Physiological Effects of Multimodal Postural Training In Trampoline Gymnasts’ Training Program

Albina Andreeva

Abstract

Based on results we can conclude that despite of high content of balance exercises in high-volume multimodal training (9 weeks), it doesn`t lead to positive adaptive shifts in movement control system, it just evaluates athletes’ general work capacity and optimizes body composition. On the contrary, intensive training protocol (6 weeks) leads to significant improvement of dynamic balance even in high-level athletes. Further investigations will be aimed at optimization of the postural multimodal training protocols considering athletes’ level, age, specialization etc. Future studies should also analyze individual adaptive shifts in sportsmen after postural training of different intensity and type.

Albina Andreeva; Moscow Centre of Advanced Sport Technologies; Moscow, Russian Federation.

Keywords: balance, postural training, athletes, trampoline, multimodal program.

Correspondence: Albina Andreeva; Sovietskoy Armii Street 6, Moscow, Russia

E-mail address: moymio@yandex.ru

Introduction

Nowadays postural training protocols, which are applied in practice and rehabilitation, are widely used by coaches and doctors in athletes’ training systems.1-8 Specialists highlight such kinds of training programs as multimodal, proprioceptive, strength and exergame programs which provide biofeedback.9-11 In general, multimodal training program include balance, flexibility, endurance, strength and plyometric exercises.12-14 It is shown that application of multimodal training program reduced risk of falling and significantly improved dynamic balance in elderly people.15-19 Can coaches expect similar effects in athletes?

Background

Many authors point out that postural training programs as well as core-training programs are still poorly developed. Postural training protocols differ considerably in terms of its intensity and content.8, 20-22 Literature proposes several common protocols ranging from 1-hour training sessions twice a week (during 4 weeks) to 2-hour sessions 3 times a week (during 9 weeks).9 In such protocols multimodal sets of exercises are commonly included as well as highly intense balance training with biofeedback, for instance, 10 sessions (each lasting 10 minutes) per day once a month for 7 months. Hence, we can differentiate between high-volume and intense training programs.11

In trampolining practice, as well as in all gymnastic family of sports, where postural training might be of a great relevance, micro cycles are widespread. Coaches try to develop explosive power and coordination skills, which also include balance,7,9,22 in athletes simultaneously in such micro cycles. Based on complexity and inconsistency of current postural training model, we suppose that it`s quite relevant to work out more precise and consistent one. The objective of our study is to determine physiological effects of high-volume and intensive multimodal postural training in trampoline athletes.

Methods and Experimental Protocol.

Stabilography («Stabilan-01-2», 50 Hz), vertical jump test (squat jump (SJ) and countermovement jump (CMJ) on force platform «AMTI», 1000 Hz), PWC170 (two 5-minutes loadings), body composition analysis (ABS «Medass», bioimpedans) were used to evaluate 10 trained athletes’ performance. Experimental group of 6 athletes (EG, n = 6) was tested before and after high-volume and intensive training, control group (CG, n = 4) was tested before and after high-volume training only. Experiment
was carried out from February to August 2016. There were 2 courses of both types of training programs with 4-week break between them. Multimodal postural training program included exercises on BOSU, motile kinesio platform «iMoove», fitball, exergame programs (Figure1). Aerobic and plyometric training were also included in the protocol. Aerobic training consisted of cycling and swimming. Legs power work out included plyometric exercises (drop jump, skipping rope) as well as conventional exercises for developing power such as box jump, sprints, countermovement jump and etc.

High-volume training lasted for 9 weeks and was performed twice a week, 1.5 hours long; intensive training lasted for 6 weeks, 5 times a week, 2.5 hours long.

Results
According to ANOVA analysis, high-volume multimodal postural training led to reduction of fat content ($F = 7.7; P < .01$), and to enhancement of general fitness parameters, i.e. power output ($F = 7.4, P < .01$; $PWC_{170}$), absolute ($F = 7.7, P < .01$) and relative ($F = 12.2, P < .002$) values in both groups. Stabilographic signal analysis and vertical jump test showed no significant differences. Student’s $t$-test for linked samples (carried out only in EG) revealed significant differences ($P < .01$) in sagittal linear speed parameter during stance on unstable support – speed lowered from 57.5 (15.5) to 34.2 (2.7) mm/sec (Table 1). We need to mention that individual variability of adaptive shifts in EG due to intensive multimodal postural training should be taken into account during planning of postural training program and training process in general (Table 1).

Discussion
Based on results we can conclude that despite of high content of balance exercises in high-volume multimodal training (9 weeks), it doesn’t lead to positive adaptive shifts in movement control system, it just evaluates athletes’ general work capacity and optimizes body composition. On the contrary, intensive training protocol (6 weeks) leads to significant improvement of dynamic balance even in high-level athletes. Further investigations will be aimed at optimization of the postural multimodal training protocols considering athletes’ level, age, specialization etc. Future studies should also analyze individual adaptive shifts in sportsmen after postural training of different intensity and type.

References

Table 1. Results of Student’s $t$ test analysis in experimental group.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mean value, standard deviation</th>
<th>$P$ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body length, cm</td>
<td>153.60 ± 7.66</td>
<td>.75</td>
</tr>
<tr>
<td>Body weight, kg</td>
<td>43.98 ± 4.77</td>
<td>.98</td>
</tr>
<tr>
<td>Fat content, %</td>
<td>20.93 ± 2.71</td>
<td>.69</td>
</tr>
<tr>
<td>Muscle content, %</td>
<td>43.23 ± 4.61</td>
<td>.64</td>
</tr>
<tr>
<td>SJ height, m</td>
<td>.22 ± .04</td>
<td>.64</td>
</tr>
<tr>
<td>CMJ height, m</td>
<td>.24 ± .03</td>
<td>.23</td>
</tr>
<tr>
<td>CMJ/SJ</td>
<td>1.07 ± .07</td>
<td>.20</td>
</tr>
<tr>
<td>COP area (eyes open), mm$^2$</td>
<td>171.50 ± 45.99</td>
<td>.21</td>
</tr>
<tr>
<td>COP speed (eyes open), mm/sec</td>
<td>8.63 ± .48</td>
<td>.46</td>
</tr>
<tr>
<td>COP area (eyes closed), mm$^2$</td>
<td>212.50 ± 40.12</td>
<td>.46</td>
</tr>
<tr>
<td>COP speed (eyes closed), mm/sec</td>
<td>11.75 ± 1.71</td>
<td>.35</td>
</tr>
<tr>
<td>Romberg Coefficient, %</td>
<td>132.50 ± 61.46</td>
<td>.92</td>
</tr>
<tr>
<td>Balance quality function, %</td>
<td>74.00 ± 1.41</td>
<td>.91</td>
</tr>
<tr>
<td>Oscillation spread, mm$^2$</td>
<td>13.50 ± 1.29</td>
<td>.01</td>
</tr>
<tr>
<td>Speed (sagittal), mm/sec$^2$</td>
<td>57.50 ± 15.55</td>
<td>.03</td>
</tr>
<tr>
<td>$PWC_{170}$, W</td>
<td>102.25 ± 6.34</td>
<td>.16</td>
</tr>
<tr>
<td>$PWC_{170}$, W/kg</td>
<td>626.50 ± 37.81</td>
<td>.16</td>
</tr>
</tbody>
</table>

*significant differences ($P < .05$)

Abbreviation: COP, centre of pressure.


