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# **A LONGITUDINAL STUDY OF PUBERTAL TIMING AND EXTREME BODY CHANGE BEHAVIORS AMONG ADOLESCENT BOYS AND GIRLS**

**Marita P. McCabe and Lina A. Ricciardelli**

## **ABSTRACT**

Recent studies have examined the prevalence of disordered eating and other health risk behaviors among adolescent boys and girls. However, these studies generally have not examined predictors of these behaviors, and have not embedded the investigations within a theoretical framework. This study employed a longitudinal design to evaluate the validity of a biosocial model in explaining health risk behaviors related to extreme body change strategies (disordered eating, exercise dependence, use of food supplements, steroid use) among adolescents. The participants were 430 adolescent boys (mean age = 13.33 years) and 451 adolescent girls (mean age = 13.28 years) who completed measures of pubertal timing, perceived popularity with peers, body dissatisfaction, focus on sport, involvement in competitive sport, strategies to lose weight, strategies to increase muscle, disordered eating, use of food supplements and steroids, and exercise dependence. It was found that both early and late maturing girls were at greatest risk of engaging in health risk behaviors, whereas boys demonstrated more variability in the relationship between pubertal timing and extreme body change behaviors. The results of this study provide important insights into the role of pubertal development in the adoption of extreme body change behaviors among adolescents.

Extreme behaviors related to exercise and eating are of increasing concern for professionals working with adolescent boys and girls (e.g., Hausenblas & Carron, 1999; Parks & Read, 1997). These behaviors are adopted by adolescents to change their bodies to match the sociocultural ideal for boys (McCabe & Ricciardelli, 2001a) and for girls (Moore, 1993). For boys, the ideal is a muscular body with a large chest and shoulders and a slim waist. For girls, it is a slim overall body (Ricciardelli & McCabe, 2001a). The attainment of this ideal body is seen as being central to popularity with both same-sex and opposite-sex peers.

The present study used a biosocial framework, developed by the authors from the literature on health risk behaviors among adolescents,

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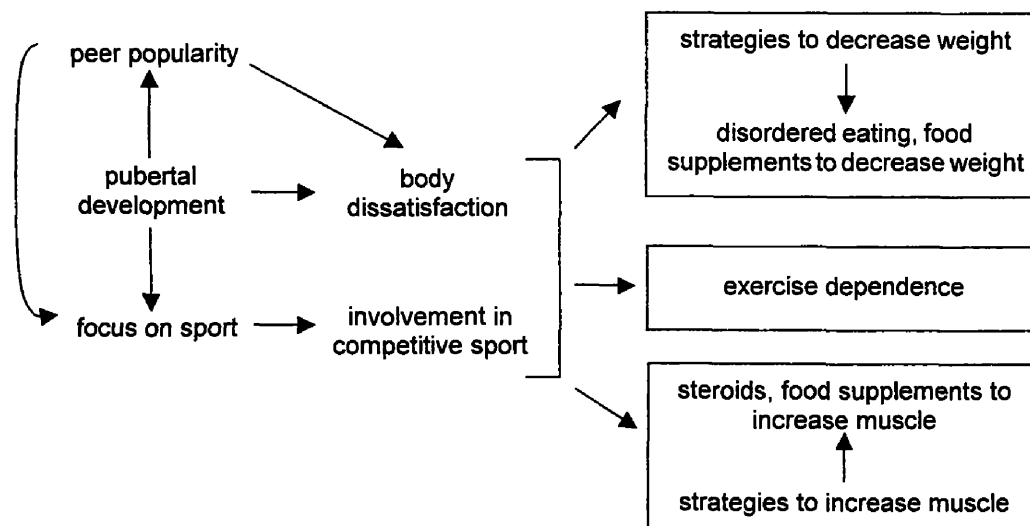
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to determine which adolescents are at greatest risk of engaging in extreme body change behaviors (e.g., exercise dependence, disordered eating, and the use of food supplements and steroids). A longitudinal design was employed to examine the temporal relationships between variables, and to assess how changes in the biosocial variables are associated with levels of disordered eating and exercise dependence over time. The biosocial framework in Figure 1 outlines the proposed relationships between pubertal timing, popularity with peers, involvement in sport, and the development of problem behaviors associated with eating and exercise among adolescent boys and girls.

The timing of puberty in relation to adolescent boys' and girls' peers appears to have important implications for body image and popularity (Graber, Lewinsohn, Seeley, & Brooks-Gunn, 1997). Early maturing boys are generally at a developmental advantage, both in terms of their body build conforming to the sociocultural ideal and in terms of their athletic ability, compared to late maturing boys (Silbereisen & Kracke, 1997). Late maturing boys would appear to be at greater risk of both developing higher levels of body dissatisfaction and engaging in detrimental eating and exercise behaviors to bring their bodies into line with the sociocultural ideal (Falkner, Neumark-Sztanier, Story, Jeffery, Beuhring, & Resnick, 2000; Silbereisen & Kracke, 1997). Late maturing boys may also be more likely to engage in competitive sport and have a greater focus on sport to achieve an athletically competent body (Wichstrom & Pedersen, 2001). The reverse appears to be true

Figure 1. Biosocial Model of Problem Behaviors in Adolescent Boys and Girls



for adolescent girls, with late maturing girls rather than early maturing girls being more likely to have a body that conforms to the sociocultural ideal (Swarr & Richards, 1996).

Empirical studies have demonstrated that early maturing boys are viewed by others as more attractive and self-confident, are more popular with their peers, have a more positive body image, and tend to be more successful athletes than late maturing boys (Freedman, 1990). In contrast, early maturing girls tend to be less popular with their peers, show a consistently more negative body image, and are more likely to be depressed than late maturing girls (Petersen, Sarigiani, & Kennedy, 1991; Stice, Prenell, & Bearman, 2001).

The effects of pubertal timing for boys and girls, and the associated changes in body mass index (BMI), are consistent with the different cultural notions of attractiveness for men and women. Research has clearly demonstrated the role of BMI in social, educational, and psychological adjustment among adolescent boys and girls (Falkner et al., 2000). With pubertal development, girls experience a normative increase in body fat and their hips broaden. These physical changes move girls further away from society's ideal body shape for a woman. As a result, after the onset of puberty, many girls report higher levels of body dissatisfaction and a poorer self-image (Swarr & Richards, 1996). In contrast, at the onset of puberty, boys gain muscle definition and their shoulder width increases, which moves the majority of boys closer to society's ideal body shape for a man.

Among boys, there is an emphasis on athletic prowess, as this brings social recognition and popularity (Kindlundh, Hagekull, Isacson, & Nyberg, 2001). There is also a clear association between engaging in competitive sport and the development of exercise dependence (Pasman & Thompson, 1988), disordered eating (Brehm & Steffen, 1998), and the use of steroids (Drewnowski, Kurth, & Krahn, 1995). In a review of studies related to eating disorders among athletes, Hausenblas and Carron (1999) found that both male and female athletes across all categories of sport were more likely to report bulimic symptomatology than were comparison groups. Research has also consistently indicated that top athletes, as well as those at sub-elite levels, are more likely to use steroids to enhance their performance (e.g., Wichstrom & Peterson, 2001). The use of anabolic steroids is likely to achieve quick results in terms of weight gain among adolescent boys (Wang, Yesalis, Fitzhugh, & Buckley, 1994).

Exercise dependence is well recognized as a symptom of disordered eating, particularly among girls (e.g., Yates, 1991), but it has not been considered a separate construct in recent models of disordered eating

involvement in competitive sport, and exercise dependence at time 1 (see Table 1 for a summary of the means and standard deviations for each group). There was a significant effect for pubertal timing,  $F(22, 1732) = 2.9, p < .001$ , and gender,  $F(11, 865) = 31.00, p < .001$ . There was also a significant interaction between pubertal timing and gender,  $F(22, 1732) = 2.23, p < .001$ .

Univariate tests indicated that there were significant differences between the groups for body dissatisfaction,  $F(5, 875) = 14.56, p < .001$ . There was a significant gender effect,  $F(1, 879) = 44.50, p < .001$ , and a significant interaction between gender and pubertal timing,  $F(2, 878) = 6.46, p < .01$ . Overall, girls demonstrated higher levels of body dissatisfaction than did boys. Further, early maturing and on-time girls demonstrated higher levels of body dissatisfaction than late maturers, whereas on-time and late maturing boys evidenced higher levels of body dissatisfaction than did early maturers.

There were no significant differences between the groups for popularity with same-sex peers,  $F(5, 875) = 4.23, p > .05$ . However, there were significant differences between the groups for popularity with opposite-sex peers,  $F(5, 875) = 5.04, p < .05$ . Specifically, there was a significant effect for pubertal timing,  $F(2, 878) = 9.97, p < .001$ . Early maturing and on-time boys and girls were more popular with the opposite sex than were late maturers.

There were significant differences between the groups for strategies to lose weight,  $F(5, 875) = 22.37, p < .001$ , with significant effects for gender,  $F(1, 879) = 87.24, p < .001$ , and pubertal timing,  $F(2, 878) = 4.30, p < .01$ . Girls were more likely to adopt strategies to decrease weight than were boys, and early maturing boys and girls were more likely to adopt strategies to decrease weight than were on-time or late maturers. There were also significant differences between the groups for strategies to increase muscle,  $F(5, 875) = 19.06, p < .001$ , with a significant gender effect,  $F(1, 879) = 73.25, p < .001$ , and a significant interaction between gender and pubertal timing,  $F(2, 878) = 5.10, p < .05$ . Boys were more likely than girls to engage in strategies to increase muscle, and early maturing boys were the most likely to engage in these strategies.

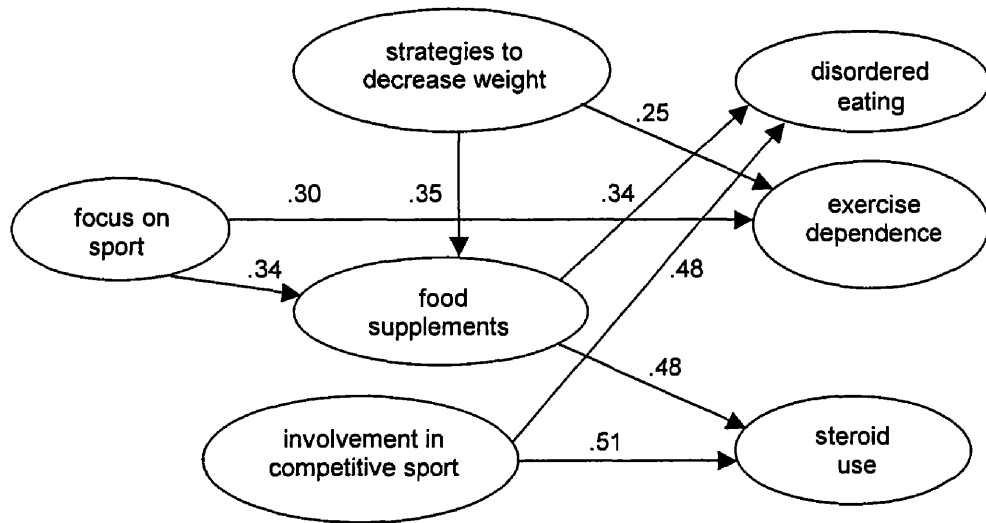
There were significant differences between the groups for disordered eating,  $F(5, 875) = 4.90, p < .05$ , with a significant gender effect,  $F(1, 879) = 8.32, p < .01$ . Girls were more likely to engage in disordered eating than were boys. There were also significant differences between the groups for the use of food supplements,  $F(5, 875) = 5.56, p < .001$ . Specifically, there were significant effects for gender,  $F(1, 879) = 9.90, p < .01$ , and pubertal timing,  $F(2, 878) = 3.85, p < .05$ , and a significant

Table 1

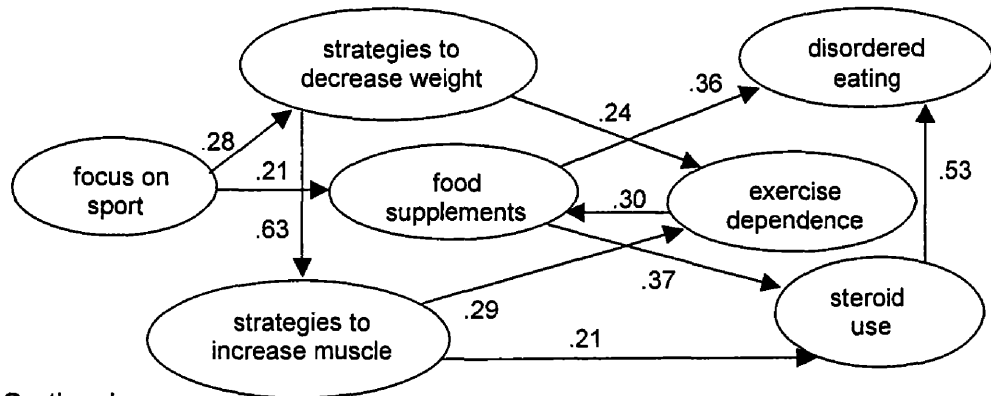
Means and Standard Deviations for Body Dissatisfaction, Popularity with Same-Sex and Opposite-Sex Peers, Body Change Strategies, and Sport Variables for Adolescent Boys and Girls at Time 1

Variable	Boys						Girls					
	Early		On-Time		Late		Early		On-Time		Late	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Body dissatisfaction	11.24	6.45	12.44	5.76	13.68	5.76	16.63	6.80	15.95	7.67	14.40	6.54
Popularity with same-sex peers	40.17	6.70	40.16	6.82	38.79	7.16	41.49	6.06	42.28	5.45	41.00	6.91
Popularity with opposite-sex peers	35.18	9.02	34.14	8.30	32.15	8.80	33.34	9.43	34.26	7.97	30.07	10.01
Strategies to decrease weight	15.80	6.04	15.31	5.43	14.77	5.14	20.57	6.25	19.27	6.42	18.19	6.31
Strategies to increase muscle	18.50	6.97	16.37	5.16	16.33	5.56	13.60	4.53	13.80	4.44	15.20	4.49
Disordered eating	4.90	5.76	4.36	4.71	5.70	6.47	6.89	6.48	6.39	5.88	5.32	5.17
Use of food supplements	19.94	3.11	18.80	1.95	19.05	1.67	17.04	2.66	17.93	2.51	18.18	2.19
Steroid use	3.14	.21	3.09	.69	3.13	.93	3.02	1.09	3.09	.86	3.07	.48
Focus on sport	7.43	3.00	6.76	2.79	6.97	2.71	5.91	2.80	6.27	2.93	6.52	2.96
Involvement in competitive sport	1.12	.33	1.17	.38	1.18	.39	1.29	.52	1.34	.53	1.25	.44
Exercise dependence	29.76	8.24	32.14	6.62	31.44	7.18	29.04	6.49	30.10	7.35	30.00	7.62

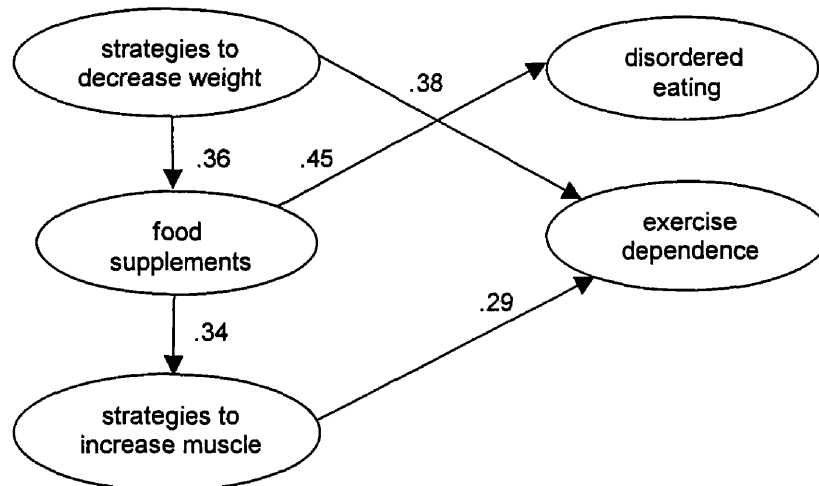
Figure 2. Final Structural Models for Boys at Time 2



a. Early maturing boys

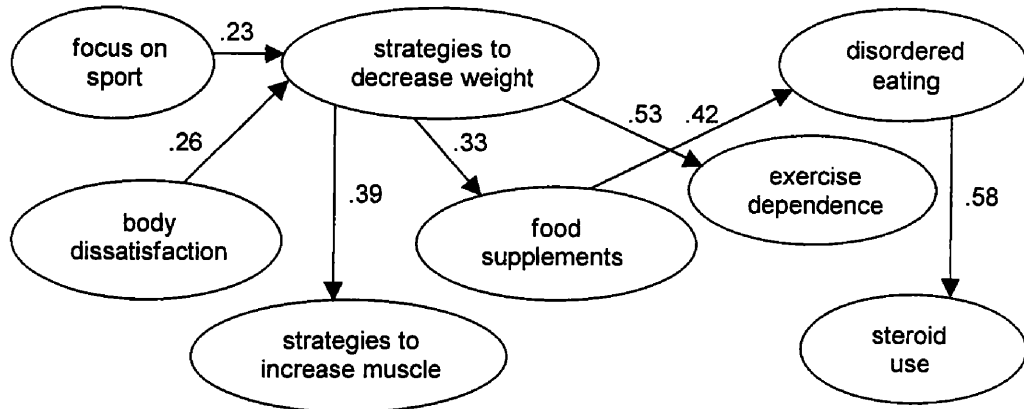


b. On-time boys

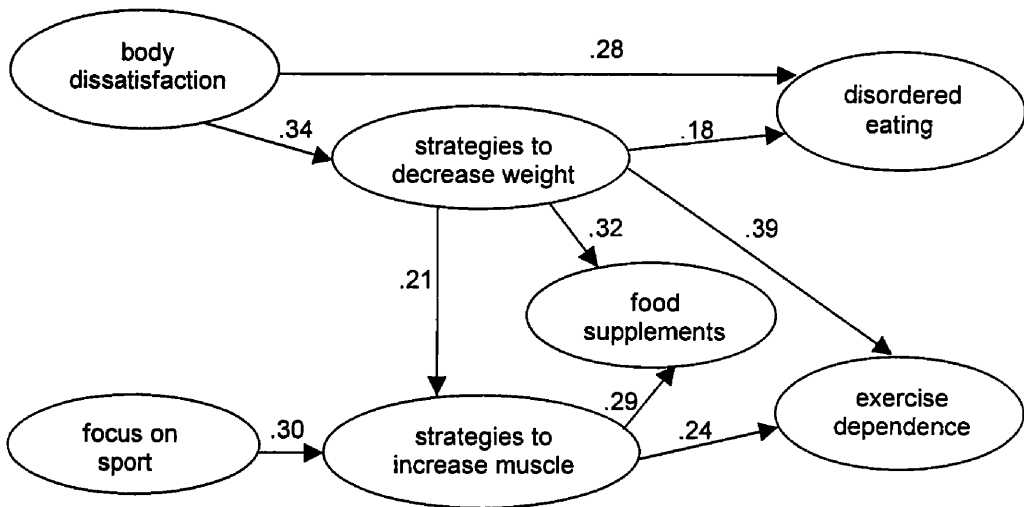


c. Late maturing boys

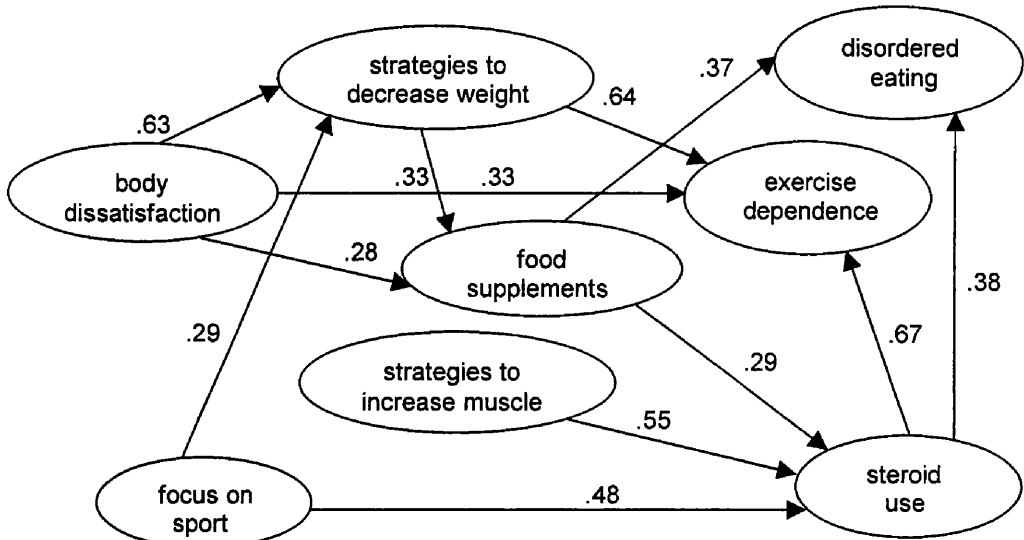
Figure 3. Final Structural Models for Girls at Time 2



a. Early maturing girls



b. On-time girls



c. Late maturing girls



Table 2

Model Parameters for Early, On-Time, and Late Maturing Adolescent Girls and Boys

	$\chi^2$	<i>df</i>	GFI	AGFI	NFI	TLI	RMSEA
Early maturing boys							
Original model	141.40	3.29	.83	.74	.36	.25	.14
Final model	37.23	1.86	.93	.90	.71	.83	.09
On-time boys							
Original model	378.25	8.80	.78	.66	.11	-.17	.18
Final model	39.63	2.20	.96	.93	.85	.90	.07
Late maturing boys							
Original model	80.33	1.87	.84	.76	.26	.11	.11
Final model	5.95	0.60	.97	.96	.86	.99	.00
Early maturing girls							
Original model	136.13	3.17	.85	.76	.37	.27	.13
Final model	21.86	0.99	.96	.94	.84	1.00	.00
On-time girls							
Original model	122.92	2.86	.91	.86	.47	.43	.09
Final model	28.03	1.48	.97	.95	.85	.94	.05
Late maturing girls							
Original model	138.63	3.22	.83	.74	.47	.41	.15
Final model	33.51	1.46	.92	.88	.85	.94	.07

*Note.* GFI = goodness-of-fit index, AGFI = adjusted goodness-of-fit index, NFI = normed fit index, TLI = Tucker-Lewis index, RMSEA = root mean square error of approximation.

Strategies to decrease weight predicted strategies to increase muscle, and both of the strategies predicted exercise dependence and use of food supplements. Strategies to decrease weight also predicted disordered eating. Focus on sport predicted strategies to increase muscle, which, as outlined above, predicted other health risk behaviors (see Figure 3b).

Among late maturing girls, body dissatisfaction predicted strategies to decrease weight, as well as directly predicted exercise dependence and use of food supplements at time 2. Use of food supplements predicted disordered eating and the use of steroids. Strategies to decrease

weight predicted exercise dependence and the use of food supplements. Strategies to increase muscle predicted steroid use, which, in turn, predicted disordered eating and exercise dependence. Focus on sport played some role in health risk behaviors, as it predicted strategies to decrease weight as well as steroid use (see Figure 3c).

## DISCUSSION

This study was designed to determine the predictors of extreme body change behaviors among adolescent boys and girls. More specifically, it examined the role of pubertal timing, peer popularity, body dissatisfaction, focus on sport, and involvement in competitive sport in predicting strategies to decrease weight and increase muscle, as well as several extreme body change behaviors (disordered eating, use of food supplements and steroids, and exercise dependence). A longitudinal design was employed so that the temporal relationships between the variables could be determined. Changes in the independent variables over an 8-month period were used to determine the variables that predicted body change strategies and health risk behaviors. The pathways outlined in Figure 1 were tested using structural equation models. Since pubertal timing was a focus of this study, the adolescents were divided into six groups for the analyses: early maturing, on-time, and late maturing boys, and early maturing, on-time, and late maturing girls.

Adolescent girls experienced higher levels of body dissatisfaction than did adolescent boys, which is consistent with previous findings (McCabe, Ricciardelli, & Banfield, 2001). Germane to the sociocultural ideal, girls who matured early and boys who matured late evidenced the highest level of body dissatisfaction. These results support Stice et al.'s (2001) findings in regard to early maturation for girls. They also empirically confirm that, at least in terms of body dissatisfaction, early maturing boys are at an advantage (Falkner et al., 2000; Silbereisen & Kracke, 1977).

Early maturation seemed to confer an advantage to both boys and girls in regard to popularity with the opposite sex. These results suggest that maturing early may not be associated with negative consequences in all areas of functioning for adolescent girls.

Not surprisingly, there were strong gender differences in terms of body change strategies, involvement in sport, and exercise dependence. Boys were more likely to engage in strategies to increase muscle, use food supplements, focus on sport, and engage in competitive sport. Consistent with previous research (McCabe & Ricciardelli, 2001a;

McCreary & Sasse, 2000), these results demonstrate that boys use strategies to increase muscle in their attempts to develop a body shape that conforms to the sociocultural ideal for men. In contrast, girls are more likely than boys to engage in strategies to lose weight, as well as to exhibit disordered eating and exercise dependence. Such strategies represent attempts to get their bodies closer to the sociocultural ideal for women (Brehm & Steffen, 1998; Paxton, Wertheim, Gibbons, Szmuckler, Heller, & Petrovich, 1991).

Overall, the results indicate that across the whole range of strategies, adolescents attempted to achieve the body shape endorsed by the broader society. The only exception to this finding was in regard to the use of steroids. However, steroid use was very low among these adolescents, which likely prevented meaningful trends from emerging.

The results for pubertal timing were less consistent. Early maturing boys were more popular with the opposite sex, demonstrated higher levels of body satisfaction, were more likely to adopt strategies to decrease weight and increase muscle, and were more likely to use food supplements and be exercise dependent. In contrast, early maturing girls demonstrated higher levels of body dissatisfaction and higher levels of popularity with the opposite sex, were more likely to adopt strategies to decrease weight, and were more likely to be exercise dependent but not to use food supplements.

These findings are of particular interest because, on the basis of previous research (e.g., Freedman, 1990), one would expect late maturing boys, whose bodies are more likely to deviate from the sociocultural ideal, to be more likely to adopt body change strategies in order to build muscle and tone their bodies. Perhaps early maturing boys are more focused on their bodies because of their early maturation, whereas late maturing boys have not yet developed this focus. It is therefore important to conduct a similar study among older adolescents to determine if late maturing boys are likely to evidence health risk behaviors.

Although early maturation for girls was associated with greater popularity with opposite-sex peers, these girls were also more likely to engage in health risk behaviors such as adopting weight loss strategies and being exercise dependent. However, late maturing girls were more likely to use food supplements. As opposed to previous research that has shown that early maturing girls are at a disadvantage in terms of their psychological and interpersonal adjustment (Stice et al., 2001; Swarr & Richards, 1996), this study suggests that both early and late maturing girls are susceptible to engaging in health risk behaviors.

It was expected that levels of peer popularity would predict health-risk behaviors over time. However, peer popularity (both same-sex and

opposite-sex popularity) was removed from each of the six models due to its low contributions to the fit of these models. These findings are in contrast to earlier cross-sectional research that suggested that peer popularity predicts body change strategies (McCabe & Ricciardelli, 2001b; McCabe & Ricciardelli, 2003; McCabe et al., 2002; Ricciardelli & McCabe, 2001a). It would appear that once other variables are entered into longitudinal models to explain body change behaviors, peer popularity no longer explains variance in these behaviors. Pubertal timing and peer popularity may be so closely related that peer popularity does not add to the factors explaining the development of these behaviors once participants are separated into different groups on the basis of their pubertal timing. Clearly, this needs to be investigated in future studies.

Sport was a factor that contributed to various health risk behaviors for most groups of adolescent boys and girls. For early maturing boys, involvement in competitive sport predicted steroid use and disordered eating. These findings support research by Drewnowski et al. (1995) and Wichstrom and Peterson (2001), who found an association between competitive sport and steroid use, and by Hausenblas and Carron (1999), who found an association between competitive sport and disordered eating. However, it was focus on sport that was a more important predictor of health risk behaviors over time. Both early maturing and on-time boys who demonstrated a high focus on sport were more likely to use food supplements at time 2. Early maturing boys with this focus were also more likely to demonstrate exercise dependence, and on-time boys to engage in strategies to decrease weight, which, in turn, predicted exercise dependence. On-time girls with a high focus on sport were more likely to engage in strategies to increase muscle, which, in turn, predicted exercise dependence and the use of food supplements. Late maturing girls with this focus were more likely to use steroids, which, in turn, predicted exercise dependence and disordered eating.

Most investigations of the role of sport in health risk behaviors have examined the ability of competitive sport to predict use of steroids, disordered eating, and exercise dependence among boys (Brehm & Steffen, 1998; Drewnowski et al., 1995; Hausenblas & Carron, 1999; Pasman & Thompson, 1988). The current findings indicate that, for both adolescent boys and girls, a focus on sport may result in the adoption of a number of health risk behaviors. These behaviors may be adopted in an attempt to improve athletic performance irrespective of whether the adolescent is involved in competitive sport. It was those boys who would be expected to be most involved in sport (early maturing and on-time), rather than late maturing boys, who showed the

strongest association between sport and health risk behaviors. This finding needs to be explored further, over a longer period of time, to clarify these relationships.

An interesting finding was that among some adolescent boys and girls, nonextreme strategies that were being used to decrease weight developed into health risk behaviors at time 2. For early maturing boys, relationships between strategies to decrease weight and health risk behaviors at time 2 were not expected to change (Falkner et al., 2000; McCabe et al., 2003; Silbereisen & Kracke, 1997). However, if they engaged in strategies to decrease weight due to their larger body size, they were more likely to use food supplements and demonstrate exercise dependence at time 2. Both on-time boys and late maturing boys who were more likely to adopt strategies to decrease weight demonstrated exercise dependence at time 2, and late maturing boys also used food supplements at time 2. Similar findings were obtained for the three groups of girls. Regardless of their pubertal status, an increase in the adoption of strategies to decrease weight between time 1 and time 2 predicted the use of food supplements and exercise dependence at time 2. The adoption of strategies to decrease weight also predicted disordered eating at time 2 for on-time girls.

These findings demonstrate that, regardless of pubertal timing, the adoption of strategies to decrease weight may lead to more hazardous health risk behaviors. These results are consistent with earlier findings in regard to disordered eating (Ricciardelli & McCabe, 2001b; Stice, 2001), but demonstrate that strategies to decrease weight relate to a broader range of health risk behaviors (e.g., exercise dependence, use of food supplements).

A similar pattern of risk behaviors was associated with strategies to increase muscle, although the associations were not as strong as for strategies to decrease weight. Strategies to increase muscle predicted exercise dependence at time 2 among on-time and late maturing boys. In addition, on-time boys were more likely to engage in steroid use at time 2 if they engaged in strategies to increase muscle at time 1. Likewise, strategies to increase muscle predicted the use of food supplements and exercise dependence among on-time girls, and the use of steroids among late maturing girls. Thus, on-time and late maturing boys and girls were most at risk of using steroids and becoming exercise dependent if they had previously focused on strategies to increase muscle.

There were strong interrelationships among the health risk behaviors for all of the adolescents. Use of food supplements predicted disordered eating for all groups of boys. In addition, use of food supplements

predicted steroid use among early maturing and on-time boys. These behaviors may have been due to the pressure placed on boys to achieve the ideal body shape (McCabe & Ricciardelli, 2001b; Pope et al., 1999; Ricciardelli, McCabe, & Banfield, 2000).

For girls, the relationships were more complex. Among early maturing girls, the use of food supplements predicted disordered eating, which, in turn, predicted steroid use. There were no relationships between the health risk behaviors for on-time girls. However, among late maturing girls, use of food supplements predicted both disordered eating and steroid use, with steroid use also predicting exercise dependence and disordered eating.

An interesting finding was that while body dissatisfaction failed to predict body change strategies or health risk behaviors among boys, it was a predictor for all groups of girls. This is consistent with previous findings, namely that body dissatisfaction does not appear to determine whether boys engage in body change strategies (McCabe & Ricciardelli, 2001a), although this is the case for girls (Stice, 2001). Also consistent with previous research, body dissatisfaction predicted strategies to decrease weight among all groups of girls.

The findings from this study demonstrate the importance of pubertal timing in understanding health risk behaviors related to changing body size among adolescent boys and girls. Within each group of boys and girls, there were different predictors of health risk behaviors; they adopted different strategies in an attempt to achieve a body shape that conformed to the sociocultural ideal for their gender. Of greatest concern was the finding that strategies to either decrease weight or increase muscle predicted the adoption of more serious health risk behaviors over time. This suggests that intervention programs should target these low risk strategies as well as more serious health risk behaviors.

These results cannot be generalized to other groups, and need to be explored further. The relationships identified in the present study should be examined over a longer time period and among a more culturally diverse group of adolescents, as well as among younger and older adolescent boys and girls.

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