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Motivation and Body-Related Factors as Discriminators of Change in Adolescents' Exercise Behavior Profiles

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A B S T R A C T

Purpose: A prospective study was conducted to explore the relative contributions of weight-related self-perceptions and exercise-related motivation variables in predicting change in leisure-time exercise within a sample of adolescents in the United Kingdom.
Methods: A cohort of 310 adolescents (51% male, Mean age = 14.08 ± .32 years at baseline) was classified into four groups on the basis of reported change in leisure-time exercise over 10-months: those who maintain, drop out from exercise, take up exercise, and those who were continually inactive. Discriminant function analyses were conducted to predict group membership from adolescents' profiles of motivational and weight-related perceptions at baseline.
Results: For boys, the first discriminant function (DF1) revealed that exercise maintainers reported higher identified regulation, introjected regulation, competence, relatedness, and body satisfaction than all other groups (between-group R^2 = .45). DF2 was more indicative of current exercise levels than change, indicating higher intrinsic motivation and lower amotivation for both active groups at baseline (between-group R^2 = .40). In girls, DF1 showed that exercise maintainers reported higher intrinsic motivation, identified regulation, autonomy, competence, relatedness, and lower external regulation than all other groups (between-group R^2 = .58). DF2 indicated that higher body mass index, and perceiving greater pressure to lose weight positively predicted drop out, and negatively predicted exercise uptake (between-group R^2 = .26).
Conclusions: Fostering autonomous (self-determined) motivation seems a key determinant to maintaining leisure-time exercise for both boys and girls. Additionally, reducing perceptions of pressure to lose weight and promoting positive interactions with others during exercise may be particularly useful to prevent dropout in girls.

Declining rates of physical activity and exercise during adolescence are a significant concern for public health [1]. Exercise is acknowledged to be crucial for health and wellbeing in both childhood and adulthood [1,2], yet by the age of 15 it is estimated that only 71% of UK boys, and 36% of girls are sufficiently active for health [2]. Previous studies have identified the importance of motivation [3,4] and changes in adolescents' perceptions of their body image [5,6] as key factors in studying change in their exercise participation. The present work set out to bring these areas of research together by comparing the relative contributions of motivational constructs and body- and weight-related cognitions in predicting change in exercise behavior in the same study. The purpose of this approach was to develop profiles of characteristics that could be used to identify adolescents who may be at risk of dropping out of sport and exercise in future.

A theory that presents a dynamic view of motivation, linking characteristics of an individual's social environment to its motivational consequences, is self-determination theory (SDT) [7]. SDT proposes that motivation is multidimensional, and resides along a continuum of self-determination ranging from more controlled types of motivation (e.g., acting in response to exter-

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nal pressures such as reward or punishment, or internal cues such as guilt) to more autonomous forms of motivation (e.g., for pleasure, or the value of an activity). An individual's motivation can move along the continuum to become more autonomous if support for three basic psychological needs is provided by the social environment [8]. Specifically, these needs are for autonomy (the need for personal agency and to perceive oneself as the origin of one's actions), competence (the need to feel effective in one's environment and to have opportunities to demonstrate one's efficacy), and relatedness (the need to feel connected to, cared for, and valued by others). In the exercise domain, cross-sectional research has demonstrated that autonomous forms of motivation are positively associated with both subjectively [9] and objectively assessed exercise behavior [10].

Body image as well as exercise participation is reported to deteriorate during adolescence [5]. As a multidimensional construct [11], changes in body image can include cognitive elements, such as awareness of a societal pressure to adhere to a thin ideal weight [6], and affective elements, such as an increased self-consciousness of negative evaluation by others (as indicated by social physique anxiety [12]), in addition to perceptual body image itself [5]. These different dimensions of body image may affect different behavioral determinants of exercise, one of which is motivation. From an SDT perspective, poor body image would be expected to affect motivation through compromising need satisfaction, for example, perceived external pressures would be predicted to compromise the need for autonomy, and concern that others are judging one's body shape negatively to compromise the need for relatedness [3].

Past work suggests that adolescent boys and girls differ in terms of motivation, exercise, and body image. Significant gender differences have been reported in the volume of leisure-time exercise undertaken (greater in boys; [2]), physical self-perceptions (poorer in girls; [13]), and awareness of media pressure to lose weight (greater in girls; [6]). In addition, poor body image may have a different basis, with girls expressing the desire to be thin, and boys being equally likely to desire to gain physical (muscle) bulk [14]. As diet alone does not develop muscle definition, exercise may be more of a necessity to achieving a desired body shape for boys than it is for girls.

In summary, the present study aimed to test the relative importance of motivational variables (i.e., need satisfaction and motivation), and weight and body image-related constructs in predicting change in adolescents' reported exercise behavior over a 10-month period.

Method

Participants

Participants were recruited from three rural co-educational secondary schools (size range = 855–1431 pupils) in South West England, with very few pupils from ethnic minorities (<1%). Head teachers provided written consent for pupils to participate, and passive consent was obtained from parents or guardians. Pupils were informed that they did not have to take part and could withdraw any time without any negative effects on their schooling. All personally identifying information was removed from data before storing.

The initial sample comprised 506 Year 9 (equivalent to US Grade 8) pupils (50% male, *Mean* age, 14.08 years; *SD* = .32; range, 13.05–14.82 years). Complete data for both measurement occasions were available for 310 of the original sample (male, $N = 157$, female, $N = 153$; M age = 14.93 years; $SD = .30$; range, 13.88–15.64 years). Dropout was because of usual absences from school (e.g., illness, field trips; $N = 95$), failure to provide complete data ($N = 32$), unreliable data (e.g., unreasonable response patterns or scores; $N = 31$), multivariate outliers ($N = 9$), and being unwilling to be weighed ($N = 29$). Incomplete data were defined as having missing responses for all parts of an individual measure; isolated missing items were replaced with mean values. No significant difference for any of the study variables was reported in the t test analyses comparing baseline measures of those who dropped out with those retained in the final analysis.

Procedure

Approval to conduct the study was granted by the local research ethics committee (equivalent to a Human Subjects review board). After obtaining consent, pupils were first guided through the exercise questionnaire to ensure correct understanding (i.e., clarification of a 15-minute time frame relating to a school breaktime or popular TV show, clarification of exercise intensity using concrete examples). They then completed the remaining questionnaires independently. An investigator was available to provide assistance as necessary. Height and weight were measured in a separate room by two trained researchers. Measures were taken in the winter school term (i.e., January–March) on two occasions approximately 10-months apart.

Measures

Leisure-time exercise

The Leisure-Time Exercise Questionnaire (LTEQ) [15] was used to assess the frequency of leisure-time exercise, through recording bouts of 15 minutes or more over the past week at three different intensities: mild, moderate, and strenuous. Test-retest reliability of the LTEQ has been established with adolescents [16], and it is reported to have comparable concurrence with other self-report measures when contrasted with objective measures in adolescents [17]. Participants' responses were added to time spent in compulsory physical education (recorded on a class-by-class basis), after which they were classified as sufficiently or insufficiently active for health in accordance with UK Government guidelines (≥1 hour of moderate exercise on each day of the week; [2]). Participants were then categorized as follows: (1) active at both time points (termed *maintainers*), (2) active at baseline but inactive at follow-up (*dropouts*), (3) inactive at baseline but active at follow-up (*take-ups*), and (4) inactive on both occasions (*avoiders*).

Body mass index

Body mass index (BMI; kg/m2) was calculated from weight measured on portable electronic scales (Omega 873, Seca Ltd., Birmingham, UK) and height measured with a portable stadiometer (Leicester Height Measure, Seca Ltd., Birmingham, UK) in light clothing without shoes. BMI was expressed as z-scores based on UK age- and sex-matched reference values [18].

Behavioral regulations

Motivation toward exercise was measured using the Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2) [19]. This scale comprises 19 items designed to assess five types of regulation outlined within SDT. From the least to the most autono-

mous, these were: amotivation (lacking motivation to act), external regulation (acting to gain rewards or avoid punishment), introjected regulation (acting to avoid guilt or shame, or to achieve ego-enhancement), identified regulation (acting to achieve a personally meaningful goal), and intrinsic motivation (acting for the inherent satisfaction of an activity) [20]. (Within SDT, integrated regulation is a type of extrinsic motivation with the highest inherent level of autonomy. This type of motivation, however, is more often encountered among adults than in children, as younger populations may be too young to have experienced or achieved a sense of integration within their self [21]. Furthermore, the BREQ-2 measure does not assess this construct. For these reasons, the construct is not assessed, nor elaborated on further, in the present study). Responses were provided on a 5-point Likert-type scale anchored by 0 (*not true for me*) to 4 (*very true for me*). Adequate factorial validity and reliability has been reported for this measure in adolescents [22]. For ease of interpretation, introjected and external regulations were classed as controlled forms of motivation, and identified regulation classed as autonomous (and therefore predicted to result in more positive behavioral and affective outcomes) [7].

Need satisfaction

Need satisfaction in an exercise context was measured through three five-item measures to assess autonomy [23], competence [24], and relatedness [25]. Responses were made on a 7-point Likert type scale anchored by 1 (*strongly disagree*) to 7 (*strongly agree*). Support for the reliability and factorial validity of these scales with adolescents has been shown in the previous studies [23,26].

Perceived pressure to lose weight was assessed through six items taken from the socio-cultural influences scale [27]. Participants rate the degree to which they feel pressure from (a) parents, (b) friends, and (c) the media, to (1) be thin and (2) lose weight. Ratings are made on a 5-point Likert scale from 1 (*never* [perceive pressure]) to 5 (*always*). The scale is reported to have adequate test–retest reliability in adolescence (r = .84 for girls and .80 for boys), and to correlate significantly with body dissatisfaction (r = .38) [28].

Body satisfaction was measured using a 5-point Likert scale taken from the Body Change Inventory [28]. Participants rate how satisfied they are with their (i) weight, (ii) body shape, and (iii) muscle tone. Scales within the inventory have been shown to be reliable and valid in a series of four studies involving 1,732 adolescent boys and girls [29]. Ratings range from 1 (*extremely dissatisfied*) to 5 (*extremely satisfied*).

Social physique anxiety was assessed using the Social Physique Anxiety Scale (SPAS) [30]. A 9-item version of the scale found to have good internal reliability with an adolescent population was used in the present work [31]. Responses were indicated on a 5-point Likert-type scale ranging from 1 (*not at all*) to 5 (*extremely*).

Data analysis

Data were analyzed using a direct discriminant function analysis (DFA). DFA involves computing composite functions from a set of predictor variables that can maximally discriminate between designated groups (in this case, exercise-change categories). The multivariate mean (centroid) of each function can be used to conduct *post hoc* univariate analyses to identify specific between-group differences. The contributory predictors for each discriminant function (DF) were identified using the conventional criterion of association between the predictor and DF of $r \geq .33$, and selecting only the largest absolute correlation for variables loading onto more than one function [32].

DFA is robust to failures of multivariate normality if caused by skewness rather than outliers [32]. Nine multivariate outliers were deleted to avoid the distortion of results, but no other challenges to multivariate normality were detected (based on critical Mahalanobis D^2 = 34.27, calculated for each group separately). DFA is also robust to unequal sample sizes if the smallest group contains more cases than there are predictor variables. In the present study, the smallest group size was 13 (male *avoiders*), and there were 12 predictor variables in the analysis. Correlations between variables were computed to test for multicollinearity (Table 1). No associations exceeded the cut-off criteria of r = .9 [32], and therefore all variables were retained in the analysis.

Results

Descriptive statistics

The distribution of male and female participants across exercise-change groups is shown in Table 2 alongside descriptive statistics

Table 1
Pearson correlations between study variables

	Alpha[a]	2	3	4	5	6	7	8	9	10	11	12	13
1. Total exercise	—	.03	.14**	.04	−.12*	−.16**	−.01	.07	.23***	.24***	.22***	.25***	.16**
2. BMI z-score	—	—	−.30***	.37***	.26***	.17**	.22***	.01	−.12*	−.14*	−.11*	−.23***	−.07
3. Body satisfaction	.82		—	−.35***	−.58***	−.19***	−.16**	.02	.28***	.34***	.34***	.53***	.28***
4. Perceived pressure to lose weight	.89			—	.50***	.23***	.44***	.21***	−.02	−.09	−.15**	−.25***	−.04
5. SPA	.80				—	.18**	.21***	.10	−.11*	−.22***	−.21***	−.37***	−.16**
6. Amotivation	.82					—	.28***	−.04	−.44***	−.47***	−.42***	−.43***	−.36***
7. External regulation	.76						—	.40***	.09	−.08	−.14**	−.15**	0.00
8. Introjected regulation	.74							—	.54***	.31***	.15**	.17**	.20***
9. Identified regulation	.74								—	.73***	.51***	.58***	.42***
10. Intrinsic Motivation	.87									—	.62***	.64***	.45***
11. Autonomy	.90										—	.61***	.48***
12. Competence	.89											—	.53***
13. Relatedness	.95												—

SPA = social physique anxiety.
* $p < .05$.
** $p < .01$.
*** $p < .001$.
[a] Cronbach's alpha values are presented as measure of internal consistency for each scale.

Table 2
Group means for discriminating variables in sex specific canonical discriminant functions

Male	Maintainers (N = 93, 59%)	Dropouts (N = 23, 15%)	Take-ups (N = 28, 18%)	Avoiders (N = 13, 8%)	Post hoc ANOVA[a]	(Partial η^2)[b]
BREQ-2 (scale 0–4)						
Intrinsic motivation[c]	3.00 (.87)	2.78 (.83)	2.39 (1.01)[d]	2.25 (.78)[d]	$F_{(3,1)} = 5.30^{**}$	.09
Identified regulation[e]	2.78 (.83)	2.20 (.77)[d]	2.25 (.96)[d]	2.10 (.74)	$F_{(3,1)} = 6.09^{**}$	.11
Introjected regulation[e]	1.43 (1.04)	.97 (.70)	1.03 (.96)	1.38 (.93)	$F_{(3,1)} = 2.19$	.04
External regulation	.84 (.83)	.84 (.68)	.71 (.76)	.88 (.55)	$F_{(3,1)} = .25$	.01
Amotivation[f]	.18 (.41)	.27 (.39)	.68 (1.02)[d]	.73 (.75)[d]	$F_{(3,1)} = 7.37^{***}$	.13
Need satisfaction (scale 1–7)						
Autonomy	5.21 (1.13)	5.11 (.88)	4.75 (1.21)	4.89 (1.15)	$F_{(3,1)} = 1.37$	.03
Competence[e]	5.12 (1.13)	4.44 (1.05)	4.46 (1.46)	4.41 (1.26)	$F_{(3,1)} = 4.05^{**}$	.07
Relatedness[e]	5.11 (1.05)	4.30 (1.53)[d]	4.58 (1.30)	4.71 (1.20)	$F_{(3,1)} = 3.70^{*}$	.07
Body satisfaction[e] (scale 1–5)	3.33 (.83)	2.70 (.70)[d]	3.23 (.81)	3.05 (.81)	$F_{(3,1)} = 4.01^{**}$	.07
Perceived pressure to lose weight (scale 1–5)	1.59 (.78)	1.63 (.76)	1.80 (.77)	1.42 (.44)	$F_{(3,1)} = .90$	.02
SPA (scale 1–5)	2.46 (.66)	2.62 (.65)	2.56 (.81)	2.67 (.80)	$F_{(3,1)} = .66$	.01
BMI Time 1	19.94 (2.85)	19.82 (3.38)	20.25 (3.04)	20.78 (4.43)	$F_{(3,1)} = .36$	.01
BMI (z score) Time 1	.56 (1.37)	.49 (1.48)	.78 (1.38)	.94 (1.99)	$F_{(3,1)} = .46$	.01
Female	(N = 48, 31%)	(N = 27, 18%)	(N = 26, 17%)	(N = 52, 34%)		
BREQ-2 (scale 0–4)						
Intrinsic motivation[e]	2.99 (.96)	2.29 (1.10)[d]	2.51 (1.16)	1.97 (.98)[d]	$F_{(3,1)} = 8.40^{***}$	.15
Identified regulation[e]	2.71 (.80)	2.13 (.84)[d]	2.15 (.82)[d]	2.01 (.73)[d]	$F_{(3,1)} = 7.34^{***}$	.13
Introjected regulation	1.42 (1.17)	1.30 (1.20)	1.01 (.95)	1.12 (.93)	$F_{(3,1)} = 1.08$	.02
External regulation[g]	.36 (.55)	.74 (.88)	.56 (.55)	.71 (.64)[d]	$F_{(3,1)} = 3.01^{*}$	.06
Amotivation	.20 (.39)	.42 (.66)	.38 (.76)	.39 (.54)	$F_{(3,1)} = 1.29$	.03
Need satisfaction (scale 1–7)						
Autonomy[e]	5.20 (1.09)	4.63 (1.24)	4.60 (1.30)	4.18 (1.32)[d]	$F_{(3,1)} = 5.67^{**}$	.10
Competence[e]	5.08 (1.13)	4.35 (1.35)	4.76 (1.35)	3.80 (1.34)[d,h]	$F_{(3,1)} = 8.83^{***}$	.15
Relatedness[c]	5.28 (1.10)	4.45 (1.30)[d]	5.36 (1.13)[i,j]	4.57 (1.14)[d,h]	$F_{(3,1)} = 6.47^{***}$	.12
Body satisfaction (scale 1–5)	3.03 (.84)	2.79 (1.08)	2.81 (.74)	2.83 (.88)	$F_{(3,1)} = .66$	.01
Perceived pressure to lose weightf (scale 1–5)	1.63 (.75)	2.10 (1.03)[d]	1.63 (.56)	1.68 (.59)	$F_{(3,1)} = 2.88^{*}$	.06
SPA (scale 1–5)	3.06 (.84)	3.25 (1.03)	2.88 (.82)	3.09 (.84)	$F_{(3,1)} = .81$	.02
BMI[f]	21.53 (3.27)	21.50 (3.81)	20.08 (2.22)	20.28 (3.49)	$F_{(3,1)} = 1.99$	.04
BMI (z score) Time 1	.82 (.13)	.81 (1.51)	.26 (.91)	.33 (1.37)	$F_{(3,1)} = 1.93$	.04

SPA = social physique anxiety.
* $p < .05$.
** $p < .01$.
*** $p < .001$.
[a] *F* values and effect sizes relate to (gender specific) between-group differences.
[b] interpretation of partial η^2: ≥.01 = small, ≥.06 = moderate, ≥.14 = large [33].
[c] significant negative predictors for Function 2.
[d] significant difference from maintainers.
[e] significant positive predictors for Function 1.
[f] significant positive predictor for Function 2.
[g] significant negative predictors for Function 1.
[h] significant difference from dropouts.
[i] significant difference from take-ups.
[j] significant difference from avoiders.

of all predictor variables. A 2 (gender) × 4 (exercise-change category) analysis of variance revealed a significant gender effect for change in leisure-time exercise ($F_{(1,\ 308)} = 36.60$, $p < .001$). Girls were more likely than boys to be classified as *avoiders* or *drop outs*, and less likely to be classified as *maintainers* or *take-ups*. Table 2 presents the outcomes of analysis of variance testing gender-specific between-group differences for each predictor variable (with Bonferroni adjustment).

Discriminant function analysis

Boys

For boys, the DFA resulted in two significant canonical functions discriminating between the four exercise-change groups. The first and second functions accounted for 44% and 41% of the between-group variability, respectively (Function 1: canonical $r = .42$, adjusted $R^2 = .18$, Wilks' $\lambda = .64$, $\chi^2(36) = 64.91$, $p < .01$, partial $\eta^2 = .18$; Function 2: canonical $r = .41$, adjusted $R^2 = .17$, Wilks' $\lambda = .78$, $\chi^2(22) = 36.15$, $p < .05$, partial $\eta^2 = .17$). Function 1 significantly differentiated *maintainers* ($N = 93$) from all other groups (total $N = 64$), according to largely motivational predictor variables with the addition of body satisfaction (Table 3 and Figure 1). Although higher ratings of identified regulation (an autonomous form of motivation) and need satisfaction are consistent with theoretical predictions of behavioral persistence, the positive association of introjected regulation (a controlled form of motivation) with this function was contrary to expectations.

Function 2 significantly differentiated *drop outs* ($N = 23$) from both *avoiders* ($N = 13$) and *take-ups* ($N = 28$), and *maintainers* from *take-ups*. *Post hoc* tests indicated that those who were active at Time 1 (both *maintainers* and *dropouts*) reported higher levels of intrinsic motivation and lower amotivation at that time point than those who were inactive.

Table 3
Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

	DF1	DF2
Male		
Intrinsic motivation		−.52
Identified regulation	.71	
Introjected regulation	.36	
Amotivation		.72
Competence	.58	
Relatedness	.55	
Body satisfaction	.58	
Female		
Intrinsic motivation	.69	
Identified regulation	.62	
External regulation	−.39	
Autonomy	.56	
Competence	.69	
Relatedness	.50	
Perceived pressure to lose weight		.48
BMI		.36

Note: Only factors with significant loadings correlations with discriminant functions (DF) are listed.

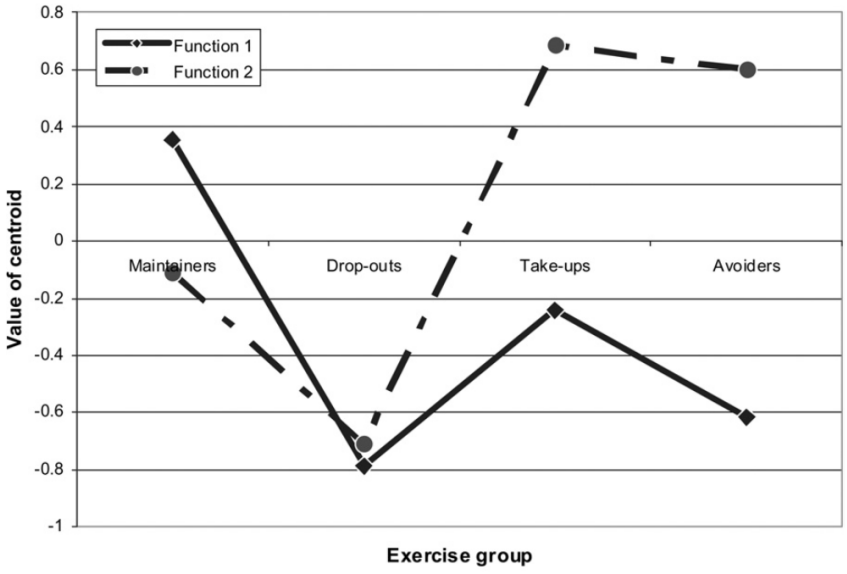
Girls

The DFA for girls also resulted in two significant canonical functions accounting for 58% and 26% of the between-group variability, respectively (Function 1: canonical $r = .51$, adjusted $R^2 = .26$, Wilks' $\lambda = .57$, $\chi^2(36) = 80.00$, $p < .001$, partial $\eta^2 = .26$; Function 2: canonical $r = .38$, adjusted $R^2 = .14$, Wilks' $\lambda = .78$, $\chi^2(22) = 35.79$, $p < .05$, partial $\eta^2 = .14$). Function 1 significantly differentiated the *maintainers* ($N = 48$) from all other groups (total $N = 105$), and the *take-ups* ($N = 26$) from the *avoiders* ($N = 52$). DF1 was predicted solely by motivational variables in the direction predicted by theory (Figure 2). DF2 significantly differentiated the *drop outs* ($N = 27$) from all other groups (total $N = 126$), and *maintainers* from *take-ups* (Figure 2). DF2 represented a weight-related function, and indicated that girls reporting greater perceived pressure from others to lose weight and who had a higher BMI z-scores were more likely to drop out from exercise. Conversely, low scores on DF2 predicted exercise uptake.

Discussion

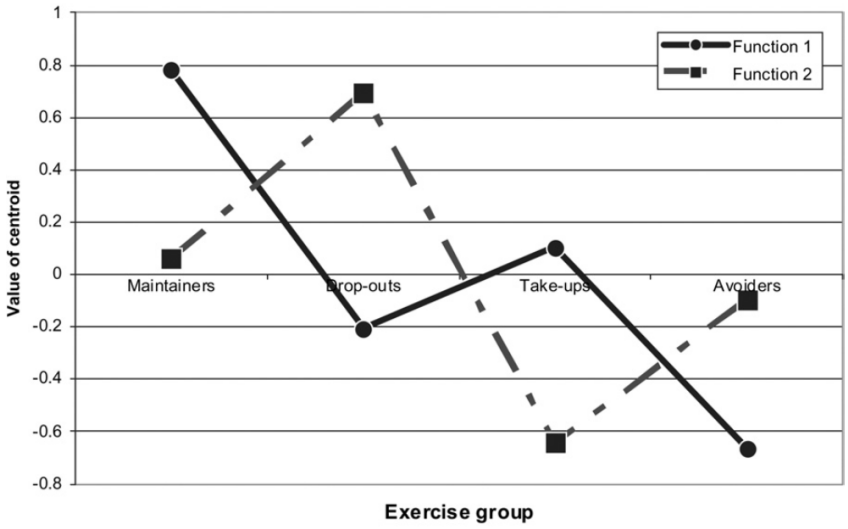
The present study extends previous cross-sectional work by combining body image and motivational constructs to form profiles that predict change in adolescent exercise levels over a 10-month period. Through DFA, a combination of these factors was demonstrated to be important in predicting change. Autonomous motivation and need satisfaction positively predicted exercise maintenance in both genders, as predicted by theory. However, differences between genders were observed in the additional contribution made by body image- and weight-related factors. In girls, the most important of these was the degree of pressure perceived from others to lose weight, and additional variance was accounted for by body weight for stature (i.e., BMI z-score); higher perceived pressure and BMI were associated with drop out from exercise, whereas low scores were positively associated with its uptake. For boys, body satisfaction was positively associated with the maintenance of exercise participation.

Despite the contribution of weight- and body-related factors, motivation emerged as the primary discriminating factor for both genders. Motivation reflects the reasons "why" people engage in activities; thus, this finding makes intuitive sense. Among boys, the strongest predictor of exercise maintenance was identified regulation (an autonomous form of motivation). This supports and extends past cross-sectional work with older samples that showed identified regulation, not intrinsic motivation, to positively predict reported exercise behavior [34]. That is, exercise engagement in boys is determined more by its perceived importance and value to them than by inherent enjoyment,



Notes: The *centroid* is the location of the point that represents the multivariate mean of each discriminant function.

Figure 1. Differences in discriminant functions 1 and 2 between exercise groups for boys.



Notes: The *centroid* is the location of the point that represents the multivariate mean of each discriminant function.

Figure 2. Differences in discriminant functions 1 and 2 between exercise groups for girls.

which may itself not be sufficient to sustain participation against the other priorities at this stage of life [35]. This inference was supported by the findings of DF2, in which intrinsic motivation (and amotivation) was associated with current exercise levels, but not the potential for change.

Although the need for autonomy did not emerge as a significant predictor for boys (perhaps as scores were already high, suggesting a ceiling effect), the inclusion of competence and relatedness alongside identified regulation is consistent with the theory, as the satisfaction of basic needs is predicted to facilitate the process of internalization from more controlled to more autonomous forms of motivation [36]. All three needs were predictive of exercise maintenance in girls. Need satisfaction is theoretically more responsive to changes than motivation within the social environment (e.g., teaching or parenting style), and as such can provide an indicator of likely future change in motivation [8]. As such, the inclusion of need variables in the DF, in addition to motivation, supports a dynamic view of motivation, in which internalized forms of motivation and behavior are only sustained by ongoing satisfaction of needs in the social exercise environment. In practical terms, potential strategies for facilitating need satisfaction and supporting internalization include providing tasks that promote cooperation between participants (i.e., promoting relatedness), conceptualizing success in terms of self-referenced targets, setting of challenging yet attainable tasks and providing informational feedback (i.e., promoting competence), and promoting choice and meaningful rationales for activities (i.e., promoting autonomy) [36].

The finding that introjected regulation (a controlling form of extrinsic motivation) also emerged as a significant, albeit weaker, predictor of reported leisure-time exercise behavior in boys was contrary to theoretical predictions [7]. However, a similar short-term positive effect has previously been reported elsewhere; in a prospective study of competitive swimmers, an initially positive effect of introjected regulation was found at 10-months, but reverted to no association at 2 years [3]. This would suggest that introjected regulation can be experienced as an initial facilitative stage of internalization from controlling to autonomous forms of motivation. Qualitative work exploring the experience of introjected regulation in adolescents has also suggested that introjected regulation can be perceived positively by male teenagers as a means of obtaining pride and social recognition, and is perceived to sustain the training necessary to compete at valued sports, or gain entry to preferred social groups [37]. Over the long-term, however, behavior sustained by introjected regulation would be expected to be maladaptive [7], resulting in outcomes such as social physique anxiety [4].

In girls, the primary DF was formed entirely of motivation-related variables. The components differed from DF1 in boys by the inclusion of the need for autonomy and intrinsic motivation, and the absence of introjected regulation. This suggested that exercise enjoyment was still important for girls, but that exercising to avoid guilt or to enhance ego was not a useful behavioral prompt.

The finding of DF2 that perceived pressure to lose weight when combined with a high BMI was predictive of drop out from exercise is important, as it implies that promoting exercise to overweight girls as a means of weight control may be counter-productive. Previous work demonstrating an association between weight criticism during exercise and a decrease in its enjoyment, perceived competence, and participation, supports this suggestion [38]. Furthermore, it has been reported that despite recognizing exercise as a means for weight control, girls rarely adopt this strategy, preferring dietary approaches [39]. However, responding to this finding is challenging, as although within the school or home context reducing perceived pressure may be achieved through orienting adolescents toward more intrinsic exercise goals (such as challenge, health, and social affiliation), combating pressure perceived to stem from society as a whole may require a societal level change.

Limitations

The use of a self-report exercise measure is a limitation of the present work, as although adolescents have been found to be

comparably reliable to adults in reporting their own physical activity [16], self-report measures commonly overestimate exercise participation and are less accurate than objective measures [40]. In acknowledgement of this, we chose not to use raw activity estimates, but categorized participants into low- and high-activity groups, using the achievement of physical activity guidelines [2] as the cut-off value. Although we consider that this provides more readily interpretable results than using a median split, we acknowledge that this use of the LTEQ has not been previously validated.

In addition, the present findings relate to predominantly white UK adolescents living in small town settings, and therefore can only be generalized beyond this population with caution. A final limitation was the large drop-out rate from the baseline participant sample. This may suggest some bias, with students with a greater interest in sport and exercise being more willing to participate; however, no significant differences were found for any study variable suggesting this bias was limited.

Conclusions

The results of the present study suggest that profiles of motivational, and weight and body image-related constructs can be useful in predicting change in leisure-time exercise behavior in adolescents. As the first prospective study of this duration to examine these constructs simultaneously, and to classify participants based on scores related to physical activity guidelines, these findings contribute to our ability to identify adolescents who might be at risk of future inactivity. This is not only useful as a means of targeting exercise interventions to those likely to gain the greatest benefits, but also in informing intervention content.

Several theoretically-informed suggestions have been made for designing social exercise environments that support motivation, and reduce the negative effect of poor body image. These include providing opportunities for cooperative exercise activities, providing self-referenced informational feedback, and emphasizing choice and personal control [36], and focusing adolescents away from weight control as a reason for exercise, and on to more intrinsic goals that are still meaningful to them (e.g., social relationships, positive challenge). However, as these suggestions are based on purely observational findings, future work would do well to explore whether manipulating social environments as suggested can bring about meaningful changes in behavior.

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