Title

Physical Self-Concept in Adolescent Girls: Behavioral and Physiological Correlates

Journal

Research Quarterly for Exercise and Sport, 74(3)

ISSN

0270-1367

Authors

Dunton, Genevieve Fridlund
Jamner, Margaret Schneider
Cooper, Dan Michael

Publication Date

2003-09-01

DOI

10.1080/02701367.2003.10609104

Research Quarterly for Exercise and Sport

Vol. 74, No. 3, pp. 360–365

Physical Self-Concept in Adolescent Girls: Behavioral and Physiological Correlates

Genevieve Fridlund Dunton, Margaret Schneider Jamner, and Dan Michael Cooper

Key words: body fat, cardiovascular fitness, physical activity, self-esteem

For the past two decades, researchers in exercise and sport psychology have worked to refine an instrument to measure the subjective evaluations of the physical self. These perceptions of physical competence and appearance, known as physical self-concept, are believed to contribute to global self-esteem in a hierarchical fashion (Shavelson, Hubner, & Stanton, 1976). According to this model, perceptions of one's behavior in particular situations influence appraisals of the self in certain domains (e.g., physical, academic, and social), which combine to create an overall self-concept. Although it was historically assessed as a single construct, emphasis on the hierarchical nature of physical self-concept has given way to multidimensional measures. Recently, instruments with the ability to distinguish between specific components of physical perceptions (e.g., health, fitness, and body composition) have been developed (Fox, 1990; Marsh, Richards, Johnson, Roche, & Tremayne, 1994; Richards, 1988).

Among these multidimensional measures, the Physical Self-Description Questionnaire (PSDQ) has demonstrated superior psychometric properties. In a multitrait-miltimethod analysis of an adolescent Australian sample, Marsh et al. (1994) found the PSDQ to have higher internal reliability and factor loadings than comparison instruments. Confirmatory factor analyses differentiating the 11 scales of the PSDQ and demonstrating good test reliability have also been provided (Marsh, 1996b). Nigg, Norman, Rossi, and Benisovich (2001) recently replicated these unique factor loadings of the PSDQ scales in an American university sample. Despite sound support for the internal structure of the PSDQ, less evidence for its construct validity has been provided.

Research attempting to validate the PSDQ using external criteria has been limited. In one study, Marsh (1996b) found that the PSDQ endurance and sports competence scales were most highly correlated with field tests of cardiovascular endurance. Scores on the PSDQ scales were also associated with corresponding behavioral measures of physical activity, endurance, strength, body composition, and flexibility (Marsh, 1996a). These results generally supported the convergent and discriminant validity of the PSDQ scales. Consistent with the hierarchical framework proposed by Shavelson et al. (1976), Marsh's (1996a) findings also suggested that objective measures of physical abilities and composition might be more closely related to *specific* (e.g., perceived endurance and body fat) versus *global* aspects of self-esteem.

The current research study sought to further contribute to the PSDQ construct validation literature by (a) using more sensitive measures of physiological and behavioral criteria than have been used in the past and (b) determining whether the PSDQ is valid for use in a relatively unfit population. Previous validation studies relied on external criteria gathered in field settings (e.g., shuttle run, 50-m dash, body mass index, skinfolds, and body girth; Marsh, 1996a, 1996b). The present study objectively assessed body composition and cardiovascular fitness field through clinically based instruments (e.g., dual x-ray absorptiometer and ramp-type progressive exercise test). In addition, past research has tested the PSDQ in samples representing an average to high range of cardiovascular fitness (Marsh, 1996a, 1996b;

Submitted: August 5, 2002
Accepted: February 13, 2003

Genevieve Fridlund Dunton is with the Department of Psychology and Social Behavior at the University of California–Irvine. Margaret Schneider Jamner and Dan Michael Cooper are with the Department of Pediatrics at University of California–Irvine.

Marsh, Hey, Roche, & Perry, 1997; Marsh et al., 1994; Nigg et al., 2001). Information about the validity of PSDQ assessments in unfit populations is lacking. The present study determined if PSDQ physical perceptions accurately reflect behavioral and physiological parameters in a sample of low-active adolescent girls.

The study tested the hypotheses that physiological and behavioral measures would correlate strongly with specific PSDQ scales assessing corresponding perceptions and weakly with the PSDQ global self-esteem scale. Specifically, we anticipated that objectively measured body fat would be related to perceived body fat, cardiovascular fitness would be associated with perceived endurance, and energy expenditure and lifestyle activity would correspond with perceived participation in physical activity. Due to its nonspecific nature, we hypothesized that the PSDQ global self-esteem scale would exhibit only weak associations with the objectively measured physiological and behavioral indicators.

Method

Participants

The study sample consisted of 89 low-active adolescent girls ages 14–17 years (M = 15.03 years, SD = 0.79) enrolled in 10th and 11th grades. Participants were recruited from two Southern California high schools located in upper middle class suburban communities. Data were collected as part of a larger intervention study examining the impact of physical activity on bone development in low-active female adolescents. Inclusion criteria were: (a) participation in fewer than three bouts per week of vigorous physical activity lasting at least 20 min and fewer than five bouts per week of moderate physical activity lasting at least 30 min, (b) performance at or below the 75th percentile of cardiovascular fitness for their age determined by a maximal cycle ergometer test, and (c) no health problems that prevented participation in physical activity. The selection criteria used for determining low-active status reflect definitions commonly used by the Centers for Disease Control and Prevention and the American College of Sports Medicine (Pate et al., 1995). The ethnic breakdown was as follows: 41% Caucasian, 27% Hispanic/Latino, 22% Asian, 6% Middle Eastern, and 4% Other. All participants provided informed consent, and the Institutional Review Board at the University of California–Irvine approved the study.

Measures

Physical Self-Concept. Physical self-concept was assessed through the 70-item PSDQ (Marsh et al., 1994). Respondents indicated the degree to which they agreed with declarative statements about themselves on a 6-point scale. The PSDQ scales measure nine specific components of physical self-concept (i.e., body fat, appearance, physical activity, endurance, strength, coordination, flexibility, sports competence, and health). The instrument also assesses two components of global self-concept (i.e., global physical self-concept and self-esteem). Each of the scales comprises six–eight separate items. The PSDQ has good test-retest reliability (r = .83; 3 months) and high alpha coefficients for each of the 11 scales (Marsh, 1996b).

Energy Expenditure. Physical activity level was measured using a 2-Day Physical Activity Recall (2DPAR) modeled after the Previous Day Physical Activity Recall developed by Weston, Petosa, & Pate (1997). Participants recalled their activity for the previous 2 days between 7:00 a.m. and 11:00 p.m., segmented into 30-min intervals. Respondents chose from a provided list of activities to describe each 1/2-hr interval. Activity types were converted into metabolic expenditure units (METs), and average daily energy expenditure in kilocalories (kcal) was calculated using the procedure and formula set forth by Ainsworth et al. (1993): (METs x body weight [kg] x 30 min/60 min)/2 days.

Lifestyle Activities. Unstructured aspects of lifestyle physical activity were assessed through the Stanford Usual Physical Activity Scale developed by Sallis, Haskell, and Wood (1985). On a yes-no scale, participants indicated their usual participation in six lifestyle activities, such as taking the stairs instead of the elevator and walking short distances instead of driving.

Cardiovascular Fitness. Measurements of peak oxygen consumption in milliliters per minute per kilogram of body weight (VO_2peak) were obtained through a ramp-type progressive exercise test on an electronically braked cycle ergometer (Whipp, Torres, & Wasserman, 1981). Using the SensorMedics Vmax 229 metabolic cart (SensorMedics, Yorba Linda, CA), measurements of VO_2peak were obtained through a method previously designed for children and adolescents (Cooper, Weiler-Ravell, Whipp, & Wasserman, 1984). Gas exchange was measured breath by breath (Beaver, Lamarra, & Wasserman, 1981).

Percentage of Body Fat. The proportion of participants' total body mass composed of fat tissue was measured by a dual x-ray absorptiometer (DEXA) using a Hologic QDR *4500 densitometer (Hologic, Inc., Bedford, MA). Using software designed for a pediatric population, a series of scans were performed and analyzed. Participants lay flat on their backs during the entire procedure. The percentage of body fat DEXA provides a more accurate measure of body composition than body mass index, because it is able to differentiate fat body mass from lean sources of body weight, such as muscle, bone, nervous tissue, skin, and organs.

Procedure

Written questionnaires and physiological assessments were completed as part of baseline testing for a larger intervention study. All measurements were obtained at a clinical research testing facility for a major university in Southern California. During the 2–3-hr clinic visit, participants completed the PSDQ, 2DPAR, and Stanford Usual Physical Activity Scale. In addition, participants underwent a general nursing assessment, a DEXA scan, and a cycle-ergometer exercise test. Participants completed the questionnaires prior to the exercise test to avoid any contamination of responses due to exercise fatigue.

Data Analyses

Missing PSDQ values were replaced by the individual's mean for the remaining items on a particular scale. For example, if a participant was missing a score for an item on the PSDQ perceived appearance scale, scores from the remaining five items on that scale were averaged to estimate this value. Given the high internal reliability of items on each PSDQ scale (*r*s = .79–.94), this imputation method should not have introduced any systematic biases. Data were determined to be missing completely at random (i.e., levels of cardiovascular fitness, percentage of body fat, energy expenditure, and reported number of lifestyle activities did not statistically differ among cases missing vs. not missing). Overall, 0.4% of the PSDQ data were imputed. Missing values for external criterion measures were handled through pairwise deletion.

Data screening procedures uncovered some violations of the normality assumption for parametric tests. Due to the low-active nature of the study sample, the following variables were significantly positively skewed: PSDQ endurance, PSDQ physical activity, VO_2peak, and kcal. Consequently, nonlinear monotonic square root transformations were performed to normalize these distributions (Ferketich & Verran, 1994). In addition, the PSDQ health scale underwent a power series squaring transformation to remedy its negative skewness. Following these data preparation and screening measures, Pearson bivariate correlations between PSDQ scales and external criteria were calculated.

Results

Analyses revealed that most of the PSDQ scales were related to one or more aspects of body composition,

Table 1. Bivariate correlations between PSDQ scales and external criteria

PSDQ scale[a]	External criteria				*M*	*SD*	α
	LA[b]	VO_2peak	DEXA[c]	kcal[d]			
Body fat	-.138	.180	-.776***	-.571***	3.77	1.60	.94
Appearance	.036	.016	-.237*	-.088	4.00	1.17	.91
Physical activity	.451***	-.033	.203	.281**	2.39	1.17	.91
Endurance	.378***	.258*	-.174	-.014	2.61	1.10	.89
Strength	.217*	-.021	.083	.290**	3.32	1.27	.91
Coordination	.085	-.046	-.191	.072	3.56	0.85	.79
Flexibility	.018	.046	-.289**	-.017	3.77	1.17	.89
Sports composition	.106	-.018	-.134	.107	3.03	1.26	.94
Health	.230*	.088	.048	.209	4.67	0.83	.82
Global physical self-concept	-.049	.082	-.423***	-.209	3.30	1.29	.94
Self-esteem	.093	-.067	-.163	.093	4.65	0.89	.87
M	3.72	24.11	31.53	1,757.20			
SD	1.40	5.39	6.15	606.27			

Note. PSDQ = Physical Self-Description Questionnaire; LA = lifestyle activities (number); VO_2peak = cardiovascular fitness (ml/min/kg); DEXA = percentage of body fat; kcal = daily energy expenditure (kilocalories).
[a]All PSDQ scores were generated from a 6-point scale.
[b]Participants could report up to six different lifestyle activities.
[c]*n* = 87.
[d]*n* = 88.
*$p < .05$.
**$p < .01$.
***$p < .001$.

physical activity, and physical fitness. DEXA values were negatively associated with four PSDQ scales: body fat, appearance, flexibility, and global physical self-concept (see Table 1). In addition, VO_2peak was positively related to PSDQ endurance. Participants who engaged in more lifestyle activities reported significantly higher scores on the PSDQ physical activity, endurance, and health scales. Kcal correlated positively with PSDQ physical activity and strength and negatively with PSDQ body fat. The overall self-esteem scale was unrelated to any of the behavioral or physiological criteria (see Table 1).

Discussion

The findings from the present study considerably support the construct validity of the PSDQ instrument. In particular, objectively determined body fat was significantly related to the PSDQ body fat scale. Similar to previous findings using weight, girths, skinfold tests, and body mass index as external measures of body composition (Marsh, 1996a), participants in the present study with a greater percentage of body fat as measured by DEXA correctly perceived the overweight nature of their body composition (as represented by lower values on the PSDQ body fat scale). Also consistent with past PSDQ construct validation research (Marsh, 1996a), respondents who were high in objective measures of body fat rated themselves lower on perceived appearance, flexibility, and global physical self-concept. These results suggest that relationships between body composition and aspects of physical self-concept may not be domain-specific. Body fat and weight may play a role in evaluating multiple physical domains. The apparently salient role of body fat as a correlate of physical self-concept among adolescent girls resonates with the current social norms that promote a thin physique as an ideal.

Another objectively determined parameter of fitness—cardiovascular fitness—corresponded with self-perceptions of endurance as measured by the PSDQ. This finding is compatible with previous research demonstrating the association between the perceived endurance scale and shuttle-mile run times (Marsh, 1996a). Unlike past studies (Marsh, 1996a, 1996b), however, the present measure of cardiovascular fitness did not significantly relate to any of the other PSDQ scales, suggesting that these previously used field indicators of physical fitness may actually measure a more complex aggregation of physical abilities, whereas the cycle ergometer fitness test is a fairly specific test of cardiorespiratory endurance. The fact that perceived endurance was the only PSDQ scale to relate to a sensitive measure of peak oxygen consumption suggests that it accurately reflects cardiovascular fitness and the various other PSDQ scales may tap independently into aspects of physical self-concept unrelated to cardiovascular fitness.

In addition to the physiological factors assessed, the two behavioral measures included in the study confirmed the utility of certain PSDQ scales for distinguishing involvement in different physical activity levels. As expected, participation in lifestyle activities, such as taking stairs instead of elevators, related positively to perceived physical activity, endurance, and strength. Interestingly, participation in lifestyle activities was also associated positively with the PSDQ health scale, suggesting one of two possibilities: (a) healthier girls may be more likely to find ways to incorporate moderate forms of activity into their daily routines, or (b) engaging in these types of activities may help girls to feel healthier in general. Similar to the objective measure of body composition, participation in lifestyle activities seems to be related to a variety of self-concept domains. Although past research has mainly examined PSDQ scales in relation to participation in vigorous physical activity, results from the present study suggest that aspects of physical self-concept are related to informal physical activities as well.

The second behavioral physical activity measure, kilocaloric expenditure, was also related to several PSDQ scales. As expected, the PSDQ physical activity and strength scales were positively associated with energy expenditure. Surprisingly, participants who engaged in more physical activity, determined by the estimated number of kilocalories burned over a 2-day period, evaluated themselves more negatively in terms of PSDQ body fat. Similar results were observed in the relationship between objectively determined body fat and daily energy expenditure, $r(86) = .682$, $p < .001$, suggesting that the aforementioned finding is not specific to the PSDQ body fat scale. We hypothesize that such a pattern may be due to one of two processes. On one hand, girls in this low-active group who engaged in at least some physical activity may have been motivated to do so, because they felt they were overweight or unattractive. For example, French, Perry, Leon, and Fulkerson (1995) found that overweight female adolescents were more likely to use exercise as a weight control behavior than nonoverweight female adolescents. On the other hand, however, girls in this study who did some exercise may have felt more negatively about their body image, because their occasional participation in physical activity afforded them the opportunity to attend more closely to their weight. Zabinski, Calfas, Gehrman, Wilfley, and Sallis (2001), whose physical activity intervention bolstered females' desire for thinness, observed similar negative side effects of exercise participation.

The demonstrated relationships between certain physiological and behavioral criteria and the PSDQ scales confirmed several predictions made a priori. Failure of the overall self-esteem scale to predict any of the physiological or behavioral factors explored suggests that spe-

cific (vs. global) components of self-concept are more closely related to physical activity, fitness, and body composition criteria. The strength and specificity of these relationships provided evidence for the discriminant validity of the PSDQ scales. For example, PSDQ body fat was most highly associated with objectively determined body composition, and PSDQ physical activity was related to participation in lifestyle activities but not physical fitness as measured by VO_2peak. Findings from this study have extended prior evidence for the construct validity of the PSDQ by using more sensitive measures of physiological and behavioral criteria than that used in past research (i.e., percentage of body fat instead of body mass index, peak oxygen consumption instead of shuttle run time, and average daily energy expenditure instead of recalled hours spent in hard and very hard activity; Marsh, 1996a). Results suggest that the PSDQ adequately reflects physical self-perceptions in an unfit and low-active sample.

It should be noted that two of the specific PSDQ scales (i.e., coordination and sports competence) showed no relationship to any of the external criteria measured in this study. By excluding regular exercisers, one might hypothesize that the range of scores on the PSDQ coordination and sports competence scales was restricted sufficiently to preclude uncovering any significant associations. However, given that the standard deviations of these two scales were comparable to those of scales that showed significant associations with external criteria (see Table 1), it is more likely that the types of external criteria used in this study simply did not reflect these constructs. Future validation studies should include more appropriate behavioral and physiological measures of coordination and sports competence (i.e. sports skills test).

In general, the statistically significant correlations between the PSDQ scales and physiological measurements represented moderate to large effect sizes (R^2s = .05–.33), except for the relationship between perceived and objectively measured body fat (R^2 = .60). Although these effect sizes would most likely be larger in a sample representing a wider range of cardiovascular fitness, they are similar in magnitude to the findings of Marsh (1996a). Moderate associations between self-perceptions and external criteria may also reflect slightly obscured views held by low-active female adolescents. With fewer opportunities to evaluate themselves in a physical capacity, low-active individuals may have more difficulty estimating the extent of their physical abilities. The strong relationship between PSDQ body fat and percentage of fat DEXA, on the other hand, once again points to the salience of this domain for female adolescents. Despite some inconsistencies between self-reported and externally measured physical abilities, low-active participants seemed to be acutely aware of their body composition.

Limitations

A major limitation of this study was its inability to determine the causal direction of the relationships between physical self-concept and behavioral and physiological factors. Due to the cross-sectional study design, conclusions about the effects of physical activity and exercise on physical self-concept cannot be made. This question requires a longitudinal approach, and future research needs to follow adolescents in the context of prospective and intervention studies to determine whether increased physical activity will enhance physical self-concept.

References

Ainsworth, B. E., Haskell, W. L., Leon, A. S., Jacobs, D. R., Montoye, H. J., Sallis, J. F., & Paffenbarger, R. S. (1993). Compendium of physical activities: classification of energy costs of human physical activities. *Medicine & Science in Sports & Exercise, 25,* 71–80.

Beaver, W. L., Lamarra, N., & Wasserman, K. (1981). Breath-by-breath measurement of true alveolar gas exchange. *Journal of Applied Physiology, 51,* 1662–1675.

Cooper, D. M., Weiler-Ravell, E., Whipp, B. J., & Wasserman, K. (1984). Aerobic parameters of exercise as a function of body size during growth in children. *Journal of Applied Physiology, 56,* 626–634.

Ferketich, S., & Verran, J. (1994). An overview of data transformation. *Research in Nursing and Health, 17,* 393–396.

Fox, K. R. (1990). *The Physical Self-Perception Profile manual.* DaKalb, IL: Northern Illinois University.

French, S. A., Perry, C. L., Leon, G. R., & Fulkerson, J. A. (1995). Dieting behaviors and weight change history in female adolescents. *Health Psychology, 14,* 548–555.

Marsh, H. W. (1996a). Construct validity of Physical Self-Description Questionnaire responses: Relations to external criteria. *Journal of Sport and Exercise Psychology, 18,* 111–131.

Marsh, H. W. (1996b). Physical Self-Description Questionnaire: Stability and discriminant validity. *Research Quarterly for Exercise and Sport, 67,* 249–264.

Marsh, H. W., Hey, J., Roche, L. A., & Perry, C. (1997). Structure of physical self-concept: Elite athletes and physical education students. *Journal of Educational Psychology, 89,* 369–380.

Marsh, H. W., Richards, G. E., Johnson, S., Roche, L., & Tremayne, P. (1994). Physical Self-Description Questionnaire: Psychometric properties and a multitrait-multimethod analysis of relations to existing instruments. *Journal of Sport and Exercise Psychology, 16,* 270–305.

Nigg, C. R., Norman, G. J., Rossi, J. S., & Benisovich, S. V. (2001). Examining the structure of physical self-description using an American university sample. *Research Quarterly for Exercise and Sport, 72,* 78–83.

Pate, R. R., Pratt, M., Blair, S. N., Haskell, W. L., Macera, C. A., Bouchard, C., Buchner, D., Ettinger, W., Heath, G. W., King, A. C., et al. (1995). Physical activity and public health: A recommendation from the Centers for Disease

Control and Prevention and the American College of Sports Medicine. *Journal of the American Medical Association, 273*, 402–407.

Richards, G. E. (1988). *Physical Self-Concept Scale.* Sydney, Australia: Australian Outward Bound Foundation.

Sallis, J., Haskell, P., & Wood, P. (1985). Physical activity assessment methodology in the Five-City Project. *American Journal of Epidemiology, 121*, 91–106.

Shavelson, R. J., Hubner, J. J., & Stanton, G. C. (1976). Validation of construct interpretations. *Review of Educational Research, 46*, 407–441.

Weston, A. T., Petosa, R., & Pate, R. R. (1997). Validation of an instrument for measurement of physical activity in youth. *Medicine & Science in Sport & Exercise, 29*, 138–143.

Whipp, B. J., Davis, J. A., Torres, F., & Wasserman, K. (1981). A test to determine parameters of aerobic function during exercise. *Journal of Applied Physiology, 50*, 217–221.

Zabinski, M. F., Calfas, K. J., Gehrman, C. A., Wilfley, D. E., & Sallis, J. F. (2001). Effects of a physical activity intervention on body image in university seniors: Project GRAD. *Annals of Behavioral Medicine, 4*, 247–252.

Authors' Notes

This study was supported by research grants HD-37746 from the National Institute of Child Health and Development and MO-1 RR00827-S1 from the National Institutes of Health. The authors would like to thank Debbie Ford, John Johansen, Jack Clement, Stacia Pollock, and Frank Manzo for their assistance and contributions. Please address all correspondence concerning this article to Genevieve Fridlund Dunton, 209 Social Ecology I, University of California, Irvine, Irvine, CA 92697-7080.

E-mail: gdunton@uci.edu