DIFFERENCES IN MORPHOLOGICAL CHARACTERISTICS AMONG PRESCHOOL CHILDREN WITH REGARD TO THE INVOLVEMENT IN EXERCISE PROGRAMS AND CONNECTION TO THE PARENTS’ NUTRITIONAL CONDITION

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Abstract
The aim of this study is to determine the differences in anthropometric morphological characteristics between the experimental group, which is participating in the kinesiology program in kindergarten, and the control group, which is not participating, as well as to determine whether there are differences between boys and girls in the group. One of the aims is to determine the relationship between the morphological characteristics of children with indicators of the nutritional condition of their parents, and to determine whether there are differences between the parents whose children are involved in an additional sports program and those parents whose children are not. Based on the obtained results it can be determined that the studied preschool children differ significantly in the space of morphological characteristics with respect to age, gender and group. The total of the obtained results of the correlation between the morphological characteristics of children with nutritional condition of their parents indicates a significant influence of parents on their children's anthropometric characteristics. The obtained significant differences in fathers are observed in the body mass index and the obesity index (WHR) in favor of fathers whose children are involved in the sports program.

Key words: morphological characteristics, preschoolers, parents, differences, connection

Introduction
Physical activity is a prerequisite for the optimal growth and development of children (Canadian Pediatric Society, 2002), and has a great impact on the children's health (Biddle et al., 2004). Children who are physically active have better cognitive, psychological and socioemotional characteristics (Campbell, 2006; Parfitt, 2005) as opposed to those children who tend to lead a sedentary lifestyle and have the potential to develop chronic health problems in later life such as obesity, osteoporosis, diabetes and cardiovascular disease (Reilly, 2005). It is also shown that preschool children who are physically active have a lower share of body fat, higher levels of HDL cholesterol, a greater aerobic endurance, better motor competences and a greater attainment of motor skills (Parizkova, 2008).

Some authors point out the increasing number of obese children and that the amount of body fat may affect the participation in exercise programs. It is also the recommendation of many authors that obesity should be prevented from preschool age, i.e. before it occurs (Ogden et al. 2000; Phineas and Zietler 2000; Campbell et al., 2001; Canning et al., 2004; Spurrier et al., 2008). Involving children in sports programs and their level of activity depend on a series of factors such as current conditions and the equipment of kindergartens within which sports programs are implemented, personnel who conducts sports programs, as well as the attitudes and preferences of parents towards sports activities for children and their usual level of physical activities.

Some studies point to the differences in the physical activity of children on weekends and conclude that overweight and obese children are less physically active, and which can be connected to the family lifestyle (Planinšec and Matejek, 2004). Given all the above, the objective of this study is to determine the differences in the anthropometric morphological characteristics between the experimental group, which is participating in the kinesiology program in the kindergarten, and the control group, which is not, as well as to determine whether there are differences between boys and girls in the group. One of the problems is to determine the relationship between the morphological characteristics of children with indicators of the nutritional status of their parents, as well as to determine whether there are differences in the morphological characteristics among parents whose children are involved in additional sports programs and parents whose children are not.

Methods
Sample
The survey covered a total of 302 children. The sample consisted of children from kindergartens in the city of Rijeka, Croatia. During the test, all subjects were healthy. The experimental group consisted of 146 children aged 5 and 6 (49 girls and 97 boys) participating in the kinesiology program "Through play to sport" organized in the morning, during the stay of the children in the kindergarten, four times a week for 45 minutes (Pejčić 2003).
According to age, this group consisted of 66 five-year-olds (23 girls - 34.85 % and 43 boys - 65.15 %), and 80 six-year-olds (26 girls - 32.5 % and 54 boys - 67.5 %). The control group consisted of a total of 156 children aged 5 and 6 (81 girls and 75 boys), who attend the regular kindergarten program. According to age, this group consisted of 93 five-year-olds (42 girls - 45.16 % and 51 boys - 54.84 %) and 63 six-year-olds (39 girls - 61.9 % and 24 boys - 38.1 %) who attend the regular kindergarten program. A sample of parents of preschool children consisted of 109 female and 97 male parents (206 parents). Of the 109 mothers, 74 mothers were among the children in the control group and 35 in the experimental group. Of the 97 fathers, 64 fathers were in the control group and 33 in the experimental group. The average age of the parents was 35 years.

The sample of the variables

The sample of the variables measured in children makes 14 anthropometric measures (body mass - MASS, body height - H, leg length - LL, arm length - AL, elbow diameter - ED, fist diameter - HD, knee diameter - KD, arm girth - AG, thigh girth - TG, abdomen girth - AG, hip girth - HG, forearm skin fold - FSF, back skinfold - BSF, shin skinfold - SSF) measured by standard procedure under the International biological program (Weiner and Lourie, 1969; Mišigoj – Duraković, 2008). The sample of the variables for parents consists of four anthropometric measures: body height, body mass, waist girth and hip girth, and two derived measures (BMI and WHR index).

Methods of data processing

For the purposes of this study the basic descriptive parameters, two-factor multivariate analysis of the variance, t-test for independent samples and the Mann-Whitney U-test separately by subgroups according to group and gender, and the canonical correlation analysis were calculated.

Results

Based on the results of the two-factor analysis of the variance it may be determined that the studied preschool children differ significantly in the space of morphological characteristics with regard to gender, group and the interaction of the gender and the group (Table 1). The obtained results of the t-test for the independent samples for girls and boys in the control and experimental group, and the differences between the groups are shown in Table 2. In the control group the statistically significant differences were revealed between girls and boys between the ages of 5 and 6 for the knee diameter and the elbow diameter in favor of the bigger dimensions for boys while the girls had significantly larger dimensions than boys in measures of the leg length, arm girth, thigh girth, upper arm skin fold, back skin fold and calf skin fold. Similar differences in large mass measures and the body volume among boys and the larger skin fold among girls were obtained by some other authors (Bala and Katić, 2009).

In the experimental group, significant differences between boys and girls between the ages of 5 and 6 were revealed in the height, arm length, body mass, abdominal girth, and in all three diameters (diameter of the fists, elbows and knees) in favor of the larger dimensions among boys. Such results indicate that the boys participating in the sports program are significantly higher than girls of the same age, have a bigger mass and coarser skeleton, bigger dimensions and diameter. It is interesting to note that among boys and girls participating in the sports program there is no difference in the skin folds such as observed in the control group. With the age increase, girls and boys in the control group differ significantly in the amount of subcutaneous fat while the differences were not obtained in the experimental group. The results of the t-test between the girls’ control and experimental groups indicate that girls in the experimental group had significantly lower values of two skin folds (skin fold of the upper arm and lower leg) than the girls in the control group. These are precisely the dimensions sensitive to the effects of external factors. The obtained differences can be attributed to the impact of sports programs, i.e. that the girls in the experimental group have through regular physical exercise during the day and due to the participation in the kinesiology program reduced the subcutaneous adipose tissue as opposed to girls that are not included in the sports program. Similar results were obtained in the study (Trajkovski Višić et al., 2008). The results show differences between the two groups in measures sensitive to external effects, especially physical activities such as arm girth in boys and skin folds in girls. In girls who participate in the sports program, unlike the girls in the control group, the ratio of body fat and muscle is changed in a way that the skin folds are reduced and body weight is significantly increased with age.

Determining the degree of correlation of morphological characteristics of children with their parents’ nutritional status (anthropometric measures) was tested with the canonical correlation analysis separately for fathers and in particular for mothers. The total canonical correlation coefficient of morphological characteristics of children and their indexes with morphological features, i.e., with indicators of their mother’s nutritional status which is 0.64 and are statistically significantly associated (p = 0.007). The canonical correlation coefficient of the children’s morphological characteristics and their indexes with morphological features, i.e. indicators of the nutritional status of their fathers is 0.66, but not statistically significantly associated (p = 0.11) due to the smaller sample of male parents. The obtained results indicate a significant influence of parents on their children’s anthropometric characteristics. A significant relationship between the nutritional status and distribution of body fat in children and their mothers are in favor of the significant influence of the biological heritage, but probably of the habits that affect the definition of these indicators and which are created within the family (Bouchard and Perusse 1994).
Table 1. Two-factor multivariate analysis of the morphological characteristics variance for the factors gender, group and the interaction of the gender and the group

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
<th>F</th>
<th>Effect df</th>
<th>Error df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>Wilks</td>
<td>0.000098</td>
<td>207534.4</td>
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<tr>
<td>GENDER</td>
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<td>14.7</td>
<td>14</td>
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<td>14</td>
<td>285</td>
</tr>
<tr>
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<td>0.90112</td>
<td>2.2</td>
<td>14</td>
<td>285</td>
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</tbody>
</table>

(Value = result of the Wilks test, F = F-test result, Effect df = number of degrees of freedom for the effects, Error df = degree number of error freedom and p = level of significance).

Table 2. T-test between the genders and the groups in the control and the experimental group between the ages of 5 and 6 (XM ± SD = mean boys, XF ± SD = mean girls, t = t-test for independent samples, z = score Mann - Whitney U-test, p = level of significance).

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>GROUP</th>
<th>XM±SD</th>
<th>XF±SD</th>
<th>t or z*</th>
<th>p</th>
<th>t or z*</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTROL</td>
<td>115.5±6.05</td>
<td>116.6±6.11</td>
<td>1.192</td>
<td>0.235</td>
<td>-4.025</td>
<td>0.0001</td>
<td>-0.0695</td>
</tr>
<tr>
<td>EXPERIMENTAL</td>
<td>119.2±5.97</td>
<td>116.7±5.84</td>
<td>2.380</td>
<td>0.018</td>
<td>-2.866</td>
<td>0.0044</td>
<td>1.0409</td>
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<tr>
<td>GENDER</td>
<td>Wilks</td>
<td>0.580414</td>
<td>14.7</td>
<td>14</td>
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<td>0.000000</td>
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<td>GENDER*GROUP</td>
<td>Wilks</td>
<td>0.90112</td>
<td>2.2</td>
<td>14</td>
<td>285</td>
<td>0.006955</td>
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</tbody>
</table>

Table 3. Comparison of the differences of anthropometric indicators of the nutritional condition between parents of children in the control and experimental group

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>XCMSD</th>
<th>XESD</th>
<th>t or z*</th>
<th>p</th>
<th>NC</th>
<th>NE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEIGHT MOM</td>
<td>167.9±5.97</td>
<td>168.5±5.03</td>
<td>-0.56857</td>
<td>0.5708</td>
<td>74</td>
<td>35</td>
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<td>MASS MOM</td>
<td>67.6±12.047</td>
<td>67.0±10.679</td>
<td>0.24354</td>
<td>0.8081</td>
<td>64</td>
<td>33</td>
</tr>
<tr>
<td>BMI MOM</td>
<td>23.96±3.066</td>
<td>23.5±3.398</td>
<td>0.52293</td>
<td>0.6021</td>
<td>1149</td>
<td>33</td>
</tr>
<tr>
<td>STOMACH MOM</td>
<td>79.8±11.652</td>
<td>77.9±8.734</td>
<td>0.84366</td>
<td>0.4007</td>
<td>1149</td>
<td>33</td>
</tr>
<tr>
<td>HIPS MOM</td>
<td>97.4±6.118</td>
<td>100.4±6.651</td>
<td>-1.34719</td>
<td>0.1807</td>
<td>1149</td>
<td>33</td>
</tr>
<tr>
<td>WHR MAMA</td>
<td>0.819±0.128</td>
<td>0.775±0.102</td>
<td>0.72564</td>
<td>0.4767</td>
<td>1149</td>
<td>33</td>
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<tr>
<td>HEIGHT DAD</td>
<td>181.9±7.017</td>
<td>184.2±6.605</td>
<td>-1.3752</td>
<td>0.1712</td>
<td>1149</td>
<td>33</td>
</tr>
<tr>
<td>MASS DAD</td>
<td>91.8±13.391</td>
<td>89.2±11.406</td>
<td>0.96253</td>
<td>0.3382</td>
<td>1149</td>
<td>33</td>
</tr>
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<td>BMP DAD</td>
<td>27.6±2.972</td>
<td>26.2±2.558</td>
<td>2.37107</td>
<td>0.0197</td>
<td>1149</td>
<td>33</td>
</tr>
<tr>
<td>STOMACH DAD</td>
<td>97.2±12.048</td>
<td>94.4±9.494</td>
<td>1.16827</td>
<td>0.2468</td>
<td>1149</td>
<td>33</td>
</tr>
<tr>
<td>HIPS DAD</td>
<td>101.6±11.011</td>
<td>102.9±8.025</td>
<td>-0.64265</td>
<td>0.5219</td>
<td>1149</td>
<td>33</td>
</tr>
<tr>
<td>WHR DAD</td>
<td>0.960±0.089</td>
<td>0.982±0.068</td>
<td>2.38748</td>
<td>0.0189</td>
<td>1149</td>
<td>33</td>
</tr>
</tbody>
</table>

(XC ± SD = mean parents of children in the control group; XE ± SD = mean parents of children in the experimental group, N = number of subjects parents, t = t-test for independent samples, z score = Mann - Whitney U - test, p = significance level)

*Mann-Whitney U Test.
Comparison of differences in the indicators of the parents’ nutritional status whose children are involved in preschool sports programs and parents whose children are not included in the preschool sports programs is shown in Table 3. The results show slightly lower body weight, body mass index (BMI) and abdominal girth values in children whose mothers were included in the experimental sports program. The differences, however, are not significant. Obtained significant differences in fathers are observed in the body mass index-BMI (t-value = 2.37, p = 0.0197) and the index of the risk of obesity-type WHR (t-value = 2.38, p = 0.0189) in favor of those fathers whose children are involved in the sports programs. In other indicators (nutritional status lower values (body weight and abdominal girth) are observed among fathers of children involved in the preschool sports programs, but the differences are not significant. The smaller indices for fathers of children involved in the sports program are probably such because they care more about their body and health and they pass their way of thinking and lifestyle, from their childhood, to their children and, in addition, include them in sports programs from the preschool age.

Conclusion

We can conclude that the application of well-programmed kinesiology programs positively influence the individual morphological characteristics of preschool children and with the increase of the kinesiology content in a child’s daily life from the preschool age the likelihood that the child will accept physical activity and exercise as a permanent value is increased. Also, the results have shown that there is a connection between the morphological measurements of the parents and the morphological characteristics of their children.

Furthermore, parents of children from the control and experimental group differ in the variables of the body mass index (BMI) and the obesity index (WHR) among fathers in favor of better results of father of children from the experimental group.

References


RAZLIKE U MORFOLOŠKIM ZNAČAJKAMA KOD PREDSKOLSKOGE DJECE OBZIROM NA UKLJUČENOST U PROGRAME VJEŽBANJA I POVEZANOSTI S NUTRICINALNIM STANJEM NJIHOVIH RODITELJA

Sažetak
Cilj ovog rada je utvrditi razlike u antropometrijskim morfološkim karakteristikama između eksperimentalne grupe koja sudjeluje u kineziološkom programu unutar vrtića i kontrolne grupe koja ne sudjeluje, kao i utvrditi razlike između dječaka i djevojčica unutar grupe. Jedan od ciljeva rada je i utvrditi povezanost morfoloških obilježja djece s pokazateljima stanja uhranjenosti njihovih roditelja, kao i utvrditi postoje li razlike između roditelja čija su djeca uključena u dodatni sportski program i roditelja čija djeca nisu. Prema dobivenim rezultatima može se utvrditi da se ispitivana djeca predškolske dobi statistički značajno razlikuju u prostoru morfoloških obilježja s obzirom na dob, spol i grupu. Ukupno dobiveni rezultati povezanosti morfoloških obilježja djece sa statusom uhranjenosti njihovih roditelja ukazuju na značajan utjecaj roditelja na antropometrijska obilježja njihove djece. Dobivene značajne razlike kod očeva uočavaju se u indeksu tjelesne mase i indeksu rizičnosti tipa pretilosti u korist očeva čija su djeca uključena u sportski program.

Ključne riječi: morfološka obilježja, predškolci, roditelji, razlike, povezanost

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