National Journal of Physiology, Pharmacy and Pharmacology

RESEARCH ARTICLE

Comparison of the effect of two selected resistance training patterns on some physical and physiological factors of elite freestyle wrestler young boys

Mohammad Mohammadi[1], Hjjatollah Siavoshy[2], Seyyed Gholam Hossein Rahimi[1]

[1]Department of Physical Education, Faculty of Literature and Humanities, Malayer University, Malayer, Iran, [2]Ph.D. Student of Sport Physiology, Department of Exercise Physiology, Sports Medicine Research Center, Sport Sciences Research Institute, Tehran, Iran

Correspondence to: Mohammad Mohammadi, E-mail: M.mohammadi@malayeru.ac.ir

Received: October 13, 2017; **Accepted:** November 08, 2017

ABSTRACT

Background: Wrestling is a sport heavy and severe activity due to certain physical and physiological needs such as anaerobic, power, strength, speed, lactate tolerance, and anaerobic stamina because wrestling matches are carried out at different weights. A more successful wrestling is a more effective athletic performance for repeated exercises and endurance fatigue. **Aims and Objectives:** The main objective of this research was to compare the effect of two resistance training methods (dual pyramid and diagonal pyramid) on some physical and physiological factors of elite freestyle wrestler's young boy in Hamadan province. **Materials and Methods:** Subjects were divided into three groups of 10 (Experimental I Dual Pyramid Practices, Experimental II Diagonal Pyramid) and control group. The three groups trained for every 12 weeks and each week had 3 sessions. In terms of the method of research, three groups participated in a 12 week exercise program with three sessions per week. Body combination, fat index, muscular density, strength, muscular endurance and anaerobic capabilities of wrestlers were measured both prior and post to the intervention program using the Kolmogorov–Smirnov, Multivariate Analysis of Covariance (MANCOVA) in addition to Sidak Post-Hoc Test. **Results:** The results of the statistical test showed that there is a significant difference between the two groups in power of muscle strength, muscular endurance, power, and fat percentage ($P \leq 0.05$). **Conclusion:** The results of this study suggest that two different exercise programs produce similar results in strength, endurance, and muscle mass, but it may have more effectiveness to improve the ability of diagonal training programs and to improve the body composition and reduce the percentage of fat and pyramid training programs.

KEY WORDS: Dual Pyramidal Fruiting Pattern; Diagonal Pyramidal Foliar Pattern; Elite Freestyle Wrestler's Young Boy; Physical and Physiological Factors

INTRODUCTION

Wrestling is a heavy and severe activity due to certain physical and physiological needs such as anaerobic (power, strength, speed, lactate tolerance, and anaerobic stamina) and it is a power-speed exercise that doing resistance training is necessary to improve the performance of the athlete. Although wrestling competitions are carried out at different weights, a more successful wrestling is the more powerful of the endurance to carry out repetitive techniques and tolerance of fatigue. High levels of muscular strength are needed to implement high-level techniques and skills. Hence, the design of a suitable program is the main factor in the success of strength training, at each level of readiness and consistency. Based on the results of studies, the genetic backgrounds such as age, sex, other and factors are mediators of the response

Access this article online	
Website: www.njppp.com	Quick Response code
DOI: 10.5455/njppp.2017.7.1040508112017	

to the exercise protocol of muscle hypertrophy. In fact, the amount of free fat is affected by these factors. In addition, an increase in muscle mass can be gradually improved by increasing exercise experience. However, relatively few studies have examined muscular adaptation in response to different rates of fecundity.[1]

Although to increase the maximum power, it is recommended to perform maximum load times; it seems that how to use maximal loads in macrocycle, microcycle, mesocycle, and even in the training session from one time to the next, and it is important to create the optimal training stimulus. In general, it has been accepted that multiple exercises to increase muscle strength and muscle hypertrophy, due to the greater volume of resistance training, are superior to the one-time practice method. On the other hand, the use of the foliar pattern with a gradual increase of load from one turn to the next, using the number of repetitions in lower load times, increases the time under the stress of muscle.[1]

Furthermore, based on the results of the studies, the greatest increase in muscle strength and muscle mass is achieved when the maximum unit is used. In the initial stages of resistance training, there is almost no muscle hypertrophy, and often, the improvement of strength at this stage is related to neural adaptation. However, a few months after the exercise, the muscle begins to increase due to hypertrophy, and it becomes the dominant factor for improving the strength. It is clear that a strength training program will improve the strength of each unit of the cross-sectional area of the muscle. In fact, increased muscle strength in subjects practice may be due to adaptation in muscle hypertrophy.[1]

The key to an effective workout program is the choice of enough movements. Often it's a difficult task to determine the right number of movements, and some coaches choose more exercises to strengthen muscle groups. The consequence of this work is a very tedious plan. The most important factor in designing a resistance training program is to focus on the variables of the resistance training program, such as the practice type, the number of sets, the choice of resistance, the number of repetitions, or the rest between the training sessions. Various programs can be designed for people with different readiness. Furthermore, according to the results of studies, the greatest increase in muscle strength and muscle volume occurs when the maximum unit of motion is used. Some coaches are advocating the use of different loads instead of using constant loads. Studies that have examined different methods of resistance training by varying the intensity of exercise at each turn have reported similar increases in muscle strength. In the research, comparing two models of the flat pyramid and peripheral pyramid in soccer players did not show significant differences in power, muscle strength, and volume. According to performed reports, 97% of fitness coaches use multiple duty exercise methods to increase power. Salman *et al*. (2016) in their study stated that both training methods (simple pyramid and flat pyramid) increased strength and increased muscle mass in the subject,[2] and Yaghoub *et al.* (2012) also pointed out in their research on young wrestlers that two different dual pyramidal resistance training programs and reverse stairs had the same results in maximizing muscle strength and muscle mass, but to increase muscular endurance, the inverse stepwise foliation pattern was more suitable for dual pyramidal fecundity to increase the strength of the legs.[3] On the other hand, Hosseini *et al.* (2014) suggested that two different exercises of resistance training create similar results in increasing strength, endurance, muscle volume, and anaerobic power in young wrestlers.[4] Given the importance of maximum power, the endurance of anaerobic power and power in the good performance of elite adult free-rider wrestlers and the lack of consistency of studies conducted to determine the best method of rheumatology, as well as the extension of the use of practice protocols to increase strength and muscle mass study about this field is indispensable. Therefore, the purpose of this study is to compare the effect of selected resistance training patterns on some physical and physiological factors of elite freestyle wrestler's young boy.

MATERIALS AND METHODS

The present study was a semi-experimental design with pre- and post-test design in three experimental dual pyramidal groups (10 people), diagonal pyramid (10), and control group (10 people). After completing the consent, the subjects participated in the research and medical information questionnaire in this study. All subjects had no illness or complications at the beginning of the research and had no history of smoking, alcohol, medication, and injuries. Subjects were asked to maintain their daily activities and diet during the study. The day before the beginning of the test, the subjects became familiar with how they were performed and measurements of height and weight, fat percentage, repeatability, anaerobic power, and muscle mass were performed. The exercise is done in the evening to avoid the effects of boarding rhythm on the variables studied from the subjects. Before starting the measurements, all subjects participated in a training exercise for 1 week to get familiar with the training equipment and to teach the correct techniques of movement. The power of the subjects in two movements of the half squat and bending of the arm were evaluated using the 1RM test in the manner as described by McQuaygan *et al.* (2008).[5] The lower muscle strength of the subjects was evaluated using the Vertical Jump Test Sargent Jump Test (true) by Braun and Weir Method. After initial heating, each subject performed three jump tests, and the fourth jump was considered as the main jump. Using the vertical jump height and the equations provided by Harman *et al.* (1991), the maximum power and average power were calculated.[6] Muscle mass was calculated using the anthropometric method for hip muscles (quadriceps and

hamstrings), according to Intelligence *et al.* (1995), and for muscle of the arm area according to the method described by Friesenko *et al.* (1974).[7]

Equations used to estimate the cross-sectional area of the muscle complex are as follows:[8]

Hamstring transverse cross-sectional area (1.08×half the circumference of the thigh by millimeters)−(64×the thickness of the skin of the skin in the anterior thigh region to millimeters) - 22.69

Total cross-sectional thickness of the thigh muscle (4.68×half the circumference of the thigh to millimeters)−(2.09×the thickness of the skin of the skin in the anterior thigh region to millimeters) - 80.99

Quadriceps transverse cross-sectional area (2.52×half the circumference of the thigh by millimeters)−(1.25×the thickness of the skin of the skin in the anterior thigh region to millimeters) - 45.13.

Equations used to estimate arm size are as follows:[9]

Arm diameter (mm): [Arm circumference (mm)÷TT]−[(mm) Thickness of the skin of the triceps]

Arm muscle area (mm): [Arm circumference (mm) − TT]×[Thickness of the skin of the triceps (mm)]

Arm muscle arm (m^2m): [TT÷4×] [Arm diameter $(mm)^2$]

The maximum power of the subjects was measured using the 1RM test by McGuigan *et al.* (1997). Hence, before the test and after general heating, 5 repetitions with 30% (2 min rest), 4 repetitions with 50% (2 min rest), 3 repetitions with 70% (3 min. rest), and one repetition with 90% (3 min of rest)) were done to warm up. After the last run with 90% of 1RM, the load in the next turn with the feedback of the subjects based on the displaced weight was added to get 1RM (2.5–10 kg after each successful attempt). To obtain 1RM, after the determination of 90% of the 1RM, three test steps were taken, and each resting effort was considered to be 4 min.[10] After identifying 1RM subjects, 60% of their 1RM was calculated individually in each move individually, and they were asked to perform a maximum repeat with that calculated weight (from 60% of 1RM). About the speed of movement, the subjects were told that the move went on for a second and lasted for 2 s on the back or up. In the end, the number of repetitions performed is considered as the muscular endurance of the muscle. In the strength training program, after initial measurements, the subjects were trained for 12 weeks using two selective foliar patterns. Two training sessions for subjects were designed. The first group uses a dual pyramid program, 80%/4, 85%/3, 90%/2, 95%/1, 95%/1, 90%/2, 85%/3, 80%/4 [Figure 1]. Which performed 4 repetitions with 80% (1RM) in the first turn, and after this stage, the exercise load was progressively increased. At each stage, 5% was added to the workload to reach a load of 95%. At this stage, the fruiting was reduced and the number of replicates went up to the initial stage, 80% with 4 replicates. Totally, each muscle was trained 12 times in the dual pyramidal training pattern. The second group practised using a diagonal pyramidal program 80.5%, 95.2%, 90.2%, 85.4%, and 80.5%. At that time, the exercise load, after performing one turn with 80% of 1RM in the next 3 consecutive times, increased by 5% at each turn, and when the load reached 95% of the 1RM in the fourth turn, one time with 80% of 1RM was running. After each turn, the subjects were resting for 3–4 min [Figure 2]. Figure 1 shows a screenshot of the two applied patterns.

The subjects performed 12 sessions a week and 3 sessions in synchronization during the 6th movement (chest, lumbar, arm, leg press, back, thigh, and forehead), respectively.[11] All the active muscles in these movements were practised in each session. In each training session, the researcher monitored the subjects. Every 1 week, 1RM test was taken from subjects. Depending on the amount of displacement, the new program was given to the subjects to comply with the overdraft principle. To compare physical and physiological changes after 12 weeks of strength training, data were first analyzed for Kolmogorov–Smirnov (K-S) for determining normality. For inferential statistics, Multivariate Analysis of Covariance (MANCOVA) test was used with Sidak post-hoc test. All operations and statistical analysis were analyzed by SPSS software version 21 and also considered in this study ($P < 0.05$).

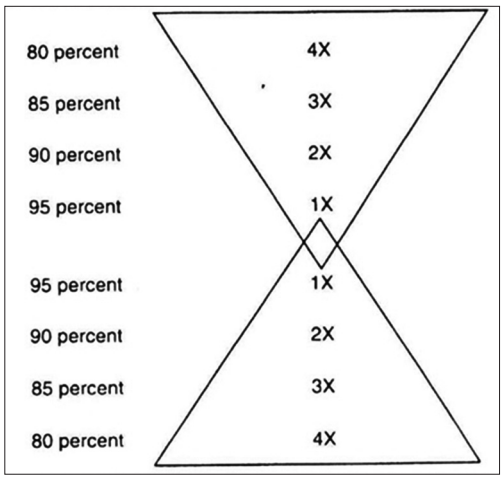

Figure 1: The method of execution of twofold pyramid program

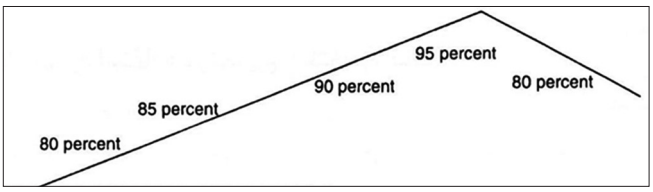

Figure 2: The method of execution of the diagonal pyramid program

RESULTS

After collecting data, the results of the normal distribution of data were analyzed by K-S test, all of which were normal data ($P > 0.05$). Therefore, MANCOVA analysis was used for analyzing inferential statistics which pre-test values were used as covariance variable, and after the significance of this test, Shidak post-test was used as a complementary test for two by two comparisons. The findings of this study showed that the strength and endurance of the upper and lower extremity muscles, as well as the cross-sectional area of the quadriceps and muscle diameter in both training groups, showed a significant difference compared to the control group ($P < 0.05$). However, the value of Sergeant height jump and the absolute and relative power peaks was only significant in the group that had the pyramid diagonal program compared to the other two groups ($P < 0.05$). In contrast, body fat percentage was significantly higher in the dual pyramidal group than in the other two groups ($P < 0.05$). Furthermore, the amount of arm circumference and total muscle area in the dual pyramid group was significantly different from the control group ($P < 0.05$), but the difference was not significant ($P > 0.05$) in comparison to the diagonal pyramidal training group ($P > 0.05$). Other research variables did not show any significant difference compared to other research groups [Table 1].

DISCUSSION

The results of this test showed that the strength and endurance of upper and lower extremity muscles, as well as the cross-sectional area of the quadriceps and muscle diameter in both training groups, showed a significant difference compared to the control group. These findings suggest that both of these exercise programs have had a positive effect on improving the functional levels of these variables and have improved these physical fitness factors.

Findings of the study on the strength, endurance, and muscle mass of the upper and lower limbs, with the results of research by Campos *et al.* (2002)[12] and Brandenburg *et al.* (2006),[13] but not consistent with the results of the study by Campos *et al.* (2002) and Baird *et al.* (2005). In the field of muscle strength, the results of the study were compared with the results of Häkkinen and Komi (1985),[13] Rutherford *et al*. (1986),[14] McGuinness *et al.* (2008),[5] and Salman *et al.* (2016).[2] Regarding the body mass index and fat percentage, the results of the non-matching with the results of researches by Yaghoub *et al.* (2012),[3] Hosseini *et al.* (2014),[4] Brad (2010),[15] and Brid *et al.* (2009)[16] are consistent.

According to the presuppose of the research, the diagonal pyramidal foliar pattern (SPLP) did not increase muscle strength in comparison with the dual pyramidal pattern despite the incremental increase in load at each turn. Given the fact that the training volume in both training programs was almost identical, such an outcome was not far off expectation. It has been reported that using of maximal loads and low repetitions, by calling the fast-moving motor units and exerting pressure on the muscular nervous system, and by changing the nervous activity of the muscle, increase muscle strength. Therefore, it seems that the use of the same mechanism for stimulating the nervous system of the muscle causes the same initial neuromuscular adaptations by two different protocols. Of course, 6 weeks of initial resistance training, in the hypertrophy stage, may partially affect the power increase by two different protocols.

Kraimer *et al*. (2004) suggested that the subjects at the level of practice may have different adaptations in response to resistance training. They reported an increase of 40% in inflammatory subjects and an increase of 2% in elite practice subjects. Considering the use of maximum loads in both exercise programs, it seems that a similar method has been used to stimulate neuromuscular devices and recall motor units.[17]

Plutz *et al.* (1994) reported that the use of maximum loads to increase power triggers the use of special motor units (high-threshold motor units) that cannot be achieved with light-to-moderate loads. Some coaches tend to use different loads instead of using constant loads. Increasing muscle endurance of trained groups than the control group is another result that was obtained from this study. Studies have shown that resistance training can be effective on muscular endurance, and the higher the frequency and the lower the frequency, the more effective the muscular endurance.[18] Other results of the study showed that the amount of arm circumference and total muscle area in the dual pyramidal group was significantly different from that of the control group, but the difference was not significant between the participants in the diagonal pyramidal training program. This phenomenon also shows that dual pyramidal training programs may have more effects on physical inactivity but may not have much benefit and benefit from having diagonal pyramidal training programs. On the other hand, muscle tiredness can cause a rapid recall of fast contractions, the consequence of which in this pattern of fetal development, rather than increased power, has been increased muscle mass. The results of this study, in accordance with other findings, showed a significant increase in muscle and muscle mass in the two groups after mid-term strength training (12 weeks).

Campus *et al.* (2002) reported that after 8 weeks of resistance training on untrained men, after training, muscle volume was higher in the group with a low and moderate repetition.[12] Bird *et al.* (2005) showed that low volume and high-intensity programs produce significant increases in muscle volume compared to high volume and low-intensity programs. Contrary to the initial claim, the dual pyramid pattern is said to have more effect on muscle mass.[16]

Table 1: Results and findings of variables used in the research (data as mean±standard deviation)

Variable	Group††			Percent change †	Post-test	Pretest	Effect size‡
	SPLP	DPLP	Control				
Body weight (kg)							
Control	0.969	0.309	-	0.77±0.42	92.10±15.11	91.40±14.98	0.103
DPLP	0.493	-	0.309	2.94±4.01	84.30±8.20	81.98±8.48	
SPLP	-	0.493	0.969	1.44±0.74	85.50±6.8	84.31±7.12	
Body mass index (kg/m^2)							
Control	0.891	0.162	-	0.77±0.42	28.50±4.9	28.28±4.4	0.14
DPLP	0.436	-	0.162	2.4±4.1	27.24±2.4	26.45±1.53	
SPLP	-	0.436	0.891	1.44±0.74	26.69±1.7	31.26±1.13	
Strength of upper muscles of the body (kg)							
Control	<0.001	<0.001	-	2.27±2.94	9±95	10±93	0.713
DPLP	0.189	-	<0.001	13.16±4.64	9±101	10±89	
SPLP	-	0.189	<0.001	15.77±4.19	8±106	5±92	
Strength of the lower muscles of the body (kg)							
Control	<0.001	<0.001	-	3.30±2.33	14±117	15±113	0.786
DPLP	0.15	-	<0.001	17.1±5.24	11±120	13±103	
SPLP	-	0.15	<0.001	18.29±5.42	9±128	9±108	
Upper muscles endurance (number)							
Control	<0.001	<0.001	-	5.3±4.46	2±24	2±23	0.767
DPLP	0.082	-	<0.001	32.33±9.21	3±30	3±23	
SPLP	-	0.082	<0.001	27.87±9.53	1±27	1±23	
Endurance of the lower muscles of the body (number)							
Control	<0.001	<0.001	-	7.2±3.18	3±27	3±26	0.776
DPLP	0.256	-	<0.001	34.66±10.68	2±37	1±27	
SPLP	-	0.256	<0.001	31.96±7.65	3±34	2±26	
Jump height (cm)							
Control	<0.001	0.263	-	4.75±4.88	37.5±3.55	35.96±4.16	0.646
DPLP	<0.001	-	0.263	20.90±8.56	14.38±18.70	12.29±1.40	
SPLP	-	<0.001	<0.001	23.67±8.89	41.5±2.83	33.65±1.77	
Body fat percentage (%)							
Control	0.768	0.041	-	0.07±10.94	12.35±2.1	12.35±1.39	0.304
DPLP	0.01	-	0.041	−10.66±8.55	12.23±1.46	13.77±1.32	
SPLP	-	0.010	0.768	4.98±2.43	12.12±1.47	11.56±1.52	
Peak of absolute power (watts)							
Control	<0.001	0.24	-	8.32±9.37	16.75±25.88	14.37±27.93	0.613
DPLP	<0.001	-	0.24	20.90±8.56	14.38±18.70	12.29±1.40	
SPLP	-	<0.001	<0.001	42.34±15.97	17.43±16.98	12.75±1.33	
Absolute average power (watts)							
Control	0.074	0.965	-	20.86±46.87	56.24±11.3	20.2±123.5	0.211
DPLP	0.118	-	0.965	−41.7±13.62	12.12±99.9	−63.88±84.21	
SPLP	-	0.118	0.074	−69.54±13.88	240.80±340.43	−75.38±13.54	
Relative peak power (watts per kilogram)							
Control	<0.001	0.09	-	7.49±8.43	16.68±2.44	15.69±3.32	0.681
DPLP	<0.001	-	0.09	57.17±9.65	17.75±3.42	15.31±3.34	
SPLP	-	<0.001	<0.001	40.37±16.20	20.10±3.32	14.43±1.88	

(Contd...)

Table 1: *(Continued)*

Variable	Group††			Percent change †	Post-test	Pretest	Effect size‡
	SPLP	DPLP	Control				
Relative average power (watts per kilogram)							
Control	0.088	0.973	-	19.95±45.86	0.46±1.43	0.07±1.59	0.196
DPLP	0.149	-	0.973	−402.84±134.6	0.19±1.9	−0.73±1,44	
SPLP	-	0.149	0.088	−69.15±14.76	2.99±5.65	−0.98±0.37	
Cross-sectional area of hamstring muscle (square millimeter)							
Control	0.957	0.199	-	0.78±0.9	52.68±7080	52.51±68.64	0.135
DPLP	0.394	-	0.199	12.5±7.49	17.75±3.42	15.31±3.34	
SPLP	-	0.394	0.957	17.75±3.42	48.38±79.43	44.33±75.15	
Thickness of cross-section of total hip (mm²)							
Control	0.979	0.196	-	0.45±0.42	20.50±7.9	21.54±4.49	0.14
DPLP	0.299	-	0.196	4.4±4.02	23.24±2.58	28.45±1.32	
SPLP	-	0.299	0.979	1.44±0.12	26.69±1.54	31.26±1.12	
Cross-section of quadriceps (mm²)							
Control	0.013	0.006	-	−4.20±15.55	12.12±99.9	−63.88±84.21	0.349
DPLP	0.995	-	0.006	4.98±2.43	12.12±1.47	11.56±1.52	
SPLP	-	0.995	0.013	10.49±5.55	2.99±5.65	−0.98±0.37	
Arm muscle Length (mm)							
Control	0.014	<0.001	-	−0.49±5.80	37.38±20.69	38.60±20.44	0.463
DPLP	0.166	-	<0.001	2.94±4.01	84.30±8.20	81.98±8.48	
SPLP	-	0.166	0.014	42.34±15.97	17.43±16.98	12.75±1.33	
Arm muscle circumference (mm)							
Control	0.212	0.015	-	24.18±66.75	120.64±68.88	111.39±18.98	0.267
DPLP	0.377	-	0.015	15.85±7.49	2113.78±12.76	184.70±40.55	
SPLP	-	0.377	0.212	10.95±4.51	199.54±17.84	180.29±20.51	
Total cross-sectional area of the muscle of the arm (mm²)							
Control	0.071	<0.001	-	-0.17±17.60	1447.94±45.9843	1447.54±76.8742	0.408
DPLP	0.133	-	<0.001	34.74±17.50	3779.65±17.7687	2879.32±23.7532	
SPLP	-	0.133	0.071	22.99±9.77	5431.61±17.7645	3531.19±34.8742	

DPLP: Dual pyramid program, SPLP: Diagonal pyramid, MANCOVA: Multivariate covariance. †Post-test values minus pre-test values divided by pre-test values multiplied by; ††The results were analyzed using MANCOVA analysis with pre-synonym variables as covariance ($P \leq 0.05$); ‡The effect of dependent variable (measured variables) on the independent variable (assignment of research groups)

According to the studies, the use of moderate-to-heavy loads, moderate-to-high repetitions, multiple turns for each movement, and the execution of several moves per session are generally considered as high-profile programs, which are special training exercises, training programs for muscle mass. Salman *et al.* (2016) concluded that both methods of training (simple pyramid and flat pyramid) increased strength and muscle mass in subjects. It can be suggested to use these types of training methods, especially simple pyramid training, to gain a better result in increasing hypertrophy and muscle strength, instructors or athletes. Another result of the research showed that the amount of jump in sergeant height and absolute peak power relative to the one in the group that had the pyramid diagonal program was significant compared to the other two groups. In contrast, however, the percentage of body fat was significant only in the dual pyramidal group compared to the other two groups, which also indicates that diagonal pyramidal training programs may be more effective than double pyramidal exercise programs to improve their power; however, dual pyramidal training programs can play a more effective role in changing body composition and lowering body fat. While the authors reported 21% increase in vertical jump height using explosive power exercises percentages. Furthermore, Rutherford *et al.* (1986) did not show a significant change in maximum power output after 12 weeks of isokinetic resistance training with maximum

loads.[14] Häkkinen and Komi (1985) observed only 7% increase in vertical jump height after 24 weeks of training using maximum loads.[19] Most likely, due to the higher vertical jump height in the flat pyramidal group, a relatively greater increase in muscle strength was observed in this group. Such a finding is in accordance with other findings, the maximum power utilization using maximum loads and slow contraction velocity to increase the vertical and vertical jump height. Mirzaei *et al.* (2012) stated that the results of this study showed that the use of maximum loads in multiple turns of maximum resistance training did not have a significant effect on the desired increase in strength, power, and hypertrophy.[20] In general, we conclude that it might be possible to have more effectiveness to improve the power of diagonal pyramidal training programs and to improve body composition and lower body fat percentages, although more research is needed to validate these findings.

The strengths of the research are that given the fact that in both exercise programs, the maximum loads were used, so it seems that a similar method was used to stimulate neuromuscular devices and the recall of motor units, and that to improve the power, programs diagonal pyramidal training may have a greater impact than a dual pyramidal exercise program, while dual pyramidal training programs may play a more effective role in altering body composition and reducing body fat percentages. Moreover, the research limitations were adequate diet and rest time after exercise.

CONCLUSION

In general, we conclude that it might be possible to have more effectiveness to improve the power of diagonal pyramidal training programs and to improve body composition and lower body fat percentages, although more research is needed to validate these findings.

REFERENCES

1. Folland JP, Williams AG. The adaptations to strength training: Morphological and neurological contributions to increased strength. Sports Med 2007;37:145-68.
2. Salman N, Sharif S, Ali M, Asadollah C. Comparison of the effect of two methods of resistance training on three-headed muscle thickness and its relationship with maximum strength in athletes with bodybuilding. Sport Sci 2016;8:217.
3. Yaghoub H, Bahman M, Gholamreza N. The effect of a strength training course with two different funnel patterns of dual pyramid and reverse stage (on the physiological functions of young wrestlers. Res Sport Sci 2002;16:151-66.
4. Hosseini Y, Nemati GR, Mirzai B. The effect of a strength training period with two different dipole pyramidal and flat pyramidal rates on strength, endurance, muscle mass and anaerobic power. Physiol Sports 2014;23:42-24.
5. Mcguigan MR, Winchester JB. The relationship between isometric and dynamic strength in college football players. J Sports Sci Med 2008;7:101-5.
6. Harman EA, Rosenstein MT, Frykman PN, Rosenstein RM, Kraemer WJ. Estimates of human power output, from vertical jump. J Appl Sport Sci 1991;5:116-20.
7. Frisancho A, Roberto. Triceps skin fold and upper arm muscle size norms for assessment of nutritional status. Am J Clin Nutr 1974;27:1052-8.
8. Housh DJ, Housh TJ, Weir JP, Weir LL, Johnson GO, Stout JR, *et al.* Anthropometric estimation of thigh muscle cross-sectional area. Med Sci Sports Exerc 1995;27:784-91.
9. Fry AC. The role of resistance exercise intensity on muscle fibre adaptations. Sports Med 2004;34:663-79.
10. Benedict, T. Manipulating resistance training program variables to optimize maximum strength in men: A review. J Strength Cond Res 1999;13:289-304.
11. Bompa T, Pasquale M. Cornacchia L. Text book. Serious Strength Training. Champaign, IL: Human Kinetics; 2002. p. 43.
12. Campos GE, Luecke TJ, Wendeln HK, Toma K, Hagerman FC, Murray TF, *et al.* Muscular adaptations in response to three different resistance-training regimens: Specificity of repetition maximum training zones. Eur J Appl Physiol 2002;88:50-60.
13. Brandenburg J, Docherty, D. The effect of training volume on the acute response and adaptations to resistance training. Int J Sports Physiolo Perform 2006;1:108-21.
14. Rutherford OM, Greig CA, Sargeant AJ, Jones DA. Strength training and power output: Transference effects in the human quadriceps muscle. J Sports Sci 1986;4:101-7.
15. Schoenfeldthe BJ. Mechanisms of muscle hypertrophy and their application to resistance training. J Strength Cond Res 2010;24:2857-72.
16. Bird SP, Tarpenning KM, Marino E. Designing resistance training programmers to enhance muscular fitness, a review of the acute programmed variables. Sports Med 2005;35:841-51.
17. Kraemer WJ, Ratamess NA. Fundamentals of resistance training: Progression and exercise prescription. Med Sci Sports Exerc 2004;36:674-88.
18. Ploutz LL, Tesch PA, Biro RL, Dudley GA. Effect of resistance training on muscle use during exercise. J Appl Physiol 1994;76:1675-81.
19. Häkkinen K, Komi PV. Effect of explosive strength training on electromyography and force production characteristics of leg extensor muscles during concentric and various stretch-shortening cycle exercises. Scand J Sports Sci 1985;7:65-76.
20. Mirzaei B, Arazi H, Curby D, Barbas I, Moghadam M, Hosseini Y. The effect of two different resistive loading patterns on strength, hypertrophy, anaerobic power and endurance in young wrestlers. Int J Wrestling Sci 2012;1:41-6.

How to cite this article: Mohammadi M, Siavoshy H, Rahimi SGH. Comparison of the effect of two selected resistance training patterns on some physical and physiological factors of elite freestyle wrestler young boys. Natl J Physiol Pharm Pharmacol 2018;8(2):278-284.

Source of Support: Nil, **Conflict of Interest:** None declared.