

Does Personality Moderate the Intention-Behaviour Relationship in Exercise?

Abstract

Existing research into the moderating effects of personality on the intention-behaviour relationship in exercise is scarce and inconsistent. The present study aimed to contribute to this research area. A total of 150 undergraduate students from The University of Sheffield took part in this study which involved two questionnaires, issued 1 week apart. The study utilised a quantitative approach involving regression analyses, mediation analyses, and moderation analyses. It was found that extraversion had a positive moderating effect for light exercise, whilst conscientiousness had a negative moderating effect for light exercise. No moderating effects were found for total exercise. It was concluded that the moderating effect of personality was limited to light exercise. These findings are largely inconsistent with previous literature, although they do not rule out the possibility of other moderating effects. The explanations and implications of these findings are discussed alongside methodological limitations. It is recommended that future research utilises alternative measures of personality and exercise behaviour to improve validity.

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Introduction

Regular exercise has a range of physical, emotional, and cognitive benefits. It is estimated to save around 3.9 million lives annually (Strain et al., 2020), and increasing levels of exercise by just 10 minutes per day has the potential to save a further 110,000 lives per year in the US alone (Saint-Maurice et al., 2022). Furthermore, regular exercise has been shown to delay the onset of at least 40 chronic conditions including stroke, cancer, and type-2 diabetes (Booth et al., 2012), as well as reducing all-cause mortality by up to 35% and increasing life expectancy by up to 6.9 years (Reimers, Knapp & Reimers, 2012). Regular exercise also has a wide range of cognitive benefits including improvements in executive function and memory (Northey et al., 2018), and can significantly decrease symptoms of major depression and anxiety disorders (Renee, 2003). The National Health Service recommends adults to complete at least 150 minutes of moderate intensity activity, or 75 minutes of vigorous intensity activity per week. However, around 37% of men and 40% of women do not achieve this level of physical activity (GOV.UK, 2022), and a separate survey from the European Commission (2022) found that 45% of Europeans never exercise, with only 6% exercising 5 or more times per week. These sources have also identified a range of demographic variables which are associated with exercise avoidance, with women consistently less likely to exercise than men, and Asian ethnicities less likely to exercise than other ethnicities in the UK. Whilst this has allowed for more targeted public health interventions, particularly towards South Asian adults in the UK, these interventions have not resulted in significant behavioural change (see King, Nigel & Anne, 2017). Therefore, it is important to investigate other ways of targeting interventions so that exercise behaviours can be encouraged.

The Theory of Planned Behaviour

There has been extensive research into why people carry out certain behaviours, guided by theories such as the Theory of Planned Behaviour (TPB; Ajzen, 1991). The TPB describes how the performance of a behaviour is a result of intention, and states that there are three factors which contribute to intention. The first is the individual's *attitude* towards the given behaviour. The second determinant is *subjective norm* (SN), which refers to the individual's perception of the extent to which other people would approve or disapprove of the individual engaging in the behaviour. Third, *perceived behavioural control* (PBC) refers to the extent to which the individual believes they have the capability to carry out the behaviour. The TPB states that, collectively, these factors influence an individual's intentions to carry out a behaviour which, in turn, affects performance of the behaviour. The relative weights of each of these determinants vary between different behaviours, individuals, and populations (Ajzen, 2005). Furthermore, PBC has the potential to impact on behaviour both indirectly, through intentions, and directly. This is because it can be assumed to be partially reflective of actual control over the behaviour, so it can potentially determine the behavioural outcome regardless of intention. There is evidence that all three determinants are correlated with behavioural intentions ($r \sim .70$; E.g., Godin & Kok 1996; Sheeran & Taylor 1999). A meta-analysis by McEachan et al. (2011) summarised the correlations between each determinant, intentions, and behaviour. The correlation between attitude and intention was found to be .57, between SN and intention was .40, and between PBC and intention was .54. Furthermore, the correlation between PBC and behaviour was .31, and it was concluded that the TPB explained 44.3% of the variance in intention, and 19.3% of the variance in behaviour. In the context of exercise, the TPB has been shown to be predictive of both exercise intentions and future exercise behaviour. Norman et al. (2000) analysed attitudes towards exercise in 87

patients following a health promotion clinic. The TPB successfully explained 53% of the variance in exercise intentions, although PBC was found to be the only independent predictor of exercise intention. At a 6-month follow-up, exercise behaviours were measured and the TPB was able to explain 15% of the variance in exercise behaviour and PBC remained the only independent predictor of exercise. Other studies have found attitudes to also be an independent predictor, whilst the role of SN is consistently less significant than that of either attitude or PBC (Hausenblas, Carron, & Mack, 1997). Despite these conflicting aspects of the research, a consistent finding is that the TPB explains intentions much more effectively than it does behaviour. Research has found that variation in intentions only explains an average of ~25% of the variation in behaviour (Sheppard, Hartwick & Warshaw, 1988; Webb & Sheeran, 2006). This discrepancy between intentions and behaviour is known as the intention-behaviour (I-B) gap. It represents the variance in behaviour that is not explained by intentions. A strong I-B relationship is indicative of a low I-B gap, and a weak I-B relationship is indicative of a large I-B gap. A meta-analysis by Rhodes and de Bruijn (2013) involved 10 studies in total and found the I-B gap for physical exercise to be 46%. This was caused overwhelmingly by 54% of intenders who did not subsequently exercise. Only 2% of non-intenders went on to exercise. This supports the TPB by showing that intentions are almost always necessary for exercise behaviour to be carried out, but these intentions often do not translate into behaviour. It is vital to understand why the I-B gap exists in exercise, as it has implications for the health and wellbeing of millions of people.

Explanations of the intention-behaviour gap

Ajzen (2005) theorised several reasons for why the I-B gap exists, including occurrence of unexpected events, dependence on others, and instability of intentions. Previous research has also established that planning, self-efficacy, and action control can reduce the I-B gap for physical activity (Sniehotta et al., 2004). Sheeran and Webb (2016) further suggested that the failure to realise intentions can be separated into three key problems: failure to get started, failure to keep goal pursuit on track, and failure to bring goal pursuit to a successful close. Within each of these problems there exists many possible explanations. Failure to get started can be a result of forgetting one's intentions, missing opportunities to carry out the behaviour, or failing to prepare. For example, Einstein et al. (2003) found that 7.5% of intentions are forgotten after just 5 seconds, and when attention is directed elsewhere, this rises by ~17%. It is possible that intentions to exercise are quickly disregarded for this reason. Considering the failure to keep the goal pursuit on track, common problems include distractions and temptations. People often struggle to follow more than one intention at any given time, so their attention naturally diverts to whichever intention is most salient, relevant, or achievable. For example, it has been found that participants intentions to drive safely can be immediately undermined by priming the goal of moving quickly (Gollwitzer et al., 2011). Dispositional factors such as thoughts, feelings and personality traits can also affect the ability to keep a goal on track. For example, social anxiety has been shown to hamper performance (e.g., Webb et al., 2010). These factors have the potential to prevent individuals from engaging in physical activity to their intended extent. It has also been found that self-efficacy and keeping track of ones' progress increases the likelihood of continuation towards a goal (e.g., Harkin et al., 2016). The final problem that can prevent intentions from translating into behaviour is failure to bring the goal to a close. This can be a result of withdrawing effort too early or

continuing to pursue the goal in a futile or counterproductive manner. This is especially problematic when there are multiple goals involved. Since individuals are unlikely to exert maximum effort towards every goal, it is likely that the pursuit of certain goals will be compromised in favour of others (Baumeister et al., 2014). These factors all have the potential to cause individuals to disregard or disengage from their intended exercise behaviours. Of these factors, dispositional factors such as personality are particularly interesting. It has been suggested that the enduring temporal stability of personality traits could make them a more accurate predictor of exercise than intentions, in that personality traits remain constant for extended periods of time whereas intentions can change quickly (Rhodes & Courneya, 2003). Personality could be a vital aspect of the I-B relationship, as it is possible that certain traits could influence how the individual copes with problems in the pursuit of their goal. For example, conscientiousness involves a high degree of organisation and planning, which has been shown to increase the likelihood of goal pursuit. It is possible, therefore, that conscientiousness increases the likelihood of intentions being realised.

Personality and Exercise

The dominant approach to studying personality traits is the Five Factor model of personality (Goldberg, 1990) which consists of five broad traits, also known as the Big Five;

Extraversion refers to the extent to which an individual is sociable and assertive,

Agreeableness refers to cooperation and an avoidance of conflict, *Conscientiousness* refers to individuals who are organised, orderly, and task-focused, *Neuroticism* refers to one's proclivity towards negative emotions such as depression and anxiety, and *Openness* (also referred to as *Intellect*) refers to those with a broad range of interests and sensitivity to art and beauty. Research into personality and the TPB has established that individuals with low conscientiousness are more likely to procrastinate, making them less likely to get started on

an intended behaviour (e.g., Johnson & Bloom, 1995). They are also less likely to keep their goals on track (Conner, Rodgers, & Murray, 2007), possibly due to a lack of executive function and willpower (e.g., Allan, Johnston & Campbell, 2011). Furthermore, studies have found moderate correlations between procrastination and neuroticism, as anxiety may lead to task avoidance (e.g., Beswick, Rothblum & Mann, 1988). These effects have been replicated in the context of exercise behaviours. Rhodes and Smith (2006) used meta-analytic procedures to investigate the ‘exercising personality’ in 33 studies. It was found that extraversion ($r = .23$), conscientiousness ($r = .20$), and neuroticism ($r = -.11$) were significantly related to exercise participation. In a separate study, regression analyses showed that conscientiousness and neuroticism influenced exercise indirectly through their impact on extraversion, and that extraversion was the only independent predictor of exercise behaviour (Rhodes, Courneya & Jones, 2003). These findings are consistent with other models of personality, including Eysenck’s personality theory (Eysenck, 1966) which posits that individuals seek situations that match their own levels of extraversion and neuroticism. According to this theory, it would be expected that individuals that are high in neuroticism would avoid particularly stimulating or social situations such as attending a gym, whereas those high in extraversion would actively pursue such environments. This is reflected in research into personality differences and perceived exercise intensity. It has been found that, when extraverts and introverts are given the same exercise, extraverts tend to rate their levels of exertion and effort as lower compared to introverts (Koller, Haider, & Recher, 1984). Extraverts were also shown to exhibit better overall mood during the exercise. This is likely a result of their natural proclivity towards higher levels of stimulation. However, these findings have not been consistently replicated, with some studies finding no association between extraversion and perceived exertion (e.g., Williams & Eston, 1986). Furthermore, the results

from these studies do not necessarily reflect changes in the I-B gap. Since Rhodes and Smith (2006) only measured exercise participation rather than intentions to exercise, one cannot be sure that these personality traits moderate the I-B relationship.

Personality and the intention-behaviour relationship

Theoretically, each of the Big Five personality traits have the potential to moderate the I-B relationship. Extraversion may increase the likelihood of intention realisation as extraverts tend to be more energetic, therefore more likely to carry out intended behaviours.

Agreeableness is associated with a tendency towards prosocial behaviour, which could mean prosocial intentions are more likely to be realised in those high in agreeableness.

Conscientiousness may increase intention realisation by increasing planning and organisation abilities and has also been associated with reduced procrastination (Johnson and Bloom, 1995), and improved goal attainment (Conner, Rodgers, and Murray, 2007). Neuroticism is associated with feelings of anxiety which can lead to either a lack of action, or a proclivity towards action. Finally, openness may increase one's tendency to follow through with intentions if such intentions involve creativity or imagination. However, research into the personality facets that may moderate the I-B relationship is scarce, with very few replicated results. MacCann et al. (2015) analysed HEXACO personality domains (Ashton & Lee, 2004) alongside exercising behaviours and the TPB. It was found that honesty-humility, which refers to a sense of cooperation and fairness comparable to conscientiousness in the Big Five, was the only strong predictor of exercise, but it did not moderate the I-B relationship. Thus, honesty-humility likely impacts exercise behaviour, without having a moderating effect on the relationship between intentions and behaviour. It has been shown that honesty-humility is moderately correlated with conscientiousness (Baiocco et al., 2017), so conscientiousness may also be associated with exercise behaviour. In fact, recent meta-

analytic research into the I-B gap for physical activity has established conscientiousness as an independent moderator (Rhodes et al., 2022). Hoyt et al. (2009) conducted a similar study analysing moderation between multiple facets of personality, the TPB and exercise, and found slightly different results. Each of the Big Five personality traits were separated into six facets. Four facets of both neuroticism and extraversion moderated the I-B relationship, as well as the fantasy facet of openness. Interestingly, none of the conscientiousness facets moderated the I-B relationship. When a multivariate analysis was conducted, the anxiety facet of neuroticism emerged as the only significant independent moderator. This supports the role of neuroticism as an independent moderator but brings the role of conscientiousness into question entirely. However, a systematic review by Rhodes, Cox, and Sayar (2022) showed that the moderating effect of conscientiousness was consistent across four studies, with only Hoyt et al. (2009) finding no effect, and most studies found no effect for neuroticism. These studies represent the very limited and inconsistent area of research into personality and the I-B relationship in exercise, an area which the current study seeks to build upon.

The current study

This study measured students' personality traits, TPB variables, intentions to exercise, and exercise behaviour over seven days. Previous research has focused almost exclusively on strenuous exercise behaviours; this is potentially excluding a vital area which was addressed by the present study by analysing light, moderate, and strenuous exercise both individually and collectively. A multiple regression analysis was performed between the TPB determinants (attitudes, SN, and PBC) and intention, to establish whether the determinants were accurate predictors of intention as suggested by the TPB. Hierarchical regression and mediation analyses were also performed to examine the extent to which variance in exercise

behaviour was explained by intention and the determinants. It was hypothesised that the determinants would have an indirect effect on behaviour via intentions, and that intentions would mediate the relationship between the determinants and behaviour, therefore indicating that the TPB is a valid model of exercise in the study sample. Finally, a moderation analysis was carried out to determine whether any of the Big Five personality traits moderated the I-B relationship in exercise. Consistent with previous research, it was hypothesised that extraversion would have a positive moderating effect on the total I-B relationship, such that it would reduce the I-B gap. It was hypothesised that conscientiousness would also have a positive moderating effect on the total I-B relationship, reducing the I-B gap.

Method

Participants

150 undergraduate psychology students from The University of Sheffield were recruited through the Online Research Participation Scheme, which awards undergraduate students with course credits for taking part in research. Participants had to be aged between 18 and 24 to take part. There were no other exclusion criteria for this study. Participants volunteered to take part via the University research website and were offered a course credit for their participation.

An a priori power analysis indicated that it was necessary to recruit 55 participants to detect an effect size of $f^2 = 0.15$, in a multiple regression analysis with 3 independent variables, with alpha set at .15 at 80% power.

Measures

All questionnaires were administered through Qualtrics software (www.qualtrics.com).

Reasoned Action Approach

The questionnaire was shared with two other researchers who were concerned with the Reasoned Action Approach (RAA; Fishbein & Ajzen, 2010). The RAA includes the same variables as the TPB which made it suitable for the present study. Items to assess the RAA were developed in line with guidelines (Conner & Sparks, 2015) and similar to previous studies (e.g., Jones & Norman, 2022). Two items were used to measure each RAA construct including *experiential attitude* (e.g., “Exercising in the next week would be... Pleasant-Unpleasant”), *instrumental attitude* (e.g., “Engaging in exercise over the next week would be... Harmful-Beneficial), *injunctive norms* (e.g., “People who are important to me would approve/disapprove of me engaging in exercise over the next week... Disapprove-Approve”), *descriptive norms* (e.g., “Of the people who are important to you, how many will engage in exercise over the next week? None-All”), *capacity* (e.g., “How confident are you that you could engage in exercise over the next week if you wanted to? Not at all confident-Very confident”), *autonomy* (e.g., “How much control do you have over whether you engage in exercise over the next week? No control-Complete control”), and *intention* (e.g., “I intend to exercise over the next week... Definitely do not-Definitely do”). Items were rated on 7-point response scales and scored so that high values indicated high levels of the variable of interest. Additional questions at the end were used to ask participants exactly how much light, moderate, and strenuous exercise they intended to complete (e.g., “How many hours of strenuous exercise do you intend to complete in the next week?”).

Personality

To measure personality traits, a personality questionnaire was used. This was a 20-item measure based on the Five Factor Model (Goldberg, 1999), called the Mini-IPIP (Donnellan

et al., 2006) which asked participants to rate statements on a scale of 1-5 based on how accurately they reflect their personality. There were 4 items to measure each of the 5 constructs including Extraversion (e.g., “Am the life of the party”), Agreeableness (e.g., “Sympathise with others’ feelings”), Conscientiousness (e.g., “Get chores done right away”), Neuroticism (e.g., “Have frequent mood swings”), and Intellect (e.g., “Have a vivid imagination). An analysis of the Mini-IPIP by Donnellan et al. (2006) found high levels of internal consistency between different studies ($\alpha > .60$), as well as similar test-retest correlations to the original 50-item measure (IPIP-FFM). It was concluded that the Mini-IPIP was a suitable replacement for longer personality measures, which makes it ideal for the current study because participants would likely lose interest or concentration if the measure was excessively long. The Mini-IPIP also has high levels of criterion validity, with research showing variation across gender and age to be consistent with previous studies of personality differences (Laverdière et al., 2013). Furthermore, Perry et al. (2020) found the correlations between the Mini-IPIP and emotional distress to be consistent with a large body of previous research. For example, there was a positive association between neuroticism and depression, anxiety, and anger, which is consistent with a range of previous studies (e.g., Orom et al., 2015). This suggests that the personality traits measured by the Mini-IPIP are consistent with other measures and have high levels of validity.

Exercise Behaviour

In the second wave of data collection, the Godin Leisure-Time Exercise questionnaire (Godin, 2011) was used to ask participants about their exercise behaviour in the elapsed week (e.g., “Over the last 7 days, how often have you done the following kinds of exercise [Light,

Moderate, and Strenuous] for more than 15 minutes?”). The total leisure activity score was calculated as shown in (1).

$$\text{Weekly leisure activity score} = (9 \times \text{Strenuous}) + (5 \times \text{Moderate}) + (3 \times \text{Light}) \quad (1)$$

This produced the data for the dependent variable – total behaviour. Exercise subtypes were based on their corresponding part in the equation (e.g., ‘Strenuous behaviour’ = 9 x Strenuous). The validity of the Godin Leisure-Time Exercise questionnaire was assessed by Motl et al. (2018), who compared responses on the questionnaire to accelerometry data that measured how much the individual moved. A medium-sized correlation was found between the two measures for moderate-to-vigorous physical activity ($r = .46$), although only a small correlation was found for light physical activity ($r = .16$). Analyses involving light physical activity will be interpreted in the context of this limitation.

Design and Procedure

This study used a correlational design with two waves of data collection one week apart.

Participants interested in taking part in the study were directed to a survey hosted on Qualtrics. Participants read the information sheet and consent form before deciding if they wished to take part in the study. The consent form was in the form of a checkbox at the beginning of the survey – participants could only proceed if they provided consent.

Participants then completed measures of the TPB, intentions and personality. The questions in the RAA and intention questionnaires were presented in a random order to minimise the possibility of order effects or demand characteristics. The questions in the personality

questionnaire were presented in a standardised order as designed by the original researchers. Once participants had completed this section, they were asked to provide an email address as a means of receiving the follow-up survey. The follow-up survey was sent to the participants after one week to measure their exercise behaviour. Participants then read a final debrief which explained how their data would be used, and the contact details of the researchers for any queries. All participants received 1 SONA credit after the final questionnaire had been completed. The study received ethical approval from the University of Sheffield Research Ethics Committee (ref: 050497).

Data Analysis

Attrition analyses were conducted to assess whether there were any significant differences between those who completed both surveys and those who only completed the first survey. An independent t-test was used to assess the differences between males and females in the sample. Descriptive statistics were calculated to establish the means and standard deviations of all variables of interest. A correlation analysis was also carried out to establish the extent to which each of the variables were associated with one another. Several analyses were then conducted to establish the applicability of the TPB. A multiple regression analysis was conducted to identify the extent to which the determinants predicted intention, followed by a hierarchical regression analysis which identified whether the determinants explained variance in behaviour beyond that explained by intention, and a mediation analysis tested whether intention mediated the link between the determinants and behaviour. The primary hypothesis was tested using moderation analyses. These identified the personality traits that were most likely to moderate the I-B gap. Subsequently, simple slopes analyses were conducted to establish the nature of the moderation effects.

Results

Participants

The first part of the study was completed by 150 participants in total. 18 responses were deleted for incomplete data as they missed one or more of the TPB, personality, or intentions questions, 6 duplicates were deleted, and 3 exceeded the age exclusion criteria. 130 participants took part in the second part of the study. 5 were deleted for incomplete data, 4 were deleted for incorrect responses, 19 duplicate responses were deleted and 7 were deleted as their email did not correspond with any responses from the first survey. This resulted in a total of 123 participants for the first survey and 93 participants for both surveys. A further 10 participants were excluded from analyses of intentions, and 5 were excluded from analyses of behaviour due to being outliers beyond ± 2.5 standard deviations of the mean. The mean age of the sample was 18.8 years (range = 18-23, $SD = 1.11$). The sample was made up of 14 cisgender males (11.4%), 101 cisgender females (82.1%), 6 non-binary (4.9%), 1 transgender male (<1%) and 1 other (<1%). The sample was 74% White, 22.8% Asian and 3.3% other. All intention and behaviour scores underwent a square root transformation to ensure normality.

Attrition analyses were conducted to compare the demographics, intentions and personality scores of participants who completed both surveys compared to those who only completed the first survey. Three significant differences were found. First, those who completed both surveys had higher levels of agreeableness ($M = 4.21$, $SD = 0.69$) than those who only completed the first survey ($M = 3.92$, $SD = 0.60$; $t(121) = -2.04$, $p = .04$). Second, those who completed both surveys had significantly higher intellect ($M = 3.80$, $SD = 0.80$) than those who only completed the first survey ($M = 3.41$, $SD = 0.81$; $t(121) = -.232$, $p = .02$). Third, those who completed both surveys had significantly higher moderate exercise intentions ($M =$

134.80, $SD = 136.57$) than those who only completed the first survey ($M = 83.0$, $SD = 71.83$; $t(121) = -1.96$, $p = .05$). All other comparisons were non-significant, and the two groups did not differ by age, sex, gender, or ethnicity. An independent t-test was also conducted to establish whether intention, behaviour, and personality scores differed by gender. It was found that the mean exercise behaviour score for males ($M = 10.8$, $SD = 3.01$) was significantly higher than that of females ($M = 7.41$, $SD = 3.14$; $t(80) = 3.03$, $p = .002$). There were no significant gender differences in exercise intentions or personality.

Descriptive Findings

Table 1 shows the means and standard deviations of the non-transformed intention and behaviour scores, determinants, and personality constructs.

Table 1. *Descriptive Statistics*

	<i>N</i>	<i>M</i>	<i>SD</i>
Strenuous Intention	118	5.03	8.94
Moderate Intention	112	8.17	8.40
Light Intention	121	13.46	15.05
Total Intention	113	127.1	110.65
Strenuous Behaviour	88	2.80	5.41
Moderate Behaviour	92	6.73	6.48
Light Behaviour	92	10.22	10.23
Total Behaviour	88	89.52	80.37
Attitudes	123	5.51	1.27
Subjective Norms	123	5.07	1.07
Perceived Behavioural Control	123	5.52	1.21
Extraversion	123	3.08	0.98
Agreeableness	123	4.14	0.68

Conscientiousness	123	3.50	0.82
Neuroticism	123	3.29	0.75
Intellect	123	3.71	0.82

All exercise intention and behaviour variables are in sets of 15 minutes. Mean exercise intentions were greatest for light exercise ($M = 13.46$) and lowest for strenuous exercise ($M = 5.03$). Similarly, mean exercise behaviour was greatest for light exercise ($M = 10.22$) and remained lowest for strenuous exercise ($M = 2.80$). Mean total exercise behaviour ($M = 89.52$) was lower than the mean total exercise intentions ($M = 127.1$).

Correlation Analyses

Table 3 is a correlation matrix showing the Pearson correlation coefficients between all variables of interest.

Table 3. *Correlation Matrix*

	1	2	3	4	5	6	7	8	9	10	M	SD	N
1. Beh	-										7.96	3.33	88
2. Int	.42***	-									9.47	3.73	113
3. Att	.29**	.40***	-								5.51	1.27	123
4. SN	.19	.13	.45***	-							5.07	1.07	123
5. PBC	.25*	.28**	.50***	.26**	-						5.52	1.21	123
6. E	.20	.17	.37***	.32***	.23*	-					3.08	0.979	123
7. A	.15	.06	.16	.04	.20*	.32***	-				4.14	0.679	123
8. C	-.20	-.07	.11	-.00	.10	-.23*	.04	-			3.50	0.818	123
9. N	.02	-.07	-.12	-.18*	-.03	-.12	.03	-.16	-		3.29	0.746	123
10. I	.06	.10	.08	-.07	.07	.11	.24**	.04	.07	-	3.71	0.818	123

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

There were significant medium-sized correlations between extraversion and attitudes, and extraversion and SN. There were weak correlations between extraversion and PBC, and

between agreeableness and PBC. There was also a weak, negative correlation between neuroticism and SN.

Predicting Intention from the Determinants

A multiple regression was performed with intention as the dependent variable and the determinants (attitudes, SN, and PBC) as the independent variables. Table 4 shows the results of the regression analysis. The independent variables explained 14.5% of the variance in intention, $F(3, 109) = 7.34, p < .001$. Inspection of the beta weights revealed that attitude was the only significant independent predictor of intention.

Table 4. *Summary of regression analysis for variables predicting intention (N = 113)*

Variable	<i>B</i>	<i>SE B</i>	β
Attitude	1.08	0.32	.37***
Subjective Norms	-0.19	0.34	-.06
Perceived Behavioural Control	0.35	0.31	.11

Note. $R^2 = .15$, *** $p < .001$

Predicting Behaviour from the Determinants

A hierarchical regression was performed to explain variance in the dependent variable, behaviour. The independent variables were entered in two blocks: (i) intention and (ii) attitude, subjective norms, and perceived behavioural control. As such, it was possible to assess the extent to which attitude, subjective norms, and perceived behavioural control explained variance in behaviour over and above that explained by intention.

Table 5 displays the results of the hierarchical regression analysis. Intentions explained 17.6% of the variance in behaviour, $R^2 = .176, F(1,79) = 16.9, p < .001$. As such, the

intention-behaviour gap was 82.4%. Adding attitude, subjective norms, and perceived behavioural control in Block 2 explained a non-significant further 1.7% of the variance in behaviour, $\Delta R^2 = .017$, $\Delta F(3,76) = 0.53$, $p = .66$. The variables in the final regression model explained a significant 19.3% of the variance in behaviour, $\Delta R^2 = .193$, $F(4,76) = 4.55$, $p = .002$, with intention making the only significant contribution to the prediction of behaviour.

Table 5. Summary of hierarchical regression analysis for variables predicting behaviour (N = 81)

Block	Variable	<i>B</i>	<i>SE B</i>	β
1.	Intention	0.39	0.10	0.42***
2.	Attitude	0.08	0.36	0.37
	Subjective Norms	0.08	0.37	0.03
	Perceived Behavioural Control	0.33	0.31	0.12

Note. $R^2 = .176$ for Block 1, $p < .001$; $\Delta R^2 = .02$ for Block 2, $p = .66$. *** $p < .001$.

Mediation Analyses

Mediation analyses were conducted using the PROCESS macro in SPSS to test whether the effects of attitude, subjective norm, and perceived behavioural control on behaviour were mediated by intention.

In the first analysis, attitude was entered as the independent variable along with intention as the potential mediator. Behaviour was entered as the dependent variable. The paths from attitude to intention, $B = 1.43$, $SE = 0.28$, $p < .001$, and from intention to behaviour, $B = 0.36$, $SE = 0.11$, $p = .002$, were both significant. The effect of attitude on behaviour, $B = 0.72$, $SE = 0.29$, $p = .017$, was reduced to non-significance when controlling for intention, $B = 0.21$,

SE = 0.32, $p = .52$, therefore indicating mediation. Bootstrapping procedures revealed a significant indirect effect of attitude on behaviour, $B = 0.51$, SE = 0.17, CI = 0.20 to 0.88.

In the second analysis, subjective norm was entered as the independent variable along with intention as the potential mediator. Behaviour was entered as the dependent variable. The paths from SN to intention, $B = 1.02$, SE = 0.37, $p = .007$, and from intention to behaviour, $B = 0.38$, SE = 0.10, $p < .001$, were both significant. The effect of SN on behaviour, $B = 0.55$, SE = 0.36, $p = .13$, was non-significant. Significance was reduced further when controlling for intention, $B = 0.16$, SE = 0.35, $p = .64$, indicating a potential mediation effect.

Bootstrapping procedures revealed a significant indirect effect of SN on behaviour, $B = 0.39$, SE = 0.17, CI = 0.08 to 0.74.

In the third analysis, perceived behavioural control was entered as the independent variable along with intention as the potential mediator. Behaviour was entered as the dependent variable. The paths from PBC to intention, $B = 0.71$, SE = 0.32, $p = .03$, and from intention to behaviour, $B = 0.36$, SE = 0.10, $p < .001$, were both significant. The effect of PBC on behaviour, $B = 0.62$, SE = 0.31, $p = .05$, was reduced to non-significance when controlling for intention, $B = 0.36$, SE = 0.29, $p = .23$, therefore indicating mediation. Bootstrapping procedures revealed a significant indirect effect of PBC on behaviour, $B = 0.26$, SE = 0.15, CI = 0.04 to 0.19.

Moderation Analyses

Table 6. *Moderating Effects of Personality on the Light Exercise I-B Relationship.*

Intention		Moderator		Interaction	
B	SE	B	SE	B	SE

Intellect	0.38***	0.07	-0.09	0.28	-0.05	0.10
Extraversion	0.38***	0.07	0.19	0.22	.15*	0.07
Agreeableness	0.36***	0.07	0.41	0.38	0.32	0.14
Conscientiousness	0.35***	0.07	-0.37	0.26	-0.28**	0.10
Neuroticism	0.37***	0.07	-0.17	0.30	-0.01	0.09

Note: * $p < .05$., ** $p < .01$., *** $p < 0.001$.

Table 7. *Moderating Effects of Personality on the Moderate Exercise I-B Relationship.*

	Intention		Moderator		Interaction	
	B	SE	B	SE	B	SE
Intellect	0.59***	0.09	-0.11	0.12	0.10	0.12
Extraversion	0.60***	0.09	0.36	0.25	-0.10	0.09
Agreeableness	0.57***	0.09	-0.13	0.36	0.10	0.11
Conscientiousness	0.58***	0.09	0.01	0.33	0.12	0.12
Neuroticism	0.58***	0.09	-0.05	0.32	-0.07	0.13

Note: * $p < .05$., ** $p < .01$., *** $p < 0.001$.

Table 8. *Moderating Effects of Personality on the Strenuous Exercise I-B Relationship.*

	Intention		Moderator		Interaction	
	B	SE	B	SE	B	SE
Intellect	0.33***	0.08	-0.11	0.37	-0.05	0.11
Extraversion	0.32***	0.08	0.22	0.30	0.08	0.09
Agreeableness	0.33***	0.08	-0.02	0.43	0.05	0.12
Conscientiousness	0.33***	0.08	-0.19	0.36	-0.06	0.10

Neuroticism	0.33***	0.08	-0.06	0.37	-0.04	0.11
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*Note: * $p < .05$., ** $p < .01$., *** $p < 0.001$.*

Table 9. *Moderating Effects of Personality on the Total Exercise I-B Relationship.*

	Intention		Moderator		Interaction	
	B	SE	B	SE	B	SE
Intellect	0.42***	0.10	-0.01	0.43	-0.23	0.15
Extraversion	0.38***	0.10	0.49	0.34	-0.00	0.10
Agreeableness	0.38***	0.10	0.74	0.53	0.06	0.15
Conscientiousness	0.37***	0.10	-0.79	0.40	-0.05	0.12
Neuroticism	0.41***	0.10	0.25	0.45	-0.08	0.14

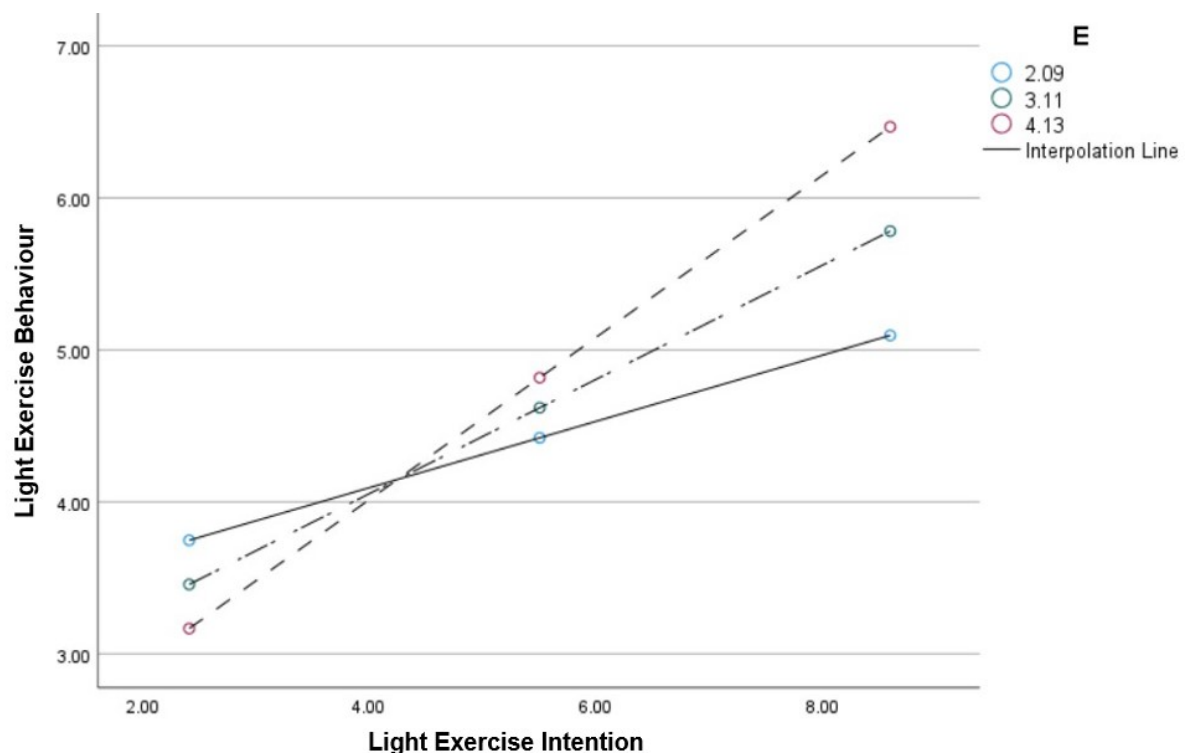
*Note: * $p < .05$., ** $p < .01$., *** $p < 0.001$.*

Moderation analyses were conducted using the PROCESS macro in SPSS to test whether personality traits (i.e., intellect, extraversion, agreeableness, conscientiousness, and neuroticism) moderated the intention-behaviour gap. The moderation analyses were conducted by testing each personality measure for each type of exercise behaviour (i.e., light, moderate, strenuous, and total) in turn.

Considering light exercise, light exercise intentions were entered as the independent variable, light exercise behaviour was entered as the dependent variable, and the potential moderators were tested individually. It was found that there was a significant, positive moderating effect of extraversion on the relationship between light exercise intention and behaviour ($B = 0.15$, $SE = 0.07$, $p = .04$). Simple slopes analysis revealed that the strength of the relationship between intention and light exercise was stronger at high ($M + 1SD$; $B = 0.53$, $SE = 0.11$, $p <$

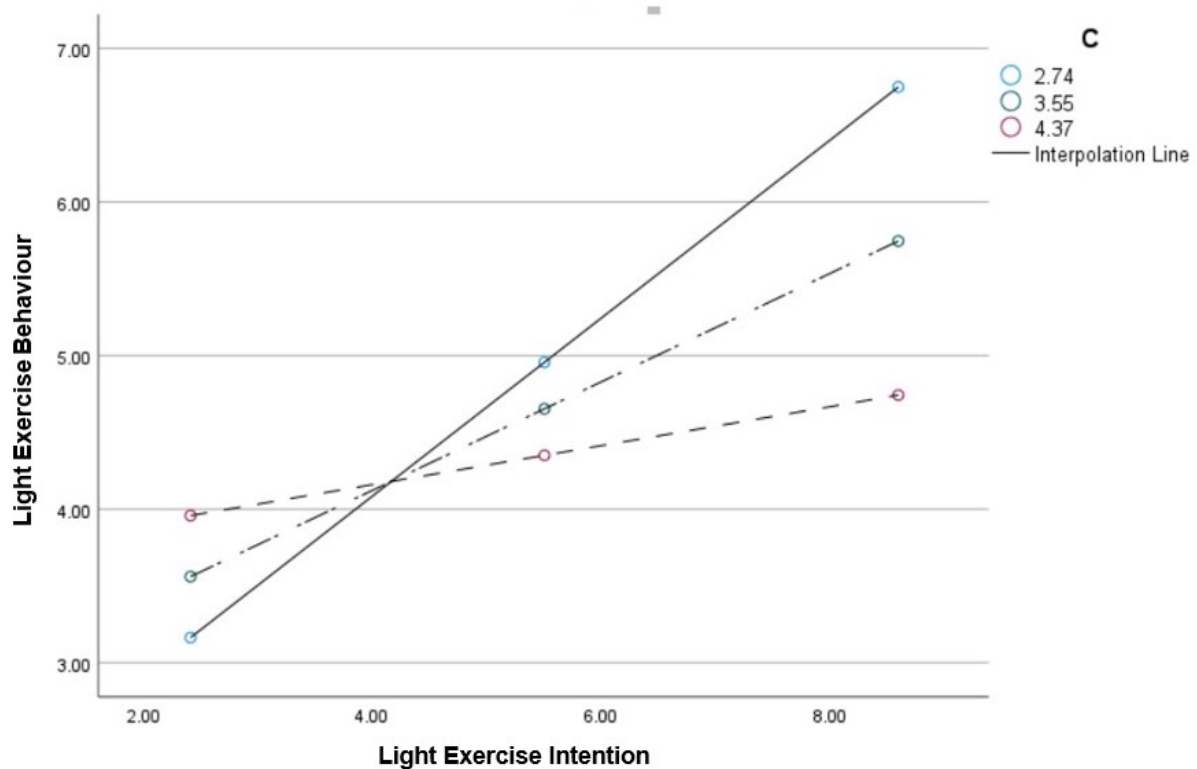
.001) than at moderate (M ; $B = 0.38$, $SE = 0.07$, $p < .001$) and low ($M - 1SD$; $B = 0.22$, $SE = 0.10$, $p = 0.03$) levels of extraversion. This effect is illustrated in Figure 1 below.

Figure 1. *The relationship between light exercise intention and behaviour at different levels of extraversion.*



There was also a significant, negative moderating effect of conscientiousness on the relationship between light exercise intention and behaviour ($B = -0.28$, $SE = 0.10$, $p = .009$). Simple slopes analysis revealed that the strength of the relationship between intention and light exercise was stronger at low ($M - 1SD$; $B = 0.58$, $SE = 0.11$, $p < .001$) than at moderate (M ; $B = 0.35$, $SE = 0.07$, $p < .001$) and high ($M + 1SD$; $B = 0.13$, $SE = 0.11$, $p = .26$) levels of conscientiousness. This effect is illustrated in Figure 2 below.

Figure 2. *The relationship between light exercise intentions and behaviour at different levels of conscientiousness.*



Considering moderate exercise, moderate exercise intentions were entered as the independent variable and moderate exercise behaviour was entered as the dependent variable. It was found that no personality variables had a significant moderating effect. The same was found for the strenuous exercise analysis, where strenuous exercise intentions were entered as the independent variable and strenuous exercise behaviour as the dependent variable. Similarly for total exercise, when total exercise intentions were entered as the independent variable and total exercise behaviour was entered as the dependent variable, no personality variables had a moderating effect on the total intention-behaviour relationship.

Discussion

Aims and Findings

The purpose of this study was to gain a better understanding of how the TPB applies to exercise and the personality traits that moderate the intention-behaviour relationship.

There are 4 key findings of the present research. Firstly, the results support the hypothesis that the TPB is a valid model of exercise in the study sample. Second, it was found that extraversion had a moderating effect on the relationship between light exercise intentions and behaviour. This effect was such that the relationship between intentions and behaviour was stronger for those with high levels of extraversion compared to those with low levels of extraversion. This means the I-B gap was smaller at high levels of extraversion and greater at low levels of extraversion. Third, it was found that conscientiousness also had a moderating effect on the relationship between light exercise intentions and behaviour. This effect was such that the relationship was weaker for those with high levels of conscientiousness compared to those with low levels of conscientiousness. This means the I-B gap was greater at high levels of conscientiousness and smaller at low levels of conscientiousness. Fourth, it was found that personality did not moderate the intention-behaviour gap for moderate, strenuous, or total exercise. The hypothesis that the exercise I-B gap is moderated by neuroticism was not supported.

TPB as an explanation of exercise in a student population.

The finding that the TPB is applicable to exercise in a student population is very well supported (Lu et al., 2022; Zhang et al., 2022; Feng et al., 2022). The present study found that attitude, SN, and PBC explained 14.5% of the variance in intention, although attitude was the only significant independent predictor. This finding is in accordance with the research of

Hausenblas, Carron, and Mack (1997) who found that exercise intentions are most strongly determined by attitudes. It was also revealed that intentions mediated the link between the determinants and exercise behaviour. As such, the present study supports the notion proposed by the TPB that intentions are the strongest predictor of behaviour.

Less supported, however, is that the I-B gap was found to be 82.4%. Previous research has placed the I-B gap much lower, at around 46% (e.g., Rhodes & de Bruijn, 2013). It is worth noting that this gap was partly caused by intenders exercising beyond their intentions. Whilst most participants failed to realise their exercise intentions, 34.6% of participants exercised beyond their intentions. This contrasts with previous research which has found only around 6% of participants to exceed their exercise intentions (Rhodes, Courneya & Jones, 2003).

Exercising beyond intentions still contributes the I-B gap as it weakens the I-B relationship, although this is not concerning from a public health perspective. Indeed, after controlling for those who exercised beyond their intentions, the I-B gap dropped to 53.8% which is much closer to that of the previous literature. There are many factors which can influence the I-B gap. For example, it has been found that intention realisation is more likely for well-educated (Vallerand et al., 2016) and conscientious individuals (Schwarzer, 2009), both of which could apply to university students (Verbree et al., 2021). This could explain why a significant proportion of the I-B gap in the present study was caused by participants exercising beyond their intentions. However, even an I-B gap of 53.8% is concerning; 65.4% of participants did not realise their exercise intentions. Given that data collection occurred partly during a holiday period, it is possible that participants became distracted or established alternative goals. Goal conflict has been well established in the previous literature as increasing the I-B gap (e.g., MacCann et al., 2015). However, with fewer time constraints during the holidays, it

is also possible that participants were able to exercise beyond their intentions during this period.

Personality and the I-B relationship.

The moderation results are largely inconsistent with previous literature. Rhodes, Cox, and Sayar (2022) found a positive moderating effect of conscientiousness in four studies, and no effect in one, whereas the present study found a negative moderating effect such that conscientiousness increased the I-B gap for light exercise. On the surface, this result suggests that the moderating effects of conscientiousness could vary according to exercise intensity. However, previous research has found conscientiousness to be a positive moderator of the I-B relationship in the context of leisure-time walking (Rhodes, Courneya, Blanchard, & Plotnikoff, 2007), which suggests consistency of the moderating effect even at light intensity. The contrasting finding of the present study is likely better explained by methodological limitations or random error. For example, the current study took place across both term-time and holidays. It is possible that intention realisation may have been disrupted during holidays as other events, such as examination preparation, took priority. Conscientiousness is associated with improved academic performance (Chamorro-Premuzic & Furnham, 2003), risk avoidance (Soane et al., 2010) and effective goal prioritisation due to cortical thickness in areas implicated in the Goal Prioritisation Network (Rueter et al., 2018). As such, it is possible that the more conscientious participants, looking to maximise their academic performance and minimise the risk of failing examinations, prioritised academic goals over their light exercise intentions during the holiday period.

The present study also found a moderating effect of extraversion such that increased extraversion reduced the I-B gap. This finding has mixed support in the previous literature,

with some studies finding a similar moderation effect (Rhodes, Courneya & Jones, 2003) and others finding no effect (Chatzisarantis & Hagger, 2008). The theoretical explanation of this finding would be that extraverts tend to be more energetic and may direct this energy towards realising their intentions, and they may feel encouraged to take part in exercise with a social component. The current study defined light exercise as that of minimal effort such as golf, yoga, and bowling. These exercises tend to have a social aspect and often take place in groups, which could explain why extraverts are more likely to realise their light exercise intentions. This also makes sense in the context of the methodological factor that previously explained the conscientiousness effect. During holiday time, whilst conscientious individuals may pursue academic goals which they perceive as being most important, extraverted individuals may instead use this time to pursue more social goals. This could explain why contrasting effects were seen for conscientiousness and extraversion. This finding has implications for public health interventions. In many areas of the UK, the NHS uses “social prescriptions” which involve prescribing light exercise such as walking and cycling for physical and mental health benefits. When prescribing light exercise, healthcare professionals would benefit from knowing that their more introverted patients may be less likely to adhere to the prescribed exercises and may need additional support as a result.

Finally, it was found that neuroticism did not have a moderating effect on any type of exercise. This contrasts with previous research which has found neuroticism, particularly the anxiety facet, to moderate the I-B relationship in exercise such that the I-B gap is larger for those with high levels of anxiety (Hoyt et al., 2009). The theoretical explanation for this is that anxious individuals tend to avoid particularly stimulating situations, and this avoidance facilitates the maintenance of anxiety disorders (Hofmann & Hay, 2018). Methodological differences could explain why the present study did not find such an effect; Hoyt et al.

separated the neuroticism construct into multiple facets and analysed these individually, this highlighted that the anxiety facet was the strongest moderator. On the other hand, the present study analysed the moderation effect of neuroticism as a single broad trait, so it was not possible to observe the moderation effects of specific facets such as anxiety. It is possible that, by analysing the different facets of neuroticism, an effect may have been observed.

Limitations and Future Directions

These findings must be interpreted in the context of the methodological limitations that could have given rise to them. It is worth noting that, whilst the second survey was sent to participants one week after the first, they may not have completed it immediately. Therefore, the behaviour that participants reported may not have taken place in the elapsed one-week timeframe. This means the behaviour measure may not be a valid representation of participants' actual exercise. Furthermore, the behaviour measure relied on participants' memory and judgement which may not be accurate. These factors could have culminated in an invalid measure of exercise behaviour, which may explain the inflated I-B gap found in the present study. The Godin Leisure-Time Exercise questionnaire is also limited in that there is a high degree of overlap between the light, moderate, and strenuous exercise categories and how these are interpreted by different individuals. For example, some individuals may find walking to be highly physically demanding, whilst others may find it extremely easy. Therefore, it is difficult to establish exactly which category this relates to. Furthermore, the example exercise lists given in the questionnaire are not exhaustive and the questionnaire does not make a clear distinction between the categories of light, moderate, and strenuous exercise. For example, 'easy walking' is listed under light exercise and 'fast walking' is listed under moderate exercise, but walking activities that fall between these two descriptors have no clear category. This means the individual exercise categories may lack validity, and the

results of the individual analyses should be interpreted with this in mind. Furthermore, Motl et al. (2018) found that the light exercise measure on the Godin Leisure-Time Exercise questionnaire had only a weak association with accelerometry data. It has been found that the I-B gap is larger when using an accelerometric device to measure movement (62-79%) compared with self-report measures (28-34%; Rhodes, Quinlan & Naylor, 2020). Assuming that accelerometric devices are a more accurate measure of exercise behaviour, this suggests that the measure of exercise in the present study may not be an accurate representation of actual behaviour and, as such, the moderating effects found for light exercise may not be valid. To improve the accuracy of exercise data, future research may benefit from the use of an accelerometric or biometric device or an exercise diary. This would ensure that exercise data does not rely on how well participants remember their behaviour, or how well they understand the reporting measure. The use of a biometric device would also address the limitations of the Godin Leisure-Time Exercise questionnaire as it would be possible to establish specific exercise intensity categories based on heart rate or sweat conductance.

Whilst the Mini-IPIP was suitable for the present study as it made survey completion highly efficient, it is worth noting that the reliability coefficient of the neuroticism construct measured by the Mini-IPIP was not acceptable ($\alpha = .40$), suggesting that this construct was not a reliable measure. This compromises the validity of statistical analyses involving this measure which makes a type-II error more likely - whereby the null hypothesis is accepted where an effect does exist. This could explain why no effects were seen for neuroticism despite previous evidence pointing towards this trait being a moderator. Future research would benefit from a more comprehensive measure of personality. By using the original Big Five Inventory (John et al., 1991) with 50 items, the reliability of this measure could be maximised in future research. Future research should also investigate the possibility that

specific facets of neuroticism moderate the I-B relationship. This would explain why most studies have failed to find a moderating effect of neuroticism but the one study that did find a moderating effect examined specific facets of the trait.

The generalisability of the findings is limited by the overwhelming proportion of female participants. Whilst this alone does not compromise the findings, the fact that the mean exercise behaviour scores were significantly lower for females compared with males means that the behaviour of this sample is not typical of the wider population. This generalisability issue is exacerbated by the finding that the original sample differed from the final sample in terms of agreeableness, intellect, and exercise intentions, suggesting that certain types of individuals were less likely than others to complete both surveys. These findings collectively imply that the final sample of the present study was not an accurate representation of the wider population. As such, the findings of the present study are indicative of a small subset of the population from which one should be cautious to extrapolate. It seems the issue of generalisability is one that is faced by many other researchers in this area, as the finding that participants with greater exercise intentions are more likely to complete the study has been found in similar studies (e.g., Sniehotta, Scholz & Schwarzer, 2004). Future research should seek to maximise the generalisability of the findings by striving for a more representative sample. This could be achieved by utilising stratified sampling, in which the strata within the sample are representative of the wider population. Attrition may be reduced in future research by ensuring that participants are incentivised sufficiently; if participants feel like their input is not being adequately compensated, they may be less likely to complete the study. So, whilst incentivisation should not pressure participants into completing the study, it may be necessary for participants feel appropriately compensated for their time.

Conclusion

The present study investigated whether personality moderates the relationship between exercise intentions and exercise behaviour. It aimed to address the conflicting findings that are present within the literature by contributing to the lack of empirical studies in the field. This study supports the notion that personality moderates the I-B relationship in exercise, although the moderation effects in the present study were unique to light exercise and somewhat inconsistent with previous literature. As such, whilst this study does add some credibility to existing findings, it also questions the reliability of others. That the TPB is a reliable explanation for exercise behaviour in a student population is not a surprising finding but adds to the wealth of literature pointing towards the applicability of the TPB which reinforces the reliability of this theory. The finding that conscientiousness reduced the relationship between intentions and behaviour for light exercise was surprising finding, and perhaps a reflection of methodological limitations and confounding variables rather than a generalisable effect. With previous research having mixed findings for the moderating effect of extraversion, the present study points towards the existence of such an effect which has important practical implications, particularly in the healthcare sector. In the context of the methodological limitations of this study, the findings should be interpreted cautiously, and they do not necessarily refute previous literature. Rather, they suggest that the moderating effects of personality are complex and are easily confounded by methodological and practical factors. As such, there remains a significant contribution that can be made by future research. The inconsistent findings in this area point towards the need for a further study that utilises a more objective measure of exercise and a more comprehensive measure of personality.

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