Coordination Motor Abilities in Scientific Research

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DIFFERENCES IN SOME ANTHROPOLOGICAL CHARACTERISTICS BETWEEN BOYS ENGAGED IN MARTIAL ARTS AND BOYS NON-ATHLETES AGED 12

Mario Baić, Hrvoje Sertić, Ivan Segedi

INTRODUCTION

According to their definition, martial arts belong to group of poly-structural sporting activities in which dynamic and complex acyclic structures dominate, and in which direct contact and physical confrontation between two fighters take place. They are characterised by a large number of techniques and different variations in which it could be performed, and an infinite number of motions, which help to conduct tactical elements. Under the term «Martial Arts», in this work, we refer to judo and wrestling, whose athletes were tested for the needs of this research. For both sports events, demanding training sessions are peculiar, with the goal of developing motor and functional abilities and anthropometrical characteristics. For that reason we presume that the anthropological status of children in these sports is changing more than in the population of children, of the same age, who do not practice sport. With a battery of tests we tested motor abilities-coordination, strength, flexibility and functional abilities and anthropometrical characteristics.

Similar research has been done as part of this project on boys aged 11.

Cvetković, et al. (2004) compared boys wrestlers and boys non-athletes at the age of 11 in the same anthropological characteristics. Results showed that the wrestlers were better in all tests, and statistically important differences appeared in 4 of 11 tests (latitude of forearm, polygon backwards, trunk lifting, 6 minutes running).

Vračan, et al. (2004) compared the population of boys judokas and boys non-athletes in some anthropological characteristics. Judokas were better in almost all performed tests and statistically significant differences appeared in 4 of 11 tests (polygon backwards, lifting the trunk, forward arm stretch with legs apart, 6 minutes running).

Scientific research led to equations of specification for judo and wrestling. Sertić, et al. (2004) brings the equation of specification for judo in which strength, coordination, functional abilities, speed, flexibility and balance have a great influence. For the sport of wrestling, Marić et al. (2003) came to the conclusion that

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1 This paper is a part of scientific-research project “Observations of changes in anthropological status of children in wrestling sports” (code: 0034214), approved by Ministry of science and technology of the Republic of Croatia.
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the most important abilities are strength, endurance, speed, coordination and balance.

If we analyse this information, it is not unusual that the boys practicing Martial arts achieve better results in tests in which abilities that are most important for judo and wrestling are tested.

METHODS

The sample of participants included 224 boys aged 12.127 boys practiced Martial arts (67 – judo, 60 – wrestling), 97 boys didn’t participate in any organised sport, except for during physical education classes in school, conducted twice a week for 45 minutes.

Boys judokas had an average training tenure of 41.71 months, and along with physical education classes, they attended training sessions in their clubs 3.09 times a week on the average. Boys wrestlers had an average sporting tenure of 16.02 months, and average number of 3.13 training sessions per week.

Samples of participants were tested with a battery of 11 tests for evaluating anthropometrical characteristics (ATV-body height, ATT-body weight, AOP-width of forearm, ANN-wrinkle of upper arm), motor abilities; coordination (MPN-polygon backwards), flexibility (MPR-forward arm stretch with legs apart), power (MSD-long jump from standing position), speed of movement (MTR-tapping with hand), static force (MIV-hang time), relative strength (MPT-trunk lifting) and functional abilities (F6-6 minutes running). All tests were conducted in every day classes and are the best indicators of particular characteristics. They may be used during the whole process of pupil’s education. Tests are of a satisfactory standard as far as metric characteristics and for now they are best tests we have (Findak 1996). A detailed description of tests can be found in the book «Norms» (Findal et al. 1996)

The results were processed in the Statistica 6.1 program for Windows. Using descriptive statistics we obtained central and dispersed parameters for every item and every group. For testing differences between the two groups of participants, the t-test for independent samples was used.
RESULTS

Table 1. Descriptive statistics for the group of boys engaged in Martial Arts

<table>
<thead>
<tr>
<th>Test</th>
<th>Valid N</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Std.Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATV</td>
<td>122</td>
<td>157,4041</td>
<td>135</td>
<td>178,9</td>
<td>8,069516</td>
</tr>
<tr>
<td>ATT</td>
<td>122</td>
<td>49,01631</td>
<td>27,8</td>
<td>80</td>
<td>10,87377</td>
</tr>
<tr>
<td>AOP</td>
<td>127</td>
<td>22,63465</td>
<td>18</td>
<td>27,8</td>
<td>2,111998</td>
</tr>
<tr>
<td>ANN</td>
<td>127</td>
<td>12,81365</td>
<td>3,333333</td>
<td>44,33333</td>
<td>6,671645</td>
</tr>
<tr>
<td>MPN</td>
<td>126</td>
<td>12,25103</td>
<td>7</td>
<td>23,26</td>
<td>3,007484</td>
</tr>
<tr>
<td>MPR</td>
<td>127</td>
<td>52,11942</td>
<td>25,66667</td>
<td>72,5</td>
<td>9,83138</td>
</tr>
<tr>
<td>MSD</td>
<td>127</td>
<td>184,3924</td>
<td>126,3333</td>
<td>251,3333</td>
<td>20,32182</td>
</tr>
<tr>
<td>MTR</td>
<td>123</td>
<td>27,37263</td>
<td>11,66667</td>
<td>39,66667</td>
<td>6,196615</td>
</tr>
<tr>
<td>MIV</td>
<td>126</td>
<td>38,48032</td>
<td>0</td>
<td>131</td>
<td>26,61476</td>
</tr>
<tr>
<td>MPT60</td>
<td>127</td>
<td>42,68504</td>
<td>23</td>
<td>66</td>
<td>8,843167</td>
</tr>
<tr>
<td>F6</td>
<td>105</td>
<td>1169,429</td>
<td>834</td>
<td>1450</td>
<td>131,7129</td>
</tr>
</tbody>
</table>

Table 2. Descriptive statistics for the group of boys non-athletes

<table>
<thead>
<tr>
<th>Test</th>
<th>Valid N</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Std.Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATV</td>
<td>89</td>
<td>160,482</td>
<td>141,5</td>
<td>182</td>
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<tr>
<td>ATT</td>
<td>90</td>
<td>48,80444</td>
<td>27,9</td>
<td>79,2</td>
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<td>86</td>
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<td>17,1</td>
<td>26,6</td>
<td>2,030773</td>
</tr>
<tr>
<td>ANN</td>
<td>90</td>
<td>14,54444</td>
<td>4,666677</td>
<td>42,33333</td>
<td>8,47519</td>
</tr>
<tr>
<td>MPN</td>
<td>88</td>
<td>15,66386</td>
<td>8,61</td>
<td>58,01</td>
<td>6,001672</td>
</tr>
<tr>
<td>MPR</td>
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<td>46,52747</td>
<td>26,66677</td>
<td>77</td>
<td>9,076637</td>
</tr>
<tr>
<td>MSD</td>
<td>88</td>
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<td>95</td>
<td>231,66677</td>
<td>21,75252</td>
</tr>
<tr>
<td>MTR</td>
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<td>27,86364</td>
<td>10</td>
<td>36</td>
<td>3,834003</td>
</tr>
<tr>
<td>MIV</td>
<td>88</td>
<td>34,68545</td>
<td>0</td>
<td>103</td>
<td>24,07977</td>
</tr>
<tr>
<td>MPT60</td>
<td>87</td>
<td>36,08046</td>
<td>8</td>
<td>53</td>
<td>7,42281</td>
</tr>
<tr>
<td>F6</td>
<td>91</td>
<td>1110,604</td>
<td>675</td>
<td>1633</td>
<td>185,9814</td>
</tr>
</tbody>
</table>

Legend: Valid N-number of entities; Mean-arithmetic mean; Minimum-minimal value; Maximum-maximal value; Std.Dev. - standard deviation
Table 3. Results of the t-test for independent samples

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean M.A.</th>
<th>Mean N.S.</th>
<th>t-value</th>
<th>df</th>
<th>p-level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATV</td>
<td>157,404</td>
<td>160,482</td>
<td>-2.74367</td>
<td>209</td>
<td>0.006604</td>
</tr>
<tr>
<td>ATT</td>
<td>49,016</td>
<td>48,804</td>
<td>0.13952</td>
<td>210</td>
<td>0.889171</td>
</tr>
<tr>
<td>AOP</td>
<td>22,635</td>
<td>22,014</td>
<td>2.13720</td>
<td>211</td>
<td>0.033732</td>
</tr>
<tr>
<td>ANN</td>
<td>12,814</td>
<td>14,544</td>
<td>-1.68131</td>
<td>215</td>
<td>0.094155</td>
</tr>
<tr>
<td>MPN</td>
<td>12,251</td>
<td>15,664</td>
<td>-5.47741</td>
<td>212</td>
<td>0.000000</td>
</tr>
<tr>
<td>MPR</td>
<td>52,119</td>
<td>46,527</td>
<td>4.27494</td>
<td>216</td>
<td>0.000029</td>
</tr>
<tr>
<td>MSD</td>
<td>184,392</td>
<td>176,292</td>
<td>2.79208</td>
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<td>0.005713</td>
</tr>
<tr>
<td>MTR</td>
<td>27,373</td>
<td>27,864</td>
<td>-0.65836</td>
<td>209</td>
<td>0.511029</td>
</tr>
<tr>
<td>MIV</td>
<td>38,480</td>
<td>34,685</td>
<td>1.06683</td>
<td>212</td>
<td>0.287264</td>
</tr>
<tr>
<td>MPT</td>
<td>42,685</td>
<td>36,080</td>
<td>5.72022</td>
<td>212</td>
<td>0.000000</td>
</tr>
<tr>
<td>F6</td>
<td>1169,429</td>
<td>1110,604</td>
<td>2.57978</td>
<td>194</td>
<td>0.010626</td>
</tr>
</tbody>
</table>

Legend: Mean M.A. - arithmetic means for group of Martial Arts; Mean N.S. - arithmetic means for group of non-sportsmen; t-value - value of t-test; df - number of participants; p-level - level of importance, mistake with which is claimed that the difference is statistically important.

Table 4. Aritmetic means of the results of wrestlers and judokas

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean WR</th>
<th>Mean JU</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATV</td>
<td>157,240</td>
<td>157,563</td>
</tr>
<tr>
<td>ATT</td>
<td>48,458</td>
<td>49,540</td>
</tr>
<tr>
<td>AOP</td>
<td>22,445</td>
<td>22,804</td>
</tr>
<tr>
<td>ANN</td>
<td>13,522</td>
<td>12,179</td>
</tr>
<tr>
<td>MPN</td>
<td>12,336</td>
<td>12,176</td>
</tr>
<tr>
<td>MPR</td>
<td>49,025</td>
<td>54,891</td>
</tr>
<tr>
<td>MSD</td>
<td>183,397</td>
<td>185,284</td>
</tr>
<tr>
<td>MTR</td>
<td>29,449</td>
<td>25,458</td>
</tr>
<tr>
<td>MIV</td>
<td>43,650</td>
<td>33,781</td>
</tr>
<tr>
<td>MPT</td>
<td>39,517</td>
<td>45,522</td>
</tr>
<tr>
<td>F6</td>
<td>1166,702</td>
<td>1171,638</td>
</tr>
</tbody>
</table>

Legend: Mean WR - arithmetic mean of wrestlers, Mean JU - arithmetic mean of judokas

**DISCUSSION**

Results given from processing in Statistica program for Windows, with t-test for independent samples are shown in table 1. We can see that the boys from the group of Martial Arts gained better results in almost all tests from the battery. Statistically significant differences appeared in 7 from a total of 11 variables.

In variables which describe anthropometric characteristics there were statistically important differences in variables for body height (ATV) and width of forearm
(AOP). In the variable body height boys from the group of non-sportsmen had better results, and in the variable width of forearm (AOP) boys from the group of Martial Arts had better results. Body height is not conditioned by a training process, but by genetics so these results are not as interesting for this research, but from the variable forearm width we can conclude that these results are an outcome of an organised training process of Martial Arts where the strength of hands plays an important role in attaining positive results. Body weight has some higher values in the group of boys engaged in Martial Arts but in combination with results in test wrinkle of upper arm (ANN), which give insight into the quantity of body fat, where the group of non-athletes had worse results, we can conclude that with training we can lower our body fat and increased body weight is a product of muscle growth. If we compare judokas and wrestlers in variable width of forearm (AOP) given results show that judokas are better in this variable so they significantly influenced the total difference between these two groups and the group of non-athletes. Comparing the results of participants with norms for the Republic of Croatia we see that results of both groups are above average for this age.

Motor abilities are described by 6 variables. In the variable polygon backwards (MPN) which evaluates coordination of the whole body, the t-test indicates a statistically significant difference between these two groups of participants in favour of the group of boys practicing Martial Arts. Both groups of participants have results above average according to norms for Republic of Croatia for this age, and by comparing judokas and wrestlers we notice that wrestlers have better results, so they had a bigger influence on the total difference between boys practicing Martial Arts and boys non-athletes. From the hypothetic equation of specification of judo (Sertić, Lindi 2003) and wrestling (Marić, Bać, Aračić 2003) we noticed that this ability is very important for results in judo and wrestling (15%). So it is not surprising that the results from this test are second in amplitude from whole battery of tests. Flexibility is measured by a forward arm stretch with legs apart (MPR), in which boys non-athletes have worse results, but still within the average for boys in this age in Republic of Croatia. Hypothetical equations of specification of judo and wrestling give flexibility small part in creating the result. But nevertheless statistically important difference in benefit of group of martial arts has been measured in this test. From this result it is logical that judokas have better results in this variable and contributed more towards the total difference between the two compared groups. The tests long jump from standing position (MSD), hang time (MIV), trunk lifting (MPT) describe the motor ability component of strength and these abilities in particular: jumping power, static force, and relative repetitive strength. In all three tests boys from the group of Martial Arts had better results, and statistically important differences between the two tested groups were found in the long jump (MSD) and trunk lifting (MPT) variables. Strength in both sports has a dominant influence on results so this distribution of results is expected. Inside the group of boys from Martial Arts better results in the long jump and trunk lifting tests were
achieved by judokas, while wrestlers had better results in the hang time tests so they had a bigger influence on the total difference between the two tested groups in that area. According to norms for the Republic of Croatia, our participants attain average and above average results, and only in the hang time test did boys non-athletes attain under average results for boys of this age. In the variable tapping with hand (MTR) for evaluating the speed of movement frequency, boys non-athletes attained better results than boys practicing Martial Arts but that difference is not statistically important. The movements from this test are not characteristic for judo or wrestling because in judo and wrestling movements are mostly circular and in this test they are straight and lateral, so this can be the cause and explanation for inferiority in this test. According to norms for the Republic of Croatia both groups of participants have average results, and comparing judokas and wrestlers we can see a dominance of wrestlers in this test. The last test was running for 6 minutes (F6), for evaluation of functional abilities. Results for the non-athletes are below average for the Republic of Croatia at this age. The t-test determined a statistically important difference between the two groups of participants analysed in this test. Functional abilities, as one of the important factors for success in all sports, are developed only during a long-term and organized training process so these results are not unusual.

The training process is a long-term process of developing physical, psychological, technical and tactical capacities of an athlete which is reflected in improvement and stabilisation of competitive results (Vittori 1984, according to Milanović 1997). The training process has a positive affect on an athlete. By testing the difference between boys athletes and non-athletes of the age of 12 we proved that the former (in this case boys from the Martial Arts) are, even at this age, dominant in almost every ability compared to boys non-athletes of the same age who develop their anthropological status only in physical education classes, two times a week for 45 minutes. It had already been proved (Sertić et al. 1997, Vračan et al. 2004), and now it has been confirmed that exercising twice a week do not bring any improvement in the anthropological status of children. Children athletes even at this young age are starting to develop faster and in a more positive way than children non-athletes of the same age. Practicing Martial Arts has proven to be beneficial for developing all abilities and characteristics of a person’s anthropological status.

REFERENCES
