

CORRELATION BETWEEN PARENT-CHILD BODY MASS INDEX (BMI)

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ABSTRACT

Improper physical development is influenced by both endogenous and exogenous factors. The family plays a very specific role, because it presents a potential of healthy physical development in terms of biological and social influence. The objective of the research was to find a relation between the body mass indexes (BMI) of parents and their children. The research sample involved pupils of the sixth (n=152) grade of elementary schools, second grade students of higher secondary schools (n=147) and their parents from three regions of Slovakia. The results of correlation analysis proved significant relations between parent-child BMI in all age groups, except for 12-year old girls, more significantly between parents and their sons. The results of multiple correlation analysis proved that the BMI variability in children is significantly determined by the variability of monitored parameters of both parents with certain sex-based differences, closer in sons ($p < 0.01$) than in daughters ($p < 0.05$).

Key words: BMI, parents, children, relation

INTRODUCTION

The process of individual's development, including his/her physical development, happens within the limits of heritability under particular environmental conditions. Its level is a result of factors not only endogenous, genetic and epigenetic factors but also social/cultural incentives. Changes in living conditions of the current generation of children and youth, with respect to their indisputable positives, result in many negative consequences. These include serious impacts of significant reduction of physical activity. The functions of movement in school physical education are difficult to be fulfilled, not only because of the time schedule but also by disinterest and low activity of children.

Moreover, the problem of insufficient physical activity of most children and youth is intensified by the character of spending leisure time, focused mainly on physically modest activities. A lack of physical stimulation is reflected in the reduced level of physical fitness and unfavourable physical development (MEDEKOVÁ – ŠELINGEROVÁ, 2004, ŠELINGEROVÁ – ŠELINGER, 2008).

One of the serious consequences of the deficit of motion is an increase of weight and increasing occurrence of child obesity (MAFFEIS et al., 1998, GORAN et al., 1999, PAŘIZKOVÁ, 2000, DOWDA, 2001, BOUCHARD et al., 2007 etc.) The research conclusions are consistent in views that physical activity is an effective preventative means for optimal physical development, psychic and social health in addition to adequate nutrition. Children with excessive weight are exposed not only to deprivation resulting from their physical appearance, but they are often confronted with refusing, lower acceptance, isolation or gibe that makes their socialisation with their mates difficult and significantly harms their mental health and quality of life (SCHWARTZ – PUHL, 2003). Excessive weight and obesity in childhood increase its probability in adulthood and at the same time significantly increase the risk of other serious health disorders (DIETZ, 1998). In this context, a question emerges of the influence of a family as a factor dominantly participating on the physical education of children, forming their positive attitude to movement and creating regular physical habits. This is confirmed also by our knowledge of positive relation between the levels of physical activity of parents and children (MEDEKOVÁ, 2000). Similar conclusions were presented by the authors (SIGMUND et al., 2008) who highlighted the potential of a family as a physical activity mediator – from parents to their children. The conclusions document a transfer to children with lower as well as higher level of physical activity. In this context, it should be mentioned that in spite of a certain agreement to the results concerning relations between the physical activity of parents and children, the issue of inter-generation continuity, transfer of sport activity to children, is more complex. Parents' behaviour (physical activity, nutritional habits and leisure activities) is largely reflected in their children's behaviour including physical activity. However, some information (HAINER et al., 1997, THORNBURN – PROIETTO, 2000, MEDEKOVÁ, 2000 etc.) point to biological determinants of physical activity and its hereditary background. Heritability of quantitative polygenic parameters, such as body height and weight, is supported by positive correlation between the relatives, most often assessed between parents and children.

In terms of our research topic, we considered as inspiring the research results (MAFFEIS et al., 1998) achieved by longitudinal monitoring of physical development of 8 to 12-year old children and their parents. They confirmed that BMI is a relatively stable parameter of the body composition. The evaluation of the relation between the parents' and their children's BMI, BMI was confirmed as a parameter, which is a significant predictor of BMI of children. There are similar results of a parent-child BMI monitoring (WHITAKER et al., 1997, LAKEA et al., 1997, STUNKARD et al., 1999), which suggest that parents' obesity assessed by BMI is a relevant predictor of children's obesity with a high risk of preservation in adulthood. The above information was used as a basis for our research.

The objective of the research was to ascertain the relation between the body mass indexes (BMIs) of parents and their children.

METHODS

The basic statistical characteristics of the samples are presented in Table 1. The sample involved pupils of the sixth grade of elementary schools, second-grade students of higher secondary schools and their parents from three regions of Slovakia. The body mass index (BMI) of parents and their children was calculated of basic somatic parameters (body height and weight) obtained by standard anthropometric measurements in children and by questionnaire in parents. Reference samples of children with average BMI values did not significantly differ from average BMI values of ordinary population of children of the same age (ROLNÝ et al., 2004). Children-parent BMI relation was assessed by partial correlation analysis. Multiple correlation was used for testing the relations between BMI values of children (dependent variable) and BMI values of both parents (independent variables). Significance of the relation was assessed on the level of $p < 0.01$ and $p < 0.05$.

Table 1 Basic statistical characteristics of parent and child BMI

6 th grade pupils of elementary schools	Boys (n = 128)			Girls (n = 124)		
	BMI 12-year olds	BMI-O	BMI-M	BMI 12-year olds	BMI-O	BMI-M
arithmetic mean	17.75	25.94	23.40	18.25	25.97	23.30
s	2.000	2.837	2.901	2.634	2.674	3.190
min	13.56	20.15	18.17	13.16	20.02	17.72
max	24.25	37.47	32.32	26.64	36.57	36.05

BMI – body mass index of children, BMI– O BMI–father, BMI–M BMI–mother

Higher secondary school students	Boys (n = 127)			Girls (n = 120)		
	BMI 16-year olds	BMI-O	BMI-M	BMI 16-year olds	BMI-O	BMI-M
arithmetic mean	20.82	26.31	24.44	20.27	26.80	24.15
s	2.651	2.566	3.380	2.292	2.815	3.436
min	15.92	21.46	17.99	15.53	20.06	18.59
max	30.64	34.16	35.16	32.47	35.51	35.94

RESULTS

The analysis of relations between the body mass indexes of parents and children shows their differentiated level in terms of age and sex (Tables 2 and 3).

The analysis of partial correlation coefficients points out closer relations between the parents and their sons. A certain relation to sex was proved. In the samples of boys, significant relations between the BMI of fathers and sons were found in all the assessed age groups, but with the BMI of mothers only in the sample of secondary-school students. BMI of daughters did not significantly correlate with BMI of their fathers. The assessed relations reached a significant level with BMI of mothers only in the sample of 16-year old girls.

Relations assessed from the aspect of multiple correlation allow showing the BMI proportion of the both parents in dispersion of the above parameters in their children. In the sample of younger pupils we found that BMI variability in children is significantly determined by the variability of the assessed parameter in both parents, with certain differences relating to the sex of children, closer in sons ($p < 0.01$) than in daughters ($p < 0.05$). Multiple correlation results in the group of 12-year old children and their parents confirmed some significant relations only in boys.

When comparing 12-year old pupils with 8-year old (Medeková, 2012) a lower percentage share of parents' BMI variability in sons' BMI dispersion was found. The unconfirmed relations between BMIs in the group of 12-year old girls can be considered a natural result of different process of changes in body height of pubescent girls. The multiple correlation analysis in the group of secondary-school students confirmed significant relations between parent-child BMIs in the both samples of boys and girls.

Table 2 Analysis of parent-son BMI relations

Index	12-years olds (n = 128)	16-years olds (n = 127)
BMI (arithmetic mean)	17.75	20.82
rk - Father	0.245**	0.267**
rk - Mother	0.130	0.217*
F - test	4.497*	7.349**
R ² *100	5.20	10.60
R - corr. coefficient	0.259*	0.325**

** $p < 0.01$; * $p < 0.05$

Legend: rk - father – father-son twin correlation coefficient
 rk - mother - mother-son twin correlation coefficient
 R - multiple correlation coefficient
 R²*100 – percentage determinant

Table 3 Analysis of parent-daughter BMI relations

Index	12-years olds (n = 124)	16-years olds (n = 120)
BMI (arithmetic mean)	18.25	20.27
rk - Father	0.121	0.020
rk - Mother	0.160	0.230*
F - test	2.080	3.417*
R ² *100	3.30	5.50
R *	0.182	0.235*

** $p < 0.01$; * $p < 0.05$

Legend: rk - father – father-daughter twin correlation coefficient
 rk - mother - mother-daughter twin correlation coefficient
 R* - multiple correlation coefficient
 R²*100 – percentage determinant

Dispersion of parent BMI values, expressed as a percentage determinant, can explain dispersion of the dependent variable – child BMI (Tables 2 and 3). In the sample of parents and daughters, lower ($p < 0.05$) determination of daughters' BMI to parent couples was found than in the sample of parents and sons ($p < 0.01$). The above results correspond with conclusions of WHITAKER et al. (1997) and MAFFEIS et al. (1998), who also confirmed that parent BMI can be considered as a significant parameter for predicting the child's BMI.

CONCLUSION

The results show differentiated relations between the parent-child BMI from the aspect of both age and sex. Regarding age, the closest relations were found in younger pupils. In terms of sex, relations that are more significant were found between fathers and sons, and between mothers and daughters.

We understand that the results are only of limited validity, narrowed by the fact that the assessed parameters result from synergism of endogenous and exogenous factors (physical activity of parents and children, health, sedentary behaviours, neighbourhood environments, nutrition factors etc.). In order to make that information more accurate, our further investigation will be focused on the assessment of relations in wider spectrum of independent variables.

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