



**THE EFFECT OF EIGHT WEEKS OF STRENGTH TRAINING AND
CARBOHYDRATE SUPPLEMENTATION ON THE PHYSICAL FITNESS OF
MALE BODYBUILDERS**

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ABSTRACT

The purpose of the present study is to investigate the effect of eight weeks of strength training and carbohydrate supplementation consumption on physical fitness in male bodybuilders. Thirty-six young male bodybuilders, volunteered to participate in our randomly-divided three experimental, placebo and control groups. Subjects in all three groups were performing selected exercises for eight weeks, three sessions per week for 60 minutes with an intensity of 60-80 % of one repetition maximum strength. Experimental group consumed a carbohydrate supplement. The subjects in the placebo group used the placebo while the control group did not take any supplement. Before and after eight weeks, physical fitness and muscle strength were measured. Data analysis was used by means of statistical analysis and ANOVA and post hoc Bonferroni test were performed. Between the values of aerobic power ($p=0.01$), anaerobic power ($p=0.02$), explosive power ($p=0.01$), maximal voluntary contraction of pectoralis muscle ($p=0.01$), quadriceps ($p=0.01$), hamstring ($p=0.01$) and gastrocnemius ($p=0.00$) group, significant difference was observed but the amount of agility, flexibility and speed difference were not significant. According to the results, it can be concluded that strength training combined with carbohydrate supplementation leads to an increase in aerobic capacity, anaerobic power, explosive power and strength of the local muscles and it is suggested that male body builders use the carbohydrate supplement in their training program to improve their fitness benefit factors.

Key words: Strength Training, Carbohydrate Supplementation, Physical Fitness, Male Bodybuilder

INTRODUCTION

Many factors are needed for successful participation in strength training for bodybuilders. Among these factors, nutrition is one of the important factors [1, 2]. In addition to energy supply during strength training, mental aspect plays a crucial role in the successful implementation of athletes. Bodybuilders' diet should not differ from normal subjects. In addition to the everyday needs of the athletes, they need fuel for training and racing [3, 4].

Most nutritionists believe that if athletes consume a variety of grains, vegetables, fruits, dairy and meat consumption, then, they will have less need for supplementation. If there are a lot of dietary needs and food resources not meeting the need of the athletes, then, there is an increasing need to supplementation during a workout or race [5, 6]. Nutrition, as an important factor for bodybuilders, fitness and athletic performance, have been identified. Bodybuilding supplements are needed for building muscle, gaining strength and improving one's athletic performance. Many athletes believe that taking a pre-training supplement can contribute to enhance response capabilities power and helps one to concentrate [7, 8].

Carbohydrates are consumed as an energy source, the body's immediate energy,

conservation of energy storage and return of practice mode. Eliminating carbohydrates from the diet of athletes means removing him from the race. During strength training, there is a need to carbohydrates to glycogen in skeletal muscle and glucose in the blood. In case of lack of carbohydrate intake, the body uses protein for energy release resulting in the breakdown of muscle tissue [9, 10].

Strength training which is important for maintaining physical fitness is not the only requirement. Proper nutrition, adequate rest, assess health, good health habits and physical fitness are all complementary. Success in sports requires physical ability to meet the particular sport [11, 12]. Continuous measurement of the physical capabilities are the most important factors affecting sports performance and to evaluate the effectiveness of an exercise program is essential for the health of athletes. So, testing is the first step in selecting the athletes, followed by the development and management training programs and nutrition [10, 13]. Strength training exercises is one of the most popular ones for achieving physical fitness in athletes. Strength training can improve the performance of athletes such as the ability to sprint, jump, shoot. The development of basic motor skills could

lead to improve performance of athletes in various sports [14, 15].

In the last two decades, debate over sports nutrition and supplements in sport has become very hot. Many professional athletes, nutritionists, trainer, sports teams, medical personnel, as well as private coaches are looking for appropriate food supplements [16, 17]. Due to the high cost and time to participate in strength training, the importance of measuring fitness in body builders has increased and the need for research in this case is made clear [18, 19]. An eight-week study was carried out to investigate the effect of carbohydrate supplementation on strength training and aerobic power, anaerobic power and muscular male fitness. Implementation of this research will lead to improved athletic

performance and optimal results for the trainer and bodybuilding athletes will be obtained.

METHODOLOGY

This study is a semi-experimental research conducted in the field. In this study a sample of the 36 young male body builders were selected being on average 20-30 years of age. Morphological characteristics of the subjects are presented in **Table 1**. The subjects participated voluntarily in the study and were randomly divided into three experimental (n=12), placebo (n=12) and control (n=12) groups. The criteria for participation in the study included physical health, and not taking supplements such as carbohydrates, creatine, glucose, caffeine and vitamin supplement 30 days before the tests.

Table 1: Characteristics of the subjects appearance

| Group | Variable | Age | Height | Weight | BMI |
|--------------|----------|------------|-------------|-------------|------------|
| Experimental | | 25.25±3.75 | 180.76±8.67 | 82.37±14.48 | 25.24±3.38 |
| Placebo | | 24.42±3.17 | 178.96±7.82 | 86.49±13.43 | 27.20±4.65 |
| Control | | 26.08±2.96 | 177.24±9.65 | 82.87±12.64 | 25.57±3.30 |

To conduct research about the research topic, purpose, participants were aware of the exercise program. The subjects voluntarily agreed to participate in the study by signing the medical health questionnaire. Subjects in all three groups did the selected physical exercises for eight weeks, three sessions a week for 60 minutes of strength training. The pre-test aerobic capacity was measured by Cooper test, anaerobic power by RAST test, agility by 4×9 test, flexibility

by HVGR test, explosive power by Sarjent jump test, speed by sprint 36 meters and strength locale large pectoralis muscle, quadriceps, hamstring and gastrocnemius was measured by one repetition maximum test.

Strength training for the three groups included Squat, Leg Extension, Squat Leg Extension, Standing Calf Raise, Bench Press, Standing Barbell Press, Standing Barbell Curl, and Lying Barbell

Extension with the intensity of 80-60% of one repetition maximum, with rest intervals of 45 seconds to 1 minute between sets and 2 minutes between each move.

Experimental group consumed 50 grams of carbohydrate supplemented with orange flavour, Olimp brand, made of Central Europe to 30 minutes before strength training and dissolved in 200 cc of water. Subjects in the placebo group used water along with three grams of powdered orange juice in mixers. The control group did not take the supplement over the eight weeks of training. The diet was given to the participants. After eight weeks of training and again at post-test, physical fitness test, the subjects, physical fitness factors were measured.

Statistical analysis was performed using SPSS version 18. Data normality was determined by Kolmogorov-Smirnov test. To evaluate the significant difference from the average, one-way ANOVA and post hoc Bonferroni test were used. The significance level of the test was also considered $p \leq 0.05$.

RESULTS

Table 2 shows One-way ANOVA results. Significant difference was observed between the levels of aerobic power ($p=0.01$), anaerobic power ($p=0.02$), explosive power ($p=0.01$), maximal voluntary contraction of pectoralis muscle ($p=0.01$), quadriceps ($p=0.01$), hamstring ($p=0.01$) and

gastrocnemius ($p=0.00$) group, but the amount of agility ($p=0.80$), flexibility ($p=0.99$), and speed ($p=0.52$) difference is not significant.

Bonferroni post hoc test results are reported in **Table 3**. The mean of aerobic power between experimental groups was significantly different from the other two groups. The mean of anaerobic power, only between experimental and control groups, were significantly different. The mean of anaerobic power, only between experimental and control groups, were significantly different. The mean of explosive power out of the other two groups were significantly different between the experimental groups. The mean of Pectoralis muscle strength between the experimental group and the other groups were significantly different. The mean of Quadriceps muscle strength between the experimental group and the other groups were significantly different. The mean of Hamstring muscle were significantly different between the experimental group and the other groups. The mean Gastrocnemius muscle the other two groups were significantly different between the experimental groups.

DISCUSSION

This study was designed to investigate the effect of eight weeks of strength training and carbohydrate supplementation

consumption on physical fitness in male bodybuilders. The results of the study showed that aerobic power values, between the study groups, showed significant difference and the difference between the experimental group and the other groups were significant. The results were consistent with Byars *et al* (2009) [20], but did not match with Vegge *et al* (2012) [14]. Availability of nutrients, blood flow and breathing will be major factors affecting the physiological and maximal oxygen consumption. In addition, the regulation of body fluids will change plasma volume and blood volume causing change in the displacement of the oxygen capacity of the blood [21, 22]. Due to the fact that carbohydrate is the primary fuel for aerobic activities, carbohydrates and oxygen availability in the experimental group was allowed to provide the needed fuel for the muscles involved in the activity and for participants to have better results than the other two groups.

The results showed that there was a meaningful statistical difference between the values of the anaerobic power of research groups and this difference was only significant between the experimental and the control group. The results were consistent with Jarvis *et al* (1999) [15], but not with Vegge *et al* (2012) [14]. Anaerobic power and strength is a combination of two

factors: the speed and the use of force as defined in the shortest possible time. Power is very important in performing exercises as throwing body into the air. Power is the key ingredient being considered one of the most important factors to run fitness and sports skills [10,13]. Given that the subjects participated in strength training, power surge led to better results in tests of anaerobic power play. Carbohydrates can also improve anaerobic power in these subjects, however, a noticeable increase in aerobic power of the subjects in the placebo group is significant. Maybe, carbohydrates and psychological factors on placebo subjects had caused them to show significant difference in the subjects improving RAST test.

The results showed that among the levels of agility, flexibility and speed, there was no significant difference between the study groups. The results were consistent with Bortolotti *et al* (2013) [23], and Morris *et al* (2003) [17] but not with Kevin *et al* (2009) [24], Arazi *et al* (2001) [25], cooper *et al* (2013) [26], and lynch (2013) [19]. To increase agility, one should also consider factors such as balance and flexibility. Factors such as speed and agility, reaction speed and rhythm of motion or both of them play key roles. Changes in body position or speed and agility to change direction come to the force. Flexibility is a

prerequisite for the implementation of high-amplitude skills and making one a quick jumper. Successful performance depends on the magnitude of the motion of the joints or the motion which should be bigger than the needed movement magnitude [11, 25]. Thus, for safety and to avoid straining, athletes need improved flexibility. Due to the fact that, in the long run, the research program had to rely solely on strength training, these types of exercises had little effect on the speed of response, flexibility and reaction time. So, no change in the variables is justified.

The results showed that, between the amount of explosive power in the research group, the differences were statistically significant. The difference between the experimental group and the other groups were significant. The results were consistent with Arazi *et al* (2011) [25] but not with Luebbers *et al* (2003) [27]. Success in many sports depends, to a great extent, on the explosive power of the athletes' feet and their muscular strength. Several factors such as physical activity and performance, muscle mass, muscle temperature, the speed of muscle contraction, the type of contraction and the range of motion can affect the athletes' explosive power in a sport power [16,27]. Participation in strength training increases muscle strength due to the fact that all three groups had the same

power program. The experimental group had better results for carbohydrates. These subjects were able to benefit from the fast-twitch fibers and, as a result, had better results in implementing the Sargent jump test.

The results showed a significant difference between the levels of pectoralis muscle, quadriceps, hamstring and gastrocnemius and the difference between the experimental group and the other groups were significant. The results were consistent with Cooper *et al* (2013) [26], Kazemzadeh *et al* (2012) [28], Cribb *et al* (2006) [29], and Salman and Khalaf (2014) [22] but not with Cribb *et al* (2006) [29], Rozenek *et al* (2002) [30], and Tarnopolsky *et al* (2001) [31]. Carbohydrates are an important source of energy for human metabolism. Skeletal muscle glycogen and blood glucose derived from the liver which are available carbohydrates are used as the primary fuel source in aerobic and anaerobic exercises. During vigorous exercise, the analysis of muscle glycogen or blood glucose into lactic acid will lead to muscular fatigue. Using carbohydrate diet at the beginning, during and after exercise can improve a lot of muscle or liver by maintaining blood glucose homeostasis [30, 31]. In all groups, the increase in muscle strength was observed after eight weeks. However, the experimental group was higher than the

other two groups. Carbohydrates has caused the provision of the fuel needed for producing muscles in times of activity. Considering the adjustment developed

arising from strength training, a significant increase in muscle strength was observed in the experimental group and the other groups.

Table 2: One-Way ANOVA Results

| Parameter | Test | Experimental Groups | Placebo | Control Group | P.value |
|---------------------------|------|---------------------|--------------|---------------|---------|
| Aerobic Power (ml/kg/min) | pre | 42.90±10.14 | 41.22±9.43 | 41.48±8.47 | 0.01 |
| | post | 50.07±7.91 | 41.46±9.87 | 39.18±8.13 | |
| Anaerobic Power (W) | pre | 553.46±66.88 | 556.11±78.25 | 534.37±48.87 | 0.02 |
| | post | 602.90±67.94 | 554.31±78.83 | 552.47±57.93 | |
| Agility (S) | pre | 10.72±1.52 | 10.49±1.63 | 10.57±1.42 | 0.80 |
| | post | 10.74±1.40 | 10.40±1.42 | 10.55±1.45 | |
| Flexibility (cm) | pre | 30.25±3.51 | 30.66±3.43 | 30.70±3.28 | 0.99 |
| | post | 31.27±3.74 | 31.35±6.59 | 31.17±3.24 | |
| Explosive Power (cm) | pre | 46.15±8.86 | 44.34±9.92 | 45.04±10.82 | 0.01 |
| | post | 57.19±6.69 | 47.61±8.98 | 48.01±10.47 | |
| Speed (s) | pre | 5.24±0.74 | 5.12±0.59 | 5.02±0.60 | 0.52 |
| | post | 5.38±0.07 | 5.11±0.62 | 5.08±0.77 | |
| Pectoralis Muscle (kg) | pre | 98.75±21.96 | 92.92±22.60 | 98.07±17.76 | 0.01 |
| | post | 124.58±19.47 | 104.17±20.76 | 103.33±18.13 | |
| Quadriceps Muscle (kg) | pre | 99.17±24.01 | 95.83±18.80 | 93.33±19.22 | 0.01 |
| | post | 122.50±19.82 | 101.25±21.57 | 100.83±18.53 | |
| Hamstring Muscle (kg) | pre | 53.75±16.53 | 55.83±17.68 | 53.75±18.96 | 0.01 |
| | post | 75.42±12.87 | 57.50±18.89 | 55.83±18.93 | |
| Gastrocnemius Muscle (kg) | pre | 34.58±9.40 | 38.33±12.67 | 35.83±9.96 | 0.00 |
| | post | 54.17±8.74 | 42.08±11.37 | 41.25±9.79 | |

Table 3: Results of Bonferroni Post-HocTest

| Group | | Aerobic Power | Anaerobic Power | Explosive Power | Pectoralis Muscle | Quadriceps Muscle | Hamstring Muscle | Gastrocnemius Muscle |
|--------------|---------|---------------|-----------------|-----------------|-------------------|-------------------|------------------|----------------------|
| experimental | placebo | 0.07 | 0.27 | 0.03 | 0.04 | 0.04 | 0.04 | 0.01 |
| | Control | 0.01 | 0.02 | 0.04 | 0.03 | 0.03 | 0.02 | 0.01 |
| placebo | Control | 1.00 | 0.79 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

CONCLUSION

According to the results, we can conclude that strength training combined with carbohydrate supplementation leads to an increase in aerobic capacity, anaerobic power, explosive power and strength of the local muscles and suggested that male body builder with the carbohydrate supplement your training program to improve their fitness benefit factors.

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