

EFFECTS OF CONDITIONING PROGRAMME ON THE CHANGES OF MOTOR PERFORMANCE IN YOUTH CATEGORIES IN HANDBALL

Silvia Priklerová

Faculty of Physical Education and Sport, Comenius University, Slovakia

Summary: The ability to perform the stable playing performance during the whole match to larger extent depends on sufficient level of development of conditioning abilities. Technique of playing activities of an individual, decision-making process of players and especially speed of the game are influenced by already mentioned abilities. The aim of our study was to recognize the level of motor performance in regional centres of handball and at the same time to verify the efficiency of sports preparation. This programme includes the change of weekly microcycle practice, consisting of 2 conditioning trainings focused on strength and endurance. The research was realized in these age categories: younger (n=40) and older juniors (n=38). To evaluate the level of motor abilities we selected 5 simply performed activities: bench press (explosive strength of upper extremities), run for 8x5 metres (speed with change of direction), sit-ups for 2 minutes (power of abdominal muscles), standing long jump with legs together (explosive strength of lower extremities) and 12 minutes run (aerobic endurance). When following microcycle programme weekly, the results of motor test pointed out the positive influence of this programme on the development of strength and aerobic endurance ($p \leq 0.05$). In category of older juniors the performance in test of 12 minutes run has fallen significantly in comparison with the first testing ($p \leq 0.05$). The result of this study indicates the lack of recommended aerobic running practice in weekly microcycles of monitored teams.

Key words: handball, training level, strength abilities, endurance

Introduction

We can characterize handball as a power speed collective sports. Among determining conditioning abilities we rank strength, speed, speed and strength abilities and special endurance. The movements in handball are characterized by short accelerations (from 0 – 3 metres), by frequent change of movement direction, sprints (in range of 10 – 30 metres depending on player's function (Michalsik et al. 2011; Povoas et al. 2012). 1 – 3 % from total playing time are ascribed just to sprints or quick direction changes.

Massuca et al. (2014), Hermassi et al. (2016), Wagner et al. (2014) point out to their physical exactingness as well. Except for technical and tactical skilfulnesses the antropometric characteristics and high level of strength abilities are important factors which influence the successfulness in top handball (Gorostiaga et al. 2005; Rannou et al. 2001). Loftin et al. (1996) affirms that the 90 % of released energy during 60-minute match must be powered by aerobic way the running performance of player is about 4 – 6 km at middle intensity at 80 – 90 % of maximum heart frequency. Sporiš et al (2010) indicate following indicators of maximum oxygen consumption of Croatian players of top level: goalkeeper ($53.4 \pm 1.2 \text{ ml.kg}^{-1}.\text{min}^{-1}$), wing ($56.0 \pm 3.1 \text{ ml.kg}^{-1}.\text{min}^{-1}$), back ($53.7 \pm 5.2 \text{ ml.kg}^{-1}.\text{min}^{-1}$) and pivot player ($50.8 \pm 0.5 \text{ ml.kg}^{-1}.\text{min}^{-1}$). Platen (2009) in his research from top event of men presents the spans of VO_2max from 49 – 58 $\text{ml.kg}^{-1} \text{ min}^{-1}$ (wing 57.5 $\text{ml.kg}^{-1}.\text{min}^{-1}$, back 53.4 $\text{ml.kg}^{-1}.\text{min}^{-1}$, pivot player 49.4 $\text{ml.kg}^{-1}.\text{min}^{-1}$, goalkeeper 50.3 $\text{ml.kg}^{-1}.\text{min}^{-1}$). At comparison of more studies which measured VO_2max in running tests (Buchheit et al. 2009; Michalsik et al 2011b; Rannou et al. 2001) it was found-out that VO_2max in top handball players is fluctuated between 55 and 60 $\text{ml.kg}^{-1}.\text{min}^{-1}$).

According to Donnelly et al. (2009) aerobic and strength training do not serve only for an increase of level of training state they are important like prevention against injuries they enable to perform daily physical activities without problems. The strength training is performed for increasing the hypertrophy, development of maximum strength and performance which are necessary to implementation of playing activities like shooting, feint activity, screening, quick direction changes at physical confrontation with opponent (Michalsik et al. 2014; Michalsik & Aagaard 2015). The aerobic training serves for increase of level of aerobic performance which is important for maintenance of high intensity during the whole match 2 x 30 minutes. A low level of training state influences negatively the playing performance.

More authors dealt with problems of strength abilities in handball. Gorostiaga et al. (2005) examined strength abilities of Spanish top and amateur players and he found-out that elite players have in bench-press by 22 % higher one-time maximum (1RMBP), higher average performance of upper extremities by 20 % and of low extremities by 16 % higher than the amateur ones. Also this research confirmed that the players at the top level must have the strength abilities at higher level than current players. The players utilize the power/strength at all offensive and defensive activities because the occurrence of contact with opponent in handball is very frequent. In several studies (Chelly et al. 2010; Debanne & Laffaye 2011; Granados et al. 2007; Marques et al. 2007) recorded the positive influence of strength for example on speed of ball flight. Gorostiaga et al. (2005) indicate that the higher values of maximum strength and muscle strength provide a clear advantage for maintaining of muscle contractions during the entire match. The strength training and weight training are important for improvement of performance in handball.

Methodology

The aim of our study is to know the level of motor performance in regional centres of handball. The research team was formed by players of Regional Centres of Handball: younger juniors (n = 40, average body height 186 ± 6.4 cm, sports practice 9 ± 3 years), older juniors (n = 38, average body height 170 ± 6.9 cm, sports practice 7 ± 2 years). Every subject was informed about the scope of the research prior to the testing procedure and gave a written consent to participate in the study.

Reference players are ranked into newly-emerged Regional Centres of Handball which started their efficacy on July, 2017 and they manage sports training in category of youth according to unified methodology with accent on conditioning preparation and individual technique. Based on this requirement of Slovak Union of Handball the weekly microcycle of teams has been regulated according to possibilities of training with engagement of two conditioning strength training in weight training room (60') and of two running trainings focused on development of aerobic endurance (30'). In weekly microcycle the load presented 840 minutes + 90 minutes was a match. From point of view of content the conditioning training creates 210 minutes, the individual technique 180 minutes and the team training forms 450 minutes. The total volume of strength training was 1 800 minutes during the period under consideration volume of running training was 900 minutes.

For verification of the efficacy of programme but also of activities of centres test battery has been created, which consists of 5 easily implementable tests of general motor performance: bench-press, run for 8 x 5 metres, standing long jump with legs together, sit-up for 2 minutes and 12-minute run. Within the year training cycle 3 stages of testing have been planned: October 2017, February 2018 and June 2018. In the contribution we analyze running results from the first and second testing. Before the first testing check tests have been implemented for verification of test reliability.

Individual teams recorded the content of sports training in computer programme Matchmeeting. Among other things the programme serves also for check of fulfilment of the fixed weekly microcycles. For evaluation of obtained data we used basic mathematical and statistical characteristics, parametric paired T test for dependent samplings and Wilcoxon's T test. We selected the significance level $\alpha = 0.05$ for all statistical testings.

Results and discussion

We indicate the gained results from particular tests of motor performance ability of both reference age categories of players in Table 1 and 2.

Table 1
Results of testing motor performance ability of older juniors

	Bench press (kg)	Agility (s)	Sit-up (n)	Jump, legs tog. (cm)	12-min run (m)
October 2017	71±13	10,28±0,52	69±14	235±15	2763±320
February 2018	76±14	9,7±0,48	74±13	240±19	2660±326
T test	p=0.0001 p≤0.05	p=0.22628 p≥0.05	p=0.000152 p≤0.05	p=0.015484 p≤0.05	z=3.7459 p≤0.05

Table 2
Results of testing performance ability of younger juniors

	Bench press (kg)	Agility (s)	Sit-up (n)	Jump, legs tog. (cm)	12-min run (m)
October 2017	65±15	10,39±0,70	70±12	224±19	2690±241
February 2018	70±13	10,12±0,54	72±11	229±21	2744±257
T test	p=0.001697 p≤0.05	p=0,044378 p≤0.05	p=0.01714 p≤0.05	p=0.040941 p≤0.05	p=0.033488 p≤0.05

Average results of tests of motor performance ability of reference players in both age categories were behind requirements of play and claims to players of top level also after verification of training state in the middle of year cycle of sports preparation. In spite of low level of training state the reference teams belong to the best ones in their age category because the level of training state is very weak in area of conditioning preparation in young competitor's categories. We can see from gained data that the players became better by application of strength programme in tests focused on evaluation of strength abilities ($p \leq 0.05$). We can watch improvement tendency also in test in run for 8 x 5 metres where it came also to improvement in average by 0.58 s. In aerobic endurance we recorded an improvement only in category of juniors which achieved 2 744 metres in average. At its conversion on VO_2 max (Eurofit 2002) it is $49 \text{ ml.kg}^{-1}.\text{min}^{-1}$. The improved performance in 12-minute run attacks the lower limit of maximum oxygen consumption in which the handball player should fluctuate at top level. In category of older juniors it came to significant worsening, however, what we cannot ascribe to inefficiency of proposed programme, to microcycle respectively, but to its nonobservance in this age category. The average performance in test was also behind performance of younger juniors. On the basis of check of content of training units the proposed aerobic trainings were absent in some teams what influenced also average values of test. At comparison of results of motor abilities with players of junior's age (age average of 17.6 years) from 1985 (Slovík & Havlíček 1985) there is considerable difference especially in test of 12-minutes run 33 years ago the tested players made 2 993 metres in this time what is by 333 metres more than the performance in test of older juniors in the present day. The performance has been better only in the test of sit-up in the present day (1985 – 69, 2017 – 74). We can confirm also in factor of explosive strength of lower extremities in test of standing long jump that today's players are behind (1985 – 248.3 cm) and now the average performance of reference players fluctuates between 230 and 240 cm.

This negative phenomenon is characteristic not only for clubs but also for national teams which at multimatch loading “die” gradually. Determination of player's performance by motor abilities fluctuates within 35 – 68 % (Slovík & Havlíček 1985).

Conclusion

The results of this work confirm the low level of training state of players of junior's age categories according to present day requirements but also when comparing them with the data achieved the past. For this reason it is necessary to continue in set trend and give

conditioning training programme sufficient period of time in weekly microcycle of handball players. Concerning the possibility for clubs in Slovakia to include the strength and running practice in their training programme is: before the handball training or as a part of preparatory/final section of a training unit. To maintain and increase the training state we recommend: during competition period to include running practice in range of 2 times weekly by 30 minutes . It is necessary to implement the strength training in weight training centres in range of 2 times by 60 minutes weekly, During this training we recommend to practice exercises with complementary load, and basic weightlifting techniques as well. For the future we would recommend to complete the testing barrier by specialized tests, or to use diagnostics of aerobic endurance by Beep test which corresponds more with structure of handball player's loading.

This work is a part of research task VEGA 1/0529/16: Effectiveness of sports preparation of club and national basketball teams depending on age and gender.

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