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I Know I Can: A Longitudinal Examination of Precursors and Outcomes of Perceived Athletic Competence Among Adolescent Girls

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Abstract

Background—This study examined predictors of perceived athletic competence and subsequent physical activity in a longitudinal sample of adolescent girls.

Methods—A sample of 149 girls was assessed at ages 9, 11, and 13. Perceived athletic competence (PAC) was measured at all ages. Nonaesthetic versus aesthetic sport participation, body fat percentage, and breast development were measured at age 9. Accelerometers were used to measure girls' moderate-to-vigorous physical activity (MVPA) at age 13.

Results—Girls who participated in nonaesthetic sports at age 9 reported higher PAC at age 11 than those who participated in only aesthetic sports, while more advanced breast development at age 9 was associated with greater relative declines in PAC between ages 11 and 13. Both age 11 PAC and the relative change in PAC between ages 11 and 13 were significant positive predictors of age 13 MVPA. Results were independent of age 9 socioeconomic status and self-reported physical activity.

Conclusion—Perceived athletic competence is a suitable target for intervention efforts designed to increase adolescent girls' physical activity. Particular attention should be focused on girls who are overweight or experiencing puberty. Participation in nonaesthetic sports may be particularly important in the development of PAC.

Keywords

pubertal development; aesthetic sports; physical activity; breast development

Perceived athletic competence is positively associated with participation in physical activity,[1–3] perhaps because of links between perceived competence, intrinsic motivation, and persistence in the face of challenges.[4] Perceived athletic competence refers to an individual's evaluation of his or her relative abilities within the athletic domain[5] and is specific to sports and physically active games rather than to general physical activity. The relationship between perceived athletic competence and physical activity may be of particular importance in adolescent girls as less than 5 percent of girls age 12 to 15 meet the physical activity guidelines[6] and a marked decline in physical activity occurs with age.[7–11] The association between perceived athletic competence and physical activity among

adolescent girls has not, however, been extensively studied.[12] Further examination of predictors and physical activity levels associated with perceived athletic competence in adolescent girls may help to inform intervention efforts with this population.

Perceived Athletic Competence and Adolescent Girls' Physical Activity

There is evidence that boys are more physically active than girls[13,14] and this may be partially explained by the higher levels of perceived athletic competence reported by boys.[15–17] Relatively little research has, however, focused on physical activity levels associated with girls' perceived athletic competence. In a review of the literature, Biddle and colleagues identified only 5 studies that reported on the relationship between perceived athletic competence and physical activity in adolescent girls, and stated that while the evidence indicated a link between the two, more research was needed.[12] In addition, although research generally suggests that higher perceived athletic competence is associated with higher levels of physical activity[12] and that girls' perceived athletic competence declines during early adolescence,[18] few studies have assessed the relationship between changes in perceived athletic competence and girls' objectively measured physical activity.

Predictors of Adolescent Girls' Perceived Athletic Competence

Predictors of perceived athletic competence are also of interest as these may identify opportunities for intervention. Perceptions of athletic competence vary across time as a result of experiences and interpretations of those experiences.[19] Researchers have identified a variety of contextual, psychological, and biological factors that are associated with perceived athletic competence. Previous successful sport experience has been identified as a contextual contributor to perceived athletic competence.[20,21] Bandura identifies enactive attainment (having completed a task in the past) as a source of increased competency beliefs.[20] This suggests that girls who have previous successful experiences in sport and physical activity will rate their competence higher than those who have not had such experiences. Researchers have, however, proposed that the relationship between sport participation and self-perception may vary depending on the type of sport.[19]

One distinction that has been made in the literature is between aesthetic sports, where leanness and appearance are emphasized, and nonaesthetic sports, where there is less focus on appearance.[22] While variations in perceived athletic competence associated with aesthetic and nonaesthetic sport participation have not been examined, support for differences in self-perception associated with participation in aesthetic versus nonaesthetic sports has been found.[19,22–27] Although female athletes in some studies report more positive perceptions of their physical appearance, athletic competence, and body image than nonathletes,[24] participation in aesthetic sports is associated with higher weight concerns, higher risk of eating disorders, and lower body satisfaction compared with nonaesthetic sports.[23,25,27] Monsma and colleagues suggest that participation in aesthetic sports may contribute to more negative self-perceptions compared with participation in nonaesthetic sports, particularly during puberty.[19]

In addition to contextual factors such as type of sport participation, research indicates that biological factors such as puberty[28] and body fatness[29] are negatively related to perceived athletic competence. Consequently, authors have suggested that the decline in perceived athletic competence that has been observed during early adolescence may actually be the result of puberty rather than age per se.[19] Physical changes associated with puberty, such as increases in body fatness, may result directly in poorer performance or in self-consciousness that leads to poorer performance.[30] These decreases in performance may lead to a decrease in perceived athletic competence.[19,29] Additionally, psychological changes associated with puberty such as increases in depression[31] and decreases in body satisfaction[32] may be associated with decreases in girls' perceived athletic competence.

In summary, researchers have found evidence of an association between perceived athletic competence and physical activity in adolescent girls. Little is known, however, about the predictors of girls' perceived athletic competence and the studies that have been conducted have generally relied on cross-sectional data and have used self-report measures of physical activity Therefore the purpose of this study is to examine precursors of girls' perceived athletic competence and change in perceived athletic competence and links between perceived athletic competence and girls' objectively measured physical activity. This study assesses 2 specific objectives. First, this study examines the direct effects of perceived athletic competence level at age 11 and change in perceived athletic competence across ages 11 to 13 on moderate-to-vigorous physical activity (MVPA) at age 13. Second, this study examines the indirect effects of age 9 variables (aesthetic versus nonaesthetic sport participation, pubertal development, and body fat) on age 13 MVPA. We hypothesize that age 11 perceived athletic competence and change in perceived athletic competence between ages 11 and 13 will be positive predictors of age 13 MVPA, such that girls who have more positive changes in perceived athletic competence relative to their peers between ages 11 and 13 will have higher levels of MVPA at age 13. In addition, we hypothesize girls who participate in nonaesthetic sports will have both higher levels of age 11 level of perceived athletic competence and relatively more positive changes in perceived athletic competence between ages 11 and 13 than girls who participate in only aesthetic sports. Finally, we hypothesize that age 9% body fat and pubertal development will be negative predictors of level of and change in perceived athletic competence (Figure 1).

Methods

Participants

Participants were part of a longitudinal research project examining girls' nutrition, dieting, physical activity, and health at 2-year intervals beginning at age 5. Data for this study were collected when the girls' were ages 9 (n = 183), 11(n = 177), and 13 (n = 168). Participants were recruited via mailings to households located in central Pennsylvania who had female children born in 1991 or 1992. Inclusion criteria included residing with 2 biological parents and being born in the US. All participants in this study were non-Hispanic Caucasians. At each time point, participants visited the university laboratory where body fat, breast development, and questionnaire data were obtained. In addition, they wore accelerometers for 1 week at age 13. Approval for research involving human participants was obtained from

the Institutional Review Board of the associated university and written parental consent and participant assent was obtained for all procedures. The sample used for analysis consisted of 149 girls for whom data for all the variables of interest was available.

Measures

Perceived athletic competence was measured at ages 11 and 13. Measures of sport participation, body fat percentage, breast development, socioeconomic status, and self-report physical activity were obtained at age 9. Accelerometers were used to measure age 13 physical activity.

Perceived Athletic Competence—The athletic competence subscale of the modified version of Harter's Self-Perception Profile for Adolescents described and validated by Wichstrom was used.[33,34] The internal consistency coefficient in Wichstrom's study was α = .79 and the measure was validated against measures of sport involvement. Questions in this version have a 4 item response format to statements such as "I do very well at all kinds of sports." Higher scores on the 5 item subscale indicated higher perceived athletic competence. In this sample, the internal consistency coefficients were α = .84 at age 11 and α = .86 at age 13 indicating acceptable reliability. Residualized gain scores were calculated by regressing age 13 perceived athletic competence on age 11 perceived athletic competence.

Sport Participation—An activity checklist developed for this study was used to measure sport participation. Girls were presented with a list of 21 sports and athletic activities (eg, gymnastics, soccer, cheerleading, dance, softball) and asked to indicate whether they participated in each in an organized manner (ie, on a team or through extracurricular lessons) during the past year. These activities were divided into aesthetic sports and nonaesthetic sports using categorizations from previous studies by Greenleaf[22] and Davison et al.[23] Gymnastics, dance, baton-twirling, aerobics, figure skating, and cheerleading were classified as aesthetic sports. Volleyball, basketball, soccer, hockey, tennis, and softball were classified as nonaesthetic sports. Five girls reported no organized sport participation, 12 participated in nonaesthetic sports only, 36 participated in aesthetic sports only, and 96 participated in both aesthetic and nonaesthetic sports. The 5 girls who reported no sport participation were not included in the subsequent analyses. Girls who participated in both types of sports and those who participated in only nonaesthetic sports were combined into a group to provide a comparison for those girls who participated in only aesthetic sports.

Percent Body Fat—Dual-energy X-Ray absorptiometry (DXA) was used to measure girls' percent body fat at age 9. Whole body scans were done using the Hologic QDR 4500W (S/N 47261) in the array scan mode and analyzed using whole body software, QDR4500 Whole Body Analysis. DXA has is widely used and is the preferred method of assessing body composition among children, because it provides an accurate, reliable, and noninvasive means of quantifying bone mineral content and body mass content, including fat and lean mass, while minimizing radiation exposure during measurement.[35–38]

Breast Development—Girls' breast development was assessed at age 9 using Tanner's criteria for pubertal breast stages.[39] Stages range from 1 (no development) to 5 (mature development). Visual inspection of each breast was made unobtrusively by a trained nurse and a nurse's assistant while using a stethoscope to check heart rate. In cases where ratings of the 2 breasts were not equal, the lower stage was used because the girl had not fully attained the higher stage.

Self-Reported Physical Activity—The Children's Physical Activity scale (CPA) was used to measure girls' self-reported physical activity at age 9.[40] In a self-administered survey, girls responded to 15 questions such as "I participate in sports almost every day" using a 4-point scale ranging from 1 = completely false to 4 = completely true. Scores on the 15 items were averaged to create a score ranging from 1 (low activity) to 4 (high activity). In a previous study, scores on the CPA have been correlated in the expected direction with 1-mile run/walk time ($r = -.43$, $P < 0001$), body fat percentage ($r = -.41$, $P < .0001$), and BMI ($r = -.32$, $P < .0001$).[40] The internal consistency coefficient for the CPA in this study was $\alpha = .67$.

Socioeconomic Status—A composite measure of mother's and father's education (measured in years) and family income was created using principle components analysis. Both education level and family income were reported by parents.

Accelerometer Measured Physical Activity—Objective assessments of physical activity at age 13 were obtained using the ActiGraph 7164 accelerometer (Shalimar, FL). Accelerometer measurements were added at age 13 and were thus not available for ages 9 or 11. Girls were instructed to wear the ActiGraph on the right hip at all times, except when bathing and swimming, for 7 consecutive days. Girls were included in the analyses if they had 4 or more days with 10 or more hours of wearing time.[41] Raw accelerometer counts were uploaded to a customized software program for determination of total daily counts and daily time spent in moderate-to-vigorous (MVPA) physical activity. The age-specific count thresholds corresponding to the aforementioned intensity levels were derived from the MET prediction equation developed by Freedson and colleagues.[14,42]

Statistical Analysis

The path model outlined in Figure 1 was assessed through Structural Equation Modeling (SEM) using AMOS 7.0. All variables were modeled as manifest variables and all exogenous (age 9) variables were allowed to correlate freely. Direct and indirect effects of the predictor variables at age 9 (type of sport participation, breast development, percent body fat) and direct effects of age 11 variables (age 11 perceived athletic competence and relative change in perceived athletic competence between ages 11 and 13) on MVPA at age 13 were modeled.

Type of sport participation was a dummy variable with aesthetic sport participation as the referent category. Relative change in perceived athletic competence was modeled as a residualized gain score of age 13 perceived athletic competence regressed on age 11 perceived athletic competence. Measures of socioeconomic status (SES) and physical

activity (self-reported) at age 9 were included as covariates to rule out the possibility that differences in family SES or preexisting levels of physical activity confound the identified associations. Model fit was determined using χ^2 and 3 indices of fit (RHO, CFI, RMSEA). Criteria for χ^2 was nonsignificance and for the other indices, cutoffs identified by Hu and Bentler[43]: RHO > .90,[44] CFI > .90,[45] and RMSEA < .06.[46]

Results

Sample Characteristics

Families of girls in this sample had relatively high levels of education and income. None of the mothers reported less than high-school education. The majority of mothers had some postsecondary education with 26% having earned bachelor's degrees and 15% having earned graduate degrees. The fathers were also well educated with 25% reporting bachelor's degrees and 20% reporting graduate degrees. Families with household incomes over $50,000 made up 57% of the sample. Means and standard deviations or percentages for variables included the model are listed in Table 1. Bivariate correlations among continuous variables are shown in Table 2. Although girls reported relatively high perceived athletic competence at age 11 (with a mean score of approximately 3 on a scale of 1 to 4), their perceived athletic competence declined significantly ($t(167) = 2.46$, $P = .015$) between ages 11 (M = 2.92, S.D. = .629) and 13 (M = 2.79, S.D. = .654). Girls who dropped out of the study (n = 15) between ages 9 and 13 did not differ from those who completed all 3 assessments on measures of age 9 body fatness, parental education, perceived athletic competence, breast development, or self-reported physical activity.

Results of Path Model

The tested model (Table 3 and Figure 2) provided an acceptable level of fit. The nonsignificant chi-square value (χ^2 (19) = 20.551, $P = .362$) for the tested model allowed us to fail to reject the null hypothesis and to conclude that the proposed model and the pattern of the observed data were very similar. Further support for acceptable model fit was provided by the pattern of values for several fit indices: RHO = .972, CFI = .990, and RMSEA =.024. Of the exogenous (age 9) variables, breast development and body fat percentage ($r = .620$, $P \leq .001$), and body fat percentage and self-report physical activity (r = −.175, $P = .046$) were correlated.

As hypothesized, girls who participated in nonaesthetic sports or both types of sports reported higher levels of perceived athletic competence at age 11 compared with girls who participated in only aesthetic sports. In addition, body fat percentage at age 9 was a negative predictor of perceived athletic competence at age 11. Higher perceived athletic competence at age 11 was in turn associated with significantly higher MVPA at age 13, while none of the age 9 variables were significant predictors.

Breast development was a significant negative predictor of relative change in perceived athletic competence between ages 11 and 13. More advanced stage of breast development was associated with lower residualized gain scores between ages 11 and 13. Relative change

in perceived athletic competence between ages 11 and 13 was, in turn, a significant positive predictor of MVPA at age 13.

Discussion

This study examined predictors of girls' level (age 11) of and relative change (age 11 to 13) in adolescent girls' perceived athletic competence. Level of and relative change in perceived athletic competence were then explored as predictors of age 13 physical activity. Type of sport participation (nonaesthetic versus aesthetic) and body fat percentage at age 9 were significant predictors of level of perceived athletic competence at age 11, while breast development predicted relative change in perceived athletic competence between ages 11 and 13. Both age 11 perceived athletic competence and relative change in perceived athletic competence between ages 11 and 13 predicted MVPA at age 13 (Figure 2).

Although girls in this study reported generally high levels of perceived athletic competence at age 11 (level), their perceived athletic competence declined significantly between ages 11 and 13. This is congruent with previous research which has also noted declines in girls' perceived competence during early adolescence.[18]

In this study, participation in nonaesthetic sports or a combination of nonaesthetic and aesthetic sports was associated with higher levels of perceived athletic competence than participation in only aesthetic sports. This is consistent with previous research that found differences in self-perceptions between individuals participating in aesthetic and nonaesthetic sports.[19] Findings from this study complement previous research that indicates that aesthetic sports are associated with negative psychological outcomes such as higher weight concerns, risk of eating disorders, and body dissatisfaction compared with nonaesthetic sports.[25,28,30] The low number of study participants who reported no organized sport involvement did not permit us to test whether participation in aesthetic and nonaesthetic sports is associated with higher perceived athletic competence than nonparticipation.

Relative change in perceived athletic competence was predicted by pubertal development. The finding that breast development is negatively associated with relative change in perceived athletic competence across ages 11 to 13 is consistent with previous research indicating that puberty is negatively associated with perceived athletic competence.[28] Additional research with repeated measures of physical activity, body fat, and sport participation across a longer period of time is needed to determine whether pubertal development alters previously established relationships among sport participation, body fat, and perceived athletic competence and whether such perturbations are transitory or have long term effects on girls' physical activity.

Both level of and relative change in perceived athletic competence were significant positive predictors of MVPA at age 13. Congruent with conclusions drawn by Biddle and colleagues[47] and consistent with our hypotheses, we found that age 11 perceived athletic competence was a small but significant predictor of age 13 MVPA. Each 1 unit increase in age 11 perceived athletic competence was associated with a 4.4 minute increase in predicted

age 13 daily MVPA. Given the range of perceived athletic competence reported by our participants, a difference of 10.2 minutes of MVPA per day between the individuals with the lowest and highest perceived athletic competence would be expected to result from the discrepancy in perceived athletic competence. A similar pattern was observed for the relationship between age 11 to 13 relative change in perceived athletic competence and age 13 MVPA. Each 1 unit decline in perceived athletic competence was associated with a 5.0 minute reduction in predicted daily MVPA at age 13.

This study extends previous research by including precursors and an outcome of perceived athletic competence in a single model, examining both level of and change in perceived athletic competence, using an objective measure of physical activity as an outcome, and employing a longitudinal design. While these are strengths of this study, the study also has several limitations. Participants in the study were Caucasian girls residing in central Pennsylvania. Therefore, results may not generalize across geographic areas or ethnicities. In addition, objective measures of physical activity were not available before age 13. As a result, a self-reported measure of physical activity was used as a control variable and it was not possible to examine whether changes in perceived athletic competence predicted change in physical activity or the reverse. This lack of consistent measures across time limits the ability to determine directionality and infer causation. Future research should address these weaknesses by examining the models tested in this study in ethnically and geographically diverse samples. In addition, repeated objective measures of physical activity would allow for changes in physical activity based on perceived athletic competence to be examined.

Results from this study have implications for practice and intervention. The findings contribute to a small but growing body of literature regarding the relationship between adolescent girls' perceived athletic competence and physical activity. Taken together this research suggests that perceived athletic competence may be a suitable target for interventions designed to increase physical activity in adolescent girls. In addition, facilitating nonaesthetic sport participation may be a key factor in promoting perceived athletic competence. Finally, given the negative relationship between body fatness and pubertal development and level of and relative change in perceived athletic competence, doctors, teachers, and parents should pay particular attention to promoting or maintaining sport participation and increasing perceived athletic competence among girls who are overweight or who are entering puberty.

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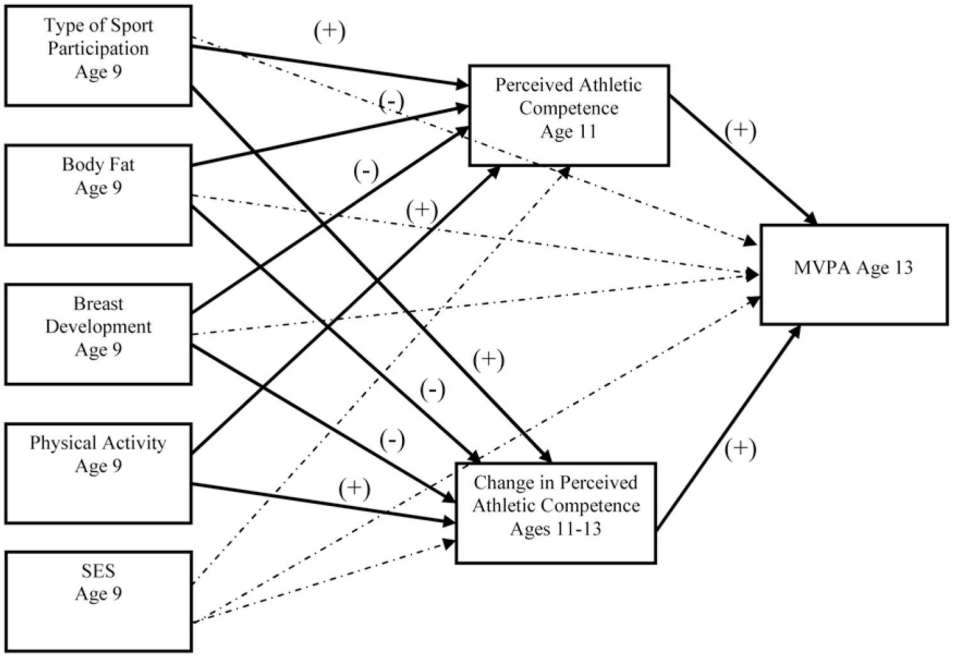

Figure 1.

Hypothesized model of predictors and outcomes of girls' perceived athletic competence. Note: Correlations among all predictor (age 9) variables were modeled. Solid lines indicate paths hypothesized to be statistically significant ($P < .05$). Dashed lines indicate paths hypothesized to be nonsignificant.

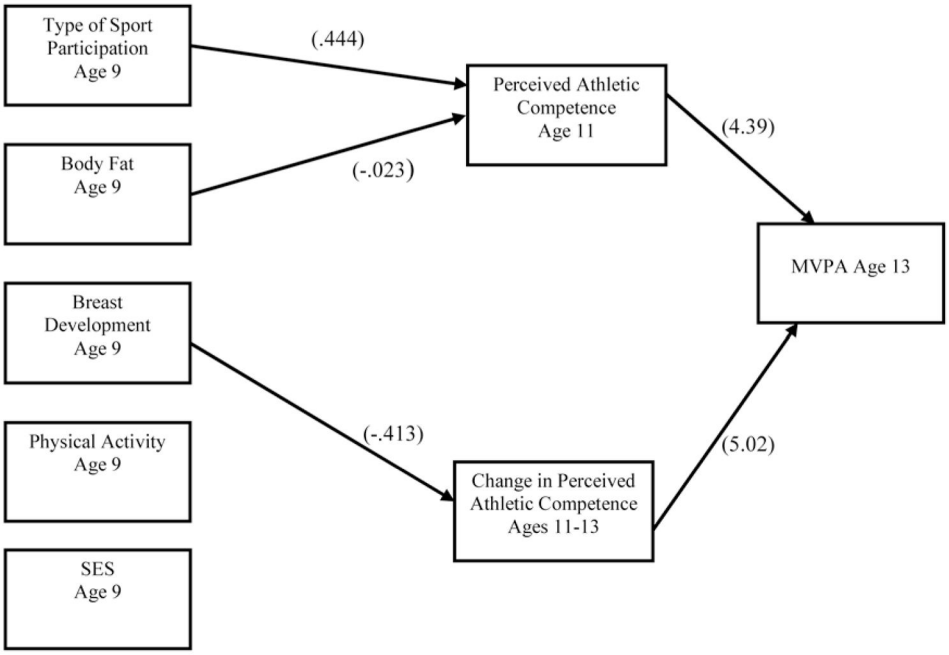

Figure 2.

Model of results. Note: Solid lines indicate statistically significant paths ($P \leq .05$). Numbers in parentheses are unstandardized regression weights. Correlations among all age 9 variables and direct and indirect paths from all age 9 variables to MVPA at age 13 were modeled.

Table 1

Descriptive Statistics

Variable	Percentage (n) or Mean (SD)	Minimum—Maximum for continuous variables
Breast development stage (age 9)		
Breast development stage 1	44% (66)	
Breast development stage 2	35% (52)	
Breast development stage 3	21% (31)	
Percent nonaesthetic or both sport participation (age 9)	75% (112)	
Percent aesthetic sport participation only (age 9)	25% (37)	
Body fat percentage (age 9)	26.74 (7.20)	13.9—45.86
Self-reported physical activity (age 9)	2.85 (.38)	1.71—4.0
Perceived athletic competence (age 11)	2.93 (.63)	1.17—4.0
Perceived athletic competence (age 13)	2.79 (.65)	1.0—4.0
Relative change in perceived athletic competence (ages 11–13)	−.14 (.62)	−1.74—1.57
Minutes of MVPA per day (age 13)	35.93 (14.75)	4.64—99.57

Table 2

Bivariate Correlations

Variable	1	2	3	4	5
1) Body fat percentage (age 9)	1				
2) Self-reported physical activity (age 9)	−.235*	1			
3) Perceived athletic competence (age 11)	−.195*	.222*	1		
4) Perceived athletic competence (age 13)	−.122	.254*	.524*	1	
5) Relative change in PAC (ages 11–13)	−.033	.153	.000	.852*	1
6) Minutes of MVPA per day (age 13)	−.193*	.240*	.175*	.271*	.209*

Table 3

Results for Path Model

Outcome	Predictor	b	95% CI	*P*
Perceived athletic competence (age 11)	Type of sport participation	.444	±.246	< **.001**
	Breast development (age 9)	.040	±.172	.654
	Percent body fat (age 9)	−.023	±.018	**.039**
	Socioeconomic status	−.031	±.058	.427
	Self-reported physical activity (age 9)	.171	±.238	.150
Relative change in perceived athletic competence (ages 11–13)	Type of sport participation (age 9)	.187	±.408	.464
	Breast development (age 9)	−.413	±.284	**.006**
	Percent body fat (age 9)	.022	±.032	.125
	Socioeconomic status	−.046	±.094	.336
	Self-reported physical activity (age 9)	.195	±.396	.325
Minutes of MVPA (age 13)	Perceived athletic competence (age 11)	4.386	± 3.905	**.039**
	Relative change in PAC (ages 11–13)	5.026	± 4.401	**.022**
	Type of sport participation (age 9)	3.137	± 6.074	.302
	Breast development (age 9)	−.731	± 4.194	.727
	Percent body fat (age 9)	−.237	±.454	.297
	Socioeconomic status	.395	± 1.348	.558
	Self-reported physical activity (age 9)	5.013	± 5.644	.076