

# Predicting Change in Physical Activity, Dietary Restraint, and Physique Anxiety in Adolescent Girls

## Examining Covariance in Physical Self-perceptions

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### ABSTRACT

**Objectives:** To examine: i) the mean changes in adolescent females' body mass index (BMI), global self-esteem, physical self-perceptions, social physique anxiety, physical activity, and dietary restraint; ii) the stability of measuring self-perceptions, BMI, self-esteem, physique anxiety, activity, and dietary restraint; and iii) the relationships among changes in these variables over 12 months.

**Methods:** 631 female adolescents (15-16 years old) involved in a two-year study of self-report measures completed validated questionnaires in high school classroom settings.

**Results:** There were small but significant group increases in BMI and social physique anxiety and significant decreases in sport, conditioning, and strength physical self-perceptions and physical activity. Stability analysis indicates moderate to strong stability for all variables. Change analyses indicated that BMI, due to its high stability, is a poor predictor of change in all variables. Stronger significant correlations were noted between change in body appearance self-perceptions and change in social physique anxiety ( $r=-0.54$ ) and dietary restraint ( $r=-0.27$ ). There was also a significant relationship between change in physical activity and the physical self-perceptions, although conditioning was the only significant ( $p<0.05$ ) predictor of change in physical activity ( $\beta=0.340$ ).

**Interpretation:** Physical self-perceptions are a stronger predictor of change in physical activity, dietary restraint, and social physique anxiety compared to BMI. This demonstrates the importance of physical self-perceptions when investigating health-related behaviours associated with dieting and physical activity. The decline in physical activity and increase in BMI is an ongoing concern, as is the link between body appearance self-perceptions and dietary restraint and social physique anxiety.

*La traduction du résumé se trouve à la fin de l'article.*

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This study examined the relationships among specific health-related behaviours (physical activity and dietary restraint), perceptions and emotions (physical self-perceptions and social physique anxiety), and physical characteristics (weight and height; BMI) in a female adolescent population over a 12-month period. Adolescence is a critical developmental period whereby social, emotional, and physical changes to the body can intensify negative self-perceptions.<sup>1-5</sup> Self-perceptions are broad self-referent psychological statements, and are often impetus to health-compromising behaviours such as dieting and either excessive or avoidance of physical activity, especially for female adolescents.<sup>6-14</sup> However, the literature on linking physical self-perceptions and health behaviours in adolescence consists almost exclusively of cross-sectional studies. These studies are at the expense of prospective research that examines the covariation between changes in perceptions and behaviours.

Physical self-perceptions are distinctive subdomains within the hierarchical multidimensional framework related to global self-esteem.<sup>5,15</sup> Specifically, physical self-worth is a sub-level of global self-esteem, and physical self-perceptions assessing sport competence, physical strength, physical conditioning, and body appearance are nested beneath physical self-worth. The relationship between physical self-perceptions and health-related behaviours can be understood through the context of the self-presentation theoretical framework.<sup>16-20</sup>

Specifically, self-presentation concerns refer to an individual's desire to control, monitor, and/or avoid emotional anxiety related to the self and perceptions of others.<sup>17,21</sup> These concerns are a major source of motivation for changes in perceptions and behaviours related to the physical self. Under this framework, anxiety related to evaluation of the body in social settings is called social physique anxiety (SPA<sup>22</sup>). Physical changes during adolescence, combined with social pressures, could lead to negative physical self-perceptions, leading to changes in SPA as well as changes in dietary restraint and physical activity behaviours. It has been suggested that increases in SPA could lead to avoidance of physical activity.<sup>16</sup>

Physical activity decreases during adolescence<sup>23-25</sup> and potential serious health risks

have been implicated, such as obesity, cardiovascular disease, osteoporosis, diabetes, and depression.<sup>26</sup> Change in physical activity could be associated with an adolescent's engagement in other harmful actions such as dietary restraint. Predictors of physical activity in youth have included physical self-perceptions related to physical conditioning and sport competence,<sup>1,6,8,12</sup> however, the nature of physical activity and self-perception covariation over time has not been examined.

Overall, several relationships between physical self-perceptions and social physique anxiety, physical activity, and dietary restraint are apparent in younger female populations; however this evidence is mainly based on cross-sectional design. Furthermore, few studies attempt to control for actual physical characteristics, such as weight and height. Body mass index (BMI), which is an objective measure of physical characteristics, has been shown to be a predictor of adolescent females' desire to reduce their weight and change their appearance.<sup>14</sup> There have also been ambiguous results relating BMI and SPA among females.<sup>16,20,27,28</sup> Due to these relationships, researchers interested in physical self-perceptions should control for physical characteristics.

The main objective of this paper is to examine the relationships among changes in adolescent females' physical self-perceptions, social physique anxiety, physical activity, and dietary restraint over 12 months, while controlling for BMI.

## METHODS

### Measures

The following self-report scales were used to measure constructs of physical activity, physical self-perceptions, dietary restraint, and physique anxiety. They have all demonstrated adequate reliability and validity in adolescent populations.<sup>1,29-33</sup>

### Physical Characteristics

The girls reported age, height and weight. Previous research found that both self-reported height and weight have acceptable validity for adolescent populations.<sup>34,35</sup> BMI was calculated by a weight-to-height ratio (kg/m<sup>2</sup>).

### Physical and Global Self-perceptions

The Physical Self-Perceptions Profile (PSP) consists of five scales that measure perceptions of general physical self-worth (PSW), sport competence (Sport), body appearance (Body), physical conditioning (Condition), and physical strength (Strength). The item score can range from 1 (low) to 4 (high) on a structured-alternative scale, offering two opposing statements on which the individual is asked to choose which statement is most like them, and then to rate how true it is for them.<sup>15</sup> (e.g., Body appearance: "Some people feel that compared to most, they have an attractive body BUT Others feel that compared to most, their body is not quite so attractive"). The "What I am Like" Questionnaire from the Adolescent Self-Perception Profile assesses global self-esteem/worth (GSE).<sup>33</sup> It also uses a structured-alternative format and is scored on a four-point scale.

### Dietary Restraint

The Dutch Eating Behavior Questionnaire – Restrained Eating (DEBQ-R) is an instrument designed to assess the degree to which an individual restrains her eating behaviour.<sup>30,36</sup> The DEBQ-R is scored on a five-point scale ranging from 1 (Never) to 5 (Very Often). A sample item is: "Do you deliberately eat less in order not to become heavier?"

### Physical Activity

Physical activity was measured using the PAQ-A,<sup>31</sup> a validated 8-item self-report 7-day activity recall. The instrument is scored on a 5-point scale with higher values indicating greater physical activity levels. A sample item is: "In the last 7 days, on how many *evenings* did you do sports, dance, or play games in which you were very active?"

### Social Physique Anxiety

The Social Physique Anxiety Scale (SPAS) is a 9-item scale, which assesses the degree of anxiety an individual experiences as a result of perceived observation or evaluation of his/her physique.<sup>32</sup> The items are presented on a 5-point Likert scale and respondents are asked to indicate the degree (i.e., not at all, slightly, moderately, very, and extremely) to which the statements are characteristic or true of them. A

sample item is: "Unattractive features of my physique/figure make me nervous in certain social situations."

### Participants and procedures

Six hundred and thirty-one girls (68% from city schools and 32% from town schools around Saskatoon, Saskatchewan) completed the second year of a longitudinal study during the first term of the 1999-2000 school year.\* All participants and their parents/guardians provided informed consent. The students represented a variety of socioeconomic backgrounds, were 15-16 years of age, and had BMI ranging from 14.8 to 36.9 (mean=21.23, SD=3.14).

In the first year (Term one, 1998/99 school year), following University Ethics Review Board and school board approvals, researchers met with students during regular academic classes to describe the study and distribute consent forms. One week later, the questionnaire package was administered during class time, with a researcher available to answer any questions. The first-year data collection yielded 705 participants. Approximately one year later, data were again collected using the same procedures, and students were matched with their baseline year-one measures. The second-year data collection yielded a sample of 631 female adolescents (74 participants had moved, missed class during data collection, or had extensive missing data).

### Statistical analysis

Statistical analyses were performed using SPSS version 10. Repeated measures ANOVA was used to determine significant time changes from year 1 to year 2. Intraclass correlation coefficients were calculated using a two-way mixed effect model to examine stability over the two assessment periods.

The final analyses were to determine if the amount of change in the physical self-perception variables covaried with changes in SPA, dietary restraint, and physical activity. The standardized residual or change score of each variable was determined using regression analysis, with year 1 being the independent variable and

\* The results from the first year research reported relationships between physical self-perceptions and dietary behaviours. Reports on physical activity and social physique anxiety were not analyzed. See Crocker et al.<sup>1</sup>

**TABLE I**  
**Descriptive Statistics, Effect Sizes for Group Differences, and Intraclass Correlation for Self-perception Variables, Physical Activity, Dietary Restraint, Social Physique Anxiety, and Body Mass Index**

Measure	Year 1 Mean (sd)	Year 2 Mean (sd)	eta <sup>2</sup>	ICC
GSE	2.93 (0.71)	2.95 (0.68)	0.001	0.59
PSW	2.65 (0.71)	2.58 (0.67)	0.017*	0.71
Body	2.31 (0.69)	2.32 (0.71)	0.000	0.72
Condition	2.77 (0.66)	2.68 (0.67)	0.031*	0.71
Sport	2.62 (0.70)	2.55 (0.70)	0.026*	0.78
Strength	2.58 (0.60)	2.54 (0.63)	0.008*	0.70
PAQ-A	2.65 (0.59)	2.40 (0.55)	0.174*	0.55
DEBQ-R	2.21 (1.02)	2.22 (1.02)	0.000	0.73
SPA	27.01 (7.40)	27.58 (7.80)	0.010*	0.68
BMI	20.68 (3.11)	21.23 (3.16)	0.102*	0.87

Note: \* significant effect size, p<0.05; ICC is single measure intraclass correlation

**TABLE II**  
**Correlations Among Global Self-esteem, Physical Self-perceptions, Dietary Restraint, Social Physique Anxiety, Physical Activity, and Body Mass Index During Year 1 and Year 2**

Year 1	1	2	3	4	5	6	7	8	9
GSE	—								
PSW	0.64*	—							
Body	0.54*	0.67*	—						
Conditioning	0.47*	0.76*	0.55*	—					
Sport	0.37*	0.64*	0.37*	0.73*	—				
Strength	0.32*	0.54*	0.23*	0.53*	0.58*	—			
SPA	-0.53*	-0.63*	-0.74*	-0.46*	-0.33*	-0.29*	—		
DEBQ-R	-0.44*	-0.43*	-0.47*	-0.27*	-0.17*	-0.08	0.46*	—	
PAQ-A	0.13*	0.29*	0.12*	0.51*	0.46*	0.32*	-0.06	-0.02	—
BMI	-0.18*	-0.29*	-0.50*	-0.33*	-0.15*	0.09*	0.36*	0.33*	0.12*
Year 2	1	2	3	4	5	6	7	8	9
GSE	—								
PSW	0.66*	—							
Body	0.62*	0.73*	—						
Conditioning	0.49*	0.79*	0.55*	—					
Sport	0.41*	0.70*	0.41*	0.75*	—				
Strength	0.29*	0.54*	0.24*	0.52*	0.58*	—			
SPA	-0.59*	-0.65*	-0.77*	-0.46*	-0.36*	-0.26*	—		
DEBQ-R	-0.40*	-0.42*	-0.46*	-0.27*	-0.23*	-0.07	0.48*	—	
PAQ-A	0.19*	0.40*	0.17*	0.58*	0.53*	0.35*	-0.12*	-0.05	—
BMI	-0.21*	-0.30*	-0.49*	-0.28*	-0.14*	0.12*	0.32*	0.32*	-0.08

\* significant at p<0.05 (2-tailed)

**TABLE III**  
**Pearson Product Moment Correlations Among the Residuals of the Health Variables, Self-perception Variables, and BMI**

Variable	1	2	3	4	5	6	7	8	9
GSE	—								
PSW	0.47*	—							
Body	0.49*	0.57*	—						
Condition	0.35*	0.59*	0.40*	—					
Sport	0.32*	0.51*	0.31*	0.53*	—				
Strength	0.25*	0.46*	0.27*	0.40*	0.43*	—			
SPA	-0.38*	-0.43*	-0.54*	-0.27*	-0.22*	-0.20*	—		
DEBQ-R	-0.18*	-0.20*	-0.27*	-0.08*	-0.08	-0.03	0.33*	—	
PAQ-A	0.12*	0.19*	0.09*	0.36*	0.25*	0.18*	-0.06	0.03	—
BMI	-0.06	-0.04	-0.14*	-0.08	-0.02	0.05	0.09*	0.06	0.05

**TABLE IV**  
**Hierarchical Regression Analysis Examining Predictors of Change in Physical Activity**

Step	Variable	B	SE B	β	R <sup>2</sup> Δ	R <sup>2</sup>
1	Physical self-perceptions				0.142*	0.142*
	Body	-0.077	0.041	-0.078		
	Conditioning	0.342	0.047	0.340*		
	Sport	0.075	0.046	0.076		
	Strength	0.034	0.043	0.035		
2	GSE				0.000	0.142*

Note: \* significant at p<0.05; intercept for step 1 was 0.005

year 2 the dependent variable.<sup>37</sup> The resulting residual, or change score, reflects the degree of change from the first to the second year of the study, independent of the first year score.<sup>38</sup> We first examined Pearson Product Moment correlations among the standardized residuals followed by hierarchical multiple regression analyses. Separate regression analyses were run for physical activity, SPA, and dietary restraint. To control for physical characteristics, the standardized residual for BMI was forced into the regression first (if significantly correlated with the criterion variable) followed by forced entry of the standardized residual of physical self-perceptions on step two, and then GSE on step three.

**RESULTS**

**Preliminary analysis**

Descriptive statistics for all variables are shown in Table I. The ANOVA analysis indicated significant increases in SPA and BMI (p<0.05); however the SPA effect size was very small. There was notable decrease in physical activity, with significant but negligible decreases in conditioning, sport, and strength physical self-perceptions. The stability estimates (Table I, ICC) indicate various individual-level changes over time across variables.

**Cross-sectional analysis for each year**

Relationships among the variables for each year can be seen in Table II. Since the primary purpose of this research is to examine change, cross-sectional regression analyses are not reported.<sup>†</sup>

**Predicting change**

*Physical Activity*

Correlations indicated that physical activity change was associated with change in all self-perceptions except BMI (Table III). The regression analysis found that only physical conditioning was a significant predictor (see Table IV).

*Social Physique Anxiety*

Correlations indicated that SPA change was associated with change in all self-perceptions and BMI (Table III). One par-

<sup>†</sup> Cross-sectional regression analysis results are available from the authors upon request.

ticipant's data were removed when her standardized residual exceeded 4 (4.9). The multiple regression analysis found that there were significant increases in explained variance in step 2 ( $R^2_{\Delta}=0.304$ ) and step 3 ( $R^2_{\Delta}=0.015$ ); however only body appearance and global self-esteem were significant individual predictors in the final model (see Table V).

### Dietary Restraint

Correlations indicated that dietary restraint change was associated with change in perceptions of global self-esteem, physical self-worth, body appearance, and conditioning but not BMI (Table III). Two participants' data were removed when their standardized residuals exceeded 4 (4.8 and 5.3). The regression analysis found that only body appearance was a significant predictor (see Table VI).

## DISCUSSION

This study provides important evidence demonstrating that changes in several specific physical self-perceptions, independent of BMI, are related to changes in dietary restraint, physical activity, and social physique anxiety in young Canadian female adolescents over 12 months. This data set allows us to examine both cross-sectional relationships as well as changes over time at the group and individual level. The cross-sectional research results are consistent with previous research in that social physique anxiety (SPA), dietary restraint, and physical activity are related to specific physical self-perceptions.<sup>1,12,14,18,27</sup> Group data showing decreases in physical activity and increases in BMI are also consistent with previous work.<sup>24,25,39</sup> However, group data can be deceptive because they mask individual variation over time. The findings indicate that health-related behaviours (i.e., dietary restraint and physical activity), social physique anxiety, and physical self-perceptions show only modest stability over time, with BMI being highly stable. The unique aspect of the data set, however, is the ability to examine relationships in the change in each variable over time. Change analyses move us one step closer to establishing causal claims between variables and within settings that are difficult to manipulate experimentally.

**TABLE V**

### Hierarchical Regression Analysis Predicting Change in Social Physique Anxiety

Step	Variable	B	SE B	$\beta$	$R^2_{\Delta}$	$R^2$
1					0.008*	0.008*
2	BMI	0.089	0.040	0.090*	0.312*	0.304*
	Physical self-perceptions					
	Body	-0.509	0.037	-0.513*		
	Conditioning	-0.016	0.042	-0.016		
	Sport	-0.047	0.041	-0.048		
	Strength	-0.056	0.038	-0.057		
3					0.015*	0.327*
	BMI	0.019	0.034	0.019		
	Physical self-perceptions					
	Body	-0.451	0.040	-0.455*		
	Conditioning	-0.001	0.042	-0.002		
	Sport	-0.031	0.041	-0.032		
	Strength	-0.048	0.038	-0.049		
	GSE	-0.142	0.039	-0.144*		

Note: \* significant at  $p<0.05$ ; intercepts for steps 1, 2, and 3 were -0.006, -0.009, and -0.008 respectively

**TABLE VI**

### Hierarchical Regression Analysis Predicting Change in Dietary Restraint

Step	Variable	B	SE B	$\beta$	$R^2_{\Delta}$	$R^2$
1	Physical self-perceptions				0.081*	0.081*
	Body	-0.271	0.041	-0.287*		
	Conditioning	-0.006	0.046	0.007		
	Sport	0.031	0.045	-0.034		
	Strength	0.054	0.042	0.059		
2	GSE				0.004	0.085

Note: \* significant at  $p<0.05$ ; intercept for step 1 was -0.019

Examination of body appearance factors in the current study revealed an interesting contradiction. Although BMI increased significantly over the year, it had little impact in predicting physical activity, dietary restraint, SPA, and physical self-perceptions. Further, BMI did not co-vary with change in body appearance perceptions, implying that physical characteristics (i.e., weight and height) and perceptions of such characteristics (i.e., body self-perceptions) are relatively unique over time. Changes in SPA and dietary restraint were both linked to body appearance perceptions. Future research is needed to identify potential social factors that might contribute to changes in perceptions of body appearance, especially given their role in predicting increases in SPA and dietary restraint. Furthermore, coping mechanisms need to be identified since it is possible that some adolescents turn to unhealthy eating behaviours as a means of dealing with both SPA and perceptions of body appearance. Our data clearly showed links in the changes in dietary restraint and SPA.

The physical activity findings indicate that conditioning self-perception is the key predictor of change. Physical activity is

only relatively stable over 12 months, although likely inflated due to the difficulties of assessing physical activity in youth.<sup>24,31</sup> Despite the individual variation, the large drop in physical activity levels is a health concern. Furthermore, individuals' physical activity behaviour changed independently of the other health-related behaviours and emotions.

The strengths of this study include the use of valid instruments and self-presentation/physical self-perception theoretical frameworks, a large diverse sample of adolescent females with high retention rates over the two data collections, and combined cross-sectional and longitudinal data analysis investigating changes in health and self-esteem variables and physical characteristics. A limitation is the small number of data points for change analysis.<sup>40</sup> Another limitation of the study is the use of self-report data for physical characteristics. Although it has been shown that there are high levels of agreement between self-reported height and weight data and actual measurements,<sup>35,41</sup> there have been reported biases in BMI disclosure among younger females.<sup>39</sup>

Implications for future research should focus on the important observation that

changes in physical self-perceptions occur independently of changes in physical characteristics (i.e., BMI). Researchers have focused attention on actual physical characteristics such as height, weight, and body fat percentage when assessing physical activity behaviour in youth due to the complex associations between physical activity and obesity.<sup>38</sup> Perhaps it is equally as important to study physical self-perceptions and to determine what other social factors produce these changes. It has been reported that peers, parents, and the media are potential socializing agents that could impact these observed changes in physical self-perceptions, and should therefore be investigated.

Nevertheless, the results of this study indicate that BMI increased and physical activity declined. This should be a concern among health practitioners in view of the preventive health benefits physical activity can provide. The reduction in physical activity throughout adolescence is likely to contribute to a range of acute and chronic psychological and physiological problems into adulthood.<sup>42</sup> The present study offers a prospective glimpse at change in perceptions and behaviours over 12 months of adolescence. It appears that physical self-perceptions, especially involving perceptions of conditioning, are integral to physical activity behaviours during adolescence.

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## RÉSUMÉ

**Objectifs :** Examiner i) les changements moyens de l'indice de masse corporelle (IMC), de l'estime de soi générale, de l'autoperception du corps, de l'angoisse sociale liée au physique, de l'activité physique et des restrictions alimentaires chez les adolescentes; ii) la stabilité des mesures de l'autoperception, de l'IMC, de l'estime de soi, de l'angoisse liée au physique, de l'activité et des restrictions alimentaires; et iii) les liens entre l'évolution de ces variables sur 12 mois.

**Méthode :** Des questionnaires validés ont été remplis en classe à l'école secondaire par 631 adolescentes (de 15 et 16 ans) participant à une étude de deux ans sur les mesures d'autodéclaration.

**Résultats :** Nous avons constaté des augmentations collectives mineures, mais significatives, de l'IMC et de l'angoisse sociale liée au physique, ainsi que des baisses significatives du sport, de la forme physique, de l'autoperception de la force et de l'activité physique. Selon une analyse de stabilité, toutes les variables présentent une stabilité moyenne à élevée. Selon des analyses de changement, l'IMC, en raison de sa stabilité élevée, est un piètre prédicteur de changement, quelle que soit la variable. Nous avons noté des corrélations significatives plus importantes entre le changement dans l'autoperception de l'apparence physique et le changement dans l'angoisse sociale liée au physique ( $r=-0,54$ ) et les restrictions alimentaires ( $r=-0,27$ ). Il existait aussi un lien significatif entre le changement dans l'activité physique et l'autoperception du corps, bien que la forme physique soit la seule variable prédictive significative ( $p<0,05$ ) du changement dans l'activité physique ( $\beta=0,340$ ).

**Interprétation :** L'autoperception du corps est un prédicteur plus solide que l'IMC pour ce qui est des changements dans l'activité physique, les restrictions alimentaires et l'angoisse sociale liée au physique, ce qui en fait un outil important pour l'étude des comportements sanitaires associés aux régimes et à l'activité physique. La baisse de l'activité physique et la hausse de l'IMC sont des préoccupations de longue date, tout comme le lien entre l'autoperception de l'apparence physique et les restrictions alimentaires et l'angoisse sociale liée au physique.

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