

Comparing 3 different relaxation times in a resistance training program on peak power of athletes and non-athletes in the bench press

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Abstract: The aim of this study is comparing the effects of different relaxation times on peak power in the bench press among athletes and non athletes. For this purpose, 40 male soccer athletes and 40 male non athlete students were invited. Athletes were divided in 4 groups of 10 persons and non-athletes were divided into 4 groups of 10 persons too, the exercise consisted of three sessions per week for 8 weeks of training, the intensity was started with 70% 1RM, each session included a warm-up, cool-down and 4 sets of bench press that interval break for Group I of athletes and non athletes was 45 seconds, for Group II it was 90 seconds, for Group III it was 180 seconds and for Group IV it was the combination of these three times. Research results due to the significant level of $P < 0.05$ indicated that the relaxation time increases the peak power but among athletes there was no significant difference between groups of people, but the difference was significant among non-athletes, so that the group that took the time 180 seconds had a significant improvement in peak power compared to the other three groups, the Group of 90 seconds had a significant improvement comparing to both groups of 45 seconds and combined time, but progress has been less than the group of 180 seconds, the group of combined time has made significant progress comparing to the group of 45 seconds but progress was less than groups of 180 seconds and 90 seconds and the group of 45 seconds had the least progress in the peak power compared to the three groups of 180 seconds, 90 seconds, and the combined group. According to the research results, we can conclude that the time of rest and relaxation depends on the individual's fitness level, which means people with less preparation, need more rest and relaxation time in implementing sets of bench press, than the athletes.

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1. Introduction

Resistance training programs are often used and designed to increase muscle strength, muscle hypertrophy, or muscle strength (1, 2, and 3). While designing a strength training programs, many variables such as intensity, volume, frequency, repetition rate, and resting between sets should be considered (2, 3, 4, 5) and manipulation of the these objectives is related to the specific objectives of individual (2, 4, 3, 8) and making mistakes in any of these variables during the development of a theory can lead to overtraining syndrome, thus manipulating these variables should be done according to individual training goals (9-2). Studies show that the ability to replicate in subsequent periods depends on the quantity of rest between shifts with a constant workload (6). Maximum power, is the maximum power generation capacity in a group of muscles against resistance (weights) that in many sports such as weightlifting and bodybuilding is considered as the principle of the motion(7). Training volume is an important factor in increasing the power. Training volume can be changed by tampering any of the training variables such as the number of exercises, number of sets or subtracting the interval between

sets. Manipulating resistance training program variables presses the muscles in different ways, resulting in enhanced peak power (7). Changes in training volume effectively stimulate the muscles that as a result the muscle adaptation occurs and produces more power. (My article) It has been shown that the volume of practice with neurological (10-11) hypertrophy (2-12), metabolic (13) and hormones effects (14, 15, and 16) lead to adaptations different from resistance training.

Rest time between sets as an important factor can be manipulated. Changing during the break between sets leads to metabolic (17), hormones (15,18,19) and heart changes (20), the appropriate response to intensity during resistance exercises, as well as the next period performance (2) and compatibility with practice (22-21). So the rest time between sets should be enough to recover energy (e.g. adenosine triphosphate (ATP) and phospho creatine), to disposal of material producing fatigue (e.g. hydrogen ions) to power restoration (8). So it is reasonable to be concerned about the amount of rest between sets in resistance training areas (25). The rest time or recovery period between sets is the interface between the training and start of next training sessions in such

a way that the physiological state of an individual would be closer to physiological condition prior to the work.

Researchers with different opinions about the rest time caused a variety of ideas about the right time to get the maximum force. Micaceous (2001) studied 10 vertical jumping with ground reaction forces during the rest times of 15, 30 and 60 seconds and concluded that the rest time does not affect the cuts and there is no significant difference between groups (1). Vilasun and Barket (2006) concluded that short break between rounds, will increase muscular endurance and suggested 2-minute intervals as appropriate rest breaks (26). Lopez and colleagues (2007) in their study concluded, when the purpose of the exercise is number of repetitions and more power to have high acceleration, short period of rest can be problematic (27).

The studies obtained different results, but none of these studies have been done between specimens with different physical fitness and the number of sessions was limited. In this study we reviewed athlete and non athlete samples with different fitness levels and this can be a reason that if the level of physical fitness has an effect on the amount of rest between sets? And also we can study the effect of hypertrophy influences on peak power in addition to investigating the effects of nerve - muscle by adding the number of sessions. We hope that the findings from this study could be a good practical guide for people with different fitness levels and given these findings, coaches and athletes can be in full fitness.

Method:

This study is semi-empirical and practical. The statistical population was Gachsaran San'at naft football team and Chamran University's students that participate in this exercise after completing medical

forms and consent form and the their mean height, weight and age have been rendered in Table 1.

In this research, a digital scale was used to measure weight, a wall stadiometer was used to measure height, Olympic standard bar weighted 20 kg, free weights weighted 1/25, 2/5, 10, 15 and 20 kg, machine ESCO, table of bench press and a stopwatch to measure the resting times were used.

How people are placed in groups by using the following formula was designed using 1RM

After measuring the maximum power of subjects we divided them into eight groups of subjects after matching based on maximum power. Athletes and non athletes were divided in four groups of 10 persons with relaxation times of 45, 90 and 180 seconds and the fourth group was a combination of these 3 rest times. The practice performed with intensity of 70% 1RM, each session includes a general and specific warm-up exercise, four sets of bench press with eight reps and cooling down. Every two weeks a 5% additional weight is added for extra time (28) and the total duration of exercises were 8 weeks and total exercise sessions was 24 sessions, each session was 48 hours before the next one.

Maximum power of the subjects were measured in the first, twelfth and twenty-fourth sessions, the first twelve sessions has the most nerve - muscle effects and the next twelve sessions express hypertrophy effects.

In this study, we used the SPSS version 16 to statistical analysis and we used repeated measurements for within-group and between-group differences in the first, twelfth and twenty-fourth sessions, and if significant Bonferroni test $p < 0.05$ was used to determine measurements times.

If significance, post hoc test was used to determine the measuring times in the five hundredth level.

Table 1: research subjects' specifications

| group | Number | Average Age | Average height | Average weight |
|-------------|--------|-----------------|-------------------|------------------|
| athlete | 40 | 24 \pm 0.91 | 174.50 \pm 5.26 | 71.17 \pm 1.56 |
| Non-athlete | 40 | 21.5 \pm 1.12 | 175.37 \pm 2.71 | 75.62 \pm 3.47 |

Conclusion:

Statistical analysis intergroup among four athletes and four non athletes due to the obtained significant 0.001 show that exercise increases the peak power. But the most important is related to the differences between groups that are illustrated in Tables 1 and 2.

Table 1 shows the differences within the non-athlete groups in peak power of subjects in bench press with rest intervals of 45, 90,180 and a combination of the above mentioned three times.

According to Table 1 and the obtained significance in the different groups and the considered probability level of $p < 0.05$, we conclude that in non-athletes, the greater the amount of rest time, the better performance, this means that a group of 180 seconds compared to the other groups have the best performance, group of 90 s had better performance compared to the combined and the 45s groups but it was performing weaker than groups of 180s and 90s and finally the worst performance is for group of 45s that has had the least progress than three other groups.

Table 1. The obtained significance in the different groups and the considered probability level of $p < 0.05$

| Upper bound | Lower bond | significance | Standard deviation of error | The mean difference between groups | Comparing groups | Main group |
|-------------|------------|--------------|-----------------------------|------------------------------------|------------------|------------|
| -1.6517 | -4.7870 | 0.001 | 0.56149 | -3.2193 | 90 s | 45s |
| -3.5063 | -6.6417 | 0.001 | 0.56149 | -5.0740 | 180s | |
| -0.0357 | -3.1710 | 0.043 | 0.56149 | -1.6033 | combined | |
| -4.7870 | -1.6617 | 0.001 | 0.56149 | 3.2193 | 45s | 90s |
| -0.2870 | -3.4223 | 0.013 | 0.56149 | -1.8547 | 180s | |
| 3.1837 | 0.0483 | 0.040 | 0.56149 | 1.6160 | combined | |
| 6.6417 | 3.5063 | 0.001 | 0.56149 | 5.0740 | 45s | 180s |
| 3.4223 | 0.2870 | 0.013 | 0.56149 | 1.8547 | 90s | |
| 5.0383 | 1.9030 | 0.001 | 0.56149 | 3.4707 | combined | |
| 3.1710 | -0357 | 0.043 | 0.56149 | 1.6033 | 45s | combined |
| -0.0483 | -3.1837 | 0.040 | 0.56149 | -1.6160 | 90s | |
| -1.9030 | -5.0383 | 0.001 | 0.56149 | -3.4707 | 180s | |

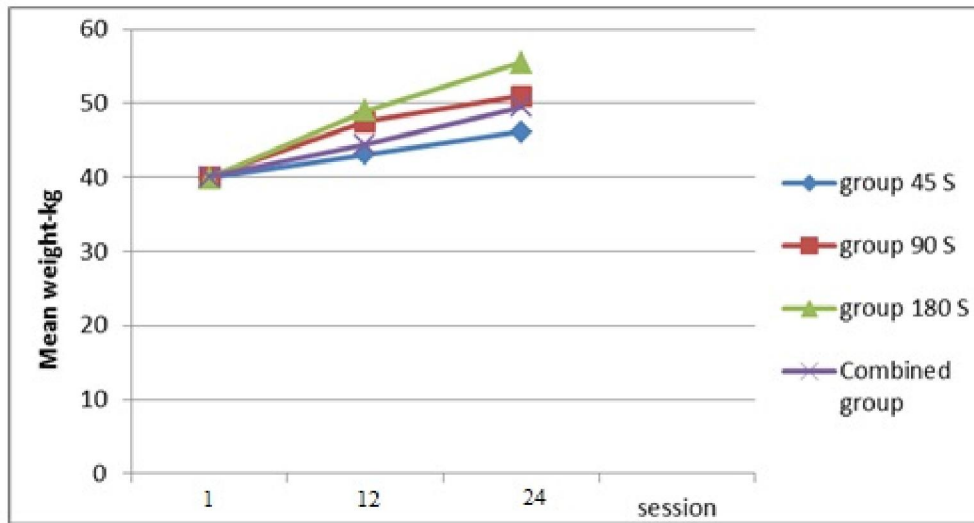


Figure (1) shows progress in the bench press in four groups of non athlete.

According to figure 1 the most progress in non athletes is for group of 180s, 90s, the combined respectively and the least progress are for group of 45s.

Table 2 shows the difference between athlete groups in subjects' peak power in bench press with break intervals 45s,90s,180s and a combination of these three times.

Table 2. The difference between athlete groups in subjects' peak power in bench press with break intervals

| Upper bound | Lower bond | significance | Standard deviation of error | The mean difference between groups | Comparing groups | Main group |
|-------------|------------|--------------|-----------------------------|------------------------------------|------------------|------------|
| 3.1915 | -4.5522 | 1.000 | 1.38679 | -0.6803 | 90s | 45s |
| 0.9458 | -6.795- | 0.252 | 1.38679 | -2.9233 | 180s | |
| 3.3465 | 4.3972 | 1.000 | 1.38679 | -0.5253 | combined | |
| 4.5522 | -3.1915 | 1.000 | 1.38679 | 0.6803 | 45s | 90s |
| 1.6289 | -6.1149 | 0.687 | 1.38679 | -2.2430 | 180s | |
| 4.0269 | -3.7169 | 1.000 | 1.38679 | 0.1550 | combined | |
| 6.7952 | -0.9458 | 0.252 | 1.38679 | 2.9233 | 45s | 180s |
| 6.1149 | -1.6289 | 0.687 | 1.38679 | 2.2430 | 90s | |
| 6.2699 | -1.4739 | 0.554 | 1.38679 | 2.3980 | combined | |
| 4.3972 | -3.3465 | 1.000 | 1.38679 | 0.5253 | 45s | combined |
| 3.7169 | -4.0269 | 1.000 | 1.38679 | -0.1550 | 90s | |
| -1.4739 | -6.2699 | 0.554 | 1.38679 | -2.3980 | 180s | |

According to table 2 and the obtained significance in different groups and the considered

probability level of $p < 0.05$ we conclude that in athletes, the resting rate doesn't affect performance

and progress in power at different power levels is the same.

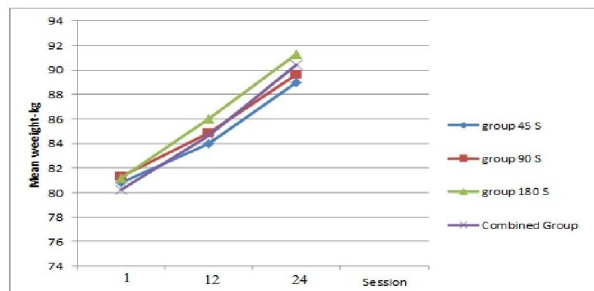


Figure 2 shows progress in bench press in four groups of athletes.

Figure 2 shows that progress level is relatively similar in groups of athletes at different times.

Discussion:

In this study, three passive recovery periods (rest periods of 45, 90, 180 seconds) and 70% of one repetition maximum loads were considered as independent variables in both athletes and non-participants. According to this study, practice with any of the rest periods of 45s, 90s, 180s and the combined one between rounds of exercise with a load of 70% 1RM bench press affects the maximum power and increases peak strength in both types of the subjects. This increase in maximum power was statistically significant. These findings are in agreement with the results of a survey done by Vilasun and Barket (2006) who studied the effect of rest interval of 1, 2 and 3 minutes between sets of bench press exercise with loads of 50 and 80% of one repetition. According to the findings of this study it can be understood that the amount of energy recovered during exercise with rest periods applied to increase the maximum power was enough and using each resting interval the practitioner can observe his/her progress in power. According to the findings, there is no difference between resting periods of 45, 90, and 180 seconds and the combined one in the bench press during a training session in groups of 24 athletes. Although there are differences between different groups, but this difference was not statistically significant, but in non-athlete group differences were observed between the groups and they were statistically significant. Findings from Barket and Vilasun research (2006) in studying the effect of three rest intervals of 1, 2 and 3 minutes between sets of bench press exercise by 50 and 80% load of one maximum repetition (8) and also Lopez et.al (2007) findings in studying the effect of resistance exercise with the short and long term rest intervals between rounds of exercise on elbow flexor

muscle strength with resistance training to a fatigue limit were inconsistent with our research results but they are aligned with the results of the non athletic group.

But Michael and his colleagues' research (2001) examined the effect of different rest intervals on the height of jumping and reaction force during vertical jump execution of a predetermined triggering (1) and also Ahtainen et al (2005) studied short and long rest periods between rounds in hypertrophy resistance training and its effect on strength, size, and hormonal adaptation in male athletes (28) and Tasiko and colleagues in 2011 investigated the issue of peak power and the amount of hypertrophy at two rest times and came to the conclusion that the different resting times don't affect maximum power (29). It is aligned with the results of our research athlete group, but it is inconsistent with the results of non athletic group.

According to the this research resulted findings, no differences between groups of athletes and some differences between groups of non athletes and the more resting time, have more useful effects for non athletes. Using different periods of rest between exercise periods and consistency with the manner and frequency of training set for them is because of their fitness level, people who do fitness training are able to have different responses to fatigue effects. This is possible because of consistency with exercise (High workload with short rest periods). These adjustments can include increasing capillary walls, the normal density of cells, and the ability to avoid and to conduct H ions out of the muscle (30). Encountering the athlete with loads beyond their ability with short recovery intervals, will be result in reducing their ability to adapt to new times. Generally, the present findings are not compatible with some past research findings and that could be due to several reasons. In this study we have used a variety of samples and the two samples had different fitness levels, so it can be the main reason for being different from other researches. Other reasons may be nutrition, subject gender, and subjects' stress, the level of arousal, the difference in duration of exercise, and the difference in the type of tests, age and number of participants.

Conclusion

The results obtained in the test group and the comparison between them, suggesting that this 24 sessions of training using resting intervals of 45s, 90s, 180s and the combined one in bench press increase peak power. However, comparing the progress of groups of athletes some differences are observed in progress, but these differences was not significant, but it was significant in non athletes. Despite the fact that previous research suggested some differences

between progresses the different rest periods but as mentioned, the conducted research consider a sample and only short-term training courses (maximum 12 sessions) and these extra meetings have considered the neurons effects.

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