PHYSICAL SELF-CONCEPT, ANTHROPOMETRY AND BODY COMPOSITION IN PREADOLESCENTS

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ABSTRACT

The main aim of this study was to determine the relationship of morphologic features and body composition to physical self-concepts in boys and girls separately. This research included 630 children from north-eastern Slovenia, aged 9 to 11 years (M = 10.01; SD = .810), of which 311 were boys and 319 were girls. Morphologic features of the children were measured with the use of a standardized anthropometric instrumentation; the Maltron BF-907 Body Composition Analyzer was used for the measurement of body fat, fat-free mass, and body water proportions. The gender, age, and physical self-concept data were acquired through the French version of The Physical Self-Inventory – a short form questionnaire for determining the physical self-concept of adolescents, adapted to Slovenia. The relation between individual morphological features and physical self-concept was determined by regression analysis. Statistical significance was established at 0.05. The results show that the physical self-concept is more closely connected with body composition and morphologic features in boys than in girls, whereas the body fat proportion is the strongest predictor of physical self-concept in boys. The findings show that, particularly in boys, the physical self-concept is also largely based on the morphologic features and body composition. It is necessary to give special attention to boys, as we often think that boys are not as concerned with the physical appearance as girls.

Key words: physical self-concept, physical development, general self-concept, body measurements, body fat, pupils

TELESNA SAMOPODOBA, ANTROPOMETRIJA IN SESTAVA TELESA V PREDADOLESCENCI

IZVLEČEK

Namen raziskave je bil ugotoviti povezanost med morfološkimi značilnostmi, sestavo telesa in telesno samopodobo ločeno pri dečkih in deklicah. V raziskavi je sodelovalo 630 otrok iz severovzhodne Slovenije, starih od 9 do 11 let (M = 10.01; SD = .810, od tega je bilo 311 dečkov in 319 deklic. Morfološke značilnosti otrok so bile izmerjene z uporabo standardiziranega antropometričnega instrumentarija, za meritve deleža maščevja, brezmaščobne mase in vode pa je bil uporabljen analizator sestave telesa Maltron BF-907. Podatki o spolu, starosti in telesni samopodobi so bili pridobljeni s pomočjo poslovenjene različice francoske verzije vprašalnika za ugotavljanje telesne samopodobe mladostnikov The Physical Self-Inventory – short form. Za ugotavljanje povezanosti posameznih morfoloških značilnosti s telesno samopodobo je bila uporabljena regresijska analiza. Statistično značilnost smo ugotavljali na ravni tveganja 0,05. Rezultati kažejo, da je telesna samopodoba tesneje povezana s sestavo telesa in z morfološkimi značilnostmi pri dečkih kot pri deklicah, pri čemer na telesno samopodobo dečkov najbolj vpliva delež maščevja v telesu. Ugotovitve kažejo, da, predvsem pri dečkih, k predstavi o telesni samopodobi v veliki meri prispevajo tudi morfološke značilnosti in sestava telesa. Posebno pozornost je potrebno nameniti tudi dečkom, za katere nemalokrat menimo, da z zunanjim videzom niso tako obremenjeni kot deklice.

Ključne besede: *telesna samopodoba, telesni razvoj, splošna samopodoba, morfološke dimenzije, šolarji*

INTRODUCTION

Self-concept is a psychological phenomenon that the researchers have been scientifically addressing since the end of the 19th century. Self-concept is a cognitive representation of one's self that includes perception of self, the assessment of one's abilities, the positions and notions about facing life challenges, and the awareness of directing one's life (Brake, 2007) and is a sum of self-efficacy and self-esteem. The forming of self-concept represents one of the key developmental objectives of childhood and adolescence that runs from the state of relative generality and non-differentiation to the state of bigger complexity, segmentation and hierarchical regularity (Schaffer, 1996).

Shavelson, Hubner, and Stanton (1976) proposed the first complex theoretical model of self-concept. They defined self-concept as an individual's perception of self that is formed based on experiences and through interpretation of one's social environment and is under the influence of assessment by important others (Marsh, 2005). Shavelson, Hubner and Stanton (1976) anticipated that the self-concept construct is multidimensional and hierarchical. Multidimensionality means that there is no single self-concept

construct but that there are several different constructs for each individual (academic self-concept, social self-concept, emotional self-concept, and physical self-concept). Hierarchicalism of the model refers to its regularity that runs from the more abstract factors on the top to more specific ones at the bottom of the hierarchy.

Physical self-concept represents a mental image of one's own body that is formed in our minds (Schilder, 1999) and is not necessarily related to the actual physical appearance of an individual (Cash, 1997). In the past physical self-concept has often been neglected but today it is considered an important component of global self-concept and is frequently the subject of studies (Planinšec & Čagran, 2003).

Physical self-concept represents one's perceptions, thoughts, and feelings about one's own body and is greatly influenced by the morphologic features of the individual's body of which we are constantly aware. Individuals develop some kind of a relationship with themselves that influences their value assessment of self as a whole (Grogan, 1999). The perception relates to the assessment of morphologic features, thoughts relate to evaluation of physical attraction, and feelings relate to the shape and size of the body. On the basis of the Shavelson, Hubner, and Stanton's self-concept model (1976) where physical self-concept as one of the areas of non-academic self-concept consists of physical activities and physical appearance, Fox and Corbin (1989) developed a multidimensional hierarchical concept of the physical image of self. The only difference between their model and the one from 1976 is that instead of two sub-areas, physical self-concept now consists of four sub-areas: appearance, strength, endurance, and sports competences. Of all the areas of self-perception the physical self-concept seems the most elementary as it begins to form in the earliest childhood of an individual's life and is crucial for forming other elements of self-concept that develop later (Dolenc, 2007) and as such has a special place in the self-concept structure as the body is, through its appearance, abilities, and characteristics, an intermediary between an individual and the outside world (Fox, 1997). By growing up the self-concept of children becomes more and more structured and complex (Gonzales, Perez, Gonzales, & Garcia, 1997; Marsh, Craven, & Debus, 1998).

The modern way of life, which in developed countries means a mainly sedentary life style and less physical activity, has an important impact on the changes of people's morphologic features and body composition. If we add excessive and often also bad or unhealthy eating habits, nowadays the excessive body weight and obesity already seen in children is a logical consequence. Body weight, along with other morphologic features, affects the individual's physical appearance most visibly. Body weight relates in particular to health issues, however most people deem morphologic features more important in connection with physical appearance than health (Tomori, 1990). Of course we cannot equate appearance with physical self-concept, but we can draw a conclusion that with the changes of people's morphologic features their relation to these and also their physical and overall self-concept change as well. Previous studies dedicated a lot of attention to determining the effect of physical activity and physical ability on physical self-concept (Fridlund Duton, Schneider, Graham, & Cooper, 2006) and to determining the effect of physical activity, morphologic features, and body composition

on physical self-concept (Fox, 2000; Anderson, Murphy, Murtagh, & Nevill, 2006). In the adult female population, changes in morphologic features as a consequence of sport activities have a limited impact on changes of physical self-concept as the reason for improving physical self-concept is more likely to be found in the individual's expectation of physical progress (Anderson, Murphy, Murtagh, & Nevill, 2006). Fox's (2000) findings confirm that the individual's feeling that by exercising they improve their morphologic features and body composition is enough to improve their physical self-concept. Bailey, Goldbergh, Swap, Chomitz and Houser (1990) and Davis (1997) claim that there is a positive correlation between dissatisfaction with one's own body in women and body weight, proportion of body fat, and specific morphologic features such as the size of hips, buttocks and stomach. Garner, Olmstead and Polivy (1983) discuss that dissatisfaction with the abdomen greatly contributes to negative physical self-concept. To be able to define the relation between the changes of morphologic features due to physical activity and changes of physical self-concept more clearly the study would have to include more morphologic features and body composition measurements. Therefore, it seems reasonable to first study the relation of the morphologic features and body composition to physical self-concept independently of physical activity. The purpose of this research is to determine the connection between morphologic features and body composition and the physical self-concept of adolescents and which dimensions of morphologic features and body composition are the strongest predictor of the physical self-concept of girls and boys.

METHODS

Participants

The sample consisted of 630 children, aged from 9 to 11 years (M = 10.01, SD = .810). the participants were recruited from various primary schools of north-eastern Slovenia. Data were collected as a part of research project No. V5 ― 0232, examining the impact of certain socio-cultural factors on children's growth and physical fitness. During the assessment, the children were healthy and there were no other special conditions that might have impeded their physical activity. The parents or guardians provided the consent. The study was approved by the Institutional Review Board at the University of Maribor, Slovenia.

Measures

Anthropometric assessment. Morphologic features of children were measured with the use of standardized anthropometric instrumentation. Standing height was measured with Martin's anthropometer and was used, with an accuracy of 0.1 cm, with

shoes removed, feet together, and head in the Frankfort horizontal plane. Body mass was measured with a calibrated Seca Beam Balance 710, with an accuracy of 0.1 kg, with shoes, sweaters, coats, and jackets removed. Triceps skin fold was measured with Lange skinfold caliper calibrated to accuracy +/- 1mm. All correlation coefficients of anthropometric measurements are statistically significant ($p < 0,001$). In addition, all correlation coefficients of anthropometric and body composition measurements are statistically significant ($p < 0,001$). The results confirm intra and inter validity of morphological and body composition measurements.

Body composition assessment. For the measurement of body fat, fat-free mass and body water proportions the Maltron BF-907 Body Composition Analyzer was used. The measuring was carried out by skilled and verified measurers. All correlation coefficients of body composition measurements are statistically significant ($p < 0,001$).

Physical self-concept

The gender, age, and physical self-concept data were acquired through the adopted questionnaire for assessing physical self-concept of adolescents, The Physical Self-Inventory – short form (PSI-SF) (Maïano et al., 2008). This is a short version of the Fox and Corbin (1989) Physical Self-perception Profile, L'inventaire du Soi Physique questionnaire (Ninot, Deligniéres, & Fortes, 2000). Three statements together comprise one of the six dimensions of physical self-concept. The verifying of metric characteristics was not necessary as it had been done in the previous studies (Maïano et. al., 2008), however the high reliability of the Slovenian version of the questionnaire was additionally determined (Pepevnik, 2009). The Cronbach alpha coefficient ($\alpha = 0.824$) showed that the internal consistency is good. The questionnaire for assessing physical self-concepts of the adolescents comprised 18 questions in which children could express their agreement or disagreement with the statements relating to the specific areas of physical self-concept (physical abilities, physical appearance etc.) on a 6-point scale. The highest level of agreement was rated with a mark of 6 and the lowest level of agreement was a mark of 1, except in statements 3, 5, and 14 that were inversely scored. As it is presented in The Physical Self-Inventory – short form (PSI-SF) manuals (Maïano et al., 2008) the sum of all answers represents the physical self-concept score.

Procedure

The measurements were carried out in spring, always before noon in a specially prepared room. The entire testing of one child did not exceed one hour. All measurements were carried out by qualified experts. All children who participated in the study were given identification numbers. These numbers were used instead of names throughout

the assessment, both in assessment of morphologic features and later in the survey. This procedure ensured the anonymity of every participant in the study. First, the chief measurer explained the measuring procedure to the children and then the children were divided into groups for each measuring post. In the research morphologic features (body height [cm], body weight [kg], waist circumference [cm], triceps skin fold [mm]) and body composition (fat free mass [FFM%], fat mass [FM%] and total body water [TBW %]) were measured. Fat, fat-free mass and body water proportions were measured with the Maltron BF-907 Body Composition Analyzer. We placed two electrodes on the subject's palm and leg. We entered the data on body height, weight, and age of the subject into the analyzer and let a weak current (less than 280 μA) that the subject could not feel through the subject's body. This enabled us to calculate the bioelectric conductivity of tissues in order to gain the data on the body fat, fat-free mass, and water in the subject's body. The measurers brought all the necessary instruments as these are not part of the standard primary school equipment. The measurers entered the results of the measurements in the tables prepared in advance where instead of names the aforementioned identification numbers appeared. Children filled in the questionnaires on physical self-concept of adolescents before the measurements of morphologic features were conducted.

Data Analyses

Before data analyses the screening procedures tested assumptions for parametric tests (normality, linearity). The Kolmgorov-Smirnov test showed that the distributions of body weight, body mass index, waist circumference, triceps skin fold, and total body water variables values statistically significantly deviate from normal distribution, therefore normalization of data for these variables was performed. Pearson correlations examined the bivariate association between body composition and physical self-concept. The unique contributions of anthropometric and body composition measurements to physical self-concept were determined through multiple-regression analyses with body height, body weight, body mass index, triceps skin fold thickness, waist circumference, percentage of fat-free mass, percentage of fat mass, and percentage of total body water. Age was entered as a control variable. Separated regression analyses were performed for each gender. Statistical significance was set at an α level of 0.05. There were no missing values.

RESULTS

First we present the results of the analysis of connection, then the regression analysis and thereby the prediction of physical self-concept by morphologic features and body composition. Boys assessed their own physical self-concept in the range between 26 and 106 (M = 74.71, SD = 17.35) and the girls in the range between 28 and 107 (M

= 71.14, SD = 14.05). With both groups of subjects the values of standard deviations point to somewhat higher dispersion of the results.

Bivariate Relationship between Physical Self-Concept, Anthropometric Measurements and Body Composition Measurements

Table 1 shows bivariate correlations between morphologic features and body composition measurements and physical self-concept indicators. In boys, physical self-concept is in negative correlation with body fat proportion, triceps skin fold thickness, waist circumference, and body weight ($p < .001$) and in positive correlation with fat-free mass proportion and total body water ($p < .001$). In both boys and girls, there is no correlation between body height and physical self-concept. In girls, physical self-concept is negatively correlated to waist circumference and body weight ($p < .01$) and triceps skin fold thickness ($p < .05$), while fat-free mass, total body water and body fat are not correlated with physical self-concept.

Table 1: Bivariate Correlations among Physical Self-Concept, Anthropometric Measurements and Body Composition Measurements and Descriptive Statistics in Boys and Girls

		Mean (SD)		Physical Self- Concept	
		male	female	male	female
Anthropometric Measurements	body height (cm)	147.46 (7.88)	148.49 (9.12)	-.036	-.084
	body weight (kg)	44.16 (10.98)	43.19 (11.65)	-.297***	-.172**
	triceps skin fold thickness (mm)	13.78 (5.62)	13.55 (5.13)	-.373***	-.157*
	waist circumference (cm)	72.76 (11.20)	70.39 (10.23)	-.319***	-.187**
Body Composition Measurements	fat-free mass (%)	79.32 (9.06)	78.36 (7.42)	.351***	.108
	total body water (%)	58.20 (5.53)	57.83 (4.85)	.336***	.044
	Body fat (%)	20.40 (8.28)	21.63 (7.42)	-.436***	-.095

*$p < .05$, **$p < .01$, ***$p < .001$

Independent Prediction of Physical Self-Concept by Anthropometrics Measurements and Body Composition Measurement

The independent prediction of physical self-concept by anthropometrics measurements and body composition measurement was conducted with the use of multiple regression analysis. In Table 2 we can find standardized regression coefficients (β) and the overall coefficient of physical self-concept determination (adj.R^2), separately for boys and girls. The results show that morphologic features and body composition variables are not statistically significant predictors of the girls' physical self-concept; both account for only 1.5 % variance of physical self-concept ($R^2 = .015$). Therefore, the predicting power of these variables regarding physical self-concept is very small. In boys, morphologic features and body composition are statistically significant ($p < .001$) connected to their physical self-concept; which implies that 18 % of variance in physical self-concept ($R^2 = .180$) is explained by morphologic features and body composition. Table 2 shows that the results in physical self-concept of boys are explained with statistical significance only ($p < .01$) by the proportion of body weight. The regression coefficient (β = -0.401) shows that boys with a larger proportion of body fat have lower physical self-concept compared to peers with a lower proportion of body fat. Regression coefficients (β) are also high when there is a correlation between physical self-concept and body weight, waist circumference, and body height, but they are not statistically significant in any of these cases.

Table 2: Summary of Multiple Regression Analyses for Variables Predicting Physical Self-Concept

		Standardized Coefficients β		Overall adj. R2	
		male	female	male	female
Anthropometric Measurements	body height	0.159	-0.007		
	body weight	-0.267	-0.001		
	triceps skin fold thickness	-0.094	-0.033		
	waist circumference	0.171	-0.209		
Body Composition Measurements	fat-free mass	-0.010	-0.075	.180***	.015
	total body water	-0.055	-0.210		
	Body fat	-0.401**	-0.178		

DISCUSSION

This research finds that morphologic features and body composition are related to physical self-concept of older children whereas it is obvious that these correlations are stronger in boys than in girls. There is an extremely negative correlation between physical self-concept and all the measurements that determine the amount of body fat and body weight. The results of the regression analysis show that the body fat proportion is the strongest predictor of physical self-concept in boys, while in girls no morphologic feature or statistically significant body composition variable predicts the physical self-concept. The results are surprising since the adolescent spurt occurs earlier at girls than at boys. During the early part of the adolescence period, girls are taller and heavier than their male peers. Later on, as adolescent spurt occurs at males, they surpass the girls (Malina, Bouchard, & Bar-Or, 2004). It is interesting that in boys a statistically significant prediction of physical self-concept is shown only for the proportion of body fat which cannot always be determined merely by sight but requires a bioelectric analysis. On the other hand, body height, which is one of the most obvious morphologic features, is in no way related to physical self-concept. It should be emphasized that both the morphologic features and body composition were measured by reliable and valid instrumentation. The reliability and validity of the original questionnaire on the physical self-concept PSI-SF (Maïano et. al., 2008) were verified in advance as well as subsequently the Slovenised version of the questionnaire (Pepevnik, 2009). The results of the research show high statistically significant ($p < .001$) correlation between boys' physical self-concept and all the body composition measurements and triceps skin fold thickness and a somewhat lower ($p < .01$) but still statistically significant correlation between the physical self-concept and the morphologic features parameters (body weight and waist circumference). In girls, physical self-concept has a statistically significant ($p < .05$), but low correlation only with body weight and waist circumference, while there is no statistically significant correlation between the girls' physical self-concept and the body composition measurements. Apparently there is a higher correlation between the physical self-concept of boys, aged 10, and their morphologic features and body composition than in girls of same age. It is therefore shown that at the same age different factors predict the physical self-concept of boys and girls. Supposedly, this is caused by the differences in the timing of cognitive, emotional, social, physical, and movement development between boys and girls that is characteristic for this period. Children also form their perception of their bodies based on the experiences related to their bodies (Dolenc, 2008). The number of experiences related to the body rises with age and is subsequently reflected in the higher correlation of the abovementioned variables. At this age boys are more physically active than girls (Trost et. al., 2002; Riddoch et. al., 2004) and hence they connect physical self-concept more to the morphologic features. The findings of many researches confirm that both physical efficacy and physical activity are closely connected to the subjective assessment of physical self-concept (Fridlund Dunton et. al, 2006). Physical activity contributes to positive general physical self-concept provided it also contributes to improving the physical efficacy (Schneider,

Fridlund Dunton, & Cooper, 2008; Sonstroem, Harlow, Gemma, & Osborne, 1994). Our findings show that, particularly in boys, physical self-concept is also largely based on the morphologic features and body composition. The adolescence period that occurs around the age of 10 or 11 is the most critical period for physical self-concept (Grogan, 1999). This is the period of changes, self-awareness, and search of identity. Particularly in girls, the concern about their physical appearance is the result of physical changes that can draw them away from the slender ideal. The issues surrounding physical appearance and related morphologic features might not be very distinctive in the early adolescence but they progress with age. The findings confirm that the children at the end of late childhood are already aware of their body and its dimensions and that these are connected to their perception of themselves. The efficiency of different approaches for fostering positive physical self-concept depends in particular on parents, teachers and other people. One of the possible limitations of this study is the missing data about the biological age of children, since we can speculate that biologically pre-mature children evolve a more structured sense of self earlier than their biologically not so mature peers. In the future we should concentrate on longitudinal studies that investigate how changes in anthropometrics and body composition influence physical self-concept from early childhood to early adulthood.

CONCLUSIONS

Our research points out that the morphologic features also play an important role in explaining the physical self-concept in children. The problems arise when morphologic features become the source of negative feelings connected to the body. By ensuring a supportive environment that strengthens and fosters a child's self-concept, parents, teachers, and others can redirect the child's attention to the areas at which the child is adept, thereby diminishing the influence of physical appearance on the child's self-assessment and in this way help the child picture themselves more accurately. The results of our research also point out that it is necessary to give special attention to the boys as well, as we often think that boys are not as concerned with the physical appearance as girls.

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