EFFECT OF 8 WEEK ISOTONIC TRAINING WITH DIFFERENT WORKOUT FREQUENCY ON UPPER BODY LOWER BODY AND MUSCLE GIRTH AMONG MALE VOLLEYBALL PLAYERS

IBRAR UL HAQ*[1], Dr. R. VENKATACHALAPATHY[2]

Ph.D. Research Scholar, Department of Physical Education, Annamalai University, Annamalai Nagar-608002, Tamil Nadu, India.[1]*

Associate Professor, Department of Physical Education, Annamalai University, Annamalai Nagar-608002, Tamil Nadu, India. [2]

***Corresponding Authors Email**:

haqabrar95@gmail.com

https://orcid.org/0000-0002-7178-3263

Abstract

The purpose of this study was to determine the effects of short-term equal-volume isotonic training with different workout frequency on upper body, lower body, and muscle girth in male volleyball players. Forty-five male volleyball players were randomly selected from Govt. Degree College Killam, affiliated with Kashmir University (UT) Jammu and Kashmir with mean ± SD: (19.45 ± 3.4 years, height of 177.18 ± 4.15 centimetres, 66.70 ± 5.30 kg and BMI 21.20 ± 3.25 were chosen). The subjects were segregated into three groups; total-body isotonic training, (12 exercises for two sessions per week) (Isotonic G-I=15), upper-body, and lower-body isotonic training (12 exercises for three sessions per week) (Isotonic G- II=15), and control group (CG=15) didn't take part in any special training. Assessments of body composition, height, weight, body mass index, and flexed arm girth, strength (one repetition maximum in bench press) and vertical jump were determined before and after 8 weeks of training. Flexed-arm girth, 1-RM bench press and vertical jump was improved significantly in all training groups ($P < 0.05$). All groups increased body weight and body composition ($P \leq 0.05$), but isotonic G-I group showed a little improvement rather than other isotonic G-II. It is concluded that in healthy young men, whole and split weight training routine produce similar results over the first 2 months of training, with minimal differences among groups.

Key Words: upper body, lower body, flexed-arm girth, isotonic training and volleyball.

1. Introduction

Volleyball is a game that largely relies both on upper body and lower body strength to achieve maximum leaping height in blocking and attacking. The elements of the volleyball game such as serving, spiking (attack), blocking and defence are the primary volleyball skills that allows players to score points and win competitions [7]. As a result, explosive leaping ability is becoming a dominant strength in volleyball, attracting the attention of both

researchers and coaches. This paves the way for the researcher to implement the isotonic training among male volleyball players. Isotonic training improves the athlete's explosive power and strength. In isotonic contraction, the tension in the muscle remains dynamic. Isotonic involves contractions where tension is uniform throughout the range of motion [15]. Isotonic training, also known as strength or weight training, has become one of the best forms of exercise for enhancing and individuals physical fitness as well as for conditioning athletes. Isotonic training has been used extensively to increase fitness and sports performance. It has been shown to improve maximal strength, power, and leaping ability [5]. A number of resistance techniques are widely recognised for stimulating an increase in one repetition maximum (1RM) strength. [17, 19]. However, only few studies have attempted to make direct comparisons of different styles of resistance training programmes to determine adaptational differences. Marcinik et al. [4] used short-term training to compare high intensity 70% of 1-RM vs moderate intensity 40% of 1-RM aerobic /circuit resistance training in females US Naval Recruits. After 8 weeks, 1-RM bench press performance was considerably higher in higher intensity group, although 1-RM leg press performance did not vary across groups. Split routines are recommended by the American college of sports medicine (ACSM) to enhance strength development in intermediate-advance resistance-trained people and athletes. Individuals that follow the split routine training paradigm exercise distinct body regions on each training session throughout a week to allow for appropriate muscle recovery and to maximise training loads. The ACSM extends on advice, stating that split training programmes should also involve training periodization [23]. When training volume was split into two sessions rather than one, Hakkinen et al. [11] saw larger gains in muscle cross-sectional area and strength. Previous research restricted resistance training to upper-body, lower body, or total- body routines. They observed that upper-body and complete-body resistance training resulted in comparable increase in performance and or overall conditioning programme aimed at muscular tissue mass growth [24, 25]. No study has ever compared the effects of designing resistance training into two parts: total-body resistance training one session per week (G-I), and resistance training three sessions per week (G-II), upper body and lower body training. There is no evidence to answer the question: is isotonic training for two session better than three sessions, or isotonic training for three session better than two sessions with different volume frequency in male volleyball players. Are vital exercise sessions. Are vital exercise sessions for novices and beginners to create resistance training? Are there distinctions in exercise sessions for improving physical fitness? These are current issues that we hope to address in our study. Therefore, the purpose of this investigation was to examine the effect of

three differences periodized resistance training programs (G-II, and G-II) on strength, endurance, and body composition in male volleyball players.

2. Methods

2.1 Subjects

Forty-five male volleyball players were randomly selected from Govt. degree college killam, affiliated with Kashmir University (UT) Jammu and Kashmir. A written consent was obtained from all subjects after explanation of all phases of the test, the subjects made clear that they had no records of pain and surgery and that they were completely healthy. All tests and training sessions were conducted at the college gym. Subjects had been never involved any type of resistance training and had normal dietary intake during the study. The descriptive characteristics of the subjects are in table. I

Table. 1

Descriptive characteristics of the subjects.*

Age (y)	Body height (cm)	Body weight (kg)	BMI
19.45 ± 3.4	177.18 ± 4.15cm	66.70 ± 5.30	21.20 ± 3.25

** Data is reported as mean ± SD.*

2.2 Procedure

The subjects were familiarized with the isotonic training program about one week before the start of training period. During the familiarization session, subject initial characteristics such as; age, height, body weight, flexed arm circumference, one repetition maximum (60% 1RM) for bench press and vertical jump were obtained. Subjects were tested pre training and post training (8 weeks). The same researchers conducted all tests. Pre and post training anthropometric measures of weight, height and percent body fat were taken. Height was measured to a nearest to 0.1 cm using height rod. Body weight with minimal clothing was measured to the nearest 0.1 kg on weighing machine. Subjects had 3 skin fold sites (chest, abdominal, and thigh) measured to determine body composition or percent body fat. The measurement was used the method of Jackson and Pollock [2]. The circumference of flexed arm was assessed by mayo tape. The vertical jump test was chosen to provide information explosive strength. Vertical jump test was used as criterion measures; the standing highest hand reach was subtracted from the jump and highest reach of the subject. Data was recorded in centimetres. For the bench press, each participant dropped the bar until it made contact with

his chest, then raised it to a fully extended elbow position. Any trials that did not match the standardised procedure criteria were removed from the study. A warm-up consisting of 5-10 repetitions at 40-60% of maximum perceived effort was done. Between each activity, there was always a 2-minute rest time. Subjects were allowed to perform maximum 8 repetitions during bench press and were used equation of Brzycki [3] for the determine of 1RM.

$$1\text{RM}=\frac{\text{weight lifted}}{1.0278-0.0278\times No.of\ Reps.}$$

After the maximal strength testing, the local muscular endurance test was performed 24 hours later. The exam was completed by performing repeats until they were exhausted. Participants completed as many repetitions as feasible without stopping or hesitating between repeats after a brief light aerobic warm-up. 60 percent of 1RM was used as resistance [21]. The bench and vertical jump were chosen as the exercises to be used in this examination.

2.3 Isotonic Training

All workouts began with a general warm-up and ended with a 5-10 minute cool-down time (low-intensity cardio vascular exercise, stretching, etc.). All topics were monitored by a trainer to ensure that all programme requirements were followed to the letter. Trainers were specifically responsible for ensuring that exercise prescriptions were followed and attained during a training (e.g., velocity of movement, appropriate spotting, appropriate safety considerations, prescribed rest periods, and proper hydration requirements). Furthermore, it has recently been proven that close supervision of resistance training is essential for maximising strength performance changes [18]. Free weight and machine workouts were included in the 8-week programme. The isotonic G-I performed upper and lower-body exercises in two training sessions per week (Saturday and Tuesday) for 8 weeks. Isotonic training programme included ; leg press, leg curl, lat-pull-down, bench press, arm curl and triceps push-down on Saturday; and leg extension, calf raise, lat pull row, pack fly, dumbbell arm curl, and dumbbell triceps extension on Tuesday. The isotonic G-II performed lower-body and upper-body exercises in three training sessions per week (Saturday, Monday, and Wednesday) for 8 weeks. Resistance training program included; leg press, leg curl, leg extension, and calf raise on Saturday; lat pull-down, lat pull-row, triceps push-down, and dumbbell triceps extension on Monday; bench press, pack fly, arm curl, and dumbbell arm curl on Wednesday.

2.4 Statistical Analysis

All data are presented as mean ± SD. Paired *t*-tests were used to identify any significant differences between the groups at the pre and post tests for the dependent variables. Effect sizes were determined using the method and interpreted based on the recommendations of Rhea [16] who defines < 0.50, 0.50–1.25, 1.25–1.90, and > 2.0 as trivial, small, moderate, and large, respectively. A criterion α level of $P \leq 0.05$ was used to determine statistical significance. Statistics were analysed using SPSS ver. 25.

3. Results

3.1 Analysis of Flexed-arm Girth

The descriptive analysis showing mean pre, post, percentage and effect size of improvement and 't' ratio of the collected data on flexed-arm girth among experimental and control group are presented in table II.

Table. II.

Paired T-test for the Pre-and Post-test of the Flexed-arm Girth.

Variable Name	Groups	Pre Test SD	Post Test SD	M.D	% Change	E.S	T. Ratio	Sig.
Flexed-arm Girth	Isotonic G-I	26.57 0.29	26.81 0.32	0.24	0.90	0.82	3.66*	0.00
	Isotonic G-II	26.48 0.29	27.19 0.29	0.71	1.52	2.44	32.06*	0.00
	CG	26.76 0.31	26.77 0.33	0.01	0.03	0.03	1.27	0.22

**Significant at 0.05 level (Required table value 2.14 with df 14) E.S= Effect Size*

It is clear from the table II, that there were significant difference (P< 0.05) in experimental group and significant changes between pre-test and post-test data on flexed-arm girth, of isotonic training G-I and G-II because the obtained 't' ratio is 3.66 and 32.06 which is greater than the required table value of 2.14 at 0.05 level of significance for the df 14. The results of the study shows 0.90, 1.52 and 0.03% change from pre to post training with 0.82, 2.44 and 0.03 effect size within the group for flexed-arm girth. The percentage of changes on Flexed-arm Girth of Isotonic training G-I, G-II and control group are given in the figure 1.

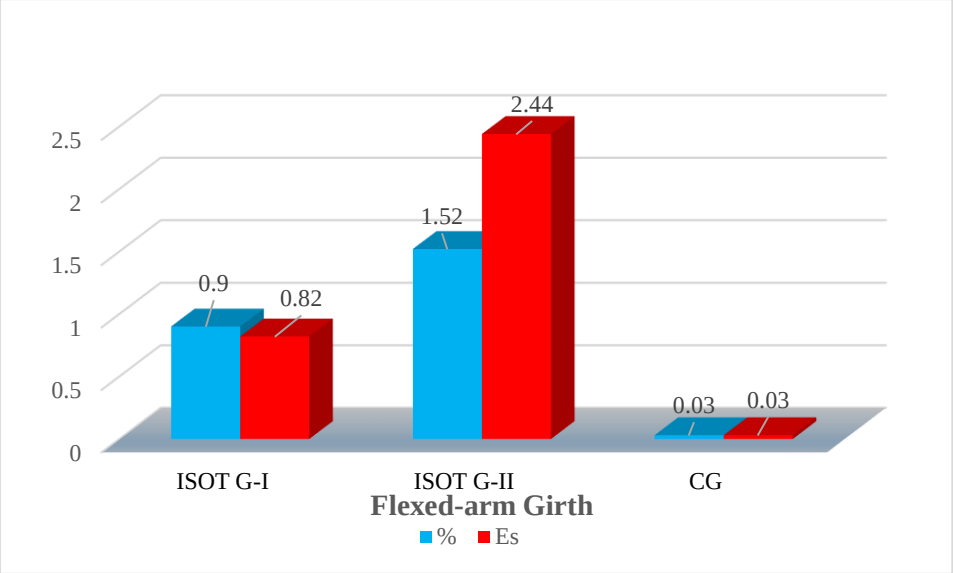

Fig. 1. *% change and effect size in three groups of Flexed-arm Girth.*

3.2 Analysis of Bench Press

The descriptive analysis showing mean pre, post, percentage and effect size of improvement and 't' ratio of the collected data on Bench Press among experimental and control group are presented in table III.

Table. III.

Paired T-test for the Pre-and Post-test of the Variable Bench Press.

Variable Name	Groups	Pre Test SD	Post Test SD	M.D	% Change	E.S	T. Ratio	Sig.
Bench Press	Isotonic G-I	42.33 1.71	46.60 1.80	4.27	10	2.49	11.49*	0.00
	Isotonic G-II	42.33 1.71	48.46 1.76	6.13	14.48	3.58	17.52*	0.00
	CG	42.46 1.68	42.80 1.76	0.34	0.80	0.20	0.48	0.63

**Significant at 0.05 level (Required table value 2.14 with df 14) E.S= Effect Size*

It is clear from the table III, that there were significant difference (P< 0.05) in experimental group and significant changes between pre-test and post-test data on bench press, of isotonic training G-I and G-II because the obtained 't' ratio is 11.49 and 17.52 which is greater than the required table value of 2.14 at 0.05 level of significance for the df 14. The results of the study shows 10, 14.48 and 0.80% change from pre to post training with 2.49, 3.58

and 0.20 effect size within the group for bench press. The percentage of changes on Bench Press of Isotonic training G-I, G-II and control group are given in the figure 2.

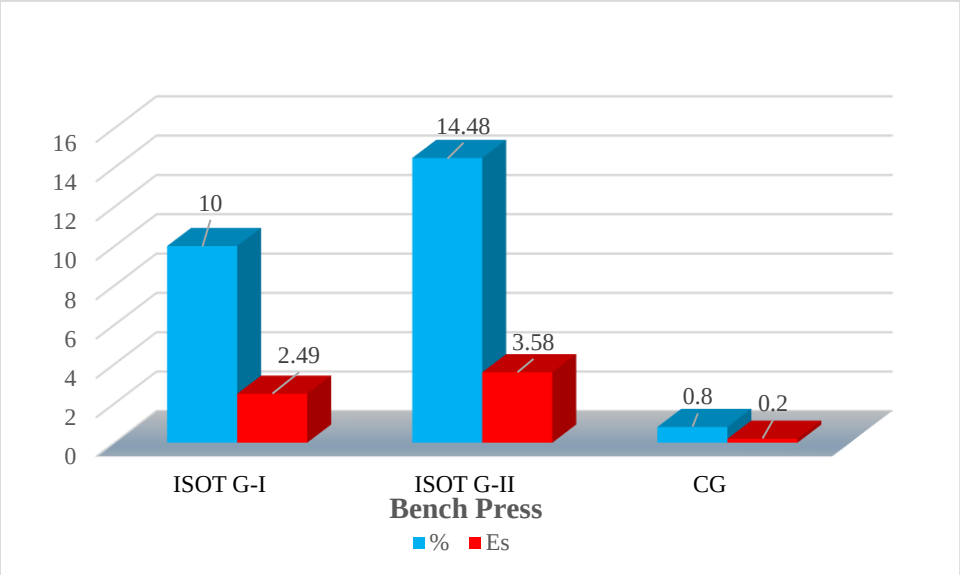

Fig. 2. *% change and effect size in three groups of Bench Press.*

3.3 Analysis of Vertical Jump

The descriptive analysis showing mean pre, post, percentage and effect size of improvement and 't' ratio of the collected data on vertical jump among experimental and control group are presented in table IV.

Table. IV.

Paired T-test for the Pre-and Post-test of the Variable Vertical Jump.

Variable Name	Groups	Pre Test SD	Post Test SD	M.D	% Change	E.S	T. Ratio	Sig.
Vertical Jump	Isotonic G-I	49.01 1.51	51.98 1.35	2.97	6.05	1.96	9.16*	0.00
	Isotonic G-II	49.05 1.77	53.66 2.20	4.61	9.39	2.60	9.57*	0.00
	CG	49.81 1.29	50.07 1.43	0.26	0.52	0.12	0.99	0.33

**Significant at 0.05 level (Required table value 2.14 with df 14) E.S= Effect Size*

It is clear from the table IV, that there were significant difference (P< 0.05) in experimental group and significant changes between pre-test and post-test data on vertical jump, of isotonic training G-I and G-II because the obtained 't' ratio is 9.16 and 9.57* which is greater than the required table value of 2.14 at 0.05 level of significance for the df 14. The

results of the study shows 6.05, 9.39 and 0.52% change from pre to post training with 1.96, 2.60 and 0.12 effect size within the group vertical jump. The percentage of changes on Vertical Jump of Isotonic training G-I, G-II and control group are given in the figure 3.

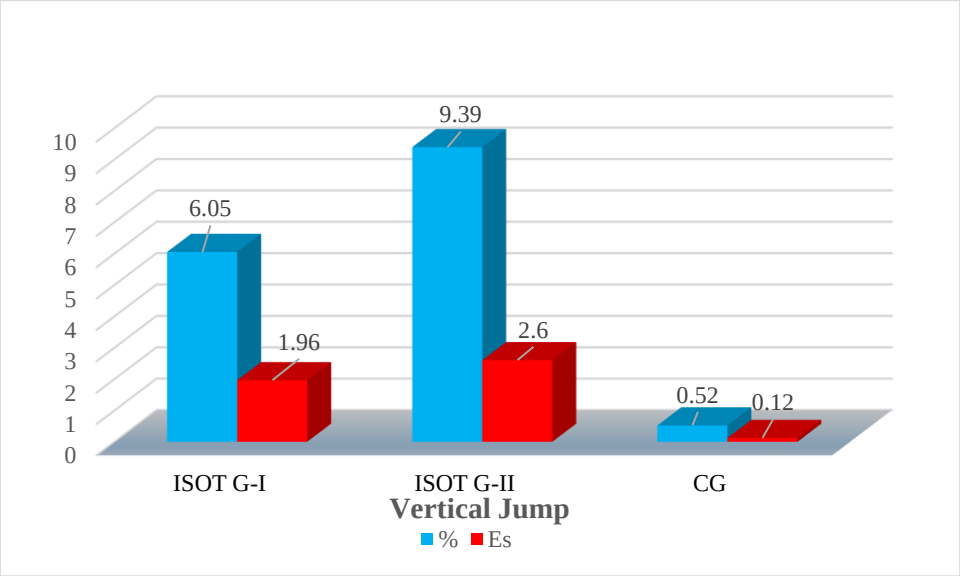

Fig. 3. *% change and effect size in three groups of Vertical Jump.*

4. Discussion and Conclusion

The purpose of the present study was to compare the effect the two equal-volume Isotonic training programmes on physiological abilities in male volleyball players. We hypothesized that, resistance training for three days are better than two days isotonic training. The main findings of the present study was that, there were significant difference among the groups of 1RM bench press and vertical jump. Also, the isotonic group II and group I showed significant improvement than pre training on flexed arm girth.

Upper and lower body strength increased significantly in all groups after 8-weeks resistance training. In contrast of our study. Berger [14], compered of one, two and three sessions/ week training the bench press or squat concluded that three sessions were superior to one or two sessions in bringing about strength increases. Another comparison of training frequency for the bench press also concluded that three sessions were superior to one or two sessions [12]. The findings of the present study are in line with graves et al. [9] who reported that one or two sessions was equally as effective as two or three sessions per week when training for isolated lumbar extension strength. Demichele et al., [13] found that two sessions per week was equivalent to three and superior to one session per week when training for torso rotation. These studies indicate that three sessions per week are superior to one or two sessions

per week when training arm and leg musculature, whereas when training spine muscles, one or two sessions per week. The training frequency of three sessions per week when training the arms and legs results in a 20 to 30 % greater strength gain than a frequency of two sessions per week [1].

Isotonic II training group significantly increased in the arm circumference, but little bit change in group I three sessions per week improved in flexed arm girth, much better than control group. P. Gentil et al., [6] suggested that untrained men experience similar muscle girth and strength with equal volume resistance training performed one or two days per week. Huffman et al., [10]. Examined the effects of 10 weeks varying self- selected training frequencies among collegiate football players using different body part training programs, and reported significant changes in the chest and thigh circumference, and sum of skin fold following four or five sessions per week training. It is believed that increase in muscle girth and muscle mass can be increase; myofilaments, actin and myosin filaments, sarcoplasm and connective tissue. [8] Additionally, Carroll et al., [22] reported that when resistance training was equated for both time and number of sessions, 2 days/week resulted in a significant increase in the proportion of myosin heavy chain II as compared with 3 days/week. The rest period between sessions must be sufficient to allow for muscular recuperation and development while alleviating the potential for overtraining [20]. Split routine can allow performance of assistance exercises and may also be useful for enhancing physiological development. Overall, we believe that beginner athletes should focus on split routine training to improve performance and promote muscle adaptations.

5. Acknowledgments

I am obliged to Annamalai University for allowing us to conduct this study, and I would like to express my gratitude especially to the subjects, college principal, and physical trainers who all participated and supported us in completing this study.

References

1. American College of Sports Medicine. The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, and flexibility in healthy adults. *Medicine and Science in Sports and Exercise.* 1998, 30: 975-991.
2. A.S. Jackson, M. L. Pollock. Practical assessment of body composition. *Physician and Sports Medicine*. 1985, 13: 82-90.
3. Brzycki, M. Strength testing-predicting a one-rep max from reps to-fatigue. *Journal of Physical Education Recreation and Dance*. 1993, 68: 88-90.
4. E. J. Marcinik, J. A. Hodgdon, J. J. O'Brien, K. Mittleman. Fitness changes of naval women following aerobic based programs featuring calisthenic or circuit weight training exercises. *European Journal of Applied Physiology.* 1985, 54: 244 -249.
5. Forthomme, B., Croisier, J. L., Ciccarone, G., Crielaard, J. M., & Cloes, M. (2005). Factors correlated with volleyball spike velocity. *The American journal of sports medicine*, *33*(10), 1513-1519.
6. Gentil, P., Fischer, B., Martorelli, A. S., Lima, R. M., & Bottaro, M. (2015). Effects of equal-volume resistance training performed one or two times a week in upper body muscle size and strength of untrained young men. *J Sports Med Phys Fitness*, *55*(3), 144-9.
7. Harmandeep, S., Satinder, K., Amita, R., & Anupriya, S. (2015). Effects of six-week plyometric on vertical jumping ability of volleyball players. *Research Journal of Physical Education Sciences*, *2320*, 9011.
8. J.H. Wilmore, D.L. Costill. *Physiology of Sport and Exercise.* Champaign, IL: Human Kinetics, 2015.
9. J. E. Graves, M. L. Pollack, D. N. Foster, S. H. Leggett, D. M. Carpenter, R. Vuoso, A. Jones. Effects of training frequency and specificity on isometric lumbar extension strength. *Spine*. 1990, 15: 504-509.
10. J. R Hoffman, W. J. Kraemer, A. C. Fry, M. Deschenes, D. M. Kemp. The effect of self-selection for frequency of training in a winter conditioning program for football. *Journal of Applied Sport Science Research.* 1990, 3: 76-82.
11. K. Hakkinen, M. Kallinen. Distribution of strength training volume into one or two daily sessions and neuromuscular adaptations in female athletes. *Electromyography Clinical Neurophysiology*. 1994, 34: 117-124.
12. M. S. Faigenbaum, M. L. Pollock. Strength training: rationale for current guidelines for adult's fitness programs. *Physician and Sports Medicine*. 1997, 25: 44-64.

13. P. D. DeMichele, M. L. Pollock, J. E. Graves, D. N. Foster, D. Carpenter, L. Garzarella, W. Brehue, M. Fulton. Isometric dorsal rotations strength: Effective training frequency on its development. *Archives of physiology and Medical Rehabilitation*. 1997, 78: 64-69.
14. R. A. Berger. Effect of varied weight training programs on strength. *Research Quarterly*. 1962, 33: 138-181.
15. Rezaeimanesh, D., & Farsani, P. A. (2011). The effect of a 6 week isotonic training period on lower body muscle EMG changes in volleyball players. *Procedia-Social and Behavioral Sciences*, *30*, 2129-2133.
16. Rhea, M. R. (2004). Determining the magnitude of treatment effects in strength training research through the use of the effect size. *The Journal of Strength & Conditioning Research*, *18*(4), 918-920.
17. R. S. Staron, M. J. Leonardi, D. L. Karapondo. Strength and skeletal muscle adaptations in heavy-resistance-trained women after detraining and retraining. *Journal of Applied Physiology.* 1991, 70: 631-640.
18. S. A. Mazzetti, W. J. Kraemer, J. S. Volek. The influence of direct supervision of resistance training on strength performance. *Medicine and Science in Sports and Exercise.* 2000, 32: 1175-1184.
19. S. J. Fleck, W. J. Kraemer. *Designing resistance training program*. Human Kinetics, 2005.
20. S. P. Brid, K. M. Tarpenning, F. E. Marino. Designing resistance training program to enhance muscular fitness. A Review of the Acute Programme Variables. *Sports Medicine*. 2005, 35: 841-851.
21. T. Benedict. Manipulating resistance training program variables to optimize maximum strength in men: A Review. *Journal of Strength and Conditioning Research.* 1999, 13: 289-304.
22. T. J. Carroll, P. J. Abernethy, P. A. Logan. Resistance training frequency: strength and myosin heavy chain responses to two and three bouts per week. *European Journal of Applied Physiology Occupational Physiology* 1998**,** 78: 270-275.
23. W. J. Kraemer, K. Adams, E. Cafarelli, G. A. Dudley, C. Dooly, M.S. Feigenebaum, S. J. Fleck, B. Franklin, A. C. Fry, J. R. Hoffman, T. TriplettMcBride. American College of Sports Medicine position stand. Progression models in resistance training for healthy adults. *Medicine and Science in Sports and Exercise*. 2002, 34: 364-380.
24. W. J. Kraemer, S. A. Mazzetti, B. C. Nindl, L. A. Gotshalk, S. J. Volek, J. A. Bush, J. O. Marx, K. Dohi, A. L. Gomez, M. Miles, S. J. Fleck, R. U. Newton, K. Ha¨kkinen. Effect of resistance training on women's strength/power and occupational performances. *Medicine and Science in Sports and Exercise.* 2001, 33: 1011-1025.

25. W. J. Kraemer, B. C. Nindl, N. A. Ratamess, L. A. Gotshalk, S. J. Volek, S. J. Fleck, R. U. Newton, K. Ha¨kkinen.. Changes in muscle hypertrophy in women with periodized resistance training. *Medicine and Science in Sports and Exercise.* 2004, 36: 697-708.