

## MENTAL HEALTH IN ADOLESCENCE: RELATIONSHIP WITH PUBERTAL DEVELOPMENT, BODY IMAGE AND PARENTAL MONITORING

Ágnes Németh, Gyöngyi Kökönyei and Ildikó Zakariás

National Institute of Child Health, Budapest, Hungary

**Abstract:** *The current study examines relationship between pubertal development and psychological well-being, measured by life satisfaction, frequency of psychosomatic complaints, and the level of depressive mood, as well as how body image mediates this connection. Gender, school grade, and parental monitoring also were included in the analysis as moderators.*

*Data of a representative sample of Hungarian adolescents aged 11–18 (n=5450) from the Health Behaviour in School-aged Children WHO collaborative Cross-National Study (HBSC) was used for examination.*

*Significant, though weak indirect effects mediated by body image were detected on all psychological variables, depending on moderator variables. Maturation indicates good psychological adjustment through increasing body satisfaction, but only among boys. Current results support the hypothesis that being early or late maturer is a challenge for psycho-social adaptation. Parental monitoring can have a moderator effect on the maturation – body image – mental health relationship, but further investigations are needed to reveal the nature of it.*

**Keywords:** *Pubertal development; Body image; Psycho-social well-being.*

### Introduction

Adolescence as a transition between childhood and adulthood can be characterized by rapid and remarkable biological, psychological and social changes. At the beginning of adolescence emotional life is starting to be perpetuated, duration of emotional episodes are longer than it was in childhood, and new drives, emotions, and impulses may challenge self-regulatory abilities (Steinberg 2005, Steinberg et al. 2006). Structural and functional brain changes are also detectable resulting impulsivity, and problems in decision making processes (Bjork et al. 2004). Besides emotional and behavioural changes, reorganization of social systems seems to be a key feature of this period. Relationship with parents normally is characterized by more autonomy, though parental monitoring (interpreted as control and bonding as well; Pedersen et al. 2001) is still a key determinant of behavioural and emotional adjustment as well (Jacobson and Crockett 2000, Wight et al. 2006).

Parallel, body image (tightly related to biological changes) and self-concept is shaped during this period. These changes are associated with emotional, cognitive and social processes as well. Boys generally try to become more muscular, whereas girls attempt to lose weight (Muris et al. 2005) according to the leading body ideal represented in media (Smolak and Stein 2006). Body change strategies to decrease weight or to increase muscles are related to negative affects (McCabe et al. 2001).

According to cross-sectional (e.g. Robins et al. 2002) and longitudinal studies (Baldwin and Hoffmann 2002) sex differences in global self-esteem are the largest in late

adolescence. A meta-analysis conducted to examine gender differences in global self-esteem also reinforces the difference favouring males, and the largest effect size emerged in late adolescence (Kling et al. 1999). It is hypothesized to be related at least partially to body-image differences, and to the relative importance of possible sources of self-esteem. Physical attraction and the social acceptance may be more related to psychological well-being among girls than among boys (Moretti et al. 1998). Though, endorsement of male physical attributes among boys is an important correlates of drive for muscularity (Smolak and Stein 2006). This is supported by McCabe et al. (2001) who found that body dissatisfaction predicted negative affect only for girls but not for boys, while body satisfaction predicted positive emotions for both genders, though endorsement of male physical attributes among boys is an important correlates of drive for muscularity (Smolak and Stein 2006).

Body satisfaction is independent frequently from objective measures (like body mass index), and the desire to lose weight is common among girls having normal weight, and it is more common among older girls (Németh 2003). The effect of body dissatisfaction on well-being can be moderated by social environment. Teasing can decrease satisfaction with the body, self-esteem, and increase depressive symptoms, and the occurrence of suicidal thoughts and attempts independently from objective weight data (Eisenberg et al. 2003).

Sex differences in psychological well-being variables are also detectable. Investigating subjective health indicators – such as life satisfaction, subjective health symptoms – also reveals sex differences. Reporting more physical and psychological symptoms is increasing during adolescence (Kököneyi 2003), but it is more pronounced among girls than among boys (Kököneyi 2003, LeResche et al. 2005), especially reporting pain symptoms (LeResche et al. 2005). Interestingly, in a study pubertal development was a better predictor of pain than was age (LeResche et al. 2005). It seems that more advanced self-reported pubertal development at early age (age 11) may have long effect on psychological well-being resulting poorer psychological well-being at age 13, and this predicted lower involvement in physical activity (Davison et al. 2007). Prevalence of depressive symptoms and depressive disorders increases, and sex differences established in adult studies can be identified among adolescents as well (Hankin and Ambranson 2001).

Since biological events of pubertal development occur in social settings, social comparisons, and the time of menarche/spermarche, the tempo of maturation and its subjective perception have an effect on psychological well-being. There are three main hypotheses describing the relation between pubertal change and psycho-social change during adolescence.

According to early timing hypothesis, early maturing children will show the signs of poor adjustment, especially girls, having more depressive symptoms (Ge et al. 2003, Kaltiala-Heino et al. 2003), being more dissatisfied with their body (Currie and Németh 2004), being more physically inactive (Davison et al. 2007), being more vulnerable to sexual messages from media (Brown et al. 2005), having more functional (Michaud et al. 2006) and bulimic symptoms (Kaltiala-Heino et al. 2001) and more active in different substance use (Currie and Németh 2004, Tschann et al. 1994) comparing to on-time and late maturing peers. Some personality traits may have a role for engaging in health-promising behaviour. Early maturing girls who are open to experiences at 5th grade were at risk for engaging in health-compromising behaviour (smoking, alcohol consumption

and kissing) a year later (Markey et al. 2003). Early maturing girls report early sexual intercourse comparing to on-time and late maturing peers (Currie and Németh 2004).

For boys, the data is far from conclusive (Kaltiala-Heino et al. 2003). While early maturing boys have better social skills because of heightened self-esteem (Simmons et al. 1979), but use more substances than their peers (Tschann et al. 1994).

According to the off-time hypothesis those who differ from the on-time peers will develop more behavioural and emotional problems. While among 11-year-old children early maturation is salient, among 13-year-olds later maturation seems to be salient (Williams and Currie 2000). In a recent study both early and late maturing boys reported high dysfunctional eating patterns, victimization and depressive symptoms (Michaud et al. 2006).

According to stress-change hypothesis change is inherently stressful, hence those who are in maturation process will experience troubles comparing to youth in pre- and post-pubertal phase (Silbereisen and Kracke 1997).

Social and neighbourhood characteristics can moderate the relationship between pubertal development and adjustment. Living in disadvantaged neighbourhood early maturing youth affiliate more with deviant peers (Ge et al. 2002), and among girls the occurrence of aggressive behaviour is increased (Obeidallah et al. 2004). Among families characterized by inconsistent or rude parental behaviour early maturing and externalizing problems are positively related (Ge et al. 2002). Among early maturers with conduct disorder the excess risk of alcohol consumption increases, especially if they affiliated with deviant peers (Costello et al. 2007). Specific family environment increases the risk of alcohol consumption. In a study, lack of supervision among early maturing girls, while poverty and problem family among early maturing boys had an effect on alcohol use (Costello et al. 2007).

We may conclude that ability to adapt to the changes of puberty partially depend on pubertal timing.

Body changes seem to be rather salient, for example growth can spur changes in how adolescents view and feel about themselves. Early onset of puberty can represent a risk in terms of negative body image, and in turn body image has an impact on health and well-being.

The aim of this study was to analyse the relationship between pubertal development and psychological well-being, as well as how body image and parental control relate to this connection. We hypothesized that self-reported pubertal development have an effect on psychological well-being, operationalized as life satisfaction, subjective health complaints, and depressive mood. According to prior studies body image was thought to act as a mediator between pubertal development and psychological well-being variables. We also investigated whether gender, school grade (quasi age) and parental monitoring have a moderator impact on this relationship.

## **Material and Methods**

This analysis was done by the use of 2006 survey data of the Health Behaviour in School-aged Children WHO collaborative Cross-National Study (HBSC, Currie et al. 2004). The main goal of this research project is to investigate young people's health in psycho-social context, thus it focuses on not only health and health behaviour indicators, but on individual features as well as social settings (i.e. family, peer group, school, socio-economical environment.)

Each survey within the HBSC study has to be conducted according to the internationally developed and approved research protocol (a detailed methodological guidance, Currie et al. 2002). HBSC is a school-based study; data collection is carried out in the classrooms, by the use of anonymous self-reported questionnaires. Filling up is voluntary followed by the consent of school directors and parents. Target groups are the 11-, the 13- and the 15-year-olds (in Hungary 17-year-olds, as well). Thus, in Hungary the surveyed groups are 5, 7, 9 and 11th formers, as these grades cover targeted age groups most adequately.

Present analysis is limited to the Hungarian nationally representative sample, which was drawn by the use of multi-stepped, stratified sampling technique in 2005. Strata were school maintainer type (e.g. municipal, church), geographical position, settlement size, secondary school type (e.g. grammar-school, vocational school). Classes were selected randomly from the sampled schools. Data collection was conducted in 264 classes of 137 schools in April–May 2006. The cleaned sample contains 5450 questionnaires filled in appropriately. The age range of the 2815 boys and 2635 girls is 10.33–18.00 years (mean ages with standard deviations by grade were  $11.66\pm 0.58$  for grade 5,  $13.65\pm 0.55$  for grade 7,  $15.71\pm 0.64$  for grade 9,  $17.59\pm 0.55$  for grade 11). Population representativity of the sample exceeds 1% in all grades. However, representativity of the cleaned sample differs from that of the initial one due to school, parental and student refusals as well as absence of a certain proportion of students on the survey day. Thus, weighted data were used in the analysis. The weighting procedure (iterative proportional fitting) needed post-stratifying (by sex, grade, geographical region, settlement size, school maintainer type, secondary school type) in order to enhance the validity of estimations.

Beside the basic demographic variables (age as well as sex and grade as moderators) several scale variables were used in the analyses. Pubertal development was measured by Pubertal Development Scale (PDS, Petersen et al. 1988, Carskadon and Acebo 1993). This scale was used in our analysis as an independent variable. This scale is widely used in epidemiological studies using self-reported data, its validity and reliability is well-established (e.g. Bond et al. 2006). All items (growth spurt, skin changes, body hair development for both sexes, facial hair development and voice deepening for boys only, as well as breast development for girls only) were scored on a scale of 1 (has not yet begun) to 4 (is completed). Fifth item for girls (menstruation) was scored 1 if the student has not had periods yet and 4 if she has already started to menstruate. Scores were summed up and then divided by the number of items to create a total score. Thus, the total score range is 1-4. A higher score indicated that the student was further along in the development of puberty. In the present sample the scale reliability has proved to be appropriate: Cronbach- $\alpha=0.80$  for boys, and Cronbach- $\alpha=0.75$  for girls.

Outcome variables were life satisfaction, psychosomatic complaints and depressive mood. Life satisfaction was measured by an 11-grade scale, Cantrill ladder (Cantrill 1965). Grade 0 indicates the worst possible life, while grade 10 indicates the best one.

Frequency of nine subjective health complaints (headache, stomach-ache, back ache, feeling low, irritability or bad temper, feeling nervous, difficulties in getting to sleep, feeling dizzy and feeling tired, Currie et al. 2002) in the past six months were measured on a 5-graded scale (from “rarely or never” to “about every day”). Total score is simply the sum of each item score. Scale range is 9–45. Higher score indicates more frequent occurrence of complaints. Reliability of the scale composed of nine items has proved to be appropriate: Cronbach- $\alpha=0.84$  for boys, and also Cronbach- $\alpha=0.84$  for girls.

The shortened version of Child Depression Inventory (CDI, Kovacs 1985, Rózsa et al. 1999) was used to measure depressive mood. CDI was not included in the 5th former students' questionnaire. The eight items measure sadness, anhedony, hostility towards himself, crying, wimpyness, suicide ideas, bad relations to others, lovelessness. Total score is the sum of item scores. Higher score refers to more disturbed mood. Scale range is 0–16, internal consistency was appropriate: Cronbach- $\alpha$ =0.75 for boys, and Cronbach- $\alpha$ =0.77 for girls.

The Body Image Subscale (BIS) of Body Investment Scale (Orbach and Mikulincer 1998) was used in the analyses as mediator variable. The six items (frustration with the own physical appearance, satisfaction with the own appearance, hate towards own body, feeling comfortable with the own body, feeling anger towards own body, liking of own appearance in spite of its imperfections) measure the attitude towards own body on a 5-graded scale (from “strongly agree” to “strongly disagree”). Total score is the sum of each item score. Higher score indicates more positive body image. The total score of the scale can be ranged between 0 and 24, its internal consistency in the present sample was appropriate (Cronbach- $\alpha$ =0.74 for boys and Cronbach- $\alpha$ =0.85 for girls).

Parental Monitoring Scale (Rispen et al. 1997) for father and mother, respectively was used to compute a moderator variable. The scale consists of five items measuring the parent's knowledge of his/her child's life. Items are related to the child's friends, how he/she spends his/her pocket money, where he/she is after school, where he/she goes out in the evenings, what he/she does in his/her spare time. Response categories are “knows a lot”, “knows a little”, “knows nothing”. A categorical parental monitoring variable was computed in two steps from the paternal and maternal scale (the two scales have similar parameters in this sample). First step was to create 3-categorical variables from the parental scales, separately (1. “problematic monitoring”: there is at least one item in the scale where the response was “knows nothing”; 2. “low level monitoring”: all responses were “knows a little”; 3. “high level monitoring”: all responses were “knows a lot”). Then the two variables were merged: if there was data only from one parent, this score was chosen as the parental monitoring score, where there was data from both parents, the maximum of them was chosen as the score of the variable.

Statistical analyses were performed using the SPSS 14.0 software. Descriptive parameters were computed for all scales and the categorical parental monitoring variable. Gender differences in scale variables were analysed by independent samples t-test, while grade differences in the same variables were tested by one-way ANOVA (Scheffe's post-hoc test). The categorical variable of parental monitoring were analysed by  $\chi^2$ -test of independence to reveal gender and grade differences.

In order to reveal relationships between independent and dependent variables as well as mediator and moderator effects, path-analyses were done by building linear regression models. The significance level was 5% in each test.

## Results

There are significant gender and age (indicated by grade) differences among the mean values of dependent and independent variables (Table 1).

As ANOVA results showed, PDS mean values increase significantly with age both in boys ( $F=950.15$ ;  $p<0.001$ ) and girls ( $F=994.11$ ;  $p<0.001$ ), though there is no significant difference between grade 9 and 11 in girls. BIS mean values decrease significantly with age both in boys ( $F=6.28$ ;  $p<0.001$ ) and girls ( $F=26.81$ ;  $p<0.001$ ), though elementary and

secondary school students' means do not differ significantly among boys, while there is no significant difference between grade 9 and 11 in girls. Mean values of life satisfaction decrease with age both among boys ( $F=60.24$ ;  $p<0.001$ ) and among girls ( $F=85.09$ ;  $p<0.001$ ), however significant change was not detectable between groups grade 9 and 11 in both sexes. Means of health complaints scale significantly increase with age both in boys ( $F=11.07$ ;  $p<0.001$ ) and girls ( $F=50.62$ ;  $p<0.001$ ), but this increase ends in grade 9 among girls, and there is no significant difference between neighbour grades among boys. Regarding CDI means, there are significant differences among grades only in girls ( $F=3.37$ ;  $p<0.05$ , for boys  $F=0.52$ ;  $p>0.05$ ), though only 7th and 9th formers differ significantly (Table 1).

Table 1. Descriptive statistics of scale variables involved in the analyses.

Grade	PDS		BIS		Life satisfaction		HC*		CDI	
	N	M±SD	N	M±SD	N	M±SD	N	M±SD	N	M±SD
Boys										
5	599	1.66±0.48	604	18.10±4.31	645	7.63±1.88	595	17.97±7.26	–	–
7	663	2.29±0.51	647	18.07±4.10	683	7.32±1.81	661	18.75±6.63	471	1.94±2.45
9	713	2.76±0.48	710	17.31±4.07	738	6.66±1.80	703	19.64±7.13	649	1.99±2.10
11	659	3.02±0.47	653	17.49±4.05	671	6.45±1.90	660	19.99±6.48	609	1.86±2.30
Girls										
5	554	1.95±0.57	547	16.88±4.61	577	7.83±1.89	547	18.75±7.77	–	–
7	550	2.77±0.49	562	15.46±5.08	582	7.25±1.90	555	21.19±7.31	375	2.54±2.46
9	743	3.05±0.34	749	14.52±5.08	752	6.50±1.91	743	23.16±7.41	736	2.95±2.69
11	658	3.25±0.37	655	14.88±4.88	661	6.31±1.87	644	23.34±6.90	646	2.71±2.53

HC\*: health complaints

T-tests of independent samples reveal several gender differences. Girls' PDS mean values are significantly higher in all grades than those of boys (grade 5:  $t=-9.18$ ,  $df=1144$ ; grade 7:  $t=-16.81$ ,  $df=1209$ ; grade 9:  $t=-12.79$ ,  $df=1449$ ; grade 11:  $t=-9.88$ ,  $df=1312$ ;  $p<0.001$ ). Boys' BIS mean values are significantly higher in all grades than girls' means (grade 5:  $t=4.64$ ,  $df=1149$ ; grade 7:  $t=9.72$ ,  $df=1207$ ; grade 9:  $t=11.61$ ,  $df=1457$ ; grade 11:  $t=10.52$ ,  $df=1305$ ;  $p<0.001$ ). Life satisfaction mean values do not differ significantly between boys and girls regardless of grade (grade 5:  $t=-1.80$ ,  $df=1220$ ; grade 7:  $t=0.70$ ,  $df=1263$ ; grade 9:  $t=1.67$ ,  $df=1488$ ; grade 11:  $t=1.36$ ,  $df=1330$ ;  $p>0.05$ ). Means of health complaints scale are significantly higher in girls than in boys in all but one grade groups. The exception is the youngest group where there is no significant gender difference in this variable (grade 5:  $t=-1.75$ ,  $df=1140$ ,  $p>0.05$ ; grade 7:  $t=-6.05$ ,  $df=1214$ ; grade 9:  $t=-9.19$ ,  $df=1445$ ; grade 11:  $t=-9.02$ ,  $df=1302$ ;  $p<0.001$ ). The CDI mean values are significantly higher in all three grade groups in girls than in boys (grade 7:  $t=-3.60$ ,  $df=844$ ; grade 9:  $t=-7.43$ ,  $df=1383$ ; grade 11:  $t=-6.19$ ,  $df=1253$ ;  $p<0.001$ ).

Distribution of three categories of aggregated parental monitoring variable analysed by  $\chi^2$ -tests, is significantly different among grades in both sexes (Table 2, boys:  $\chi^2=38.76$ ,  $df=6$ ,  $p<0.001$ ; girls:  $\chi^2=23.25$ ,  $df=6$ ,  $p<0.01$ ). Similarly, this distribution significantly differ between boys and girls ( $\chi^2=75.20$ ,  $df=2$ ,  $p<0.001$ ).

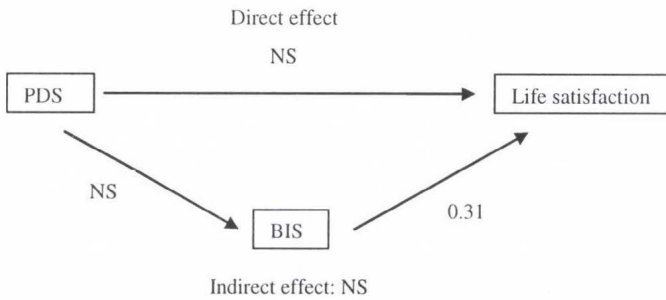
When examining the connection between PDS and outcome variables in the whole sample by linear regression analysis, significant (positive) direct relationship was found

only with health complaints scale (Fig. 1). Furthermore, indirect relationship – when BIS is involved in the model as a mediator – is not significant with none of the outcome variables. Thus, PDS has neither direct nor indirect connection with life satisfaction (Fig. 2) and CDI (Fig. 3). Between BIS and outcome variables significant and quite strong relationships were found in all cases. The relationship was positive with life satisfaction and negative both with health complaints scale and CDI. All models were controlled for both gender and grade.

Table 2. Distribution of students according to parental monitoring (N=5257).

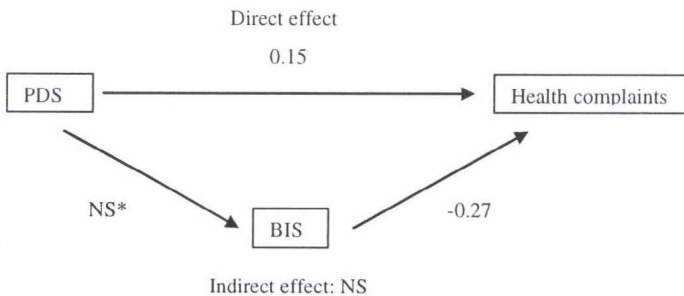
Grade	N	Parental monitoring			N	Girls (%)		
		Boys (%)	Category 1	Category 2		Category 3	Category 1	Category 2
5	616	19.8	32.6	47.6	555	15.0	28.6	56.4
7	678	15.9	38.5	45.6	578	10.9	34.1	55.0
9	734	14.7	45.5	39.8	761	10.6	36.4	53.0
11	673	12.9	47.1	40.0	662	7.7	37.3	55.0

Category 1: “problematic monitoring”, Category 2: “low level monitoring”, Category 3: “high level monitoring”



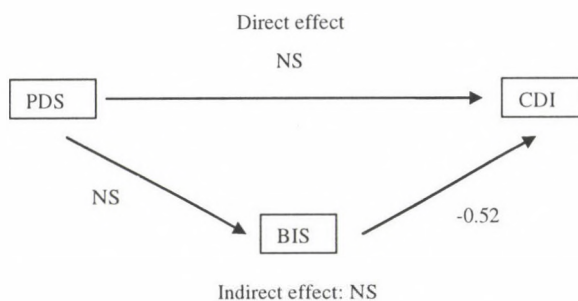
Controlled for age and gender, NS: non-significant, Adj.  $R^2=0.16$

Figure 1: Effects of pubertal development (PDS) and body image (BIS) on health complaints.



Controlled for age and gender, NS: non-significant, Adj.  $R^2=0.14$

Figure 2: Effects of pubertal development (PDS) and body image (BIS) on life satisfaction.



Controlled for age and gender, NS: non-significant, Adj.  $R^2=0.28$

*Figure 3:* Effects of pubertal development (PDS) and body image (BIS) on depressive mood (CDI).

Analyses revealed moderator role of gender, grade and parental monitoring. When analysing the role of gender, significant direct relationship was not found between PDS and life satisfaction as well as CDI in any of the sexes, while significant (positive, though weak) indirect connection with life satisfaction and negative one with CDI was found only for boys (Table 3). Regarding relationship with health complaints, PDS has significant positive direct relationship with it for both sexes, while significant (negative) indirect relationship was revealed again only for boys. All analyses examining gender moderator effect were controlled for grade.

*Table 3.* Effects of pubertal development (PDS) and body image (BIS) on subjective well-being (outcome variables) by gender.

Independent variable	Effect	Life satisfaction		Health complaints		CDI	
		Partial beta	Adj. $R^2$	Partial beta	Adj. $R^2$	Partial beta	Adj. $R^2$
Boys							
PDS	Direct	NS		0.17		NS	
	Indirect	0.02	0.13	-0.02	0.07	-0.04	0.24
BIS	Direct	0.28		-0.22		-0.50	
Girls							
PDS	Direct	NS		0.13		NS	
	Indirect	NS	0.17	NS	0.15	NS	0.24
BIS	Direct	0.31		-0.29		-0.51	

Controlled for grade, NS: non-significant

When examining grade moderator role, significant direct relationship was not found between PDS and life satisfaction in any of the grades (Table 4). Regarding indirect relationship a gradient can be observed among different grades. The relationship is negatively significant in grade 5, there is no significant relationship in grade 7 and there is significant positive connection in grades 9 and 11. The strongest connection belongs to grade 11. In the case of health complaints scale, the significant direct relationship with PDS gradually attenuates with the increasing grade until it becomes non-significant in grade 11. Indirect relationship shows again a gradient: it is positively significant in grade 5, non-significant in grade 7 and negatively significant in grades 9 and 11. There is no significant direct relationship between PDS and CDI in any of the three surveyed grades.



Furthermore, indirect connection is also not significant in grade 7, while it is negatively significant in secondary school grades. All models describing grade moderator effect were controlled for gender.

Parental monitoring was also found to have moderator effect on the relationship between PDS and subjective well-being variables (Table 5).

Table 4. Effects of pubertal development (PDS) and body image (BIS) on subjective well-being (outcome variables) by grade.

Independent variable	Effect	Life satisfaction		Health complaints		CDI	
		Partial beta	Adj. R <sup>2</sup>	Partial beta	Adj. R <sup>2</sup>	Partial beta	Adj. R <sup>2</sup>
Grade 5							
PDS	Direct	NS		0.19		-	
	Indirect	-0.02	0.06	0.02	0.11	-	-
BIS	Direct	0.24		-0.26		-	
Grade 7							
PDS	Direct	NS		0.15		NS	
	Indirect	NS	0.10	NS	0.10	NS	0.29
BIS	Direct	0.33		-0.26		-0.54	
Grade 9							
PDS	Direct	NS		0.06		NS	
	Indirect	0.02	0.09	-0.02	0.12	-0.04	0.28
BIS	Direct	0.31		-0.28		-0.51	
Grade 11							
PDS	Direct	NS		NS		NS	
	Indirect	0.03	0.14	-0.02	0.11	-0.04	0.26
BIS	Direct	0.38		-0.25		-0.50	

Controlled for gender, NS: non-significant

Table 5. Effects of pubertal development (PDS) and body image (BIS) on well-being (outcome variables) by parental monitoring.

Independent variable	Effect	Life satisfaction		Health complaints		CDI	
		Partial beta	Adj. R <sup>2</sup>	Partial beta	Adj. R <sup>2</sup>	Partial beta	Adj. R <sup>2</sup>
“problematic monitoring”							
PDS	Direct	NS		0.20	0.15	NS	
	Indirect	NS	0.20	NS		NS	0.36
BIS	Direct	0.29		-0.24		-0.54	
“low level monitoring”							
PDS	Direct	NS		0.12	0.11	NS	
	Indirect	0.02	0.14	-0.02		-0.04	0.29
BIS	Direct	0.30		-0.19		-0.49	
“high level monitoring”							
PDS	Direct	NS		0.15		NS	
	Indirect	NS	0.16	NS	0.16	NS	0.24
BIS	Direct	0.29		-0.31		-0.50	

Controlled for grade and gender, NS: non-significant

Significant direct connection was not occurred in any categories of parental monitoring in the case of life satisfaction and CDI. Similarly, significant (positive) direct connection was found in all parental monitoring categories in the case of health complaints. However, significant indirect relationship between PDS and the relevant outcome variables was revealed only in "low level monitoring" subgroup. Relationship was positive for life satisfaction and negative for health complaints and CDI. All models describing parental monitoring moderator effect were controlled for gender and grade.

## Discussion

The main purpose of this study was to investigate relationship between perceived pubertal development and subjective well-being characterized by life satisfaction, subjective health complaints, and depressive mood in 11–18-year-old Hungarian adolescents. Body image as mediator, as well as sex, grade and parental monitoring as moderators were also included.

Gender and grade differences in the independent variable (PDS), the mediator variable (BIS) and the outcome variables (life satisfaction, health complaints, CDI) were as expected. Average pubertal development was more advanced in the older grades (the only exception is when 9th former and 11th former girls do not differ, indicating that pubertal development terminates around age 15–16 in the vast majority of girls, as well as girls' mean maturation status was more advanced compared to that of boys in the same grade.

Body image is more positive in boys and in younger grades, which is consistent with previous findings (Németh et al. 2002, Ge et al. 2001).

Regarding subjective well-being, girls and elders are prone to have health complaints more frequently than boys and youngers are, higher percent of girls suffers from depressive mood than that of boys, as well as satisfaction with life falls with the increase of age in both sexes (LeResche et al. 2005, Kökönyei 2003, Siegel et al. 1999).

Significant direct relationship between pubertal development and subjective well-being was found only in the case of health complaints either in the whole sample or in the sub-samples formed by the moderator variables of gender, grade and parental monitoring. An explanation for this can be, that pubertal changes are mainly somatic and physiological (i.e. biological) changes, thus their relationship with psycho-somatic complaints is more proximate than with life satisfaction and depressive mood, which are more generalized and complex indicators of subjective well-being. When considering satisfaction with life, students obviously thought of those aspects that were important particularly for them and pubertal development probably was not among the most substantial viewpoints. Likewise, biological maturation beside other factors (e.g. social relations, individual life events, cognitive features) has not a robust influence on the development of depressive mood. On the other hand, body image is a strong predictor; it might oppress the effect of pubertal development.

However, direct relationship between body image and psychological well-being is moderate to strong, depending on the indicator. This statement can be generalized for all subgroups analysed. The connection is more pronounced in girls where partial betas of BIS and the proportion of variance explained of the regression models are higher than in boys. These results support the majority of earlier findings: positive body image is a substantial contributor to mental health in adolescence, especially in girls (Siegel 2002, Ge et al. 2001, McCabe et al. 2001, Siegel et al. 1999).

Indirect relationship mediated by body image between pubertal development and subjective well-being was not significant in none of the indicators examined when it was analysed in the total sample. Its reason is that the direct relationship between pubertal development and body image was not significant in none of the models. This can be explained by several causes. It is known from the literature, that pubertal development can influence body image reversely, depending on gender: while among girls more advanced pubertal development is often accompanied by increased body dissatisfaction, and poorer body image, unlike, among boys the former is connected with more positive body feelings in general (O'Dea and Abraham 1999, Ge et al. 2001, Németh et al. 2002). The opposite effects could extinguish each other. On the other hand puberty itself not necessarily have a well definable effect on psychological well-being (Caspi and Moffit 1991); there are many evidences for that pubertal timing is much stronger predictor than pubertal status itself (see hypotheses on relationship between puberty and psycho-social development in the *Introduction*). Furthermore, cross-sectional nature of this study could also cause that relationship between pubertal development and body image was masked, as real processes cannot be detected in this study design, only snapshots on momentary states.

Analyses revealed that gender, grade and parental monitoring have moderator effects on the relationship studied. When analysing moderator role of gender, significant indirect relationships between pubertal changes and subjective well-being were found only in boys. Among them, all three indicators (life satisfaction, health complaints and depressive mood) showed significant connection with maturation. The indirect relationship was positive in the case of life satisfaction, while it was negative both in health complaints and depressive symptoms, indicating more advanced pubertal status pertaining to higher body satisfaction in boys. Gender differences can be explained by the quite general positive relationship between pubertal development and body satisfaction in boys (e.g. Cafri et al. 2005, Németh et al. 2002) and its lack among girls (Williams and Currie 2000, Wichström 1998). Earlier studies found that pubertal timing is better predictor of body image than pubertal status in girls (e.g. Siegel 2002, Siegel et al. 1999). Moreover, Williams and Currie (2000) found body image having mediator role between pubertal development and self-esteem among 11-year-old Scottish girls, but not among 13-year-olds. In the present sample controlling for pubertal timing might have revealed relation between maturation and body image among girls.

Interesting moderator effect of grade (quasi age) was observed when analysing indirect relationships. Among 11-year-old students pubertal development had a negative effect on life satisfaction with the mediation of body image, while this effect was positive in the case of health complaints (CDI was not asked from 5th former students). This relation did not exist among 7th formers (concerning depressive mood too, as 7th formers and elders were asked about it), while in secondary school students reverse signs of indirect effects of pubertal development on subjective well-being indicators can be detected compared to those found in 5th formers. Namely, pubertal maturation had a positive effect on life satisfaction with the mediation of body image, while this effect became negative in the case of health complaints and – of course – in depressive mood.

Among 5th formers within the indirect relationships direct relationships between pubertal development and body image are negative in both cases (life satisfaction and health complaints), thus maturation influence psychological well-being negatively through body image. In this grade, pubertally more developed students are mainly early maturers, thus these results suggest that early maturation is a challenge for psychological

adjustment as it was found in many of earlier findings (e.g. Davison et al. 2007, Currie and Németh 2004, Kaltiala-Heino et al. 2003).

In the next grade group, where most young people are in the middle of his/her pubertal development this effect disappears in all mental health indicators. It seems in this age group pubertal development to have no effect on subjective well-being through body image. As the majority of these young people are in a similar biological process, they see similar external signs of this process on each other, thus probably most of them consider these changes to be normal and have no substantial concerns and fears about it. This argument can be more persuasive taking into consideration the importance of peer group during adolescence.

Regarding secondary school students, the opposite direction of indirect relationships compared to those experienced in the youngest grade, suggest that late maturers (who are in less developed status than the majority of their age peers or classmates) may adjust less successfully in psycho-social term.

These findings supports off-time hypothesis of pubertal development influence on psycho-social adjustment among adolescence, as several previous studies found evidences for this hypothesis (e.g. Michaud et al. 2006, Kaltiala-Heino et al. 2003).

Finally, taking into consideration parental monitoring influence, significant indirect effect of pubertal changes on subjective well-being were occurred only in the “low level monitoring” group. These relations indicate good adjustment to biological changes as well as positive relationship between pubertal development and body image. However, the hypothesized model with mediator effect did not proven to be significant in neither problematic parental monitoring group (when there is no consequent and/or comprehensive control), nor high level monitoring group. There are numerous literature evidences for parental control change parallel with biological maturation (e.g. Bumpus et al. 2001, Paikoff and Brooks-Gunn 1991). These processes are probably in a complex interaction; current analysis however, was not appropriate to reveal the nature of it in depth. Further, specific investigations are needed to clarify this issue.

There are several limitations of this study. The cross-national design does not allow revelation of causal relationships. Prospective or longitudinal surveys are needed to gain knowledge on this area. Furthermore, the phenomenon investigated in this study is a multifactorial issue and it is impossible to take into consideration all relevant factors. Variables examined were only some of these factors, as low adjusted  $R^2$ -s indicates only small proportions explained of total variances of the regression models. Similarly, indirect effect of pubertal development on psycho-social well-being – where it exists – is very weak in all subgroups, though it appears quite consistent through the whole sample. These findings may suggest that pubertal development – body image – mental health connection is a real one, though this line with body image mediation effect is probably only one from the several ones, which exist between biological maturation and subjective well-being. This presumption is supported by those results that show different direct and indirect effects of pubertal development on the same psychological indicator (e.g. positive direct effect between PDS and health complaints, while negative indirect effect or the lack of effect between the same variables). Moreover, interactions among moderator variables were not tested in order to avoid making the analysis non-traceably complicated, but this simplification obviously mantled further important information on this complex scientific issue.

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## References

- Baldwin, S.A., Hoffmann, J.P. (2002): The dynamics of self-esteem: A growth-curve analysis. *J. Youth Adol.*, 31: 101–113.
- Bjork, J.M., Knutson, B., Fong, G.W., Caggiano, D.M., Bennett, S.M., Hommer, D. (2004): Incentive-elicited brain activation in adolescents: Similarities and differences from young adults. *J. Neurosci.*, 24: 1793–1802.
- Bond, L., Clements, J., Bertalli, N., Evans-Whipp, T., McMorris, B.J., Patton, G.C., Toumbourou, J.W., Catalano, R. (2006): A comparison of self-reported puberty using the Pubertal Development Scale and the Sexual Maturation Scale in a school-based epidemiologic survey. *J. Adol.*, 29: 709–720.
- Brown, J.D., Halpern, C.T., L'Engle, K.L. (2005): Mass media as a sexual super peer for early maturing girls. *J. Adol. Health*, 36: 420–427.
- Bumpus, M.F., Crouter, A.C., McHale, S.M. (2001): Parental autonomy granting during adolescence: Exploring gender differences in context. *Dev. Psych.*, 37(2): 163–173.
- Cafri, G., Thompson, J.K., Ricciardelli, L., MacCabe, M., Smolak, L., Yesalis, C. (2005): Pursuit of the muscular ideal: Physical and psychological consequences and putative risk factors. *Clin. Psych. Rev.*, 25: 215–239.
- Cantrill, H. (1965): *The pattern of human concern*. Rutgers University Press.
- Carskadon, M.A., Acebo, C. (1993): A self-administered rating scale for pubertal development. *J. Adol. Health*, 14: 190–195.
- Caspi, A., Moffit, T.E. (1991): Individual differences are accentuated during periods of social change: the sample case of girls at puberty. *J. Pers. Soc. Psych.*, 61(1): 157–168.
- Costello, E.J., Sung, M., Worthman, C., Angold, A. (2007): Pubertal maturation and the development of alcohol use and abuse. *Drug Alc. Dep.*, 88: S50–S59.
- Currie, C., Samdal, O., Boyce, W., Smith, B. (2002, Eds): *Health Behaviour in School-Aged Children: a WHO Cross-National Study*. Research Protocol for the 2001/2002 Survey, HBSC, Child and Adolescent Health Research Unit (CAHRU), University of Edinburgh, Edinburgh. pp. 362.
- Currie, C., Németh, Á. (2004): Puberty and health. In: Currie, C., Roberts, C., Morgan, A., Smith, R., Settertobulte, W., Samdal, O., Rasmussen V.B. (Eds): *Young people's health in context. Health behaviour in School-aged Children (HBSC) study: International report from the 2001/2002 survey*. WHO, Copenhagen. pp. 196–204.
- Currie, C., Roberts, C., Morgan, A., Smith, R., Settertobulte, W., Samdal, O., Rasmussen, V.B. (2004, Eds): *Young people's health in context. Health behaviour in School-aged Children (HBSC) study: International report from the 2001/2002 survey*. WHO, Copenhagen. pp. 237.
- Davison, K.K., Werder, J.L., Trost, S.G., Baker, B.L., Birch, L.L. (2007): Why are early maturing girls less active? Links between pubertal development, psychological well-being, and physical activity among girls at ages 11 and 13. *Soc. Sci. Med.*, 64: 2391–2404.
- Eisenberg, M.E., Neumark-Sztainer, D., Story, M. (2003): Association of weight-based teasing and emotional well-being among adolescents. *Arch. Ped. Adol. Med.*, 157: 733–738.
- Ge, X., Elde, Jr.G.H., Regnerus, M., Cox, C. (2001): Pubertal transitions, perceptions of being overweight and adolescents' psychological maladjustment: gender and ethnic differences. *Soc. Psych. Quarterly*, 64: 363–375.
- Ge, X., Brody, G.H., Conger, R.D., Simons, R.L., Murry, V.M. (2002): Contextual amplification of pubertal transition effects on deviant peer affiliation and externalizing behavior among African American children. *Develop. Psych.*, 38: 42–54.

- Ge, X., Kim, I.J., Brody, G.H., Conger, R.D., Simons, R.L., Gibbons, F.X., Cutrona, C.E. (2003): It's about timing and change: Pubertal transition effects on symptoms of major depression among African American youths. *Develop. Psych.*, 39: 430–439.
- Hankin, B.L., Ambranson, L.Y. (2001): Development of gender differences in depression: An elaborated cognitive vulnerability-transactional stress theory. *Psych. Bull.*, 127: 773–796.
- Jacobson, K.C., Crockett, L.J. (2000): Parental monitoring and adolescent adjustment: an ecological perspective. *J. Res. Adol.*, 10: 65–97.
- Kaltiala-Heino, R., Rimpela, M., Rissanen, A., Rantanen, P. (2001): Early puberty and early sexual activity are associated with bulimic-type eating pathology in middle adolescence. *J. Adol. Health*, 28: 346–352.
- Kaltiala-Heino, R., Kosunen, E., Rimpelä, M. (2003): Pubertal timing, sexual behaviour and self-reported depression in middle adolescence. *J. Adol.*, 26: 531–545.
- Kling, K.C., Hude, J.S., Showers, C.J., Buswell, B.N. (1999): Gender differences in self-esteem: a meta-analysis. *Psych. Bull.*, 125: 470–500.
- Kovacs, M. (1985): The Interview Schedule for Children (ISC). *Psychopharm. Bull.*, 21: 991–994.
- Kököneyi, Gy. (2003): Szubjektív jóllét. In: Aszmann A. (Ed.) *Iskoláskorú Gyermekek Egészségmagatartása*. Országos Gyermekegészségügyi Intézet, Budapest. pp. 93–109.
- LeResche, L., Mancl, L.A., Drangsholt, M.T., Saunders, K., von Korff, M. (2005): Relationship of pain and symptoms to pubertal development in adolescents. *Pain*, 118: 201–209.
- Markey, C.N., Markey, P.M., Tinsley, B.J. (2003): Personality, puberty, and preadolescent girls' risky behaviors: Examining the predictive value of Five-Factor Model of personality. *J. Res. Pers.*, 37: 405–419.
- McCabe, M.P., Ricciardelli, L.A., Banfield, S. (2001): Body image: strategies to change muscles and weight, and puberty. Do they impact on positive and negative affect among adolescent boys and girls. *Eat. Behav.*, 2: 129–149.
- Michaud, P.A., Suris, J.C., Deppen, A. (2006): Gender-related psychological and behavioural correlates of pubertal timing in a national sample of Swiss adolescents. *Mol. Cell. Endocr.*, 254–255: 172–178.
- Moretti, M.M., Rein, A.S., Wiebe, V.J. (1998): Relational self-regulation. Gender differences in risk for dysphoria. *Can. J. Behav. Sci.*, 30: 243–252.
- Muris, P., Meesters, C., van de Blom, W., Mayer, B. (2005): Biological, psychological, and sociocultural correlates of body change strategies and eating problems in adolescent boys and girls. *Eat. Behav.*, 6: 11–22.
- Németh, Á. (2003): Testkép és testtömeg. In: Aszmann A. (Ed.) *Iskoláskorú Gyermekek Egészségmagatartása*. Országos Gyermekegészségügyi Intézet, Budapest. pp. 87–92.
- Németh, Á., Bodzsár, É.B., Aszmann, A. (2002): Maturation status and psychosocial characteristics of Hungarian adolescents. *Anthrop. Közl.*, 43: 85–94.
- Obeidallah, D., Brennan, R.T., Brooks-Gunn, J., Earls, F. (2004): Links Between Pubertal Timing and Neighborhood Contexts: Implications for Girls' Violent Behavior. *J. Am. Acad. Child Adol. Psychiatry*, 43: 1460–1468.
- O'Dea, J.A., Abraham, S. (1999): Onset of disordered eating attitudes and behaviors in early adolescence: interplay of pubertal status, gender, weight and age. *Adol.*, 34: 670–679.
- Orbach I., Mikulincer, M. (1998): Body investment scale: Construction and validation of a body experience scale. *Psych. Assess.*, 10: 415–425.
- Paikoff, R.L., Brooks-Gunn, J. (1991): Do parent-child relationships change during puberty? *Psych. Bulletin*, 110(1): 47–66.
- Pedersen, M., Alcón, M.C.G., Borup, I. (2001): Family culture. In: Currie, C., Samdal, O., Boyce, W., Smith, R. (Eds) *Health Behaviour in School-aged Children: a WHO Cross-National Study (HBSC), Research protocol for 2001/2002 Survey*. Child and Adolescent Health Research Unit (CAHRU), University of Edinburgh, Edinburgh. pp. 123–134.
- Petersen, A.C., Crockett, L., Richards, M., Boxer, A. (1988): A self-report measure of pubertal status: Reliability, validity, and initial norms. *J. Youth Adol.*, 17: 117–133.

- Rispens, J., Hermans, J.M.A., Meeus, W.H.J. (1997, Eds): *Opvoeden in Nederland [Parenting in the Netherlands]*. Assen: van Gorcum.
- Robins, R.W., Trzesniewski, K.H., Gosling, S.D., Potter, J. (2002): Global self-esteem across the life span. *Psych. Aging, 17*: 423–434.
- Rózsa, S., Vetró, Á., Komlósi, V.A., Gáboros, J., Kö, N., Csorba, J. (1999): Gyermekek és serdülőkorúak depresszió kérdőív mérésének lehetősége a klinikai és normatív mintán szerzett tapasztalatok alapján. *Pszichológia, 4*: 459–482.
- Siegel, J.M. (2002): Body image change and adolescent depressive symptoms. *J. Adol. Res., 17(1)*: 27–41.
- Siegel, J.M., Yancey, A.K., Aneshensel, C.S., Schuler, R. (1999): Body image, perceived pubertal timing, and adolescent mental health. *J. Adol. Health, 25*: 155–165.
- Silbereisen, R.K., Kracke, B. (1997): Self-reported maturational timing and adaptation in adolescence. In: Schulenberg, J., Maggs, J.L., Hurrelmann, K. (Eds) *Health Risks and Developmental Transitions During Adolescence*. Cambridge University Press, Cambridge. pp. 85–109.
- Simmons, R.G., Blyth, D.A., Van Cleave, E.F., Bush, D.M. (1979): Entry into Early Adolescence: The Impact of School Structure, Puberty, and Early Dating on Self-Esteem. *Am. Soc. Rev., 44*: 948–967.
- Smolak, L., Stein, J.A. (2006): The relationship of drive for muscularity to sociocultural factors, self-esteem, physical attributes gender role, and social comparison in middle school boys. *Body Image, 3*: 121–129.
- Steinberg, L. (2005): Cognitive and affective development in adolescence. *Trends in Cog. Sci., 9*: 69–74.
- Steinberg, L., Dahl, R., Keating, D., Kupfer, D.J., Masten, A.S., Pine, D. (2006): The study of developmental psychopathology in adolescence: integrating affective neuroscience with the study of context. In: Cicchetti, D., Cohen, D. (Eds) *Handbook of Developmental Psychopathology, Vol 2, Developmental Neuroscience*. 2nd Edition. John Wiley & Sons, New York, NY, USA, pp. 710–742.
- Tschann, J.M., Alder, N.E., Irwin, C.E., Millstein, S.G., Turner, R.A., Kegeles, S.M. (1994): Initiation of substance use in early adolescence: the roles of pubertal timing and emotional distress. *Health Psych., 13*: 326–333.
- Wichström, L. (1998): Self-concept development during adolescence: Do American truths hold for Norwegians? In: Skoe, E., von der Lippe (Eds) *Personality development in adolescence: A cross-national and life span perspective*, London, Routledge, 98–122. cit. Williams and Currie (2000).
- Wight, D., Williamson, L., Henderson, M. (2006): Parental influences on young people's sexual behaviour: A longitudinal analysis. *J. Adol., 29*: 473–494.
- Williams, J.M., Currie, C. (2000): Self-esteem and physical development in early adolescence: pubertal timing and body image. *J. Early Adol., 20*: 129–149.

Mailing address: Ágnes Németh  
 National Institute of Child Health  
 H-1519 Budapest  
 Pf. 478  
 Hungary  
 nagi@ogyei.hu

