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Squash and Resistance Training: Relative Comparison on Speed, Explosive Power, Muscular Endurance and Flexibility

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ABSTRACT

The purpose of the study was to compare resistance and squash training on speed, explosive power, muscular endurance and flexibility among college male students. Nineteen college male students 20-22 years divided into two groups, resistance training group (RT, n = 10) and squash training group (SQT, n = 9). RT group performed several weight machines. The SQT group undertook squash skills in addition to participation in tournaments. The training lasted for 6 weeks, 4 days/ week, 30 min per session. Subjects were tested on body composition and physical fitness before and after training. One Repetition Maximum (1RM) was used to decide maximum strength of RT group. Means, SD, independent and Paired t-test utilized with $P \leq 0.05$. The RT group exhibited greater mean difference than SQT group in BM ($P = 0.032$) and BMI ($P = 0.013$). No mean differences were observed between groups in all physical fitness parameters ($P \geq 0.05$). However, when after-training-tests were matched with before-training-tests in each group independently, RT decreased significantly in 50 m sprint time by 6% ($P = 0.008$), SLJ by 6.3% ($P = 0.004$) and sit and reach by 12.4% ($P = 0.012$) but, no change in sit-ups ($P \geq 0.05$). While, SQT showed elevation ($P = 0.003$) in sit and reach of 19%, no changes was seen in the other fitness parameters ($P \geq 0.05$). It was concluded that RT group had training effect on speed, explosive power and flexibility, while SQT group showed training effect in flexibility.

Keywords: Sit-ups, Sit & reach, Resistance, Squash training.

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INTRODUCTION

The weight machines training is a workout that uses the apparatus as loads to build up and form the musculoskeletal system and enhancing muscle character [1-3]. The advantages of weight machines are easy to use, permit the individual to exercise with heavyweight without the support and suitable for students, aged populations and particular muscle groups. In addition, the weight machines provide more security and save time for college students than the free weights [4]. Weight drill is used as a broad term identical with other conjoint terms: weight lifting and strength exercise. Physiologically, the advantage of persistent strength training includes an escalation in muscle size, tone, muscle strength [5-7] and bone mineral density [8, 9]. It is observed that lifting weights is enhanced psychological health as well, by augmenting self-esteem [10], confidence, and self-worth. Further, strength training increases energy, improve digestion, elimination processes, intellectual capacity, and productivity. In addition, strength exercise training leads to better sleep, weight loss and decreased body fat [10]. The training helps in the decrease of low density lipoprotein cholesterol [10], range of motion and flexibility.

Due to the effect of resistance training the lung function and cardiovascular circulation capacity increases. There is an effect on the overall appearance and body composition of a person indulging in resistance training. It slows down or stops the aging process [10]. It helps reduce the incidence of injury [11]. It also increases the agility, balance and coordination with more power available for the athlete. Research reveals that unless strength training is done regularly; we reduce about a half kilogram of muscle each year of our lives after age of 30 years. Unless we accomplish a safe and constructive weight lifting protocol, our muscles steadily reduce in size and strength causing atrophy, which in turn results in the loss of muscle [12] and a reduction of one-half in Basal Metabolic Rate (BMR) each year [13]. Weight-bearing exercise also results in the prevention of osteoporosis [10]. For a majority of people in rehabilitation or with an innate disability, such as following stroke or orthopaedic surgery, strength training for feeble muscles is a vital feature to improve recovery [14]. Several studies examined the impact of resistance training on different categories of body mass index [15-21].

In the sphere of indoor racket games Squash is considered as the second fastest games [22]. It is a sport that is intricate and involves higher coordination, endurance, speed and power [23]. Cardiovascular endurance, local muscular endurance, speed and speed endurance are jointly denoted to as the energy system requirements that are perilous for squash [24]. Squash game places an extraordinary emphasis on the physical fitness of top participants, which entails a swift improvement of higher force, rapid variation of direction, and quick reaction. Squash at exclusive level has been testified as being principally aerobic with a major speed (alactic anaerobic) element and a minor but capricious lactic acid (anaerobic) factor [25].

Fitness is described as an ability to execute the movement and it creates reference to the entire array of physiological and psychological abilities [26]. Features accompanying with physical fitness in squash comprise aerobic capacity, anaerobic power, strength, speed, flexibility, balance and coordination. The utmost vital features for squash are cardiovascular, strength and flexibility since they are the base for the improvement of the rest of the skills [24]. Physical fitness for squash entails bunch of items. Amongst the supreme essential factor is cardiorespiratory fitness and muscle endurance. This enables a squash player to exhibit suitable anaerobic and aerobic power along with a correspondingly significant ability for recovery. The other quality is considered as strength and speed-related skill and involves of muscle strength. Thus, it is principally essential to have a resilient abdomen and lower back with a judicious grip strength that is not beneath the threshold level and muscle speed. This helps the player to have a quick off-the mark speed of movement and racquet speed. Flexibility, particularly, the range of movement of quadriceps and hamstring muscles help avert harm and low percentage body fat (normal level 7-12% for men and 18-27% for women at the top level) are identically significant amongst the fitness variables [25].

Through the in-depth study of the literature in the area, it was observed that no study has been examined on the impact of resistance and squash training on speed, explosive power, muscular endurance and flexibility parameters of college male students. Hence, the aim of this investigation was to relate the impact of 5 weeks of resistance and squash training on 50 m sprint, standing long jump, sit ups and sit and reach parameters among college male students.

MATERIALS AND METHODS

Subjects

Nineteen healthy sedentary male college students aged between 20 and 22 years from KFUPM, Dghahran participated in this exploration. The subjects were selected depending on BMI, the healthy, normal weight subjects whose BMI was between 18.5 to 24.9 kg / m^2 were permitted to partake in this investigation. The subjects were distributed into two groups named a resistance training group (RT, n = 10) and a squash training group (SQT, n = 9).

Procedures

The dependent parameters that were tested in this investigation are the body composition (age, H, BM, BMI) and the physical fitness (50 m sprint, SLJ, sit ups and sit & reach). These tests were organized at the start and end of the training duration for all experimental groups.

Body compositions

The body composition was measured before and after the training period for all subjects, were age, Height (H), Body Mass (BM) and Body Mass Index (BMI). The body mass was assessed by SECA medical Balance-Germany to the nearest 0.1 kg, while the participant wearing T-shirt and sport pant, the height was measured by speedometer to the nearby cm and the body mass index was evaluated by dividing the body mass in kg over the height in square meter.

50 m sprint (maximum speed)

In this event of 50 m run which was conducted on the track two, participants were asked to take their positions behind a start line and run on the sound of the whistle as fast as possible till the end of the distance. The time of each participant was taken by a digital sport stop watch (Casio HS70W, China). The subjects were given two chances with a rest period of 5 minutes in between trails and the best time was taken for analysis.

Standing long jump (explosive power)

Participants were instructed to keep apart with knees bent and stand behind a take-off mark. They were asked to swing their arms and jump as far as possible and the distance was measured from take-off line to the nearest part jumped on the floor mat. The landing was observed and marked by one assistant. Each subject had two jumps and the best amongst the two was recorded in centimetres with a rest period of 5 minutes between each trail.

Sit-ups (muscular endurance)

The sit-ups were conducted on a mat on the floor. Subjects were asked to lie down in supine position with knees bent at 90 degrees and hands bent across the chest and one assistant was asked to hold the legs of the participants. On the indication of the tester, the subject was asked to move his body up from the floor with head up and touch the knees and it was counted as one sit-up. He has to return back to the original position to start the next sit-up and continue doing it till the testers signal to stop. The number of the accurate executed sit-ups completed in 30 seconds period were scored. The best of two trails was recorded with a rest period of 5 minutes in between the trails.

Sit and reach (flexibility)

A flexibility box was used to record for this test. The participants were instructed to sit on the floor by keeping their knees fully extended and keep their feet against the box and then bend their trunk, keep their hands on the top of the box with palms placed over each other and reach as far as possible on top of the box which has the markings on it. They were advised to hold this position for at least 1 to 2 seconds, while holding the knees locked all the time. The best of two trails was recorded with an interval of 5 minutes between each trails.

Training programs

Two protocols were used in this study as training programs called, a resistance training and a squash training. The resistance training involved several weight machines such as seated leg press, seated abdomen, horizontal chest press, pull down, seated row, seated calf raises, seated leg extension, horizontal leg curls and seated back extension. Subjects exercised 5 weeks, 2 times per week for 30 min per training session. They also used an intensity of 40% of 1RM, 3 sets of 20 times with a rest period of 1 min between sets during the first week. The intensity increased by 5% in each 2 weeks. But in the last week, the intensity was reduced to 35% for the purpose of resting before the post-test measurements. Moreover, the squash training consisted of several skills such as front stroke, back stroke, overhead strokes, services and drops in addition to participating in tournaments.

Statistical analysis

Dependent variables were analyzed by the use of Mean and Standard Deviation. To find out the significant difference between the RT and SQT at pre-training measures and when post-tests were deducted from pre-tests (mean difference) after training, independent t-tests were used. To estimate the significant difference within groups paired t-tests were utilized. 0.05 was taken as the level of significance and SPSS version 16 was used as statistical tool.

RESULTS AND DISCUSSION

Table 1. Body Composition Parameters (mean ± SD)

Parameters	Tests	RT Group	SQT Group	P-Values Independent t-test
Age (y)	Pre	21.00±0.66	20.67±0.70	0.305
H (cm)	Pre	174.30±5.87	170.78±5.26	0.188
BM (kg)	Pre	65.50±6.98	66.70±6.62	0.706
	Post	66.20±6.71	66.14±6.34	0.985
	Change	0.70±1.26	-0.55±1.04	0.032*
BMI (kg/m^2)	Pre	21.28±1.94	22.81±1.19	0.058
	Post	21.71±1.95	22.63±1.07	0.227
	Change	0.43±0.55	-0.17±0.35	0.013*

*: Significant ($P \leq 0.05$)

The RT and SQT groups showed no change ($P \geq 0.05$) at pre-test measures of age, H, BM and BMI. They also reported similar results ($P \geq 0.05$) in BM and BMI at post-tests. However, the RT group exhibited greater mean different values (change) than the SQT group in BM (0.70 ± 1.26 vs -0.55 ± 1.04 kg, respectively, P = 0.032) and in BMI (0.43 ± 0.55 vs -0.17 ± 0.35 kg / m^2, respectively, P = 0.013). These results can be seen in **Table 1**.

Table 2. Physical Fitness Parameters (means ± SD)

Parameters	Tests	RT Group	SQT Group	P-Values Independent t-test
50m Sprint (sec)	Pre	4.81±0.32	5.25±0.39	0.016
	Post	4.52±0.33	5.15±0.45	0.003
	Change	-0.29±0.27	-0.10±0.33	0.194
	P-Value (Paired t-test)	0.008 (6%)	0.402	
SLJ (cm)	Pre	209.40±33.12	169.89±18.03	0.006
	Post	222.60±28.51	176.33±17.58	0.001
	Change	13.20±11.07	6.44±14.35	0.264
	P-Values (Paired t test)	0.004 (6.3%)	0.215	
Sit ups (30 sec)	Pre	25.80±2.82	21.78±2.81	0.006
	Post	28.90±5.64	23.00±3.31	0.014
	Change	3.10±4.63	1.22±2.04	0.278
	P-Value (Paired t-test)	0.063	0.111	
Sit and Reach (cm)	Pre	26.50±9.60	25.56±7.16	0.813
	Post	29.80±7.07	30.44±6.38	0.838
	Change	3.30±3.34	4.88±3.44	0.322
	P-Value (Paired t-test)	0.012 (12.4%)	0.003 (19%)	

No mean differences (post minus pre) were observed between groups in all physical fitness parameters ($P \geq 0.05$). However, when the post-tests were compared with the pre-tests in each group independently (paired t-test), the RT group decreased ($P \leq 0.05$) by 6% (50 m run time), 6.3% (SLJ), 12% (sit-ups) and 12.4% (sit and reach). While, the SQT group showed remarkable (P = 0.003) drop in sit and reach by 19%, but no changes were reported in the other fitness parameters ($P \geq 0.05$). These results were illustrated in **Table 2**.

The outcomes of this study pointed out that the RT program is more effective than the SQT. The RT subjects increase their BM and BMI greater than their counterparts in SQT. This result can be understood by that the resistance training program may induce muscle hypertrophy [26]. The greater improvement of 50 m sprint, SLJ, sit-ups by the RT group may belong to the moderate intensity (40-60%), the high frequency (20 reps), the number of sets (5), and the short rest period of 60-90 seconds that were used. The similar increment in flexibility in the present study suggested that both training protocols contributed positively. The squash player always extends his arm, back, hamstring and other muscles repeatedly during a much, a

game or a training session [27]. These actions lead to the enhancement of the flexibility. The resistance training also increases the ability of the muscle to extend when the subject performs several different weight lifting drills [28]. It is challenging to associate the results of this study with the previous investigations because of the poor data in the literature regarding the resistance and the squash training on fitness parameters. Jones, *et al.*, (2018) investigated the fitness profile of International adolescent squash players aged 10-12, 13-15 and 16-18 years [29]. The data of 16-18 years were only considered to be compared with our study. Jones *et al.*, (2018) reported 40 reps (30 seconds) in sit-ups which is greater than the data of the present study (28; RT, 23; SQT) [29]. The interpretation of these results belongs to the use of trained squash players who have 2 or more years of competition experience at the international standards by Jones *et al.* [29]. These findings are equally supported by Krasilshchikov, (2014) who observed almost similar results on the Malaysain Squash players at the National level equally supports these results [30].

CONCLUSION

It was concluded that 5 weeks of resistance training are more effective than squash training on body composition, speed, explosive power and sit-ups, while both training methods showed similar significant increases in flexibility.

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