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Body Structure and Physical Self-Concept in Early Adolescence

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Abstract

In adolescence, the complexity of human ontogenesis embraces biological growth and maturation as well as mental, affective, and cognitive progress, and adaptation to the requirements of society. To accept our morphological constellation as part of our gender may prove a problem even to a child of average rate of maturation. The main purposes of the present study were to compare selected body shape factors of early adolescents belonging to different physical self-concept subgroups, and to identify those somatic factors that have the strongest influence on the physical self-concept. A randomly selected subsample of the 2nd Hungarian National Growth Study formed the sample of the analysis. Besides the anthropometric investigations, the Tennessee Self-Concept Scale was administered to altogether 2,140 adolescents (aged 11-14). The multinominal logistic regression was used to reveal the relationship between absolute body dimensions, relative body dimensions, nutritional status, body mass components, body shape, and physical self-concept. The better the physical self-concept, the less the fatness was found in both sexes. In early adolescents, having negative physical self-concept endomorphy was significantly larger than in their age-peers with good self-concept. The presumed fact that obesity is not popular in adolescence has been confirmed by this study. However, the underweight nutritional status was attractive in the girls. These results informed us about

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the considerable influence of the pubertal-not-normal nutritional status on the discrepancy between the ideal and actual self-concepts.

Keywords
2nd Hungarian National Growth Study, adolescents, obesity, body composition, body shape, physical self-concept

Introduction

In addition to the change in body form and structure, puberty is associated with such modifications of the psyche that mould personality as a whole. The course of dimensional growth, sexual maturation, the development of the secondary sexual characteristics are joined by a marked instability of psychic functions and a growing awareness and criticism of self (Barker & Bornstein, 2010; Bodzsar, 2000; Crocker & Wolfe, 2001; Neff, 2003; Roberts, Caspi, & Moffitt, 2001; Trzesniewski, Donnellan, & Robins, 2003). Identification with one's sex-linked morphological build may pose a problem even for a child of average developmental rate, and the same becomes accentuated when one's developmental rate differs from the average (Arens & Hasselhorn, 2014; Cumming et al., 2010; Erermis et al., 2004; Paxton, Neumark-Sztainer, Hannan, & Eisenberg, 2006; Puhl & Latner, 2007).

This analysis focuses on some selected factors of body structure (absolute and relative body dimensions, nutritional status, body mass components, somatotype: the phenotypic body shape) in relation of physical self-concept in early adolescence. The main purposes of the present study were to compare the body structure characteristics of adolescents belonging to different physical self-concept subgroups, and to identify those somatic features having the strongest influence on physical self-concept.

Literature Review

Adolescence is a period of individual life when youth devote particularly intense attention to their own bodies, because very fast changes occur in their growth and maturation pattern in this phase. The physiological, body structural changes result in psychological instabilities in adolescence, and are often accompanied by the decrease of self-concept level (Asgeirsdottir, Ingolfsdottir, & Sigfusdottir, 2012; Eisenberg, Neumark-Sztainer, & Paxton, 2006; Fenton, Brooks, Spencer, & Morgan, 2010; Kostanski, Fisher, & Gullone, 2004). The relationship between physical self-concept and global self-concept among adolescents is evidenced by several studies. Negative

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physical self-concept was found to be related to lower global self-concept and many emotional and behavioral problems (e.g., disordered eating, depression), and due to these psycho-social problems to reduced quality of life (Asgeirsdottir et al., 2012; Cash & Fleming, 2002; Clay, Vignoles, & Dittmar, 2005; Dorak, 2011; Horn, Newton, & Evers, 2011; Mendonca et al., 2014; Stice, 2002; Stice & Whitenton, 2002).

The relationship between somatic factors and physical self-concept in early adolescence is very complex because (a) not-normal body dimensions, nutritional status, body composition, body shape, onset or tempo of sexual maturation, or also a not age-appropriate body ideal can significantly influence the physical self-concept; and (2) an underlying psychological factor, a very low self-concept, can contribute to the development of somatic abnormality, for example, obesity or stunted, underweight status too (Cumming et al., 2010; French, Story, & Perry, 1995; Koff, Rierdan, & Stubbs, 1990; Pesa, Syre, & Jones, 2000; Ricciardelli & McCabe, 2001; Tiggemann & Slater, 2014; Williams & Currie, 2000).

It is not clearly explored whether somatic factors influence the global self-concept only indirectly through the changes of physical self-concept, or the influence of body dimensions and characteristics are limited only to the physical self-concept. Moreover, the relationships among the components of self-concept have hardly been studied until now, especially in adolescents whose personality is developing very intensively, and self-concept components may change in different tempo. Marsh, Hau, Sung, and Yu (2007) evidenced that obesity was negatively related to physical self-concept, positively to health self-concept, while unrelated to global self-concept in Chinese adolescents, in contrast to the negative relation between obesity and self-concept in adolescents growing up in the Western societies. The evidence that one of the components is influenced, while the global self-concept is not influenced by the same factor, implies that at least one of the other components is inversely influenced by obesity than the physical self-concept did.

Self-concept is defined in the literature as perceptions of oneself that are (a) formed through experience and interpretations of the environment and (b) influenced by environmental reinforcements from others (who are important for us) for one's own behavior (Shavelson, Hubner, & Stanton, 1976). The intelligence, self-efficacy, academic competence and achievement, and the relationship among the dominance of the domains may help adolescents to accept their physical attributes, that is, their strength, body fatness, fitness, sports competence, health, and appearance by promoting the over-evaluation of the desirable capabilities and the under-evaluation of self-concept deficits. Former studies on the relationship between self-concept and academic achievement confirmed this hypothesis, because they

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evidenced that high self-concept was partly the result of good school achievement in adolescents (Baumeister, Campbell, Krueger, & Vohs, 2003; Bodzsar, 1996/1997; Pesa et al., 2000), but this complex relationship has not been fully explored yet.

Nowadays, when (a) the prevalence of obesity is increasing not only in adulthood but also in childhood and adolescence (Bodzsar & Zsakai, 2014; Cawley & Meyerhoefer, 2012; Lobstein, Baur, Uauy, & IASO International Obesity Task Force, 2004; World Health Organization [WHO], 2012), (b) the influence of secular trend in body development and sexual maturation pattern mirrored in earlier developmental and maturation processes in the last decades, (c) the media idealizes and over-represents the thin body shapes (Fouts & Burggraf, 2000; Veldhuis, Konijn, & Seidell, 2014), and (d) the influence of physical self-concept on the global self-concept is more important than the other domains of life experience such as scholastic competence, social acceptance, or athletic competence in this age interval (Arens & Hasselhorn, 2014; Carey, Donaghue, & Broderick, 2014; Cumming et al., 2010; Park & Epstein, 2013), the studies of influences on global self-concept and its physical self-concept component are of very high importance. There is no doubt that sociocultural environment and age-peers are the most important intensifiers of body perceptions in adolescents (Dohnt & Tiggemann, 2006; Grabe, Ward, & Hyde, 2008; Stanford & McCabe, 2005; Veldhuis et al., 2014). Nowadays, when the sociocultural environment emphasizes thinness and appearance, it is also worthy to study whether the social and appearance pressures vary considerably between adolescent girls and boys in our societies. By exploring the relationship between the factors of physical self-concept and the objective measures and attributes of the body, it could help us to promote greater body acceptance among adolescents (Abbott & Barber, 2010; Franko, Cousineau, Rodgers, & Roehrig, 2013; Golan, Hagay, & Tamir, 2014; Webb, Butler-Ajibade, & Robinson, 2014).

By considering all these evidences in the research of self-concept analysis, the following hypotheses are proposed:

Hypothesis 1: Obesity is a not attractive form of nutritional status, that is, the higher the level of body fatness, the worse physical self-concept of early adolescents is assumed.

Hypothesis 2: Increased body linearity—that is, relative long extremity lengths—is an attractive somatic factor in adolescents.

Hypothesis 3: The most frequent somatotype categories are the most popular in the studied age interval.

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Table 1. Distribution of the Subjects by Age and Gender, and the Reliability Analysis Results (Significance Levels in the Bartlett's Test and KMO Index) of Tennessee Scale in the Studied Age Interval (for the Whole Sample Independently of Age and Gender—KMO = .925 and $p < .001$).

	Boys			Girls		
Age (years)	*n*	KMO	*p*	*n*	KMO	*p*
11	238	.701	<.001	272	.753	<.001
12	278	.770	<.001	306	.829	<.001
13	252	.761	<.001	293	.765	<.001
14	259	.781	<.001	242	.788	<.001
Total	1,027	.929	<.001	1,113	.923	<.001

Note. KMO = Kaiser–Meyer–Olkin.

Subjects and Method

The Studied Sample of Adolescents

The subjects (1,027 boys and 1,113 girls, aged 11-14 years, Table 1) represented a randomly selected subsample of the 2nd Hungarian National Growth Study (Bodzsar & Zsakai, 2007; Zsakai & Bodzsar, 2012). The body structure of children was assessed by (a) absolute and relative (measurements were expressed in the percentage of stature) body dimensions, (b) nutritional status (children were divided into underweight, normal, overweight, and obese categories by using the body mass index [BMI] age-dependent cutoff values published by Cole and his colleagues; Cole, Bellizzi, Flegal, & Dietz, 2000; Cole, Flegal, Nicholls, & Jackson, 2007), (c) body mass components (relative fat, bone and muscle masses were estimated by the anthropometric method of Drinkwater & Ross, 1980, and were expressed in the percentage of total body mass), and (d) body shape (estimated by the Heath–Carter anthropometric somatotyping method; Carter & Heath, 1990). The anthropometric measurements were performed using the standardized techniques and standard equipment (International Biological Program recommendations; Martin & Saller, 1957; Weiner & Lourie, 1969).

The Heath–Carter Anthropometric Somatotype

The Heath–Carter somatotype is a phenotypic rating of the morphological body shape; it is based on the concept of geometrical size dissociation. The somatotype is expressed in a three-number rating by estimating the *endomorphy, mesomorphy*, and *ectomorphy* components.

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Endomorphy represents the relative fatness (estimated by considering the sum of three subcutaneous skinfolds adjusted for body size): The higher the ratings in this somatotype component, the larger deposits of subcutaneous fat, and the more rounded body can be estimated.

Mesomorphy is a rating on a continuum of musculo-skeletal robustness relative to stature (estimated by using bone widths and skinfold-corrected girths of the extremities adjusted for stature): The higher the ratings in mesomorphy, the larger muscle mass with wider bone diameters relative to stature is signified.

Ectomorphy is the component of somatotype that estimates the relative linearity or slenderness of a physique (estimated by using the stature/body mass$^{1/3}$ ratio): The higher the ratings in ectomorphy, the smaller body mass relative to stature and the more elongated limb segments can be denoted (Carter & Heath, 1990).

Somatotypes can be grouped into the following 13 categories on the basis of the relationships between the dominance of the components (Carter & Heath, 1990): *central* (no component differs from the other two), *balanced endomorph* or *balanced mesomorph* or *balanced ectomorph* (endomorphy or mesomorphy or ectomorphy is dominant, the other two components are equal), *mesomorphic endomorph* or *ectomorphic endomorph* (endomorphy is dominant, mesomorphy or ectomorphy is greater than ectomorphy or mesomorphy), *endomorphic mesomorph* or *ectomorphic mesomorph* (mesomorphy is dominant, endomorphy or ectomorhy is greater than ectomorphy or endomorphy), *endomorphic ectomorph* or *mesomorphic ectomorph* (ectomorphy is dominant, endomorphy or mesomorphy is greater than mesomorphy or endomorphy), *mesomorph-endomorph* or *mesomorph-ectomorph* or *endomorph-ectomorph* (endomorphy and mesomorphy or ectomorphy and mesomorphy or ectomorphy and endomorphy are equal, the third component is smaller).

The age-group means of three-dimensional somatotypes were represented on the somatochart (Carter & Heath, 1990).

The Tennessee Self-Concept Scale

The physical self-concept was estimated by the Tennessee scale (Fitts, 1964, adapted to the Hungarian population by Devai & Sipos, 1986). It is a 20-item questionnaire to measure self-concept multidimensionally, that is, to assess an individual's identity, behaviors, and satisfaction comprehensively across five domains—physical, moral, individual, family, and social self-content). Although this instrument is a popular research and clinical measure of self-concept, the lack of empirical information on the internal structure, construct

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validity, and reliability of the method emphasizes that the estimated self-concept components and the self-concept should be considered with caution. Most of the analyses that were used—exploratory and confirmatory factor analyses and ANOVA model—confirmed (a) the multidimensional nature of the Tennessee scale responses; (b) the subscales were not independent; (c) there was consistent support for the family, social, and physical self-concept scales, but less consistent support for other self-concept scales of the method; and (d) empirically derived factors were not clearly related to the original Tennessee scales (Gable, La Salle, & Cook, 1973; Marsh, 1990; Marsh & Richards, 1988; Marsh & Shavelson, 1985; McGuire & Tinsley, 1981; Walsh, Wilson, & McLellarn, 1989).

A principal components factor analysis was done to study the structure of the Tennessee scale items and components (before the analysis, scores for negatively worded items were reversed to get a low score on all items that reflected a positive self-concept). The hypothesized five-factor model of the Tennessee scale items was tested.

A Pearson product–moment correlation matrix was calculated for all the 90 items of the Tennessee scale in both genders (both for every age-group and independently of age). The Bartlett's sphericity test was used to determine whether the correlation matrix contained significant non-random variance. The matrices were found to differ significantly from a matrix of random data in every age-group in both genders ($p < .001$). The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was used to check whether the studied data were suitable for factor analysis (KMO = .942 and $p < .001$ in Bartlett test for the whole age interval, independently of gender). The KMO index ranges from 0 to 1, and index values equal to or higher than .50 are considered suitable for factor analysis. The group of Tennessee scale items was found suitable for factor analysis both in the global sample and in every age-group in both genders (KMO was higher than .7; Table 1). Finally, the factor analysis was done for the whole sample because the main aim was to analyze age changes and sexual dimorphism in the level of self-concept. A cutoff of .40 was used for the factor loadings to be included in the interpretation of the factors.

Eighteen-eighteen items of the scale belong to each component of the global self-concept according to the original Tennessee scale method (Fitts, 1964). The item analysis produced 18 factors, the factors accounted for 60.4% of the variance. Seventeen of the 18 hypothesized items were assigned to the physical self-concept factor, and one item formed an individual factor. Twelve of the 18 hypothesized items and 1 non-hypothesized item were assigned to the moral self-concept factor, and two-two-one items formed three individual factors. Thirteen of the 18 hypothesized

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items and 1 non-hypothesized item were assigned to the individual self-concept factor, and one-one-one items formed three other factors. Seven and 6 items of the hypothesized family self-concept factor formed two factors, while two-one-one items another three factors. Fifteen of the 18 hypothesized items were assigned to the social self-concept factor, and two-one items formed other two factors. The remaining 2 items were not assigned to any factor.

In summary, 64 of the 90 items (71.1%) were assigned to the factor designated by the hypothesis. Although this confirmation is not too strong, and the described structure of items suggests subcomponents in the case of almost every component, the items of the physical self-concept, the studied component of the global self-concept, showed a very strong assignment (17/18, 94%) to the hypothesized factor.

The age changes and the sexual dimorphism in the pattern of physical self-concept scores clarified that we needed age- and gender-dependent cutoff values to divide adolescents into high, average, and low self-concept subgroups. This kind of cutoff values could not be found in the literature of Tennessee Self-Concept. Therefore, the sample-defined cutoff values were chosen. Subjects were divided into self-concept subgroups by using the 25th and 75th centile values of the physical self-concept scores as age- (for 1-year-long age-groups) and gender-dependent cutoff limits. The early adolescents belonging to the upper quartile formed the "high" level self-concept subgroup; subjects belonging to the lower quartile formed the "low" level self-concept subgroup, and the "average" level self-concept subgroup means subjects scored between the high and low categories (only the subgroups having low and high level of self-concept are presented in the figures).

Statistical Analysis

A multinominal logistic regression estimation was used to classify subjects into physical self-concept subgroups on the basis of a set of predictor somatic variables. The parameter estimation was performed through an iterative maximum-likelihood algorithm. A hierarchical cluster analysis of somatic factors and self-concept components was performed to represent the structure of variables via the construction of dendrograms. The statistical evaluations were made by SPSS v.20.0 software. Hypotheses were tested at the 5% level of random error. The Mann–Whitney test was used to compare the subgroups' somatic characteristics, while the chi-square test or Fisher exact test (in the case of very small sample sizes) was used to analyze the homogeneity of the subgroups.

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Ethical Approvals for the Study

The parents of the subjects were asked to give informed consent to the investigations. Participation was voluntary and data were anonymized and analyzed for scientific purposes only. The research objectives, the research methodology, and the questionnaires were approved by the Office of the Hungarian Parliamentary Commissioner for Future Generations and the National Human Research Ethics Committee.

Results

The Mean Somatotypes of Adolescents Having Different Physical Self-Concept Levels

Somatotype (Carter & Heath, 1990; Sheldon, Stevens, & Tucker, 1940), one possible estimation of body structure as a whole and not only its selected dimensions or proportions, was used to choose the predictor variables in the multinominal logistic regression by considering the main differences between the somatotype of children divided into the different physical self-concept subgroups.

It could be stated that the mean somatotype of boys having relatively high level of satisfaction with their body shape moved around the central type (a balanced somatotype: the three components characterize the body shape with the same dominance) independent of age. On the other hand, mean somatotype of boys with lower level of physical self-concept (a) was significantly more endomorph than in the boys with lower level of dissatisfaction and (b) changed somatotype category by age, that is, moved from the mesomorphic endomorph category (the relative fatness is dominant in the body shape but the musculo-skeletal robustness is more dominant than the linearity of the boys) toward the central somatotype (Figure 1). Girls with relatively high level of satisfaction with their body had less endomorphic but more ectomorphic somatotype than their peers with lower level of physical self-concept. Namely, the mean somatype of girls with higher level of physical self-concept was ectomorphic endomorph (the relative fatness is dominant, but the linearity of the body forms more considerably the body shape than the robusticity), while the mean somatotype of girls with lower level of body shape satisfaction was in the endomorph area of the somatochart (Figure 1).

The Selection of Predictor Factors of Physical Self-Concept

By regarding all these differences between the somatotype of children with the same age but belonging to different physical self-concept subgroups, we could

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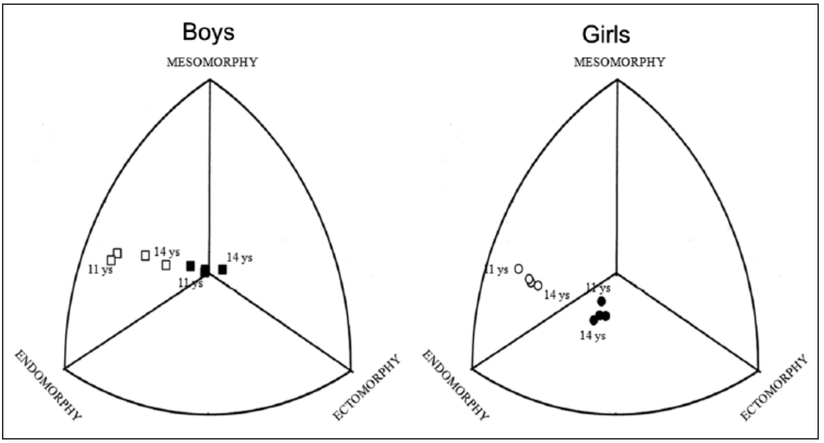

Figure 1. Mean somatotype of adolescents with high (boys: ■; girls: ●) and low (boys: □; girls: ○) level of physical self-concept.

state that the main differences between the subgroups were found in the endomorphy and ectomorphy components of the somatotypes in both genders during the studied age interval. Therefore, to determine the strength of influence upon the level of physical self-concept the following body dimensions (that are in relation with the endo- or ectomorph component of the somatotype) were selected from the measured and estimated somatic parameters as possible predictor variables of physical self-concept: (a) absolute body dimensions (continuous variables—stature [cm], body mass [kg], hip circumference [cm], waist circumference [cm], relaxed upper arm circumference [cm], thigh circumference [cm], subcutan skinfolds, triceps, subscapular, suprailiac, abdominal skinfolds [mm]), (b) relative body dimensions (continuous variables—the relative dimensions of all the selected absolute body dimensions were selected into the analysis as well), (c) body mass components (continuous variables—relative body mass [%], relative bone mass [%], relative muscle mass [%]), and (d) BMI nutritional status categories (discrete variable).

First a preliminary selection of predictors was done within the dimensional groups of absolute and relative body measurements, that is, within the trunk and extremity circumferences, within the subcutan skinfolds. These preliminary analyses revealed that stature, body mass, the abdominal skinfold (the absolute dimensions predicted better the level of physical self-concept than the relative ones), the body mass components, and the nutritional status category were the strongest predictors for physical self-concept in the studied age interval. The basic statistical parameters (mean and standard deviation) of continuous somatic variables (only those variables that

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Table 2. Mean and Standard Deviation (in Parentheses) Parameters of Self-Concept Components and the Studied Somatic Factors.

	Age-group (years)			
	11	12	13	14
Boys				
Physical self-concept score	68.6 (9.9)	68.4 (10.7)	68.3 (11.1)	68.3 (11.7)
Moral self-concept score	69.3 (9.0)	69.2 (9.4)	67.2 (9.6)	68.6 (9.6)
Individual self-concept score	71.3 (9.4)	70.6 (10.1)	69.4 (9.8)	69.5 (9.8)
Family self-concept score	73.6 (10.4)	72.5 (10.6)	70.0 (10.6)	70.2 (11.1)
Social self-concept score	67.2 (8.7)	66.6 (8.7)	65.2 (8.3)	66.0 (8.4)
Stature (cm)	147.9 (7.0)	153.4 (7.9)	160.3 (8.6)	166.4 (9.1)
Body mass (kg)	40.9 (10.7)	44.6 (11.8)	50.9 (11.5)	55.6 (13.2)
Abdominal skinfold (mm)	19.0 (14.4)	19.3 (14.7)	19.2 (14.2)	18.1 (14.0)
Relative fat mass (%)	19.1 (6.3)	18.9 (6.2)	17.8 (5.6)	16.1 (5.2)
Relative muscle mass (%)	36.9 (4.1)	37.4 (3.9)	38.4 (4.0)	39.8 (3.8)
Relative bone mass (%)	19.5 (2.0)	19.7 (1.9)	19.5 (2.0)	19.4 (1.9)
Girls				
Physical self-concept score	66.0 (10.2)	65.5 (11.1)	64.3 (10.5)	62.2 (10.9)
Moral self-concept score	70.1 (8.7)	70.4 (9.1)	69.7 (8.3)	69.8 (7.8)
Individual self-concept score	68.8 (9.6)	67.7 (10.5)	65.8 (9.5)	63.8 (10.0)
Family self-concept score	74.7 (9.6)	72.9 (11.5)	70.2 (10.8)	67.5 (13.4)
Social self-concept score	67.9 (9.1)	67.3 (9.4)	66.8 (8.8)	67.0 (8.2)
Stature (cm)	148.2 (7.1)	153.9 (7.6)	158.7 (6.5)	162.3 (6.6)
Body mass (kg)	40.5 (10.3)	45.5 (11.7)	49.6 (11.0)	53.1 (10.4)
Abdominal skinfold (mm)	20.1 (12.6)	21.0 (13.2)	21.8 (13.1)	24.2 (12.7)
Relative fat mass (%)	20.9 (5.2)	20.6 (4.9)	20.2 (4.5)	21.1 (4.7)
Relative muscle mass (%)	36.4 (3.9)	36.7 (3.9)	37.3 (3.7)	37.2 (3.6)
Relative bone mass (%)	18.4 (1.9)	18.0 (1.9)	17.5 (1.9)	16.8 (1.7)

were found to be related to physical self-concept in this analysis) and self-concepts components were used to describe the studied sample (Table 2).

The Analysis of the Relationship Between Somatic Factors and Physical Self-Concept

The most important predictors of physical self-concept were stature, body mass, abdominal skinfold, relative fat mass, relative muscle mass, and

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Table 3. The Level of Significance (*p*) and Chi-Square Statistics (χ^2, *df*) of the Strongest Predictor Variables of Physical Self-Concept Level in the Multinominal Logistic Regression (Model Fitting Was Significant in Both Genders).

	Boys		Girls	
	p	χ^2 (*df*)	*p*	χ^2 (*df*)
Stature	.010	8.54 (2)	<.001	18.42 (2)
Body mass	.011	8.81 (2)	*ns*	2.21 (2)
Abdominal skinfold	.008	11.47 (2)	<.001	16.98 (2)
Relative fat mass	.044	8.19 (2)	*ns*	1.24 (2)
Relative muscle mass	<.001	28.07 (2)	*ns*	1.59 (2)
Relative bone mass	*ns*	1.96 (2)	<.001	9.13 (2)
Nutritional status category	<.001	41.05 (2)	<.001	38.05 (2)
Concordance of observed vs. predicted categories	49.9%		50.6%	

Note. ns = not significant, therefore not used in the final regression.

nutritional status in boys, and stature, abdominal skinfold, relative bone mass, and nutritional status in girls (Table 3, Cox and Snell R^2 for boys = .540 and for girls = .601). By regarding the somatic predictors' median values of physical self-concept in the low and high physical self-concept subgroups, the strongest predictors were the subcutan fat accumulation and the fat component of the body in both genders (Figure 2). The differences in the predictor dimensions between the subgroups having low and high level of physical self-concept were significant independently of age and gender in the case of body mass components (Mann–Whitney test; Table 4). By considering the goodness of classification (observed vs. predicted frequencies by response category), we could state although the model fittings were significant, only 49.9% of the predicted self-concept categories fitted the observed ones in boys, and 50.6% in girls.

The Analysis of the Relationship Between Nutritional Status and Physical Self-Concept

The types of not-normal nutritional status were not attractive in boys; the prevalence of underweight, overweight, and obese nutritional status, respectively, was significantly higher in boys having low physical self-concept. Contrary to boys, the underweight nutritional status was very attractive in girls; its prevalence was significantly higher in girls with high level of self-concept than their age-peers having lower level of self-concept. The further

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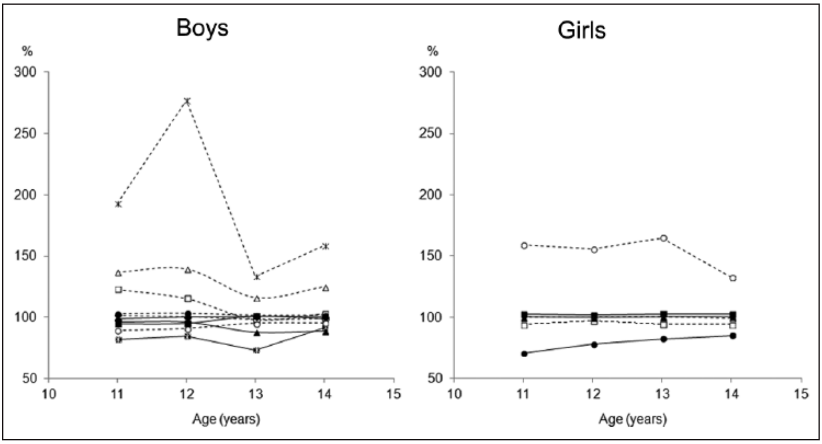

Figure 2. The somatic predictors' median values (expressed in the percentage of the age-group medians) of physical self-concept in the subgroups having low (- - - -, empty symbols) and high (—, filled symbols) level of physical self-concept (boys—♦ = stature, ■ = body mass, * = abdominal skinfold, ● = relative muscle mass, ▲ = relative fat mass; girls—▲ = stature, ● = abdominal skinfold, ■ = relative bone mass).

Table 4. The Significance of Differences (*p* Values, Mann–Whitney Test) in the Studied Body Dimensions Between the Subgroups of Having Low and High Level of Physical Self-Concept (bold faced values indicate significant differences: p<0.05).

	Age (years)			
	11	12	13	14
Boys				
Stature	**.017**	.590	**.001**	.112
Body mass	**.001**	**<.001**	.891	.508
Abdominal skinfold	**<.001**	**<.001**	**.006**	**<.001**
Relative fat mass	**<.001**	**<.001**	**.002**	**<.001**
Relative muscle mass	**<.001**	**<.001**	**<.001**	**<.001**
Girls				
Stature	.672	.635	.126	.392
Abdominal skinfold	**<.001**	**<.001**	**<.001**	**.001**
Relative bone mass	**<.001**	**<.001**	**<.001**	**<.001**

important difference between the boys and girls was that the overweight and obese nutritional status categories were almost missing in girls having high level of physical self-concept (Figure 3).

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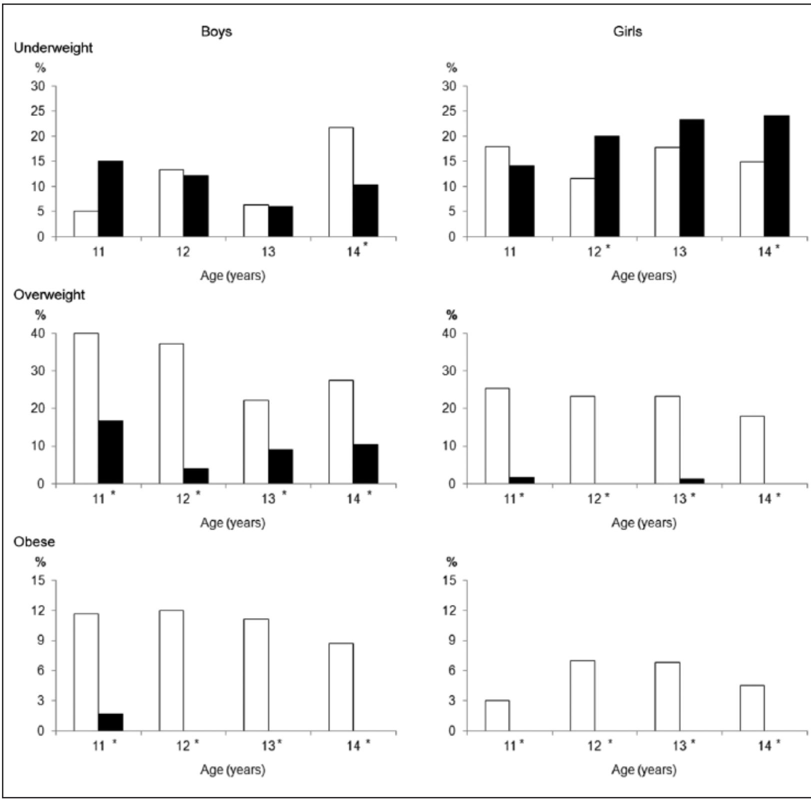

Figure 3. The prevalence of not-normal nutritional statuses in 11- to 18-year-old boys and girls in the subgroups of having low (□) and high (■) level of physical self-concept.
*Significant difference.

The Cluster Analysis of the Selected Predictors of Physical Self-Concept

The cluster analysis of somatic factors and self-concept components revealed three clusters in both genders: the cluster of self-concept components, body fatness, and body robustness, while stature showed very weak relation to the other studied somatic factors and self-concept components (Figure 4). Furthermore, two of these three clusters formed a supercluster corresponding to the supercluster of body robustness and self-concept components in boys, and the supercluster of somatic characteristics in girls.

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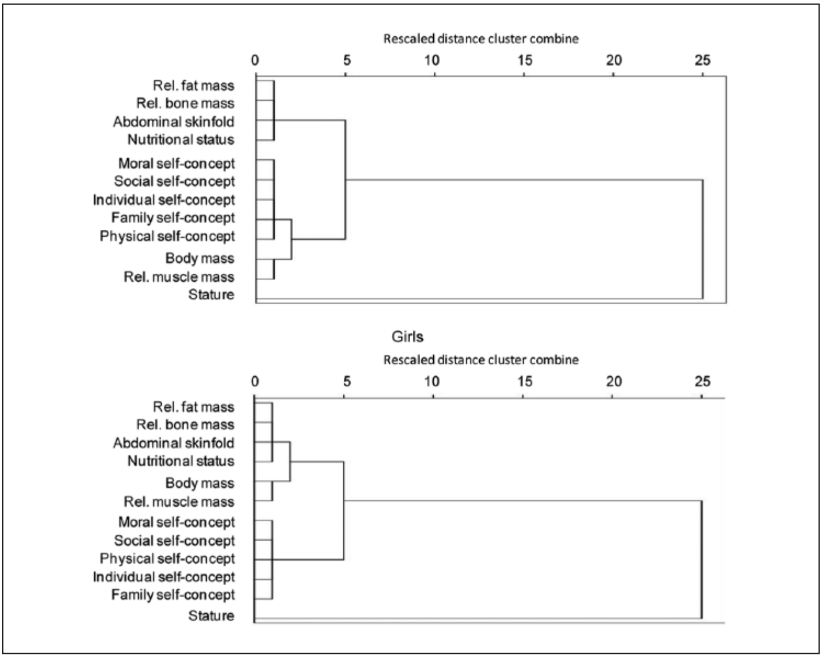

Figure 4. Dendrogram of the studied somatic factors and self-concept components (between-groups linkage cluster analysis, squared Euclidean distance method).

Limitations of the Study

Data Collection Method

The main limitations of self-concept studies can result from the type of data collection. Adolescents were asked to fill in questionnaires in this study. Although the investigators helped and supervised this self-administered data collection, the subjectivity cannot be excluded in this case.

Although the studied age interval was short enough not to result in the age effects studied cross-sectionally to be inherently confounded with birth cohort effects, the cross-sectional study design without a cross-temporal meta-analysis may have considerable influences on the studied relationship between the self-concept and somatic factors. Nevertheless, the studied sample size was unusually large in the self-concept studies. The large sample size and the method that not the age-related trends were analyzed may compensate for this methodological insufficiency of the study.

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The Psychometrical Information of the Tennessee Self-Concept

The Tennessee scale is a multidimensional self-concept instrument that was originally developed to describe the self-esteem by considering the self-concept components as a whole (Fitts, 1964). The self-concept has a multifaceted and hierarchical structure, its components are not fully independent from each other; therefore, the self-concept is suggested to obtain by extracting it from the combined subscales. The separate analysis of the components may decrease the psychometrical information, but can help to understand the complex relationship between physical self-concept and the external and internal factors having considerable influence on it.

The physical self-concept component of self-concept should be interpreted cautiously because a wide range of differentiable physical components can be described with higher level of psychometrical strength in terms of more than one scale of physical self-concept (Fox & Corbin, 1989; Marsh & Richards, 1988).

Conclusion

The presumed fact that obesity is not popular in early adolescence has been confirmed by this study, namely, the unattractive body shape among Hungarian adolescents in general was the endomorph, stout one with thick skinfolds in both genders, that is, endomorphy and high level of body fat content were unpopular characteristics of the body shape. The better the physical self-concept, the less fatness was found in both genders. Because body height and the relative length of lower extremities did not relate to the physical self-concept, we could conclude in contrast of our working hypothesis that the attractiveness did not increase by body linearity.

Boys having high level of physical self-concept had central type of somatotype, which is one of the most frequent in early adolescent boys, while girls with high level of self-concept had ectomorphic endomorph somatotype, which is absolutely not typical for girls between the age of 11 and 14 years. Moreover, the prevalence of underweight girls was significantly higher in girls with high level of physical self-concept. These results could imply that boys are satisfied with the normal (appropriate to their age) body shape, while girls are generally attracted by the media promoted ultra-thin appearance. This sexual dimorphism in the influence of the media-generated thin image of the societal ideal on adolescents' body shape control and eating behavior is consistent with the observations in the other industrial societies, because this sociocultural influence was perceived to be greater for girls than boys, for example, in Australian (aged 13-15, Hargreaves & Tiggemann, 2003; aged 12-16 years, McCabe & Ricciardelli, 2001), American (aged 9-14 years, Field et al., 2005; aged 12-15 years, Barker & Galambos, 2003; Jones

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Thorbjorg, & Yoonsun, 2004; Smolak, Levine, & Thompson, 2001; aged 11-16 years, Paxton, Eisenberg, & Neumark-Sztainer, 2006), Swiss (aged 14-16 years, Knauss, Paxton, & Alsaker, 2007), and British (aged 11-18 years, Wardle & Marsland, 1990) adolescents as well.

Important factors in global self-concept arise from physical self-concept and identification with one's physical properties. It is a far from easy task to gain social acceptance and to arrive at a sound degree of self-acceptance even for adolescents who are attractive or nice, and a much more difficult one for those obviously farther away from the "average" or "norm" or the socially desirable one (Karkus & Bodzsar, 2009; Karkus, Nemeth, & Bodzsar, 2007; Kilpatrick, Ohannessian, & Bartholomew, 1999). In this case, accepting one's physical attributes and developing a positive self-concept may only be achieved by a rearrangement of values. In the more fortunate cases, this may involve a higher priority of mental abilities before physical ones. In the less fortunate ones, it may lead to a rejection of social norms.

Moreover, adult self-concept has its roots in pubertal development. Any perceived disharmony affects adult self-concept and sense of identity, and our emotional, cognitive, and social development. As a final conclusion, we can state that it would be very important to prevent pubertal overweight and obesity because these nutritional disorders are accompanied with severe somatic and health consequences both in adolescence and adulthood; also, the discrepancy between the ideal and actual self-concepts in adolescence may considerably influence not only the adolescent but also the adult mental health (Hay & Ashman, 2003; Strauss & Pollack, 2003).

Authors' Note

All authors contributed in the fieldworks, in the statistical analysis, and in the data interpretation of the presented study.

Declaration of Conflicting Interests

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