



A Longitudinal Study of Pubertal Timing and Tempo on Body Shame Among Young Adolescent Girls and Boys

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Abstract

Objectification theory posits that puberty is likely to be a critical stage for experiencing body shame. Past research on experiences during puberty has largely focused on the association between pubertal timing (i.e., the onset of the process of physical maturation and sexual development) and physical and/or psychological health problems among adolescent girls, whereas less research has considered pubertal tempo (i.e., the rate of physical maturation and sexual development during puberty) among girls and boys and its association with body image variables. Using growth curve models, the present study examined whether pubertal tempo and pubertal timing predicted body shame at three equidistant data collection time-points over a two-year period in a sample of 755 early adolescent boys and girls from Spain (377 girls and 378 boys; $M_{age} = 11.49$; $SD = 0.67$ at Time 1). Although participants, particularly boys, showed a decline in body shame in their transition to adolescence, early maturing girls (i.e., body hair, skin changes, breast growth, and menstruation) were especially vulnerable to experiencing body shame. Boys with a slower rate of pubertal change in body hair and facial hair (beard) growth were also vulnerable to experiencing body shame. Findings showed the different role that pubertal timing and tempo appeared to have among boys and girls in predicting body shame and, in line with the gendered deviation hypothesis, suggests important gender differences in experiencing atypical pubertal development for body image.

Keywords Body shame · Adolescence · Body image · Pubertal tempo · Pubertal timing · Objectification theory · Longitudinal study · Gendered deviation hypothesis · Body ideals

Body shame is an emotion that results from an individual comparing their body to socially sanctioned and accepted beauty standards, and perceiving oneself as failing to meet those standards (Fredrickson & Roberts, 1997; Noll & Fredrickson, 1998). Research has shown that body shame is a

possible risk factor for depression, eating disorders, sexual dysfunctions, self-stigmatization, body dissatisfaction, body image concerns, and unhealthy strategies aimed at modifying body shape and size (Calogero et al., 2021; Dakanalis et al., 2015; Moradi & Huang, 2008; Schaefer et al., 2018). Puberty is a critical stage of life when early adolescents may begin to feel strongly pressured by socially accepted beauty standards and to internalize these ideals (Fredrickson & Roberts, 1997), and it is likely that individual differences in when and how pubertal development unfolds is related to body shame (Guo & Wu, 2024; Lindberg et al., 2006, 2007; Ullsperger & Nikolas, 2017). Specifically, pubertal timing refers to how early or late an individual begins and progresses through pubertal changes relative to same-age and same-sex peers, whereas pubertal tempo refers the pace at which individuals progress through puberty, that is, how quickly or slowly these changes occur in the same individual over time (Mendle et al., 2010). The aim of the present study was to examine whether interindividual and intraindividual differences in pubertal development predicted body shame among boys and girls.

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Body Shame and Objectification Theory

Grounded in feminist psychology, objectification theory has offered a testable framework for explaining women's body shame and examining its psychological and mental health consequences (Fredrickson & Roberts, 1997; Moradi & Huang, 2008). According to objectification theory (Fredrickson & Roberts, 1997), women from a very early age are subjected to a socialization process where they learn to look at and evaluate themselves based on their physical appearance. Their bodies come to be perceived as objects of sexual desire and the reiteration of these experiences causes many women to internalize this objectifying gaze and turn it against themselves through a process of self-objectification. Self-objectification runs parallel to a continuous process of controlling the external appearance of the body, because individuals who reduce their self to an observed body manifest an incessant body surveillance and a continuous comparison, driven by an attempt to attain internalized canons of beauty, which increases the risk for body shame (Roberts et al., 2018; Schaefer et al., 2018). Some research has indicated that boys and men also experience body shame as a consequence of adopting a self-objectified awareness of their bodies (Lindberg et al., 2006; Pecini et al., 2023). Therefore, although the body ideal to be achieved may vary between genders (McKinley, 2006; Sicilia et al., 2023b), research suggests similarities between girls and boys for body shame and its consequences (McKinley, 2006; Warnick et al., 2022).

Body Shame and Pubertal Development

In objectification theory, it is recognized that the internalization of body ideals has a developmental pattern that begins in early adolescence and continues through adolescence into early adulthood (Frederick et al., 2007; Morrison & Halton, 2009; Ricciardelli & McCabe, 2004). Therefore, early adolescence may be a higher risk period for the development of body shame due to the physical maturation and changes that boys and girls experience during puberty (Mendle & Koch, 2019). It should also be noted that pubertal development is accompanied by the development of secondary sexual characteristics (e.g., breast growth, wider hips for girls; facial hair, deepening voice for boys) that could put boys and girls in the spotlight of peer attention and increase the risks of appearance criticism and comparison with peers (Lindberg et al., 2007). In this sense, abrupt, dramatic, and fluctuating changes could lead early adolescents to recurrent scrutiny of their bodies and increased risk of experiencing body shame (Guo & Wu, 2024).

Three hypotheses have been commonly postulated to explain how interindividual and intraindividual differences

in pubertal development may predict adverse outcomes: the maturation disparity hypothesis, the social deviance hypothesis, and the gendered deviation hypothesis (Richburg, 2021; Ullsperger & Nikolas, 2017). The maturation disparity hypothesis has been the most widely assumed hypothesis and it posits that atypical pubertal development (i.e., being early or rapidly changing) results in cognitive and emotional maladjustment that affects individual's body image. The maturation disparity hypothesis has also been named the stage termination hypothesis (Petersen & Taylor, 1980) when referring to timing of onset. It suggests that individuals who mature early are forced to end childhood and enter adolescence without having necessarily attained the psychological, interpersonal, and cognitive resources necessary to cope effectively with the stresses of adolescence (Caspi & Moffitt, 1991; Petersen & Taylor, 1980). Therefore, an early onset of pubertal timing among children may increase the risk of feeling negative emotions regarding their bodies, because they are forced to face the new body changes and the social pressure to achieve specific body ideals with fewer psychosocial resources than those who have an onset of maturation at the same time as their same-sex peer group (Ge & Natsuaki, 2009; Ullsperger & Nikolas, 2017).

In terms of the tempo of puberty, the maturation disparity hypothesis has also been called the maturation compression hypothesis (Mendle et al., 2010). It suggests that a faster than average pace of pubertal development may make body changes more obvious and visible, in a way that may provoke more social pressure and increased negative emotions towards the body. Therefore, an unusually rapid transition through puberty compresses the time that individuals would have available to cope cognitively and emotionally with the demands that body transformation generates (Mathias et al., 2016; Mendle et al., 2010).

The social deviance hypothesis, also known as the maturational deviance hypothesis, posits that any form of offset pubertal development, whether in terms of timing or tempo, leads to a higher risk of experiencing emotional or psychological problems (Richburg, 2021; Ullsperger & Nikolas, 2017). Therefore, if the development of pubertal sexual characteristics appears earlier or later than the rest of their same-sex peers, or develops faster or slower than they do, individuals may feel that their bodies are different and generate self-objectification processes that trigger body shame (Guo & Wu, 2024).

Finally, the gendered deviation hypothesis is an extension of the social deviance hypothesis. It assumes that boys and girls exhibit significant differences in pubertal development and that social comparison is not only among same-sex peers but among all members of the same age group. Consequently, the gendered deviation hypothesis postulates that early- or rapidly-maturing girls and late- and

slowly-maturing boys are at greater risk of experiencing detrimental outcomes (Richburg, 2021). When considering that individuals reference their pubertal maturation within and across sex, both early or rapidly maturing girls and late or slowly maturing boys would be those who would be more socially and physically deviant within the entire group (Ullsperger & Nikolas, 2017). Considering that within the same-age group, girls begin to mature earlier than boys (Mendle & Koch, 2019), early or rapidly maturing girls might be more at risk of body shame by being the first to deviate more from group norms, while late or slowly maturing boys would be the last to develop within the group and would be more at risk of experiencing body shame by placing their bodies in a deviant position relative to the bodies of other group members.

Of the three aforementioned hypotheses, the maturational disparity hypothesis has received the most attention and support, showing an association between early pubertal timing and detrimental outcomes in both early adolescent boys and girls (Barendse et al., 2022; Dimler & Natsuaki, 2015; Richburg, 2021; Ullsperger & Nikolas, 2017). However, the negative effects of early pubertal timing have been more consistently tested among girls and it appears that these effects are shown to be stronger than for boys (Richburg, 2021). These differences have not only been attributed to the different biological changes and development of secondary sex characteristics that girls and boys experience during puberty, but also to the way in which body changes may evoke differences in the social influences and pressure that adolescents receive in their environment (Barendse et al., 2022). Girls have been found to be more likely to internalize socially sanctioned body ideals, experience more body dissatisfaction, and display more negative body image than boys (Paterna et al., 2021), while also exhibiting worsened mental health during puberty (e.g., eating disorders, anxiety, depression) (Ullsperger & Nikolas, 2017).

Unlike early pubertal timing, the effects of late pubertal timing have been less well examined and the results appear inconclusive. Much of the research seems to indicate that late pubertal timing is not associated with detrimental outcomes for girls (Ullsperger & Nikolas, 2017). In addition, some studies have suggested that late pubertal timing might have protective effects on mental health for girls (Gaysina et al., 2015). Consequently, the overall findings do not appear to support the social deviance hypothesis. Conversely, in line with the gendered deviation hypothesis, some studies have found associations between late pubertal timing and symptoms of psychopathology for boys (Gaysina et al., 2015; Graber, 2013), although some meta-analytic reviews have not supported this association (Dimler & Natsuaki, 2015; Ullsperger & Nikolas, 2017).

Compared to timing, tempo has received much less research attention, in part because of the need for

measurements over time (Marceau et al., 2011). Many studies have focused on measuring timing alone, without considering tempo, even though research has highlighted that timing and tempo are variables that are shown to be relatively independent (Mendle et al., 2010), such that earlier timing of pubertal onset is not shown to be systematically associated with either faster or slower maturational timing. Pubertal tempo involves intraindividual differences rather than inter-individual differences. In other words, pubertal tempo is defined in relation to the child's own previous development, irrespective of how early or late the maturational process has begun in relation to same-sex peers. It is likely that in groups of adolescents where maturational development occurs later, as in the case of boys (Mendle et al., 2019), it is not so much the time at which pubertal changes begin to manifest themselves through secondary sexual characteristics (e.g., beard, deepening voice) but rather how fast or slow these changes are occurring to reach full pubertal development that is more important (Mendle et al., 2010). Consequently, the rate of pubertal development could be a better predictor of pubertal changes for boys than the onset of puberty itself. In line with the maturation compression hypothesis, some studies have found that while early pubertal timing predicts depressive symptomatology among girls, psychopathology may be better predicted by accelerated pubertal change than by timing among boys (Ge & Natsuaki, 2009; Mathias et al., 2016; Mendle et al., 2010). Although these findings support the possibility that boys with rapid maturation have less time available to cognitively and emotionally cope with the stresses and strains of drastic body changes, to date, this idea has not been tested in relation to body image.

The rapid body changes that occur during pubertal development increase the perception of being watched and negatively evaluated by others (Sicilia et al., 2023a). Puberty has been shown to be a critical period for the development of negative emotions regarding the body, given that the development of secondary sexual characteristics could increase the risk of body shame (Guo & Wu, 2024; Lindberg et al., 2007). Previous studies have reported that early maturing girls tend to show negative body image, feel greater peer appearance pressure, compare their bodies more often with those of others, and be less satisfied with their bodies than late maturing girls (Dorn et al., 1988; Sicilia et al., 2023a; Williams & Currie, 2000). Sicilia et al. (2023a) considered pubertal timing simultaneously with tempo when examining the association of pubertal development with social physique anxiety and motivation to exercise among early adolescent girls. These findings suggest that pubertal timing rather than tempo best explain girls' body image and exercise behavior.

To date, and to the best of the present authors' knowledge, only three studies have examined the association between pubertal development (in terms of pubertal timing) and body shame (i.e. Guo & Wu, 2024; Lindberg et al., 2007; Slater

& Tiggemann, 2012). These three studies have shown that early maturing girls are at greater risk of experiencing body shame than later maturing girls. In addition, the study by Lindberg et al. (2007) included both boys and girls in their sample, and reported no relationship between pubertal timing and body shame for boys. However, the role that growth rate may play in explaining body shame among girls has not been determined. In addition, it is not clear from the literature whether pubertal development, in terms of timing and tempo, is associated with body shame for boys.

Current Study

The present study explored whether there are differential effects of pubertal timing and pubertal tempo on body shame among early adolescent girls and boys. In addition, since many studies have considered menarche as a traditional indicator to define the beginning of puberty among girls (Benjet & Hernández-Guzmán, 2002; Stubbs, 2019), even though menarche is typically a late event in the pubertal process and its onset may not coincide with other developmental pubertal traits (Beltz et al., 2014), a secondary objective was to examine whether these differential effects are observed through different pubertal indicators.

Based on the results of previous studies (Guo & Wu, 2024; Lindberg et al., 2007; Slater & Tiggemann, 2012), it was expected that early maturing girls would show a greater tendency toward body shame. However, if the maturational disparity hypothesis is correct, an early maturation or rapid pace among boys should also be related to body shame. Alternatively, the gendered deviation hypothesis would be supported if late or slowly maturing boys manifested higher levels of body shame. To clarify these relationships, the present study examines the association between pubertal variation and body shame, taking into account both inter-individual differences and intraindividual changes among early adolescent boys and girls.

Method

Participants

A non-random sample recruited from public schools comprised 755 young Spanish adolescents (377 girls and 378 boys) who met the following inclusion criteria: (a) being in the sixth grade of primary school or first grade of secondary school at the time of starting the study, (b) having obtained informed consent from their parents or legal guardians to participate in the study, and (c) completing the survey at each of the data collection time points. There were no significant differences between students who completed the survey at all three data time points and those who did not complete it

at Time 2 or Time 3 on Time 1 variables ($p > .05$), except for the comparison on menstruation for girls which showed significant differences but with a small effect size, $F(2) = 3.10$, $p = .046$, $\eta^2 = .01$. Participants self-identified as primarily White (718, 95.1%), with the remainder of the sample identifying as South American (20, 2.7%), Arab (7, 0.9%), African (6, 0.8%), or other (4, 0.5%). The participants' age ranged from 10 to 14 years ($M = 11.49$ years, $SD = 0.67$) at the time of joining the study, and body mass index ranged from 13.21 to 34.98 (BMI, $M = 18.88$, $SD = 3.30$). The participants' age at the time of study completion ranged from 12 to 16 years ($M = 13.51$ years, $SD = 0.66$), and BMI ranged from 13.33 to 34.56 ($M = 20.19$, $SD = 3.37$).

Measures

Pubertal Development

A Spanish translation of the Pubertal Development Scale (Petersen et al., 1988) was used. This scale assesses the subjective degree of development of five physical characteristics associated with pubertal maturation. These comprise growth spurt, body hair growth, and skin changes for both boys and girls; breast growth and menarche for girls only; and facial hair (beard) growth and voice change for boys only. Each characteristic is rated using a four-point scale ranging from 1 (*no development*) to 4 (*development completed*). This scale has demonstrated good internal consistency reliability and criterion validity for both girls and boys (Petersen et al., 1988).

In the light of the present study's objectives, scores from individual indicators were employed and each pubertal indicator was assessed three times. Considering that the different indicators could develop and interact differently with the other indicators, the measurement model included five constructs (one for each pubertal indicator) with three observations each (the assessment of the indicator at each of the time points). This model made it possible to identify the measurement model and calculate the composite reliability index (CRI) (Fornell & Larcker, 1981). In the present study the CRI for the boy's model was .91, while the CRI for the girl's model was .92.

Body Shame

The Body Shame subscale of the Spanish version (Sicilia et al., 2020) of the Objectified Body Consciousness Scale (McKinley & Hyde, 1996) was used to assess the degree to which individuals feel shame about their bodies when they perceive themselves as falling short of meeting cultural appearance standards. Participants rate eight items from 1 (*strongly disagree*) to 7 (*strongly agree*), such as "When I'm not the size I think I should be, I feel ashamed." Scores

range from 1 to 7, with higher scores indicating greater body shame. Previous research on this subscale among Spanish preadolescents demonstrated stable two-week test–retest reliability, invariance across gender, high internal reliability, with alpha values of .75, and good convergent and discriminant validity (Sicilia et al., 2020). In the present study, body shame showed high internal reliability with Cronbach's alpha values ranging from .77 to .85 at the different data collection time points (from .78 to .81 for boys; from .77 to .87 for girls).

Sociodemographic Variables

Participants self-reported their age, ethnicity, height, and weight, the last two being used to estimate the participants' body mass index (kg/m²).

Procedure

After obtaining approval from the first author's university bioethics committee, the schools' principals and teachers were contacted to request their participation. Students in the sixth grade of primary education and the first year of compulsory secondary education were invited to participate in the study. Having agreed to take part, and having obtained informed consent from their parents or legal guardians, participants completed a paper-and-pencil survey administered during regular class time at three equidistant data collection time points (beginning of each academic year) over a two-year period. Each participant was assigned a personal code so that the surveys completed at the different data collection points could be matched.

Data Analysis

Preliminary analyses consisted of descriptive statistics and bivariate correlations between the study variables. The effect sizes of the differences (*d*) of body shame between girls and boys and the different data collection time points were computed. The effect sizes were interpreted as trivial (*d* = .00 to .20), small (*d* = .20 to .50), intermediate (*d* = .50 to .80), and large (*d* > .80) (Cohen, 1988). Finally, a series of growth models with repeated indicators were performed to examine the effect of pubertal development and body mass index (BMI) on body shame across three time points (T1, T2, and T3). Analyses were performed for boys and girls separately. A total of five indicators of pubertal development were used for each gender, three being common (growth spurt, body hair, skin changes) and two being different (voice changes and facial hair growth for boys, and breast growth and menstruation for girls). Each indicator was modeled with two latent variables: the intercept (representing the initial level of the indicator) and the slope (representing the change over

time of the indicator). BMI scores were included as covariates in the models. Figure 1 shows the growth model tested.

All models were tested with Mplus 7.0 (Muthén & Muthén, 2015) using the robust maximum likelihood method to take into account the likely multivariate non-normality of the data (Wang & Wang, 2020). To evaluate the goodness of fit of the models, and following the recommendations of Kline (2016), the following indices were reported: chi-square test for model fit (χ^2), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and the Standardized Root Mean Square Residual (SRMR). Values above or close to 0.95 for the CFI, and 0.06 for both the RMSEA and the SRMR were considered to indicate an adequate fit between the models and the data (Brown, 2015).

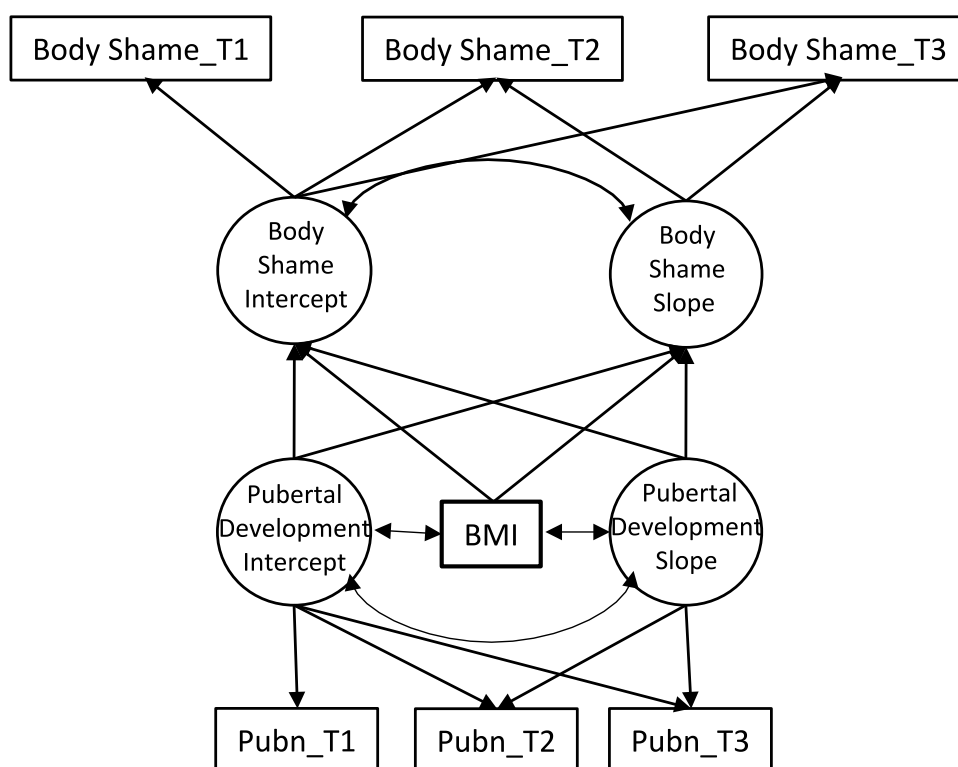
Results

Descriptive Statistics

Table 1 presents the descriptive statistics for body shame and pubertal development indicators by time point. For girls, the mean values of the pubertal indicators were close to three, and even four in the case of menstruation, reflecting a more advanced pubertal development compared to the group of boys, whose mean values of the pubertal indicators did not exceed a mean of 2.68 in any instance. On the other hand, the average body shame decreased across the three time points, but different values were observed depending on gender. In the case of boys, the average values decreased more clearly, going from 2.60 to 2.12 ($t = 5.03$; $p < .05$), with a moderate effect size (Cohen's $d = .34$). This was not the case for girls who, starting from levels similar to those of boys at T1 ($M = 2.60$), the values at T3 ($M = 2.43$) did not have an appreciable effect size with respect to T1 ($t = 1.86$; $p > .05$; Cohen's $d = .11$). In addition, the mean differences in body shame between girls and boys were not significant at T1 but were significant at T2 with a trivial effect size ($t = 2.31$; $p < .05$; Cohen's $d = .02$), and were also significant at T3 with a large effect size ($t = 2.75$; $p < .05$; Cohen's $d = .93$).

Correlations between variables are shown in Table 2. For boys, the intercept of body shame was positively related to the intercepts of the pubertal indicators, except for growth spurt ($r_{xy} = -.11$; $p > .05$), and negatively related to their slopes, except for growth spurt ($r_{xy} = .08$; $p > .05$). The correlations of the slope of body shame with the intercepts of the pubertal indicators were positive, except for body hair growth ($r_{xy} = -.10$; $p > .05$), while the association with its slopes was negative, except for body hair growth ($r_{xy} = .35$; $p < .05$) and facial hair growth ($r_{xy} = .19$; $p > .05$). The correlations between the latent variables of body shame and the pubertal indicators showed small values, with medium correlations only for the slope of body hair growth. For girls,

Fig. 1 Growth Model Tested

**Table 1** Descriptive Statistics for Indicators of Pubertal Development and Body Shame by Timepoint

Indicators of pubertal development	Boys						Girls					
	Time 1		Time 2		Time 3		Time 1		Time 2		Time 3	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Growth spurt	2.16	0.90	2.20	0.84	2.34	0.90	2.34	0.87	2.37	0.84	2.58	0.94
Body hair growth	1.99	0.87	2.14	0.90	2.37	0.95	2.12	0.94	2.53	0.96	3.08	0.90
Skin changes	2.13	1.05	2.42	1.01	2.68	0.94	2.24	1.00	2.59	1.00	2.94	0.97
Voice changes (boys) / Breast growth (girls)	1.98	0.96	2.19	1.02	2.72	1.02	2.32	0.83	2.58	0.79	2.88	0.77
Facial hair growth (boys) / Menstruation (girls)	1.66	0.87	1.93	0.94	2.40	0.98	1.86	1.23	2.66	1.41	3.55	0.99
Body shame	2.60	1.53	2.21	1.37	2.12	1.32	2.60	1.46	2.48	1.61	2.43	1.61

Note. Indicators of pubertal development ranged from 1 to 4. Body shame ranged from 1 to 7

the body shame intercept was positively correlated with the intercepts of the pubertal indicators while negatively correlated with their slopes, covering a range of small to medium correlations (-.22 to .38). The correlations of the slope of body shame with both the intercepts and the slopes of the pubertal indicators showed values close to zero in this group, except for the slope of skin change ($r_{xy} = -.24$; $p < .05$).

Growth Models

The goodness-of-fit indices for each model (see Table 3) suggested an acceptable or excellent fit to the data. A

summary of the standardized effects from the models and the explained variances for the intercept and slope of body shame are shown in Table 4. After controlling for the effects of BMI on body shame, the results showed that all the pubertal effects, except growth spurt, significantly predicted changes in body shame for girls, while for boys, two of the five pubertal indicators (i.e., body hair and facial hair growth) significantly predicted body shame. Although the mean change in body shame was negative across all boys (mean slope = -.23) and somewhat less so among girls (mean slope = -.09), the results indicated that early maturing girls in four of the five pubertal indicators (i.e., body

Table 2 Correlations Among Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. BMI	1	.18**	-.05	.02	.03	-.02	.13	.20*	-.19	.12	.09	.16*	.04
2. BS _{Intercept}	.24†	1	-.47***	-.11	.08	.24*	-.36***	.07	-.04	.14	-.06	.19*	-.25**
3. BS _{Slope}	.10	-.40***	1	.19	-.07	-.10	.35*	.08	-.06	.02	-.08	.01	.19
4. PD _{Intercept} (Spurt)	.01	.14	.01	1	-.30*								
5. PD _{Slope} (Spurt)	.02	-.07	-.01	-.32*	1								
6. PD _{Intercept} (Body hair)	.06	.33***	-.01			1	-.40**						
7. PD _{Slope} (Body hair)	-.02	-.22**	.12	-.43***		-.43***	1						
8. PD _{Intercept} (Skin changes)	.13	.38***	-.02					1	-.49***				
9. PD _{Slope} (Skin changes)	-.08	-.22*	.24*					-.35**	1				
10. PD _{Intercept} Voice changes (boys) / Breast growth (girls)	.16*	.30***	.06							1	-.39*		
11. PD _{Slope} Voice changes (boys) / Breast growth (girls)	-.07	-.09	.07							-.35**	1		
12. PD _{Intercept} Face hair growth (boys) / Menstruation (girls)	.12*	.29***	-.04									1	-.31**
13. PD _{Slope} Face hair growth (boys) / Menstruation (girls)	.01	-.15*	.08									-.68***	1

Note. PD = Pubertal development; BS = Body Shame; - = Not applicable as the correlation refers to pairs of variables not being included in the same models; Correlations boys above the diagonal; Correlations girls under the diagonal; * $p < .05$; ** $p < .01$; *** $p < .001$

hair growth, skin changes, breast growth, and menstruation) demonstrated higher levels of body shame over time. Furthermore, the predictive effects of the slope of skin changes on the slope of body shame were shown to be positive and statistically significant, suggesting that the faster this pubertal indicator appears, the faster the change in body shame ($\beta = .26$) through the girls' transition to adolescence. In the case of boys, body hair growth and facial hair growth were pubertal indicators that significantly predicted the change in body shame. A rapid change in body hair growth ($\beta = -.35$) and facial hair growth ($\beta = -.35$) significantly predicted lower levels of body shame, but also, the faster the development in body hair growth occurred, the faster the change in body shame ($\beta = .38$) through the boys' transition to adolescence.

Discussion

Puberty is a period of profound biological, physical, psychological, and emotional changes (Mendle et al., 2010; Petersen et al., 1988) and a particularly critical stage for the internalization of socially sanctioned body ideals (Lindberg et al., 2007). To the best of the authors' knowledge, the present study is the first to examine the predictive effects of time and tempo of pubertal development on body shame among a sample of boys and girls. The results indicated that, after controlling for the effects of BMI, early maturing girls in four of the five pubertal indicators considered (i.e., body hair growth, skin changes, breast growth, and menstruation) had higher levels of body shame, whereas rapidly maturing boys in two of the pubertal indicators (i.e., body and facial hair growth) showed lower levels of body shame. These results suggest that, although, in general, both boys and girls tend to experience less body shame as they transition through adolescence, an earlier onset in maturation may be a risk factor for developing body shame among girls, whereas rapid maturation may be a protective factor for body shame among boys.

The results of the present study supported the gendered deviation hypothesis and showed that the association of atypical pubertal development with body shame was different among girls and boys. In line with the gendered deviation hypothesis, one possible explanation is that deviations in pubertal development might well have different significance for each group due to inherent differences in the pubertal process. Girls mature on average a year or two earlier than boys (Mendle et al., 2019). This maturational difference means that when early maturing girls begin to show visible signs of puberty, they are the first of their peers to do so. In contrast, when early maturing boys begin to manifest signs of puberty, they may be the first among boys of their age, but not the first of their peers. Therefore, although those who mature early or late are defined with respect to when the

Table 3 Goodness-of-Fit Indices for the Growth Models

Model (pubertal development indicator)		χ^2	df	χ^2/df	CFI	RMSEA			SRMR		
						Est	90% CI			p	
							LL	UL			
Model 1 (Growth spurt)	Boys	12.20	9	1.35	.99	.03	.00	.07	.75	.02	
	Girls	13.10	9	1.45	.99	.04	.01	.07	.70	.02	
Model 2 (Body hair growth)	Boys	12.37	9	1.37	.99	.03	.00	.07	.74	.02	
	Girls	10.99	9	1.22	.99	.02	.00	.06	.81	.02	
Model 3 (Skin changes)	Boys	13.54	9	1.50	.99	.04	.00	.07	.69	.02	
	Girls	14.47	9	1.61	.99	.04	.00	.07	.62	.02	
Model 4	(Voice changes)	Boys	42.56	9	4.73	.90	.10	.07	.13	.01	.04
	(Breast growth)	Girls	16.28	9	1.81	.99	.05	.00	.08	.52	.02
Model 5	(Facial hair growth)	Boys	29.16	9	3.24	.95	.08	.05	.11	.07	.03
	(Menstruation)	Girls	19.00	9	2.11	.98	.05	.02	.09	.37	.04

Note. *df*=degrees of freedom, *CFI*=Comparative fit index, *Est.*=Estimate, *RMSEA*=Root Mean Square Error of Approximation, *CI*=Confidence interval, *LL*=Lower limit, *UL*=Upper limit, *SRMR*=Standardized root mean square residual

individual begins to progress through pubertal changes with respect to other peers of the same sex and age, comparisons are not only likely to be with their own sex, but with their peers more generally. Consequently, early maturing girls may be at even greater risk for abnormal body perceptions and social isolation than other atypical developers (Rudolph et al., 2014).

Nevertheless, the differences found between boys and girls should not only be interpreted as a biological difference between sexes, but should also be considered from the possible interpretation that each group makes of an atypical pubertal development. In Western culture, body image is clearly gendered (Smolak, 2004), such that boys and girls from a very young age are attracted to different ideals of beauty. Within Western societies and in White ethnic groups, as represented by the majority of the participants in the present study, there is an ideal of a thin body in the case of girls, and a muscular ideal in the case of boys (Frederick et al., 2007; Sicilia et al., 2023b). While rapidly maturing boys are likely to experience changes consistent with White and western cultural ideals of masculinity (e.g., greater muscle tone, body hair, facial hair growth), girls who mature early increase the volume of their bodies and are likely to move away from western ideals representing White female beauty (i.e., thin ideal), which may lead to greater self-objectification and body shame (Rudolph et al., 2014). The distance from beauty ideals that early maturing girls may feel is likely to accentuate an external gaze of their body that generates more objectified feelings and leads to the development of greater body shame (Bartky, 1990; Fredrickson & Roberts, 1997).

However, while early maturation may be a risk factor for body shame in the case of girls, rapid maturation among

boys seems to be a protective factor for experiencing body shame. These results support previous studies (Guo & Wu, 2024; Lindberg et al., 2007), and in line with the objectification theory (Fredrickson & Roberts, 1997), suggest that it is girls, rather than boys, who begin to internalize a third-person perspective and begin to feel more like an object. The appearance of pubertal development among boys, in the form of secondary sexual characteristics (e.g., facial and body hair growth) is likely to reinforce the sense of agency and power associated with male role stereotypes (Smolak, 2004), which remove them from the risk of manifesting body shame. Moreover, these gender differences support the idea that body shame associated with atypical pubertal development among early adolescents might be better explained by psychosocial mechanisms than biological ones per se. Previous research (Barendse et al., 2022) has shown that timing measured through hormone levels shows a lower association with internalizing psychopathology than when pubertal timing is measured through visible physical characteristics, which would support the importance of considering the social interpretation of the environment by boys and girls.

In line with previous studies (Ge et al., 2003; Mendle et al., 2010), the results of the present study indicated that, while pubertal timing may be a factor explaining the pubertal trajectory of girls, in the case of boys, pubertal tempo is perhaps a factor that better explains the pubertal trajectory than timing alone. Although somewhat tentative, it is plausible that for boys, not being the first to develop within the group, the rate of growth has a greater relevance in arousing positive or negative emotions regarding their body. In fact, in the present study, the results showed that it was not the early appearance of body and facial hair growth among boys that was associated with a lower level of body shame, but

Table 4 Summary of Standardized Direct Effects

	Model 1 Growth spurt			Model 2 Body hair growth			Model 3 Skin changes			Model 4 Voice changes (boys)/ Breast growth (girls)			Model 5 Facial hair growth (boys)/ Menstruation (girls)													
	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>											
	95% CI	LL	UL	95% CI	LL	UL	95% CI	LL	UL	95% CI	LL	UL	95% CI	LL	UL											
BOYS																										
BMI→BS _{Intercept}	.19	.04	.33	.08	.014	.23	.09	.38	.07	.001	.18	.02	.34	.08	.024	.17	.03	.32	.07	.019	.18	.03	.34	.08	.021	
PD _{Intercept}	-.11	-.28	.07	.09	.231	.11	-.12	.34	.12	.360	.05	-.13	.23	.09	.620	.10	-.08	.28	.09	.286	.09	-.10	.28	.10	.335	
→BS _{Intercept}	.04	-.15	.24	.10	.655	-.35	-.56	-.14	.11	.001	.02	-.23	.27	.13	.877	-.04	-.22	.14	.09	.665	-.23	-.40	-.05	.09	.014	
PD _{Slope}	-.05	-.24	.14	.10	.630	-.09	-.30	.12	.11	.387	-.07	-.28	.14	.11	.521	-.04	-.22	.15	.10	.709	-.06	-.25	.13	.10	.520	
BMI→BS _{Slope}	.19	-.06	.45	.13	.135	.05	-.25	.34	.15	.760	.08	-.17	.33	.13	.542	.00	-.24	.24	.12	.999	.08	-.18	.33	.13	.553	
PD _{Intercept}	→BS _{Slope}	-.01	-.32	.31	.16	.969	.38	.03	.73	.18	.033	-.03	-.42	.36	.20	.877	-.07	-.34	.19	.13	.595	-.22	-.05	.48	.13	.107
PD _{Slope} →BS _{Slope}	Explained Variance for BS	4.9%							19.4%					3.6%					4.8%						10.5%	
intercept	Explained Variance for BS	4.0%							13.1%					1.1%					7%						4.3%	
→BS _{Intercept}																										
GIRLS																										
BMI→BS _{Intercept}	.24	.10	.37	.07	.000	.22	.09	.35	.07	.001	.19	.03	.35	.08	.018	.19	.06	.32	.07	.005	.20	.06	.34	.07	.005	
PD _{Intercept}	.13	.00	.27	.07	.053	.27	.12	.42	.08	.000	.32	.18	.46	.07	.000	.27	.13	.42	.07	.000	.31	.15	.47	.08	.000	
→BS _{Intercept}	-.02	-.21	.16	.09	.814	-.11	-.29	.08	.09	.260	-.09	-.27	.09	.09	.334	.02	-.21	.25	.12	.877	.06	-.09	.21	.08	.450	
PD _{Slope}	→BS _{Intercept}	.10	-.01	.22	.06	.124	.10	-.03	.22	.06	.123	.12	-.01	.25	.07	.078	.09	-.04	.22	.07	.160	.10	-.03	.23	.07	.142
BMI→BS _{Slope}	PD _{Intercept}	.00	-.15	.15	.08	.967	.05	-.11	.21	.08	.538	.05	-.11	.21	.08	.519	.08	-.08	.23	.08	.331	.00	-.18	.18	.09	.999
PD _{Intercept}	→BS _{Slope}	PD _{Slope} →BS _{Slope}	Explained Variance for BS	intercept	Explained Variance for BS	1.0%			7.6%					16.3%					12.4%						1.7%	
→BS _{Slope}	12.9%								18.5%					12.9%					12.9%						1.7%	

Note. BS = Body shame, PD = Pubertal development, β = Standardized regression coefficients, LL = Lower limit, UL = Upper limit, SE = Standardized error. Statistically significant effects ($p < .05$) appear highlighted in bold

the fact that the process of body and facial hair growth was completed quickly. It suggests that boys who complete their pubertal development more rapidly in terms of secondary sexual characteristics such as body and facial hair are likely to show less body shame to the extent that they align more quickly with the male body ideal.

Conversely, it is likely that pubertal traits must have some degree of development among boys to be socially visible and valued. Consequently, boys may experience body shame even when they begin to show signs of pubertal change in their body and facial hair earlier than other same-sex peers, if these changes remain stagnant or sufficiently slow (e.g., appearance of partial facial hair, but not a beard that reflects an already developed male). Therefore, it seems necessary for boys to show sufficient body and facial hair growth to benefit from the gratification of approaching the socially sanctioned ideal that a male body represents. The latter would occur only with a rapid maturation rate that allows a more complete and visible process of pubertal development.

The results of the present study also suggest that early and late maturational development are interpreted differently by boys and girls and such social interpretation places early maturing girls and slow maturing boys in a unique position of vulnerability that does not occur in the case of other atypical developers (Mendle et al., 2010). A gender-differentiated interpretation of pubertal development would help to explain why in research where predominantly pubertal timing has been considered, without considering tempo, the results among girls have been more consistent than among boys. Although the present study's findings should be subject to replication in the future, especially considering body image variables, the data suggest that in studies with boys it seems necessary to consider the tempo and not be limited to the timing of pubertal development.

Another novel result of the present study was derived from the measurement of different pubertal indicators. The results show that all the pubertal development indicators (except growth spurt) were shown to be predictors of body shame among girls. It should be noted that in the present study, menarche (a non-externally visible pubertal indicator) showed predictive effects on body shame. Menarche has traditionally been considered a milestone of girls' pubertal development, such that early development in menarche has been indicated as one of the most robust and well-replicated antecedents of depression and other psychological problems during adolescence (Mendle et al., 2010; Sequeira et al., 2017). However, the few previous studies that have examined the relationship between menarche development and body image among girls appear inconclusive. Benjet and

Hernández-Guzmán (2002) showed that girls increased negative body image after pubertal development of menarche.

However, a study by Sicilia et al. (2023a) showed that visible indicators such as growth spurt, body hair growth, skin changes, and breast growth, but not menarche, were statistically significant predictors of physical social anxiety. A possible explanation for the results to date could be the age of the samples. The present study comprised a group of girls with a mean age similar to the study by Benjet and Hernández-Guzmán (2002), whereas in the study by Sicilia et al. (2023a) the mean age of the sample of girls was slightly lower. Similarly, the only previous study that, in line with the results of the present study, has found a relationship between the onset of menstruation and body shame (Slater & Tiggemann, 2012) included a group of girls who reported having started menstruating at a rate ranging from 88.7% to 96.4% in the time between the two study measures. Therefore, the results of the studies seem to indicate that, given that menarche is one of the pubertal indicators of later development (Beltz et al., 2014; Stubbs, 2019), it is likely to be shown as a significant predictor only among samples with sufficient maturation.

In the case of boys, only body hair growth and facial hair growth were shown to be statistically significant predictors of body shame. Although the primacy of the results makes the explanations somewhat speculative, it is possible that the non-measurement of the entire maturation process of the participants in the present study and the later onset of maturation among boys may not have shown some pubertal indicators as being significant in the present study. However, pubertal indicators that are clearly visible at first sight and reflect the body ideal in line with the male stereotype (i.e., body hair growth or facial hair growth) might well have greater relevance in triggering effects on body shame among boys than other indicators that are not appreciated by sight (i.e., voice changes) or might be less related to the ideal of masculinity (i.e., skin changes).

Finally, it was striking to note that in both genders, the pubertal growth spurt indicator, even though it is a visible indicator that affects body shape and size, showed no association with body shame. One possible explanation is that the effect of BMI on body shame could be overriding such effects. In fact, in line with previous studies that have evidenced an association between BMI and negative body image (Reel et al., 2015), the results of the present study showed that for both boys and girls, BMI had positive and statistically significant predictive effects on body shame. Therefore, the growth spurt, to the extent that it affects reducing BMI values among children, could attenuate the possible effect on body shame.

Limitations and Future Directions

Overall, the present study's findings contribute to an emerging body of research suggesting that variability in pubertal development is associated with body shame and corroborates a large existing literature on the importance of gender roles in body image (Smolak, 2004). However, some limitations in the present study should be noted. First, as in previous studies (Lindberg et al., 2007; Slater & Tiggemann, 2012), the present study was conducted using a convenience sample of mostly White early adolescents, so the consistency of these results should be examined through replications with other samples, but also in other countries and cultural contexts. Research has shown that the ideal of beauty in other ethnic-racial groups may vary from the western and White cultural model (Carter et al., 2020; Schaefer et al., 2018), so that atypical pubertal development could be associated with body shame in a different way than that found in the present study. Second, the present study included the assessment of different pubertal indicators and body shame across three time points. However, the results reflect that pubertal development may not be complete, so it is unclear whether similar effects would be replicated in later stages of adolescence. Likewise, although the present study observed an overall decline in body shame, it is not clear what levels of body shame these children had prior to the onset of pubertal development. Future prospective longitudinal studies that attempt to span the entire time period of puberty and adolescence are needed to provide further insight on how pubertal development is associated with body shame and other body image variables. Third, objective measures of pubertal development, but also of BMI, may be considered in future studies along with participants' self-reported responses (Mendle & Koch, 2019). Finally, the association between pubertal development and body shame could be mediated by sociocultural and cognitive factors not contemplated in the present study, such as social comparison, adolescents' perceived sociocultural pressure to approach specific body ideals or adolescents' internalization of such ideals (Frederick et al., 2022; Guo & Wu, 2024; Lindberg et al., 2007).

Practice Implications

Some relevant implications can be drawn from the results of the present study. Bearing in mind how variability in pubertal development is related to body shame, and probably to other measures of body image, its measurement seems necessary for meaningful research with adolescent populations (Dorn et al., 2006). Variability in the timing of onset and pace of pubertal development may be relevant in the study of body image given that age may be a vague and insufficient descriptor of the developmental stage when studying

an adolescent population. Although menarche has traditionally been considered the milestone of pubertal development among girls (Stubbs, 2019), there are different indicators that are unlikely to occur synchronously. Research should determine which ones might be more relevant to body image issues. For example, given gender differences, pubertal indicators that refer to visible traits in relation to body size and shape for each gender in relation to social ideals may be especially relevant for examining body shame.

These results suggested that girls experienced a slower decline in feelings of body shame than boys during the transition to adolescence. However, early maturing girls seem to be especially vulnerable to experiencing body shame. Although boys have been shown to be less exposed to self-objectification of their body (Kilpela et al., 2016), from an early age they may feel pressure to conform to a muscular ideal, leading to negative feelings about their body (Sicilia et al., 2023b). The negative association found in the present study between the slope of some pubertal indicators and the body shame intercept does not exclude the possibility that slowly maturing boys may also be more vulnerable to experiencing body shame. These children could be identified on the basis of their atypical pubertal development and targeted for the development of specific prevention programs. Deconstructing gender stereotypes and the ideals associated with these stereotypes could also help. Given that body shame occurs as a result of internalizing societal body ideals and failing to achieve these ideals, one goal would be to prevent the internalization of ideals among young people, especially those vulnerable groups. Therefore, activities such as analyzing messages conveyed by social media, taking selfies and/or challenging socially established gender roles may elicit psychological distress among young adolescents that encourages belief change and reduces the internalization of beauty ideals. Because of the social pressure to achieve body beauty ideals, an emphasis on discourses that challenge gender inequality and positive body image may be especially beneficial. Research has shown that feminist beliefs play a buffering or protective role in the face of the internalization of cultural standards of beauty and the development of body shame produced by the self-objectification process (Feltman & Szymanski, 2018).

However, in addition to specific strategies aimed at the most vulnerable groups, strategies aimed at reducing sociocultural pressure toward body ideals seem to be needed. The results of the present study support the gendered deviation hypothesis and, in this sense, suggest that both boys and girls may be a source of pressure for early adolescents to interpret atypical development as deviant. Consequently, both genders may play a key role in either perpetuating body beauty ideals or combating them (Kilpela et al., 2016; Warnick et al., 2022). For example, adolescent boys may promote the thin-body ideal through actions and statements about female

attractiveness, which encourages the objectification of women's bodies. Consequently, adolescent boys and girls may be especially concerned with achieving body ideals that they think are attractive to the other gender (Cohn et al., 1987). Therefore, activating both genders to combat sociocultural pressure on body ideals is imperative in order to reduce negative emotions about the body, such as body shame. Programs such as the Body Project, based on cognitive dissonance, have shown their effectiveness (for both girls and boys) in reducing the internalization of body ideals and, with it, the reduction of the adverse effects of exposure to these models among young people (Kilpela et al., 2016; Stice et al., 2012).

Conclusion

The present study advances understanding of the association between pubertal development and negative body image and provides evidence to support the gendered deviation hypothesis, suggesting that (a) early maturing girls are at greater risk for developing body shame emotions; and (b) although boys showed a faster decline in body shame in their transition to adolescence, those with a slow pace of pubertal development may also be at greater risk of experiencing body shame. Therefore, unlike the many studies almost solely focused on considering pubertal timing, these results highlight the importance of considering tempo, beyond timing, when examining associations between pubertal development and body image among adolescent boys. Overall, the present study identifies pubertal indicators that may mark atypical pubertal development and signal a need for interventions that can help them eradicate maladaptive emotions toward the body and the social pressures that instigate them.

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Data availability The data are available from the corresponding author upon reasonable request.

Declarations

Ethical Approval This study was approved by the bioethics committee of the University of Almería.

Informed Consent The study required, in addition to the acceptance of the participants, the informed consent of their parents or legal guardians.

Conflicts of Interest The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this paper.

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