reduces the incidence and severity of health problems and chronic diseases, and increases quality of life, thus making it an important constituent of health promotion (Moore et al., 2016). The scientific evidence (Garber et al., 2011) continues to build as physical exercise is also associated with physical and mental benefits that can start accumulating with small frequency (e.g., 2 times per week) every week. Despite the vast known health benefits, previous studies indicate that most of the population is physically inactive or does not engage in enough physical exercise to obtain the associated benefits (EC, 2018; World Health Organization, 2018), and those who initiate a training regimen withdraw in the early months (Buckworth et al., 2013; Sperandei et al., 2016).

Social cognitive theories offer a basis for exercise promotion interventions (Rhodes & Pfaeffli, 2010). Specifically, theoretical models examining health-related behaviours tend to emphasise reasoned aspects of behavioural actions, mainly summarised by intentions, as key variables to behaviour (Ajzen, 1991). While favourable at baseline for initiating exercise regimens, intentions may have less impact on maintenance (Armitage, 2005). Exercise frequency and consistency could support the development of routine behaviours (Kaushal & Rhodes, 2015; Sommer, 2011).

Efforts to increase exercise participation require comprehensive and coordinated strategies (Garber et al., 2011) as well as a deep understanding of the relationship between cognitive processes and actual behaviour. The measurement and examination of behavioural and cognitive determinants could provide crucial knowledge for scholars and researchers on how to promote physical exercise as an important and integrated solution, not only to reduce the burden of chronic diseases and health costs but also to promote exercise as a health-related behaviour, with both physical and psychological benefits.

Correlates of exercise adherence

Based on the theory of planned behaviour (Ajzen, 1991), intentions are the main determinant of behaviour. In other words, intentions designate the promptness to perform any given behaviour. Previous literature supports the view that intention is a reliable predictor of future behaviour (Sheeran & Abraham, 2003). Consistent with these assumptions, intention has been shown to be a significant predictor of physical activity and thus is commonly used as an indicator of future exercise participation (Brickell et al., 2006; Gomes et al., 2017; Kaushal et al., 2017).

Barring unforeseen events, individuals are expected to act in accordance with their intentions (Ajzen, 2002). However, highly developed skills or highly repeated actions of some behaviours such as exercise no longer require conscious formulation of

a behavioural plan (Gardner et al., 2011). Intentions have also been associated with a substantial amount of variability of future exercise duration and frequency, as reported by Rebar et al. (2019). Thus, despite strong intentions, individuals often refrain from acting on intended behaviours due to various barriers (e.g., motivation) as described by Buckworth et al. (2013). This so-called intention-behaviour gap describes the failure to translate intentions into action (Rhodes & de Bruijn, 2013). Recent research has highlighted the importance of integrating behavioural aspects to explain exercise participation, exploring the utility of measuring other correlates of exercise (Brickell et al., 2006). For example, Rodrigues et al. (2020) found that by inserting past behaviour in the predictor model, the effect of intentions towards future exercise adherence was removed, leaving past adherence as the only significant predictor of future behaviour.

Hagger et al. (2018) suggest that behaviours can be governed either by intentions, automatic processes, or past behaviour. The latter can be defined as actions of an individual in response to external or internal stimuli in the past (Ajzen, 2002). While past behaviour has been assessed as an overall perception of actions in the past, there seem to be two conceptual ramifications, namely frequency of the behaviour and experience with the behaviour (Sommer, 2011). Frequency of the behaviour is understood as the repetition of a behaviour in the past. On the other hand, experience with the behaviour describes when the behaviour initially started. For example, if an individual has initiated an exercise regimen six-months ago but is not acting on it and having withdrawn episodes, thus it means that there is past experience, but no frequency of the behaviour (Rodrigues et al., 2020; Sperandei et al., 2016). Oullette and Wood (1998) stated in their research that the insertion and assessment of past behaviour in social cognitive models could provide crucial information on its effects on latter behaviour. The proposition is twofold: the first is the direct association between past and future behaviour, independent of intentions. This has been demonstrated in several empirical studies (Brickell et al., 2006; Rodrigues et al., 2020) in which past behaviour displayed a statistically significant effect on future behaviour. The second is the indirect effect of past behaviour on future behaviour mediated by intentions (Hagger et al., 2018). This association is proposed to model how previous experience on the behaviour informs the subsequent behaviour, based on intention formation and beliefs on how the individual decides to act on the behaviour in the future.

Of particular interest in relation to cognitive perceptions and actions of how much individuals think they have exercised, studies (Brenner & DeLamater, 2014; Rodrigues et al., 2020) have found that individuals tend to over-report their weekly exercise frequency compared to those observed in the electronic records for tracking attendance. This should not be interpreted as an overwhelmingly negative aspect, but rather as an indication of the intention individuals could have on future exercise adherence. If individuals would self-report low engagement in physical exercise, this could be related to previous experience on the behaviour and shape their intentions towards exercising in the future. Conversely, higher means of

self-report exercise frequency could lead individuals to perceive control on the behaviour, by specifying the behaviour to be performed on the short term, based on previous experience (Rodrigues et al., 2020). Thus, self-reported frequency could increase future intentions to practice exercise, and the possibility explored in the present research is that past self-reported exercise frequency may mediate the association between past behaviour, intentions and, consequently, future behaviour.

Current research

Methodological challenges to the research of exercise adherence include the need for longitudinal designs, with large samples that can be followed prospectively, in order to identify individual engagement towards exercising. This might be particularly difficult in fitness centres since individuals may drop out from one facility and start exercising in another gym or health centre (Sperandei et al., 2016). To the best of our knowledge, a deeper investigation of the relationships between objective measures of exercise and individual perceptions of how people intend to maintain future physical exercise has only begun recently (Kaushal & Rhodes, 2015). Prospective studies examining the temporal associations between past behaviour and cognitive perceptions on future health-related behaviours are also limited (Gardner, 2015). One existing study conducted by Hagger et al. (2018), found that past behaviour displayed higher predictive power towards future exercise compared to intentions, arguing that past behaviour tends to have higher temporal stability. Most of the studies have partially examined the associations between past behaviour (experience and/or frequency) and cognitive aspects of exercising and future behaviour (Brickell et al., 2006; Hagger et al., 2018; Rodrigues et al., 2020), suggesting the need to explore the importance of behavioural correlates of exercise.

It would also be valuable to examine how objective measures and subjective perceptions of exercise are associated with future exercise adherence. Rodrigues et al. (2020) have found that while intentions mediated the relationship between motivational and cognitive determinants (behavioural regulation based on self-determination theory) and future exercise adherence, the explained variance was low (11%). Hagger et al. (2018) in their study also found a mediation role played by intentions in the relationship between cognitive factors (i.e., attitudes, subjective norms and perceived behavioural control) and behaviour, but explained variance was also low (17%). Nonetheless, both Rodrigues et al. and Hagger et al. studies showed the significant role of past behaviour in explained variance and its contribution in predicting behaviour, suggesting that other factors could better explain how the quantity and consistency predict future exercise adherence. A limitation of the study conducted by Rodrigues et al. (2020) was that the authors considered past exercise adherence as past experience, neglecting the two conceptual ramifications of past behaviour (as frequency and behaviour initiation) as described in the literature (Dunton et al., 2022; Sommer, 2011).

Based on the existing literature and limitations, the purpose of this study was to examine the mediation role of past exercise

adherence, self-reported exercise frequency, and intentions in the relationship between exercise experience and future 6-months exercise adherence. The exploratory hypothesis was that the objective measures (i.e., six-month adherence) and self-reported measures (i.e., perception of weekly frequency and intentions) would have a mediation role between exercise experience and future 6-months adherence. This assumption is based on the evidence indicating that the associations between past behaviour and cognitions could have predictive power on future behaviour (Brickell et al., 2006; Hagger et al., 2018; Rodrigues et al., 2020).

Material and methods

Participants

In total, 431 regular exercisers (female = 216, male = 215) aged between 18 and 64 (M = 34.74; SD = 10.87) years were included for the analysis. Participants were enrolled in fitness group classes (n = 188) or in resistance training (n = 241). For inclusion, we considered those who met the following inclusion criteria: i) aged 18 years or older; ii) provide informed consent to participate; and iii) have more than six months of regular exercise participation. The adoption of the third criterion was based on the transtheoretical model (Prochaska & DiClemente, 1983), as individuals with more than six months of exercise experience have a significantly lower risk of withdrawing from the behaviour (Buckworth et al., 2013).

Procedures

Ethical institutional approval (omitted for review) was obtained prior to conducting this study. Following ethical institutional approval, several fitness facilities (n = 3) were contacted. Objectives and data collection procedures were explained individually to the managers. After approval, exercisers were contacted at the reception desk prior to the training session and were asked to participate voluntarily in this study. Objectives for this study were explained to all participants, and signed informed consent was obtained individually. Participants completed measures using paper-and-pencil self-administered questionnaires. The mean time to complete questionnaires was less than 10 minutes.

Measures

Exercise experience. For measuring exercise experience, computer records were explored. For this study, exercise experience was considered as the registration date, and data was coded in months. This variable was created based on previous assumptions (Brickell et al., 2006; Sommer, 2011)

Exercise adherence. For measuring past and future exercise adherence, computer records from each participants were consulted and quantified as the number of times each participant visited the corresponding fitness facility. Then, two variables were created, namely: a) past six-month exercise, considered as exercise adherence before the application of the questionnaires; and b) future six-month exercise, considered as the exercise adherence after initial data collection. The six-month

criterion was assumed as it would provide enough variability to explain behaviour repetition. Smaller time points have shown little predictability (Gomes et al., 2017), as the time frame does not adequately capture the possible withdrawal motives (e.g., vacations and sickness), which do not translate into dropout, but rather as a temporary stopping point.

Self-reported frequency. Participants were asked once to report their weekly exercise frequency over the last week (statement: "*How many days per week do you think you have exercised over the last week?*"). This variable was assessed at baseline. Single-item measure of exercise frequency has been used in the past and considered a valid and reliable measure of exercise practice (Milton et al., 2011).

Intention. Participants completed a three-item measure of intentions towards exercise based on previous research (Ajzen, 2006). For this study, three items were created to evaluate intention towards exercise in the following six months (item example: "I plan to keep exercising in the next six months as I do currently every week"). This variable was assessed at baseline. A 7-point scale ranging from 1 (absolutely not) to 7 (absolutely yes) was used to respond to these items.

Statistical analysis

Descriptive statistics (i.e., mean, standard deviation, and normal distribution) and bivariate Pearson correlations of the variables under analysis were evaluated using IBM SPSS Statistics v23. In IBM SPSS, skewness, and kurtosis values of zero imply a perfect normal distribution. In order to determine the statistical significance of deviation from normal distribution, the skewness and kurtosis estimates were divided by their corresponding standard error to get the z score. Z-score below |1.96| suggests normal distribution.

Mediation analysis using IBM SPSS PROCESS v3.3 was performed to estimate the effects within the hypothesised model. Predictor variable, mediators, and outcome variables were standardised before testing sequential mediation analysis as proposed by several authors (Hayes, 2018; Preacher & Hayes, 2008). Intention variable was employed in the model as a manifest variable, computed by calculating the mean of the three scale items. Based on mediation analysis assumptions (Hayes, 2018), a sequential mediation model was tested (model 6; serial mediation) in which three mediators were defined, in order to examine the associations among variables of interest. Specifically, predictor variable (i.e., exercise experience), outcome variable (i.e., future six-month exercise adherence), and three serial mediators (i.e., past six-month exercise adherence, self-reported frequency and intention) were imputed in the mediation model for analysis. It is worth mentioning that this is in part retrospective-prospective analysis, and thus, variables were inserted in the model according to data assessment and time points of each variable. Bootstrap with 5000 samples was employed, and the confidence interval at 95% was considered for significance (Williams & MacKinnon, 2008). Bootstrapping procedures allow for re-sampling that is recommended for mediation analysis purposes, particularly the ones based on ordinary least squares (OLS) calculations (Hayes, 2018).

Table 1. Descriptive statistics and correlations.

	Range	M	SD	S	K	1.	2.	3.	4.	5.
1. Experience	6–480	63.06	58.96	1.15	1.45	1				
2. Past 6-month adherence	3–160	62.60	29.47	.78	.40	.16**	1			
3. Self-reported frequency	1–7	3.20	1.17	.83	.73	.21**	.67**	1		
4. Intentions	1–7	4.24	1.04	−1.58	1.94	.18**	.05	.11*	1	
5. Future 6-month adherence	2–156	56.72	29.82	.63	.09	.26**	.83**	.67**	.34**	1

Notes: M : mean; SD: standard deviation; S: skewness; K: kurtosis; * $p < .05$; ** $p < .01$.

Results

Descriptive statistics and bivariate correlations are shown in Table 1. Mean scores for past 6-months adherence were greater than future 6-months adherence. Skewness and kurtosis values were below the cut-off indicating a normal distribution. Several significant bivariate correlations emerged as expected, namely: a) experience, past six-months adherence, self-reported frequency, intentions and future six-month exercise adherence were positively and significantly ($p < .05$; $p < .01$) correlated with each other; b) past six-month adherence was positively and significantly ($p < .05$) correlated with self-reported frequency and highly correlated ($p < .01$) with future six-months adherence; c) self-reported frequency was positively associated with intentions ($p < .01$) and future adherence ($p < .05$); and, d) intentions were positively and significantly ($p < .05$) associated with future six-months exercise adherence.

Mediation analysis

Figure 1 shows the results from the serial mediation model under analysis. A small but significant direct effect was detected between exercise experience and future six-month adherence in the proposed model ($\beta = .07$; IC95% = .03, .12; $R^2 = 0.00$). The sequential indirect path from exercise experience → past six-months adherence → self-reported frequency → intentions → future six-months adherence displayed a positive and significant effect ($\beta = .19$; IC95% = .09, .31; $R^2 = 0.04$), and the total effect (i.e.,

the sum of direct and total indirect effects) was also positive and significant ($\beta = .26$; IC95% = .17, .36). Additionally, indirect effects between exercise experience, all three mediators (i.e., past six-month adherence, self-reported exercise frequency, and intentions), and future six-month adherence were all positive and significant (see, Figure 1). Looking at each indirect effect of each mediator, intention as mediator in the relationship between exercise experience and future six-months adherence displayed a positive and significant effect ($\beta = .05$; IC95% = .02, .07; $R^2 = 0.00$). Self-reported frequency as mediator in the same relationship displayed a positive and significant effect ($\beta = .02$; IC95% = .01, .03; $R^2 = 0.00$), and past six-months exercise adherence displayed also a positive and significant effect ($\beta = .10$; IC95% = .03, .20; $R^2 = 0.01$). Past six-month adherence displayed the greatest effect on future six-month adherence in the model ($\beta = .69$; IC95% = .63, .75). The R^2 adjusted for the total model is 0.79. Since the total indirect effect was positive and significant and greater than the direct effect, it is possible to assume that the proposed model presented a partial mediation effect ($P_M = 0.73$).

Discussion

The purpose of this study was to examine the associations between exercise experience and future adherence, considering
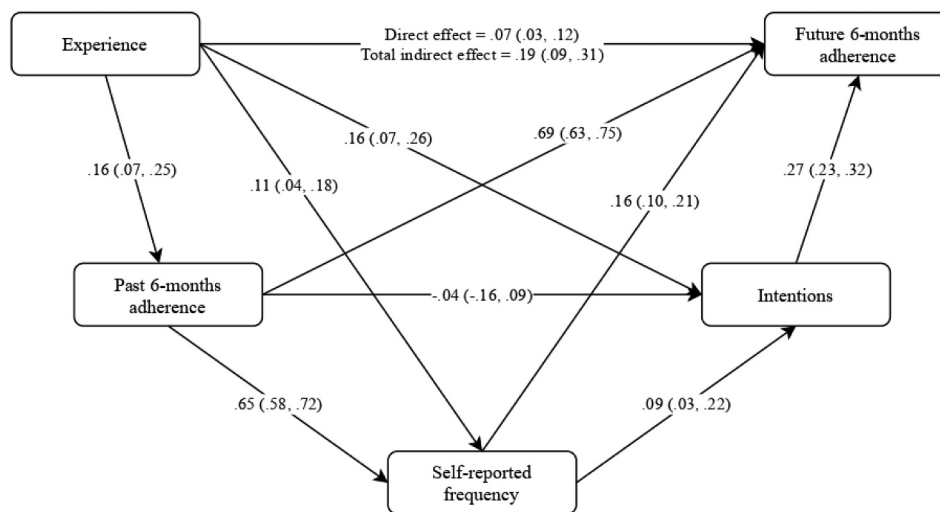
Figure 1. Sequential mediation model.
Notes: all coefficients are standardised; in brackets = confidence interval at 95%; direct effect = experience → future 6-month adherence; total indirect effect = sum of the indirect effects between independent variable, mediators and dependent variable.

behavioural and cognitive determinants as mediators. Specifically, this study analysed the mediation role of the past six-month adherence, self-reported frequency, and intentions towards exercising, in the relationship between exercise experience and future exercise adherence at that specific fitness facility.

This study showed that both exercise experience and past adherence are significantly associated with future behaviour but in different degrees. The present results support the value of distinguishing past behaviour as experience and frequency (Sommer, 2011), suggesting that both have differentiated associations with future behaviour. Experience could reason the individual to exercise (or not), but it is the frequency in the past that explains how much the individual intends to exercise in the future (Rodrigues et al., 2020). As Brickell et al. (2006) have pointed out, it seems reasonable to include past behaviour in the assessment of intentions and future behaviour, specifying the date when the individual started exercising (i.e., experience) and the frequency in the last months (i.e., adherence). It is worth mentioning that we considered exercise experience as the date in which participants registered at the fitness facility. Thus, it is unknown if participants had previous experience at other fitness facilities or exercise experience, which could have influenced current results.

Another contribution to the literature is the insertion of self-reported frequency on the behaviour–intention relationship, a variable that had some predictive power ($\beta = 0.16$; $p < 0.05$) on future exercise adherence. Looking at the theory of planned behaviour (Ajzen, 1991), self-reported frequency could be considered a determinant of perceived behaviour control as it represents a belief on how much control the person had over the behaviour in the past (Ajzen, 1991). Hence, if asking about exercise frequency, participants should have known how much control they had and intended to have on the behaviour in the future, explaining thusa positive but small association with intentions towards future adherence ($\beta = 0.09$; $p < 0.05$).

Based on the assumption of cognitive processes, individuals over-reporting their exercise frequency seem to relate to an indication of how they thought they had exercised in the past. These results give an insight into the impact of past frequency, intentions, and consistency (Kaushal et al., 2017). If the behaviour is repeated consistently in the past, the cognitive perception of the behaviour would be similar as to the self-reported behaviour. However, if the behaviour is performed at random, then individuals would self-report higher frequency compared to the ones measured. As described by Brenner and Delamater (2013), under-reporting exercise frequency is less likely to occur due to social desirability bias as participants like to respond in a favorable manner. Hence, the measurement of objective adherence and self-reported frequency have both significant contribution to determining future exercise adherence.

While it was theoretically hypothesised that intentions towards exercising predicted future exercise adherence (Rodrigues et al., 2020), the explained variance was low ($R^2 = 7\%$). These results support previous assumptions on the intention–behaviour relationship (Brickell et al., 2006; Rhodes & de Bruijn, 2013), explaining that not all intentions translate into behaviour. However, the direct effect of exercise experience on future six-month adherence was less pronounced compared to

the effect of intentions, suggesting that, while exercisers had already some experience, and they could perceive the behaviour as a routine, some intentions were needed to perform the behaviour in the future ($\beta = 0.27$; $p < 0.05$). Hence, if exercise experience is conceived as an indicator of future behaviour, then intentions seem to operate as a mediator in behaviours that have been repeated frequently in the past (Brickell et al., 2006; Rodrigues et al., 2020).

Results showed that past six-month adherence did not predict intentions, but exercise experience and self-reported frequency did. This suggests that current participants already had a high stability of behaviour frequency leading to a lower explicit process to engage in exercise. Current evidence seems to relate to the conceptualisations of habits and how exercise habits are developed. While the present study showed the temporal stability of exercising in the future, based on previous behaviour, no measures of habit development were applied. As previously observed, participants already had at least 6 months of exercise experience, reducing the possible high withdrawal rates in the early stages, as individuals with more exercise experience tend to have lesser intentions to drop out (Buckworth et al., 2013). Although previous studies have considered past behaviour to be interpreted as an indicator of habits (Oullette & Wood, 1998), it is only a proxy rather than the actual variable (Gardner, 2015). In fact, recent studies have indicated a positive prediction of past behaviour, defined only as experience, on behaviour automaticity (Radel et al., 2017), suggesting that a higher degree of adherence could lead individuals to have lesser intentions to exercise in the future, as it has been integrated as a habitual behaviour. Hence, individuals with strong exercise habits may have made the decision to be physically active so often in the past that they are now, and in the future, routinely participating in exercise with low conscious effort (Gardner et al., 2011). Examining the interactions between measures of exercise habit, intentions, past behaviour (i.e., experience and frequency) in the prediction of subsequent behaviour is a useful complement to demonstrate that the behaviour in question may be a matter of habit under some circumstances. That is, in addition to the direct impact of past behaviour on future behaviour, one should explicitly test whether habits moderate intentions when individuals have already been exercising in the past for over a year, and whether intentions towards exercising are less predictive of behaviour, as habit increases in strength in this particular context. Therefore, habit strength may increase because of frequent repetitions of the behaviour in stable conditions of exercising in health and fitness centres.

Strengths, limitations, and future agenda

The current study adds important evidence to the debate about the cognitive processes operationalised in social and cognitive research explaining exercise participation. Additionally, this study creates robust associations between objective measures of past behaviour and future behaviour, looking also on how individual perceptions could influence subsequent behaviour. Furthermore, this study addresses limitations related to previous studies (Brickell et al., 2006; Rodrigues et al., 2020) in which only simple association tests

were conducted that do not account for the variability on future behaviour. That is, current results demonstrate that future exercise adherence is associated not only with previous behaviour but also with the decision-making process based on how individuals thought they were exercising and their intentions towards exercising.

Although the present study contributes with relevant information about the predictability of behavioural and cognitive aspects of future behaviour, some limitations need to be acknowledged. First, even though this exploratory model includes objective measures, habit development was not assessed. Additionally, the assessment of exercise in fitness facilities is confined to the specificity of the context. Exercise experience was defined as the date the individual first accessed the facility, and thus, home-based activity or previous experience at other fitness centres was not considered. A limitation of this study is that participants could have been engaging in exercise long before joining the specific fitness facility in this study. Therefore, conclusions can only be drawn about exercise experience within the specific context as a predictor variable and not a broader exercise experience. Research exploring the effects of habits and other types of fitness activities (e.g., recreational jogging and online fitness programmes) should be considered in forthcoming studies and should test the proposed model with other health-related behaviours. Second, the data are correlational in nature. A more effective means to explore change would be achieved through experimental study designs, manipulating key variables for exercise participation (e.g., motivation and affective response) as it has been proposed by several scholars (Hagger et al., 2018; Rodrigues et al., 2020).

Conclusion

Taking all the evidence into consideration, the assessment of behaviour and intentions towards future exercise seems to be empirically meaningful and has several implications for managers working at fitness facilities. The current findings suggest that interventions should encourage more frequent attendance and consistency in the early months in individuals with lesser exercise experience and frequency. Thus, fitness venues should seek to provide exercisers with a positive and pleasurable experience in the early part of their membership to certify that they want to return in the future. However, it is also important for fitness managers to put in place mechanisms that, not only encourage increased adherence but also establish habitual behaviour in exercisers by focusing on consistency and stability. For example, one possible strategy would be to encourage exercisers to attend the fitness centre at the same day and time each week. One way through which this could be achieved is by instructing exercisers to form action plans describing when they will attend, as well as which fitness activity they intend to engage in.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Declaration of data availability

The dataset analysed during the current study is not publicly available due to the funding project but is available from the corresponding author upon request.

Approval

Approval from the Ethical Committee of Beira Interior University (CE-UBI-pJ-2018-044:ID683) was obtained.

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