The correlation of cardiac changes with motor performance and physical characteristics in young swimmers
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INTRODUCTION: Previous echocardiographic studies in adult athletes have demonstrated that long lasting regular physical exercise is associated with hemodynamic alterations that cause structural changes in heart (1, 2). The cardiac adaptation of prepubertal athletes to regular exercise is not studied extensively. We aim to determine the cardiac changes in male prepubertal swimmers by using standard echocardiographic parameters and the tissue Doppler imaging. We also aim to examine the correlations between these echocardiographic parameters and motor performance and physical characteristics.

MATERIALS AND METHODS: 14 male prepubertal swimmers who had been training for 2-3 years, 5 days/week and 9 age-matched boys, not participating in regular sportive activities comprised our study group. The motor performance was evaluated with surgent jump and PVC170 tests. Handgrip and leg dynamometer were used to assess the force measurements. Skinfold thickness, bone width and muscle circumference measurements were taken to determine body composition and somatotype. These parameters were assessed at the Marmara University School of Physical Education and Sport Research Center.

Any cardiac or systemic pathology was ruled out by detailed history and physical examination. Echocardiographic examinations were done at Marmara University Pediatric Cardiology Department with Philips EnVisor C Version B.0 echocardiography machine, using 3.5MHz transducer. Left ventricular dimensions and systolic function were examined with M-Mode, transmitral flow velocities and durations were measured with CW Doppler, and tissue Doppler velocities and durations were measured with PW tissue Doppler echocardiography. The regional velocities of the lateral mitral annulus in four-chamber position, left ventricular posterolateral wall and midseptum in long-axis position were examined.

RESULTS AND DISCUSSION:

<table>
<thead>
<tr>
<th></th>
<th>Age (year)</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>BMI (kg/m²)</th>
<th>Fat%</th>
<th>Endo morph</th>
<th>Meso morph</th>
<th>Ecto morph</th>
<th>Surgent jump (cm)</th>
<th>Hand grip (kp)</th>
<th>Leg Dyn. (kp)</th>
<th>PVC170 (watt/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swim. n = 14</td>
<td>11.2 (0.8)</td>
<td>148 (6.5)</td>
<td>39.7 (3.9)</td>
<td>18.1 (1.5)</td>
<td>12.2 (2.8)</td>
<td>3.1 (1.2)</td>
<td>3.8 (1.2)</td>
<td>3.6 (1.1)</td>
<td>41.9 (6.2)</td>
<td>19.7 (4.1)</td>
<td>84.5 (28.2)</td>
<td>2.76 (0.58)</td>
</tr>
<tr>
<td>Contr. n = 9</td>
<td>11.1 (0.9)</td>
<td>148.3 (6.5)</td>
<td>41.5 (8.1)</td>
<td>18.8 (3.1)</td>
<td>15.9 (6)</td>
<td>4.7 (2.5)</td>
<td>4.2 (1.1)</td>
<td>3.0 (1.8)</td>
<td>35.5 (6.5)</td>
<td>20.5 (4.5)</td>
<td>75.3 (24.4)</td>
<td>1.73 (0.58)</td>
</tr>
</tbody>
</table>

Mean (SD)
Table 1: Comparison of swimmers with control group for all parameters.

The age, height and weight of the children in both groups were similar (p>0.05). Among the echocardiographic measurements, interventricular septum (IVS) thickness, left ventricular posterior wall thickness (LVPW), left ventricular mass and relative wall thickness were increased in swimmers (p<0.05). All the tissue Doppler measurements were similar in both groups except the septal isovolumic relaxation time (IVR), which was increased in swimmers (p<0.05). The PVC170 measurements of swimmers were significantly increased in swimmers (p<0.05) whereas the handgrip, leg power and explosive power were similar in both groups (p>0.05). PVC170 test results were positively correlated to LVPW thickness, LV mass, and septal IVR (p<0.05). LV mass, stroke volume and septal IVR were also positively correlated to surgent jump (p<0.05).

CONCLUSION: Swimming, which is a dynamic sport, increased aerobic capacity in this study population. It also augmented the LVPW and IVS thickness without a significant change in the left ventricular diastolic diameter. Among tissue Doppler parameters only the septal IVR was prolonged in swimmers. These measurements were also correlated to PVC170, which is a parameter of cardiovascular endurance. Long-term follow-up of prepubertal athletes and their comparison with adult athletes will help explain the cardiac adaptation of children to exercise.

REFERENCES: