CHANGES IN SPECIFIC TRAINING AD SPORT PERFORMANCE OF 13-14 YEAR OLD ATHLETES IN RHYTHMIC GYMNASTICS

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Abstract

This study is focused on specific training and sport performance of 13-14 year old athletes in rhythmic gymnastics and establishment of the level of impact of rhythmic gymnasts' training model indices on their sport performance.

Аннотация

Эта статья посвящена изучению специфики тренировки и спортивных выступлений по художественной гимнастике спортсменов 13-14 лет и определению уровня влияния показателей модели тренировки по художественной гимнастике на спортивные достижения гимнастов.

Introduction. The efficacy of athlete's sport performance depends on the targeted training in certain periods, organization, management, individual adaptation of an athlete to the loads of training and competitions (Mester, Perl, 2000; Edelmann-Nusser et al., 2002). The trends in the changes of the training of high performance athletes (Balyi, 2004), specific features of the developments of a sport (Jastrejembskaia, Titov, 1999; Kapnemco, 2003), as well as the upturn of sports results motivate us to look for new, scientifically grounded sports technologies, methods and forms of training. The adaptation to physical loads, intensity of training loads and competitive activities of the rhythmic gymnastics has not yet been studied. The aim of this work was to determine the impact of specific training on sport performance of 13-14 year old athletes in rhythmic gymnastics.

Material & Methods.

The research involved the training of 13-14 year old athletes (n=15) in rhythmic gymnastics from the National and Kaunas city teams (Lithuania). The experiment resulted in modelling 3 different training programs (5 gymnasts in each training program) and establishing the structure of the content of the training programs for all macrocycle, as well as athletes' sports performance. The training loads protocols registered the time for choreography, elements learning, competitive routines and athletic training in each training session (JlHCHU,Ka^ н *pp.,* 1982; Jastrjembskaia, Titov, 1999).

The following **research methods** were used in this research:

Anthropometry - height in the standing position and body mass components (body mass, body mass index BMI, subcutaneous body fat layer in per cent (%), and kilograms (kg))(TANITA BODY ANALYSER TBF-300);

Athletic fitness. Athletic fitness of female athletes was estimated applying tests of flexibility, flexibility and balance, strength, muscular endurance, specific endurance, coordination abilities, explosive strength and movement abilities (JlHCHijKafl н *pp.,* 1982; Jetrejambskaja, Titov, 1999; KapneHKO, 2003). Research presented absolute values of estimation of movement abilities, and the values estimated in points. The integral index estimating athletic fitness was received summing up the points of each test.

Changes of gymnasts' **technical fitness** were registered during competitions according to the declared and realized coefficients of technical fitness – Difficult values and Artistic values.

Methods of mathematical statistics. In order to compare the data the mean (x) and the standard deviation (SD) were calculated. One-way analysis of variance -ANOVA (generalizing Student criterion for several independent samples) was used to evaluate the differences and the reliability of value differences.

Table 1.

Training loads of different training programs of 13-14 year old athletes in rhythmic gymnastics

Parameters of training loads	Training groups (x±SD)			Mean (3c ±SD)	Fisher's criterion, p level
	A	B	C		
Number of training sessions a year	283	213	258	225.66±34.6	
Number of macro-cycle hours	674	519	593	591.33±76.0	
Number of training sessions a week	5.4±1.39	4.2±1.09	5.3±0.85	5.0±1.26	F=16.74; **p<0.001**
Number of hours a week	13.0±3.29	10.3±2.94	11.9±2.75	11.7±3.19	F=8.98; p<0.001
Number of competitions a year (from - to. and average)	9-14 12.2±2.05	10-14 12.2±1.79	10-14 12.2±1.79	9-14 12.2±1.74	
Number of competition days	23 days (duration of loads of competition days ~3 h)				

Causal relations were determined applying correlation analysis (Pearson's correlation coefficient r). The significance of training and fitness factors was established by factor analysis (principal factor analysis - communalities=multiple r^2). All calculations were performed using computer programs MS Excel and STATISTICA.

Results:

Training. Training of athletes in three training programs trained unlike - their training loads were significantly different ($p<0.01$) - from 10.28 to 12.91 hours a week, as well as the indices of the training days - from 5.43 to 4.17 days a week (Table 1).

13-14 year old athletes in rhythmic gymnastics in the most effective training program (A) in specific training in our experiment received the highest loads (283 days of training in the macro-cycle, 5.44 training sessions a week on average, all in all 674 hours of training, averagely 13.0 hours a week).

Training parameters - training loads and content were different in the course of the whole macro-cycle and in different training periods ($p<0.05$). The percentage structure of the training content did not differ much in each training period. Statistically significant differences ($p<0.05$) were found in the duration of mastering elements ($p<0.02$) in the most effective training program (A), time for athletic training in program C ($p<0.05$). The percentage structure of the training loads in program C did not differ statistically significantly ($p>0.05$).

Sport performance. The most effective training program was A 533 (points) with choreographic training dominating in it (35.8%). The least effective program was C (240 points), where each gymnast collected 48.0 points on average. The age, height, weight, and body mass index of the subjects in different groups (A, B, and C) did not statistically differ ($p>0.05$) either before or after the experiment. The body fat in percent and in kilograms was different before the experiment ($p<0.05$), but after the experiment no statistically significant differences were established ($p>0.05$). The integral index of gym-

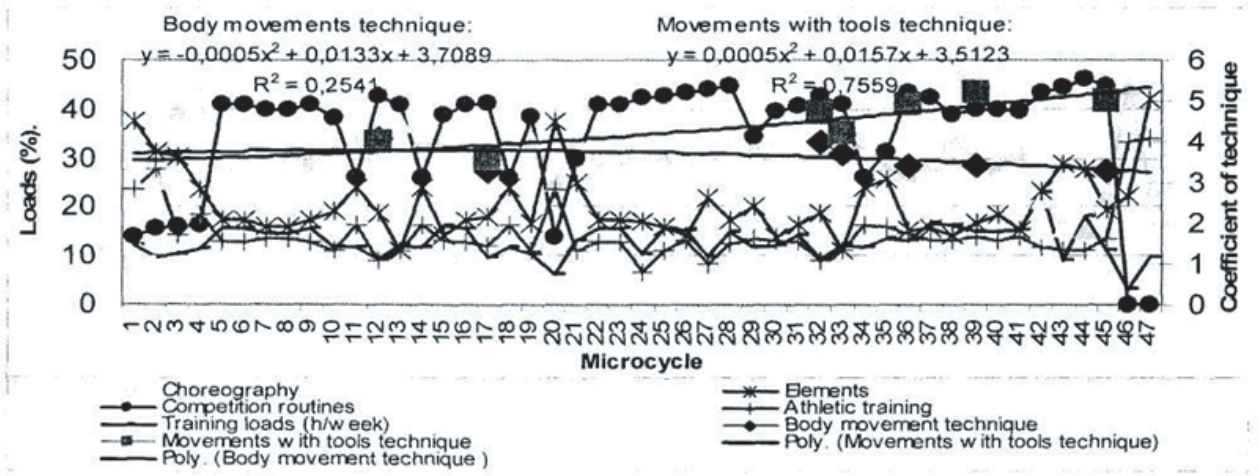

Fig.l. Changes in the volume of training loads (%) and complexity of the content and technique in the most effective training program in the experiment for 13-14 year old athletes in rhythmic gymnastics during the macro-cycle

nasts' athletic fitness was different at the beginning of the season ($p<0.05$). The differences between the muscular test results diminished, too (evaluation of "press-ups" in times and points, "sit-ups" in points), but there appeared a difference between the indices of coordination abilities ("10 seconds running into the rope" in points) ($p<0.05$). Though there were positive alterations in the indices of all movement abilities, but no statistically significant differences were established between the indices of athletic fitness in different training groups before the experiment and after it ($p>0.05$). At the beginning of the season (pO.OOl) and at the end of it ($p<0.001$) the realization of the body movement technique performing routines with different tools was different.

Training and sport performance interaction. In the most effective training program correlations between body movement techniques and program training loads were r^0.514; polynomial interdependence: y=^0.0003x2+0.0008x+0.0369; r^2 = 0.4553; and between movement with tools techniques and training loads: r=0.658; and polynomial interdependence: y = 0.0006x2 -0.0186x+0.0894; r^2 = 0.4069. Effective training of athletes in program B (11-12 and 12-13 years of age) was determined by the dominance of choreographic training. At this period of training the program was distinguished by the time for the mastering of competitive routines (33.57% on average).

The most effective training program, which included choreographic training (30.3%), element mastering (19.6%), mastering of competitive routines (37.3%) and athletic training (12.8%) since the 17th micro-cycle, improved the indices of technical fitness of 13-14 year old moderate sport performance athletes in rhythmic gymnastics: body movement technique (21.1%), tool technique (30.5%) (Fig. 1). The achieved level of performance of movements with tools (6.35%) was improved in 14 weeks, in the training program of the following structure: 27.2% of choreographic training, 21.95% of element mastering, 40.3% of mastering competitive routines, and 13.1% of athletic training. The stable level of tool technique was maintained till the end of the season (7 micro-cycles), but body movement technique almost did not change, and even diminished till 21.1% in 7 micro-cycles.

Discussion. Analysis of interaction of training and sport performance comparing *internal* (indices of moderately mastered body movements and movements with tools) and *external* (training loads in hours per week) (Mester, Perl, 2000) factors partly differs from what other scientists (Hartmann, Mester, 2000) suggest, that from the standpoint of a macro-cycle the interaction between the indices of training and sport performance is neither significant nor effective. According to some researchers (Perl, 2004; Biigner, 2005), the contradictions in the management of training are natural, because due to the inner changes of an athlete the same training loads can produce different sport performance.

Adverse changes in the indices of body technique (the indices of technique in the most effective training program decreased from coefficient 4.1 to coefficient 3.3) at the end of the season confirm the supposition raised in the previous stage of the research that the increase in difficulty of body technique stabilizes - only the number of mistakes becomes less, but movements with tools are practiced and improved further on. This confirms what other researchers (KapneHKO, 2003) suggest: the best age for developing coordination abilities is up to 12-13.

It should be noted that elite gymnasts spend 45 minutes six times a week for choreography (Apatow, 2001; Kapnemco, 2003). Our training programs contained 52 minutes 4.4 times a week (program B). In the most effective training program the reduced time for choreography (in %) affected the changes in training and sport performance (body movements and movements with tools) - the changes in the movement techniques can be explained by the following slight positive dependence: 20% (y=0.0001x2+0.0002x-0.0197; r^2 = 0.2039), and in the movement with tools technique - negative dependence of 13% (y=M).0003x2 + 0.0123x- 0.0782; r^2 = 0.1398).

After grouping the results of different factors (training and sports performance, sports performance, training), we can state that the most important factors for good results are explosive strength, strength endurance, coordination and the integral index of athletic fitness. Techniques with tools (skipping rope, ribbon, ball and average technique of all tools) were also of great importance. At this period of training the significance of training factor was not so great, thus, the significance of sports performance and technical fitness could have been conditioned by training loads applied in the earlier periods.

Conclusion. In the period of individual training of 13-14 year old athletes in rhythmic gymnastics time for mastering competitive routines (r=0.945) and integral training (r=0.861) became more significant for the efficacy of athletes' sports performance. The indices of movement with different tools technique became more significant (r=0.708-K).805), and the indices of difficulty of body movement technique remained stable. The most important factors influencing sports performance were explosive strength (r=0.819), strength endurance (r=0.794), coordination (r=0.756), and the total integral index of athletic fitness (r=0.840).

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