

Difference between absolute and relative muscle strength according to resistance exercise proficiency

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Abstract

In this study, the absolute and relative strength of six upper extremity resistance exercises were measured by classifying resistance exercise experts and non-experts. As a result, the skilled group showed higher absolute and relative muscle strength than the unskilled group in the 6 upper extremity resistance exercises. These results are judged to be the hypertrophy of fast-twitch muscles, the mobilization of motor units, and the increase in the speed of nerve conduction while the skilled person consistently performs resistance exercise. Experts use intermuscular coordination efficiently to stably perform the load according to the movement and exercise intensity performed during exercise, whereas the inexperienced person uses relatively large muscle groups rather than efficiently using intermuscular coordination. It is considered that exercise motion and load were performed by mobilizing. In addition, as a result of comparing the absolute and relative muscle strength between the 6 types of upper limb resistance exercises, there was a difference between the 6 types of upper limb resistance exercises in the two groups. It can be judged that greater muscle strength and endurance were created through liver coordination.

Keywords: *skilled, unskilled, absolute strength, relative strength*

1. Introduction

1RM (one repetition maximum), the maximum muscle strength of isotonic contraction during resistance exercise, is the maximum weight that can be lifted only once over the entire joint range of motion for each strength exercise event. It is the first step to set exercise intensity as a relative ratio of intake [1]. This is an important procedure for determining the exercise intensity suitable for the purpose of increasing muscle strength, hypertrophy, and muscular endurance when prescribing resistance exercise. However, direct measurement of 1RM requires high concentration and psychological preparation of the subject, and efforts to exert maximum muscle strength often consume too much time from daily training[2]. In addition, it was reported that beginners without experience in direct measurement of 1RM could cause muscle strain or delayed onset muscle soreness (DOMS) [3]. Because of these problems, estimation regression formulas are applied as an indirect measurement method instead of directly measuring 1RM. Among the indirect methods of estimating 1RM, the method using isokinetic equipment, the method using repetitions at submaximal intensity, and

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various methods using body data and physical strength variables [4-6]. The method using submaximal strength is a method of estimating 1RM using the number of repetitions performed to the point of failure, and it has been reported that it has a high correlation with the direct measurement method of maximal lifting [7].

On the other hand, in other previous studies, the indirect measurement method is slightly less accurate than the direct measurement method [8-9] reported that 1RM Opinions on the reliability of indirect estimation methods are not consistent, and if there is no special physical disease and sufficient education, direct It is judged that the measurement can set a more correct intensity. On the other hand, it has been reported that resistance exercise has different muscle groups depending on exercise experience, that is, skilled and unskilled people, and there are also differences in muscle activity and muscle fatigue [2]. In a previous study, as a result of comparing the number of repetitions between the skilled and the unskilled at the same exercise intensity, it was reported that the skilled group showed high muscle activity in the small muscle group as well as the large muscle group, and the number of repetitions also increased. Also Shimano [10] compared the number of repetitions, average power, and perceived exercise (RPE) during free weight exercise of the same intensity, and reported that the skilled group showed effective results in all variables compared to the inexperienced group.

Muscle strength can be classified into absolute strength and relative strength. Absolute muscle strength is the maximum muscle strength that can be exerted regardless of one's weight, and relative strength is the value obtained by dividing an athlete's absolute muscle strength by body weight. In particular relative strength is an important factor in weight class events, and weight class competitions are sports that are divided into weight classes, and representative sports include wrestling, boxing, judo, and taekwondo. As such, when competing against opponents in the same weight class, high relative strength is a factor that will give you an edge in the competition, and will have a direct impact on your performance. As mentioned above, direct measurement of 1RM when prescribing resistance exercise is an essential factor when setting the exercise intensity, and since the response of the agonist and synergist muscle used depending on the resistance exercise proficiency appears differently, direct measurement of 1RM throughout the body can help beginners and experts alike. When prescribing exercise, you will be able to prescribe taking into account your skill level. In addition, it will be possible to reset the exercise load and shape by measuring the relative muscle strength of the skilled and unskilled.

2. Experiment Materials and Methods

2.1 Subject

The subjects of this study were 10 inexperienced males who participated in exercise for less than 6 months and 10 skilled males who participated in exercise for more than 6 months without any specifically diagnosed disease among members of O Fitness in Cheonan City. The subjects were fully aware of the purpose and procedure of the study before the experiment and participated voluntarily. The physical characteristics of the subjects are shown in <Table 1.>.

Table 1. Characteristics of Subject

Age	Weight(kg)	Height(cm)	body fat(%)
37 ± 15.39	75.31 ± 4.04	172.78 ± 4.04	25.25 ± 2.83

Mean ± SD

2.2 Research procedure

2.2.1 1-repetition maximum weight test

In order to determine the weight of the bench press to be applied to the experiment, the literature of NSCA was referred to and applied according to the measurement environment, and the maximum weight (1RM) of one repetition of the bench press was checked 1 week before the experiment. 10 RM was measured. When measuring 1RM, the first set is to warm up with a weight that can be repeated 5 to 10 times, then increase the weight by 5 to 10 kg after 1 minute of rest to set a weight that is estimated to be repeated 3 to 5 times, and then lift it. After that, a 2-minute break was provided, and the weight was increased by 5-10 kg to set a weight estimated to be repeated 2-3 times, and then lifted, and a 2-4 minute break was provided. Then, 1RM was attempted by increasing the weight by 5-10 kg.

2.2.2 Relative strength measurement

Relative muscle strength was set by dividing the subject's absolute muscle strength by body weight.

$$\text{Relative strength} = \text{absolute strength} / \text{body weight}$$

2.3 Statistical Analysis

This study analyzed data using SPSS (ver 22.0) statistical program, and average and standard deviation were calculated for all variables. Absolute and relative muscle strength according to expert and unskilled was analyzed by independent t-test. In addition, the absolute and relative muscle strength according to the exercise item (6) was verified by one-way ANOVA, and the statistical significance level was set at $\alpha=.05$ for post-hoc verification.

3. Result

3.1. Comparison of absolute muscle strength between skilled and unskilled people

<Table 2> shows the result of comparing absolute muscle strength between skilled and unskilled people. Lateral raise ($p=.048$), barbell press ($p=.043$), triceps extension ($p=.009$), bench press ($p=.004$), peck deck fly ($p=.004$) between skilled and in experienced), lat pulldown ($p=.034$), the absolute muscle strength of the expert was significantly higher than that of the unskilled in all exercises.

Table 2. Result of independent t-test analysis of absolute strength by exercise(kg)

	adept	unskilled	t-value	p
Lateral Raise	11.3±3.13	9±1.14	2.118	.048*
Barbell press	50.5±16.57	38.5±5.3	2.181	.043*
Triceps extension	35.4±9.84	24.8±5.85	2.927	.009**
Bench press	92.5±21.38	67.5±10.87	3.297	.004**
Peck deck fly	48.5±10.29	35.5±7.25	3.267	.004**
Lat pull down	68.5±14.54	56.5±7.84	2.298	.034*

Mean±SD, * $p<.05$ ** $p<.01$ *** $p<..001$

3.2. Comparison of relative muscle strength between skilled and unskilled

<Table 3> shows the result of comparing the relative strength of the skilled and unskilled. Lateral raise ($p=.015$), barbell press ($p=.022$), triceps extension ($p=.002$), bench press ($p=.001$), peck deck fly ($p=.002$) between skilled and in experienced), lat pulldown ($p=.014$) In all exercises, the relative strength of the skilled workers was significantly higher than that of the unskilled.

Table 3. Result of independent t-test analysis of relative strength by exercise(kg)

	adept	unskilled	t-value	p
Lateral Raise	0.15±.03	0.12±0.02	2.68	.015*
Barbell press	0.66±0.17	0.51±0.08	2.497	.022*
Triceps extension	0.47±0.1	0.33±0.07	3.572	.002**
Bench press	1.23±0.21	0.9±0.13	4.139	.001**
Peck deck fly	0.65±0.12	0.47±0.1	3.550	.002**
Lat pull down	0.91±0.15	0.75±0.11	2.734	.014*

Mean±SD, * $p<.05$ ** $p<.01$ *** $p<..001$

3.3. Comparative results of absolute muscle strength according to unskilled exercise movements

<Table 4> shows the result of comparing the absolute muscle strength of the 6 types of exercise movements of the inexperienced. Significant differences were found among the 6 exercise movements($p<.000$), and as a result of post hoc comparison, lateral raise and barbell press, barbell press and triceps extension, and triceps extension and bench press. bench press and peck deck fly, and peck deck fly and lat pull down showed significant differences.

Table 4. Result of one-way ANOVA analysis of absolute strength by exercise(kg)

	①Lateral Raise	②Barbell press	③Triceps extension	④Bench press	⑤Peck deck fly	⑥Lat pull down	P	contrast
adept	11.3±3.13	50.5±16.57	35.4±9.84	92.5±21.38	48.5±10.29	68.5±14.54	.000***	①<②>③<④>⑤<⑥
unskilled	9±1.14	38.5±5.3	24.8±5.85	67.5±10.87	35.5±7.25	56.5±7.84	.000***	①<②>③<④>⑤<⑥

Mean±SD, * $p<.05$ ** $p<.01$ *** $p<..001$

3.4. Comparative results of relative muscle strength according to in experienced exercise movements

<Table 5> shows the results of comparing the relative muscle strength of the 6 types of exercise movements of experts. Significant differences were found among the 6 exercise movements($p<.000$), and as a result of post hoc comparison, lateral raise and barbell press, barbell press and triceps extension, and triceps extension and bench press. bench press and peck deck fly, and peck deck fly and lat pull down showed significant differences.

Table 5. Result of one-way ANOVA analysis of relative strength by exercise(kg)

	①Lateral Raise	②Barbell press	③Triceps extension	④Bench press	⑤Peck deck fly	⑥Lat pull down	<i>P</i>	contrast
adept	0.15±0.03	0.66±0.17	0.47±0.1	1.23±0.21	0.65±0.12	0.91±0.15	.000***	①<②>③<④>⑤<⑥
unskilled	0.12±0.02	0.51±0.08	0.33±0.07	0.9±0.13	0.47±0.1	0.75±0.11	.000***	①<②>③<④>⑤<⑥

Mean±SD, *p<.05 **p<.0,1 ***p<.001

4. Discussion

As a result of comparing absolute muscle strength between skilled and unskilled people, lateral raises, barbell presses, and triceps extension between skilled and unskilled people. In all exercises of tension, bench press, peck deck fly, and lat pull-down, the absolute muscle strength of the expert was significantly higher than that of the inexperienced. This is because the muscle groups used are different for skilled and unskilled people, and in muscle activation and muscle fatigue. A difference was also reported [2]. In previous studies, the number of repetitions according to the same exercise intensity was mastered.

As a result of comparison between the skilled and the unskilled, the skilled group showed high muscle activity in both large and small muscle groups. Reporting that the number of repetitions also increased, it was judged that this difference came from training habits. The result of comparing the relative muscle strength of the skilled and the inexperienced was the lateral raise, barbell press, and triceps lift of the expert and the inexperienced. In all exercises of the stance bench press, peck deck fly, and lat pull-down, the relative strength of the skilled workers was significantly higher than that of the unskilled. These results show that the hypertrophy of fast-twitch muscle fibers and motor units while the skilled person consistently performs resistance exercise.

It is judged by the mobilization of motor units and an increase in the rate of nerve conduction. Also, in the case of experts, intermuscular On the other hand, it is possible to stably perform the load according to the movement and exercise intensity performed during exercise by using coordination efficiently. Eh, in the case of unskilled people, exercise by mobilizing only a relatively large muscle group rather than using intermuscular coordination efficiently It is considered to have performed the motion and load. As a result of comparing the absolute muscle strength in the six exercise movements of the skilled and the inexperienced, significant differences were found in both groups.

As a result of post-post comparison, lateral raises and barbell presses, barbell presses and triceps extensions, and triceps extensions and Bench press, bench press and peck deck fly, and peck deck fly and lat pulldown showed significant differences between all exercise movements in the two groups. These results suggest that, compared to simple joint exercises, compound joint exercises have more muscles mobilized and greater muscular strength and endurance were created through inter-muscular coordination.

As a result of comparing the relative muscle strength in the six exercise movements of the skilled and the inexperienced, significant differences were found in both groups. Bench press, bench press and peck deck fly, and peck deck fly and lat pulldown showed significant differences among all exercise movements in the two groups. In these compound joint exercises, the ratio of agonist and coordinator muscles being mobilized is important, which directly affects the weight and number of repetitions of 1RM. Therefore, in this study, it was found that the absolute and relative muscle strength of skilled and unskilled people were higher in the skilled group who continuously performed resistance exercise, and the difference in absolute and relative muscle

strength between exercise movements showed significant differences in both groups. Absolute and relative strength were higher in multi-joint exercises than in simple joint exercises.

5. Conclusion

In this study, as a result of comparing absolute and relative muscle strength between skilled and unskilled people, the expert group showed high absolute and relative muscle strength in all exercise movements. In addition, as a result of comparing the absolute and relative muscle strength between the 6 types of motions, there was a difference between all motions within the two groups, and higher absolute and relative strength were shown in the complex joint exercise than in the simple joint exercise.

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