TRAINING AND SPORT PERFORMANCE OF THE 11—12 YEAR OLD ATHLETES IN RHYTHMIC GYMNASTICS

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ABSTRACT

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. The aim of this study was to establish the key indices of training and fitness optimization of 11—12 year old athletes in rhythmic gymnastics.

The experiment resulted in modeling five different training programs and establishing the structure of the content of the training programs, as well as athletes' sports performance (athletic, technical and mental). The training loads protocols registered the time for choreography, element mastering, competitive routines and athletic training in each training session. The efficacy of the training programs was established registering the realization of competitive activities under competitive conditions, according to the number of points received by the gymnast of each training program, according to the place won (the points awarded in the descending order).

Athletes in different training programs trained diversely — significant differences ($p < 0.001$) occurred in the indices of training loads (from 8.3 to 14.7 hours a week), days of training (from 207 to 295 days a year) and training content. Body composition indices of athletes did not differ statistically significantly ($p > 0.05$). Statistically significant differences ($p < 0.05$) were found in the indices of explosive strength and muscular, specific endurance, coordination movement abilities and the integral index of athletic fitness. The program where choreographic training (28.2%) dominated was the most efficient.

Effective sports performance of 11—12 year old athletes in rhythmic gymnastics was greatly affected by all indices of technical fitness ($r = 0.723 \div 0.883$), integral index of athletic fitness ($r = 0.881$), explosive strength ($r = 0.739$), and endurance ($r = 0.700$). Significant changes of results could be explained not only by the changes in choreographic training, but also in the components of specific training, especially the time for mastering competitive routines ($r = 0.717$) and optimal training loads (11.5 ± 2.8 hours per week). The impact of body compositions indices, compared to other factors, was not great ($r = 0.478 \div 0.557$) on the sports performance of athletes at this age.

Keywords: *rhythmic gymnastics, training, fitness.*

INTRODUCTION

The trends in the changes of training high performance athletes (Balyi, 2001; Balyi, Hamilton, 2004), specific features of the development of rhythmic gymnastics (Krug, 1996; Jastrejembskaia, Titov, 1999; Knoll et al., 2000; Медведева, 2001; Карпенко, 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 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; Torrents et al., 2001; Edelmann-Nusser et al., 2002). If the requirements of athlete training mentioned above are followed, there are premises for their successful participation in the most important international competitions.

While registering and analyzing competitive activities it is possible to establish the level of their interaction with different components of athlete training (Mester, Perl, 2000; Perl, 2004). Besides, registering and analyzing competitive activities enable us to foresee the tendencies of a sport, forecast sports results, and plan the trends of athlete training. Another important feature is the interaction of indices between training and sport performance (Busso et al., 1990, 1997; Banister et al., 1999; Edelmann-Nusser, et al., 2002; Avalos et al., 2003; Bügner, 2005; Hellard et al., 2006). Nowadays the problem has received adequate attention and is being researched. J. Perl (2001, 2003, and 2004) called this interaction a *Metamodel* — the theoretical interaction of training and sport performance — when we need to find an optimal model of athlete training which would allow achieving the highest level of sport performance. At present most research of this kind has been carried out in swimming (Edelmann-Nusser, et al., 2002; Avalos et al., 2003; Bügner, 2005; Hellard et al., 2006) and track-and-field athletics (Banister et al., 1999).

As B. S. Rushall (1995) suggests, the peculiarities of each sport raise certain demands for athletes and in this way develop their personal traits which are necessary to successfully cope with the tasks of competitive activities. Rhythmic gymnastics is a sport which requires early selection of athletes (Лисицкая et al., 1982; Карпенко, 2003; Balyi, 2001, 2004), intensive training in the periods of childhood and adolescence (Jastrejembskaia, Titov, 1999; Карпенко, 2003) and early termination of the sports career (Стамбулова, 1999).

Success in sports activities of rhythmic gymnasts mostly depends on their innate and genetically determined anatomical, functional, mental peculiarities of the human body the adaptation of which by training is limited (Jastrejembskaia, Titov, 1999; Карпенко, 2003). The program of elite athletes in modern rhythmic gymnastics becomes more and more complicated: in the early stage of specialization gymnasts have to master many technically complicated elements on the basis of which their original programs and compositions could be made up, and which could help express the individuality of an athlete (Krug, 1996; Стамбулова, 1999; Knoll et al., 2000; Карпенко, 2003). Thus the requirements for all kinds of fitness of athletes increase, as well as the loads and intensity of their training. Research has not established *models of training and sport performance* (as well as their interaction) of rhythmic gymnastics athletes of different age and sport performance levels (basic and special). That is why **the aim of research** was to establish the preconditions of training optimization of 11—12 year old athletes in rhythmic gymnastics.

MATERIAL AND METHODS

Subjects and experiment design. The research involved the training of 11—12 year old athletes (n = 25) in rhythmic gymnastics from the National and Kaunas city teams (Lithuania) (Table 1). The experiment resulted in modeling 5 different training programs (5 gymnasts in each training program) and establishing the structure of the content of the training programs for all macrocycle (48 week duration), as well as athletes' sports performance. The training loads protocols registered the time for choreography, element learning, competitive routines and athletic training in each training session (Лисицкая и др., 1982; Jastrjembskaia, Titov, 1999).

The efficacy of the training programs was established registering the realization of competitive activities under competitive conditions, according to the number of points received by the gymnast of each training program, according to the place won (the points awarded in the descending order). Participation of gymnasts in competitions was different because not all of them succeeded in winning the right to participate in more important competitions — national and international.

Research hypothesis (H_0) was that different training programs (Table 2 and 3) have the same

Table 1. **Anthropometric characteristics of subjects ($\bar{X}$ ± SD)**

Training groups	Age, y	Height, cm	Body mass, kg	BMI	BF, %
A (n = 5)	10.6 ± 0.89	144.2 ± 8.9	32.6 ± 5.71	15.6 ± 0.8	8.4 ± 4.61
B (n = 5)	11.0 ± 0.71	155.6 ± 3.3	38.9 ± 2.58	16.1 ± 1.14	12.3 ± 2.56
C (n = 5)	11.0 ± 0.71	145.8 ± 6.1	35.2 ± 5.01	16.5 ± 1.26	8.48 ± 3.18
D (n = 5)	11.0 ± 1.0	146.4 ± 10.1	33.5 ± 6.29	15.5 ± 0.87	7.74 ± 2.13
E (n = 5)	11.4 ± 0.89	148.2 ± 6.6	35.2 ± 3.97	16.0 ± 0.8	10.2 ± 2.66
Average	11.0 ± 0.82	148.0 ± 7.8	35.1 ± 4.99	15.9 ± 1.04	9.42 ± 3.33
F test; p value	F = 0.56; p > 0.05	F = 1.82; p > 0.05	F = 1.23; p > 0.05	F = 0.75; p > 0.05	F = 1.72; p > 0.05

Table 2. **Training loads of different training programs of 11—12 year old athletes in rhythmic gymnastics**

Parameters of training loads	Training groups ($\overline{X}$ ± SD)					Mean ($\overline{X}$ ± SD)	Fisher's criterion, p level
	A	B	C	D	E		
Number of training sessions a year	270	275	207	295	239	257.2 ± 34.5	
Number of macro-cycle hours	387	595	478	704	401	513 ± 135.9	
Number of training sessions a week	5.51 ± 1.2	5.31 ± 0.9	3.97 ± 1.9	5.5 ± 1.0	5.20 ± 0.9	5.10 ± 1.2	F = 16.41; p < 0.001
Number of hours a week	8.34 ± 2.2	11.15 ± 2.8	8.92 ± 3.3	14.75 ± 3.2	7.57 ± 2.0	10.23 ± 3.8	F = 19.01; p < 0.001
Number of competitions a year (from — to, and average)	2—11 6.06 t.	8—14 11.8 t.	5—14 10.4 t.	5—14 9.8 t.	6—14 9.0 t.	2—14 9.52 ± 3.5 t.	
Number of competition days	20 days (duration of loads of competition days ~3 h)						

Table 3. **Content (%) of training loads of different training programs of 11—12 year old athletes in rhythmic gymnastics**

Content of training loads	Training groups ($\overline{X}$ ± SD)					Mean ($\overline{X}$ ± SD)	Fisher's criterion, p level
	A	B	C	D	E		
Choreography	20.6 ± 5.4	28.2 ± 5.2	26.3 ± 10.7	25.5 ± 9.0	26.6 ± 12.4	25.4 ± 9.2	F = 4.74; p < 0.001
Elements	27.9 ± 8.4	27.3 ± 7.4	26.8 ± 9.8	21.5 ± 8.2	33.74 ± 11.3	27.0 ± 9.8	F = 10.64; p < 0.001
Competition routines	27.2 ± 13.3	26.1 ± 12.9	17.4 ± 11.7	26.6 ± 10.8	17.2 ± 13.7	23.6 ± 13.5	F = 10.08; p < 0.001
Athletic training	21.9 ± 8.7	18.2 ± 6.8	23.3 ± 10.9	11.0 ± 3.8	20.1 ± 8.3	18.8 ± 9.0	F = 17.69; p < 0.001

impact on sports performance. The alternative hypothesis was that different training programs have different impact on sport performance (H_1). Independent variables were the duration, content, volume, intensity of training loads, and the dependent variable was athletes' sport performance.

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 were measured.
- **Physical fitness.** Athletic fitness of female athletes was estimated applying tests of flexibility (tests of "bridge" and "splits"), complex abilities of flexibility and balance (test of "leg keeping"), muscular endurance (push-ups, sit-ups and lifting legs), specific endurance (test of "jumping into rope with double turns"), coordination abilities ("10 seconds running into the rope") and explosive strength (standing long jump on both feet). 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 (Лисицкая и др., 1982; Jetrejambskaja, Titov, 1999; Говорова, Плекшань, 2001; Карпенко, 2003).
- Gymnasts' **mental fitness** (subjective fitness for the competition — self-confidence) was evaluated before each competition. Self-confidence was evaluated applying methodology based on the *Dembo-Rubinschtein* (Столяренко, 2001) scale. Each subject evaluated herself before every competition: 10 points indicated the best mental fitness, and 1 point showed that the athlete was totally unprepared for the competition.
- Changes of gymnasts' **technical fitness** were registered during competitions according to the declared and realized coefficients of technical fitness — Difficulty values and Artistic values (Abbruzini, 2004).

Methods of mathematical statistics. In order to compare the data the mean ($\overline{x}$) 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. The following reliability levels of statistical conclusions were used: $p < 0.05$ — reliable; $p < 0.01$ — very reliable; $p < 0.001$ — absolutely reliable conclusion. 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. Questionnaire data were analyzed using χ^2 criterion (criterion of the independence of evidence. Experimental data were described using 44 variables, 43 of which were the aspects of training and fitness (X) and one was the final indicator of the efficacy of competitive activities (the mean of the points achieved by each gymnast) — Y. The principal factor analysis (communalities=r squares) was performed to estimate the interaction of the structure, the content and the volume of the complicated training process and fitness. For the evaluation of the complexity and the interaction of the training process and fitness and the training management the computer program SIMCA-P (www.umetrics.com) was chosen which evaluates multifactor changing (causal) relations with PLS (projections to latent structures).

RESULTS

Sport performance. Statistically significant differences ($p < 0.05$) were found in the indices of explosive strength and muscular endurance (long jump, push-up, sit ups, lifting legs), specific endurance (jumping into rope with double turns), coordination (10 seconds running into the rope) movement abilities and the integral index of athletic fitness (in points). No statistically significant differences were established between athletic fitness indices of different training groups before the experiment and after it ($p > 0.05$).

At the beginning of the season realization of action techniques (coefficient of Difficulty) performing routines with tools were different between the groups ($p < 0.001$). Indices of movements with tools of different training programs at the beginning and at the end of the season were also different ($p < 0.001$). However, mean subjective self-evaluation of athletes' fitness (self-confidence before the competition) during the whole season was not statistically different ($p > 0.05$).

Interaction of training and sport performance. Comparisons of training and fitness models in the experiment were not alienated from each other and did not exceed the critical limits of standard deviation of experimental (research) distribution (diagrammatical representation of model data was performed using SIMCA-P program). It allowed us comparing available training models of athletes' training and fitness. The models in the experiment were not alienated from each other and did not exceed the critical limits of standard deviation of experimental distribution.

Efficacy of specific sport contest model in rhythmic gymnastics mostly depends on the complexity of movement techniques. Thus, we chose separate medium indices of body movements and movements with tools and the training volume (hours per week) for the analysis of the interaction of training and fitness. The most effective training program B in the experiment with moderate training load (595 hours a year) did not reveal linear interdependence of training load (hours per week) and general body movement technique ($y = 0.0028x + 0.2355$; $r^2 = 0.0126$), i. e. applying such principle of increasing training load we could expect 1% of the improvement of body movement technique.

The content of the most effective training program which included choreographic training (27.6%), mastering elements (28.0%), mastering competition routines (30.4%) from the 17th micro-cycle enabled to improve the following indices of technical fitness of 11—12 year old medium level athletes in rhythmic gymnastics: body movement techniques — 16.1%, movement with tools techniques — 57.9%. We succeeded in maintaining and even improving them (body movement techniques by 5.6%, and movement with tools techniques — by 9.5%) for 11 weeks, where the training program of that period involved choreographic training (24.3%), element mastery (24.6%), mastery of competition routines (32.8%), and athletic training (18.3%). Unaltered athletic condition of gymnasts was maintained for 5 weeks (Fig. 2), though the structure of the training program changed extending choreographic training (up to 30.4%) and element mastery time (up to 29.9%). Time for athletic training remained the same (Fig. 2). The duration of athletic training in all training programs was significant to the techniques of their body movements (A — $y = 0.0024x2 – 0.1332x + 0.8654$, $r^2 = 0.7151$; B — $y = 0.0015x2 – 0.0857x + 0.5215$, $r^2 = 0.7063$; C — $y = 0.0021x2 – 0.121x + 0.7878$, $r^2 = 0.7387$ and D — $y = 0.0012x2 – 0.0729x + 0.4736$, $r^2 = 0.6099$), and it was less effective for athletes

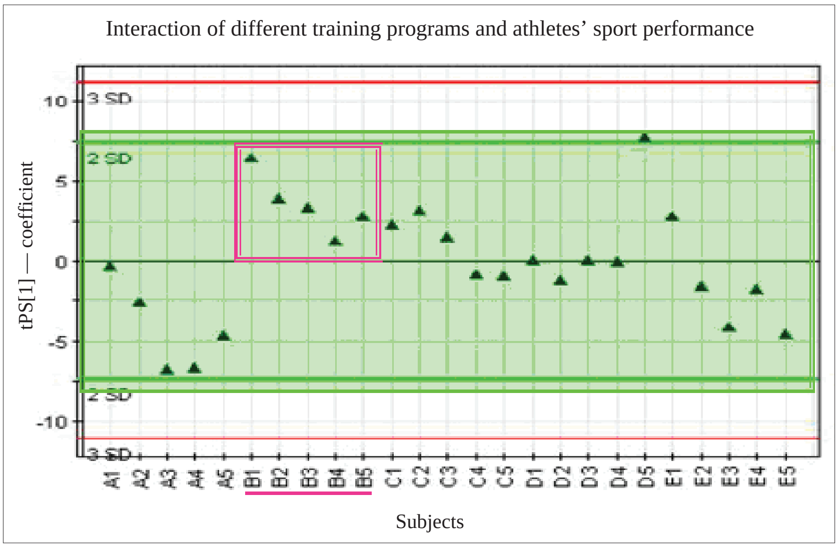

Figure 1. **Comparisons of training and fitness models (diagrammatical representation of model data was performed using SIMCA-P program)**

Note. Marked sports are summarized training and fitness variables of most effective training program (B) gymnasts — they are greater than average.
A1—A5, B1—B5, C1—C5, D1—D5, E1—E5 —gymnasts training and fitness comparison from different training programs
t [1] — variable, which summarizes all (training and fitness) variables.

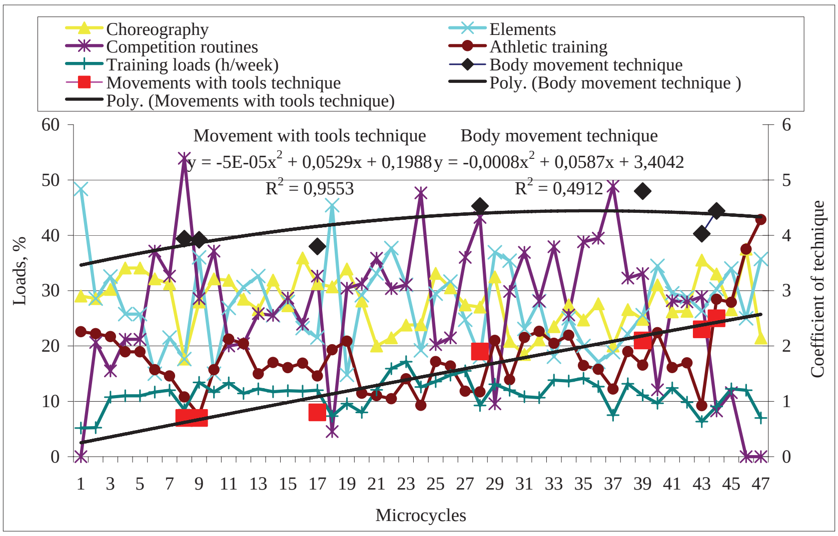

Figure 2. **Changes of the most effective program training load (%), content and complexity of technique in the microcycles during the experiment**

in program E (y = –0.0008x2 + 0.0536x – 0.476, r^2 = 0.1981).

The factor analysis (principal factor analysis — communalities = multiple r^2) allowed dividing training and sport performance indices into five significant levels. The first level factor (F1), named as “factor of athletic and technical fitness indices”, showed general athletic fitness as the most significant feature (r = 0.881), then the coefficient of general body movement technique (r = 0.831), the coefficients of general movement with tools technique (r = 0.792), routines with a ball (r = 0.798) and rope (r = 0.796) body movement technique. This factor encompassed 13 indices (out of 45), with the correlation coefficient higher than 0.700. The comparative value (sum) of the first factor was 15.87% from general dispersion (factor input). The second level factor (F2) involves indices of training load (training frequency) and content (athletic and specific training). The greatest value was attributed to number of training sessions a week (r = –0.718), time for athletic fitness in percent (r = 0.700) and hours for competition routines (r = 0.717). The value of this factor was 6.89%. The third level factor included indices of training loads (volume) and amount of body fat (kg). The most significant training hours a week (r = 0.728). The fourth level factor (F4) was only the index (r = –0,581) of athletic fitness (test of muscular endurance — “lifting legs” test). The fifth level factor (F5) includes the value of coordination (“leg keeping” in points, (r = –0.541)). All five factors account for 32.73% of general dispersion.

The factor analysis of separate training components allowed distinguishing two main factors the sum of which was 9.65%. The first level factor (F1), named “training load volume and specific training”. Included such indices as total training load of the whole macro-cycle (r = 0.945), number of training hours per week (r = 0.961), total number of training hours in the macro-cycle (r = 0.762), absolutely significant time allotted to improve competition routines (r = 0.960), hours for choreographic training (r = 0.855), and hours for the mastering of elements (r = 0.789). Our research established negative correlations of athletic training in per cent (r = –0.911) and of time for the elements training in per cent (r = –0.774). The second level factor (F2) included the number of training sessions per week (r = 0.757) and choreographic training in per cent (r = –0.787).

The factor analysis of sports performance indices allowed distinguishing three main factors, the value of which was equal to 19.70%. The first level — "technical fitness" — factor (F1) involved all indices of technical fitness (r ranged from 0.723 to 0.883), general athletic fitness (r = 0.882), long jump test result (r = 0.738) and values points (r = 0.712), and the results of coordination abilities — "jumping into rope with double turns" test (r = 0.697) and values points (r = 0.798). The second level factor (F2) consisted of anthropometrical data and muscular endurance: body fat amount in per cent (r = 0.617), body fat amount in kilograms (r = 0.627), weight (r = 0.557), muscular endurance test (sit-ups) result (r = –0.577). The third level factor (F3) included the body mass index (r = 0.478).

The significance of factors of different kinds of training is very controversial (hours of choreographic training — r = 0.855, per cent — r = –0.787; time for the improvement of elements — (hours) r = 0.789, per cent — r = –0.774); expressed in the units of measurement, let us think that the increase in training loads (absolute values — hours) enables the improvement of results, but the increase of per cent of separate kind of training, reducing the time for other kinds of training and not increasing the sum of time for training, disbalance the structure of optimal training.

DISCUSSION

Training high performance and elite athletes, excessive physical loads were repudiated and the loads were rationally allocated with regard to time (Fitz-Clarke et al., 1991; Morton et al., 1997; Mester, Perl, 2000). Our research results confirmed this point — not always high physical loads were effective. During the experiment athletes from program D (the third program according to the efficacy) were designated 704 hours for training in the annual macro-cycle, their training sessions occurred more often (295 times a macro-cycle), and they had higher medium loads per week (14.8 hours per week). Researchers (Jastrjembskaia, Titov, 1999; Карпенко, 2003) suggest that training loads in complex coordination sports for athletes from 12 years of age become greater and more intensive. If we had significantly increased the training loads in group D, it could have had negative effect on athletic fitness.

Linear interdependence (in most effective training program) of movement with tools technique and training load indices (hours per week) in our research was not established ($y = 0.0043x – 0.3041$; $r^2 = 0.0203$). The principle of forecasting sport performance and results had much been applied earlier (Busso et al., 1990; Fitz-Clarke et al., 1991; Morton et al., 1997), but further research showed that nonlinear interdependence was more suitable for the analysis of the interaction of training and fitness results (Busso et al., 1997; Edelmann-Nusser et al., 2002; Bügner, 2005; Thomas, Busso, 2005). According to the polynomial function the realization of technical fitness of athletes of the most effective program B was different: body movement technique ($y = –0.0014x2 + 0.073x – 0.3838$, $r^2 = 0.4911$) and movement with tools technique ($y = 0.0012 \times 2 – 0.0543x + 0.219$, $r^2 = 0.228$).

The established negative changes in the body movement technique at the end of the season could be explained by fatigue (Busso et al., 1997; Pichot et al., 2002), variations of different inner systems of an athlete as a complex dynamic system (Perl, 2001, 2003). The weakening relation between training and fitness confirmed the idea of other researchers (Mester, Perl, 2000; Hartmann, Mester, 2000), that from the standpoint of a macro-cycle interaction between training and sports performance indices is neither significant nor efficient.

Apatow (2001) suggests that *choreography* lays the background for the accurate performance of difficult movements. This kind of training dominated in the most effective program B (it was applied 28.23% on average in the season). With the help of the method of polynomial regression analysis we established great influence of such training on the body movement technique ($y = 0.001 \times 2 – 0.0646x + 0.462$, $r^2 = 0.5583$), and less influence on the body movements with tools ($y = –9E – 05 \times 2 – 0.0147x + 0.239$, $r^2 = 0.2905$).

Time allotted to the improvement of elements in program B changed from 11.7% to 37%. In the competition period researchers do not agree about the time that should be spared *on elements* *mastering*: some of them (Меканцишвили, 1991; Jastrejembskaia, Titov, 1999) suggest that it should be prolonged, others (Медведева, 2001) think that it should be shorter, but more time should be spent on training competition routines (number of combinations).

Researchers (Jastrejembskaia, Titov, 1999; Меканцишвили, 1991; Медведева, 2001) claim that the duration of training competition routines should be greatly increased that the body functional powers could be improved and the stability and quality of the performed program could be maintained. Our research indicated that in different training programs the time allotted to the performance of *competition routines* had different impact on athletes' sport performance.

The great significance of athletic training for technical fitness, which was established in our study, let us suppose that our athletes still lack athletic training which is vital to master difficult techniques (Менхин, 1997).

Thus, effectual fitness of athletes was affected not only by choreographic training (which dominated in the most effective program B) (Apatow, 2001) and volume of the training load (Меканцишвили, 1991), but also by another component of integral specific training — time for the improvement of competition routines.

The results of athletes in the most effective program were mostly positively affected by routine with a ball body movement technique, coordination abilities and integral index of athletic fitness. Researchers (Лисицкая и др., 1982; Карпенко, 2003) agree that rhythmic gymnastics requires overall athletic fitness; however, the most important movement abilities are flexibility and coordination (Лисицкая и др., 1982; Горбачева, Степанова, 1997; Карпенко, 2003). The significance of other indices was lower or the value of those indices infringed the critical limits of reliability. Higher indices of body composition (body mass, body mass index, body fat amount (per cent and kg) had negative impact on results. The results of gymnasts in the least effective training program were positively affected by all fitness factors) except for the routine with the ribbon body movement with tools technique), however, the average values were rather low, compared to other programs, so the efficacy of the whole program was also low.

Having grouped the results of different factor analyses (training and fitness; fitness, training) we can claim that the most important contributors seeking high results are all indices of technical fitness, integral index of athletic fitness, the volume of the training load of the whole macro-cycle, total number of training sessions in the macro-cycle, time (hours) for choreographic training and the mastering of elements, explosive strength and endurance. Though the opinions of researchers and rhythmic gymnastics experts (Лисицкая и др., 1982; Jastrejembskaia, Titov, 1999) are different, sport performance greatly depends on anthropometrical data (Литовко, 1998; Литовко, Санжарова, 1998; Douda et al., 2000), complexity of all competition routines (Литовко, 1998; Литовко, Санжарова, 1998), risk, acrobatics (Литовко, Санжарова, 1998), and flexibility (Douda et al., 2000).

CONCLUSIONS

1. Effective sports performance of 11—12 year old athletes in rhythmic gymnastics was greatly affected by all indices of technical fitness ($r = 0.723 \div 0.883$), integral index of athletic fitness ($r = 0.881$), explosive strength ($r = 0.739$), and endurance ($r = 0.700$).
2. Significant changes of results could be explained not only by the changes in choreographic training, but also in the components of specific training, especially the time for practicing competitive routines ($r = 0.717$) and optimal training loads (11.5 ± 2.8 hours per week).
3. The impact of body compositions indices, compared to other factors, was not great ($r = 0.478 \div 0.557$) on the sports performance of athletes at this age.

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MENINĖS GIMNASTIKOS SPORTININKIŲ (11—12 METŲ) RENGIMAS IR PARENGTUMAS

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SANTRAUKA

Sportininkų ugdymo veiksmingumas priklauso nuo kryptingo rengimo vyksmo tam tikrais sportininkų rengimo etapais, valdymo, individualios sportininko adaptacijos prie treniruočių ir varžybų krūvių. Tyrimo tikslas — nustatyti 11—12 metų meninės gimnastikos sportininkių rengimo ir parengtumo optimizavimo prielaidas.

Eksperimento metu buvo modeliuota penkių skirtingų rengimo programų struktūra ir registruotas sportininkių parengtumas (atletinis, techninis ir psichinis). Krūvių registravimo protokoluose buvo registruojamas choreografijai, elementų mokymuisi, varžybiniams pratimams ir atletiniam rengimui skirtas laikas per kiekvienas pratybas. Rengimo programų veiksmingumas nustatytas registruojant varžybinės veiklos realizavimą varžybinėmis sąlygomis pagal kiekvienos rengimo programos gimnastės gaunamus taškus, pagal kiekvieną iškovotą vietą (nustatytas taškų skyrimas mažėjančia tvarka).

Skirtingų programų sportininkės treniravosi nevienodai — reikšmingai skyrėsi taikomų krūvių (nuo 8,3 iki 14,7 h per savaitę) ($p < 0,001$), pratybų dienų rodikliai (nuo 207 iki 295 dienų per metus) ir sportininkių rengimo turinys. Skirtingų rengimo grupių tiriamųjų amžius, ūgis, svoris, kūno masės indeksas ir riebalinio audinio kiekis statistiškai reikšmingai nesiskyrė ($p > 0,05$) nei prieš eksperimentą, nei po jo. Statistiškai reikšmingai ($p < 0,05$) skyrėsi staigiosios jėgos bei jėgos ištvermės, specifinės ištvermės, koordinacijos judamųjų gebėjimų rodikliai ir atletinio parengtumo integralusis rodiklis, išreikštas balais. Veiksmingiausia buvo rengimo programa (483 tšk.), kurios metu vyravo choreografinis regimas (28,2%).

Veiksmingam 11—12 metų meninės gimnastikos sportininkių parengtumui reikšmingą poveikį turi visi techninio parengtumo rodikliai ($r = 0,723 \div 0,883$) — integralusis atletinio parengtumo rodiklis ($r = 0,881$), staigioji jėga ($r = 0,739$) ir ištvermė ($r = 0,700$). Reikšmingai rezultatus veikia ne tik vyraujantis kintamas choreografinis rengimas, bet ir specifinio rengimo komponentai, ypač varžybiniams pratimams tobulinti skirtas laikas ($r = 0,717$) bei optimalūs krūvių dydžiai (11,5 ± 2,8 h per savaitę). Šio amžiaus sportininkių kūno kompozicijos rodiklių poveikis varžybinės veiklos modelio rodikliams, lyginant su kitais veiksniais, nėra didelis ($r = 0,478 \div 0,557$).

Raktažodžiai: meninė gimnastika, rengimas, parengtumas.

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