



Research Article

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The Effect of Resistance Training on the Selected Physical and Physiological Variables of the Male Students

Kaukab Azeem^{1*}, Mohammed Hamdan Hashem Mohammed²

¹ Assistant Professor (v), Physical Education Department, King Fahd University of Petroleum & Minerals, Saudi Arabia

² Lecturer (A), Physical Education Department, King Fahd University of Petroleum & Minerals, Saudi Arabia.

*Email: [kaukab @ kfupm .edu .sa](mailto:kaukab@kfupm.edu.sa)

ABSTRACT

Introduction: Maintaining a quality of life and also doing regular resistance training are the hallmarks of a fit person. The purpose of this study is to examine the effect of resistance training (RT) on the selected physical and physiological variables among the university males. Method: This is an experimental research with a pre and post-test design which includes a resistance training and a control group. Sixty male participants were selected for this study who were assigned into two groups; group-A (N=30) experimental group, and group -B (N=30), control group. The participants' age was in the range between 18 to 22 years. The duration of the RT program was 45 minutes, twice per week. All the subjects were tested before and after the 12-week program. For statistical analysis, ANCOVA and SPSS 16 were used. Descriptive statistics was applied to observe the differences among the participants from the pre to post-test. Results and Discussion: According to the results, the effect of RT on the selected physical variables was significant i.e. body composition, explosive power, muscular strength, muscular endurance, and flexibility. There was also a significant difference with regard to the physiological variables i.e. resting pulse rate and breadth holding time. Lastly, no significant difference was observed for blood pressure (systolic) and (diastolic) showed changes from the pre to post-test. Conclusion: This is evident that RT is beneficial for the improvement of physical as well as physiological variables. The higher number of training sessions in a week will be more effective in improving overall fitness level among the students.

Key words: *Physiological, Exercise, Resistance training, Physical.*

INTRODUCTION

Resistance training (RT) is an important tool for improving health and performance for one and all. Strength training is of utmost importance for athletes with regard to their training program. Upper body strength is a very important part of the training program for the following sports men and women globally i.e., cricketers, basketball players, boxers, baseball players, wrestlers, judo players, etc. Strength training (ST) may provide useful benefits and enhancement in overall health and well-being, including increased bone, muscle, tendon and ligament strength and toughness, improved joints, injury prevention, augmented bone density, improved metabolism, improved cardiac function, elevated HDL, and good cholesterol [1, 2].

Balanced life is the hallmark of a fit man. Nowadays, RT is of utmost importance and necessity for the athletic condition, rehabilitation program, and general fitness [3]. Resistance training programs include several factors i.e. intensity, frequency and volume of exercise [4]. It was revealed by many researchers that weight training with the right cardio exercises is beneficial in controlling hypertension, improving the cardiovascular health, helping in controlling fat and improving lean body mass [5]. It is recommended by the American college of sports medicine (ACSM), for 8-12 repetitions of a RT exercise for each major muscle group at an intensity of 40% to 80% of 1RM max, 2-3 of rest between the sets and 2-4 sets is recommended for each muscle group [6]. Recent recommendations suggest that RT should be performed at least twice a week with moderate to vigorous intensity to maintain or increase the strength and mass [7].

In an earlier study, the effect of 12-week program of RT on lowering the heart rate, systolic blood pressure and rate of perceived exertion was investigated and it showed no changes in the group participating in walking, jogging, and cycling programs. RT, particularly circuit training improves various measures of aerobic capacity among cardiac rehabilitation patients [8].

Moreover, a study was carried out on RT considering the various parameters to address the health and performance of sports men and women. And it was mentioned that historically, RT was not recommended to children and adolescents, due to the perceived threat of injury [9].

MS is a vital fitness variable and comprises a variety of training modalities, exercises with our own body weight, elastic bands, plyometric exercises for (lower & upper body), multi fitness equipment, free weight machines and hydraulic machines [2]. ST is a kind of work out specializing in the use of resistance to influence muscular contraction which improves the strength, anaerobic endurance, and size of the skeletal muscles [10]. Skinner mentioned that exercise is a medicine and RT in particular is one of the most important medicines in controlling certain types of diseases, i.e., obesity, joint pains, muscle weakness, neuromuscular coordination, etc. [11]. This was described by a fitness professional that the push-up exercises are one of the most popular for one and all. Push-ups are important and are considered as basic exercise for the chest, and also help greatly in shaping and defining abs, triceps, shoulders and torso [12].

The specific combinations of reps, sets, exercises, and weights depend on the aims of the athletes performing the exercise; sets with fewer reps can be performed with higher weights [13]. Push-up is a multi-joint upper body exercise that can enhance the upper body muscular push strength, shoulder strength, and performance of activities demanding high level of relative strength [14]. The usefulness of RT performance-related benefits, the effects of RT on the selected health-related measures including bone health body composition, and sports injury reduction should be recognized by teachers, coaches, parents, and health care providers. These health benefits can be safely obtained by most children and adolescents when prescribed as age appropriate RT guidelines.

RT exercise is particularly designed to improve MS and endurance through increasing work-load demand and may include the use of free body weight training, machine weights, elastic tubing/stretch bands, and hydraulic machines [15]. Recent studies have shown that supervised RT programs do not appear to have any adverse effects in children and adolescents [16] and in fact may improve cardiovascular fitness, body composition, bone mineral density and blood lipid profiles [17]. RT has been considered as an important training protocol for adults [18].

The purpose of this study was to find out the effect of RT on the physical and physiological variables among University males.

The investigation's focus was on the following Objectives:

1. Designing an effective resistance training program for male students
2. Supervising, implementing and administering the training program on the participants
3. Finding the changes on the selected physiological variables
4. Finding out the effect of RT on selected Physical variables
5. Making recommendations

MATERIALS AND METHODS

This is an experimental research with a pre and post-test including a RT and a control group. Sixty male beginner participants from King Fahd University of Petroleum and Minerals were selected to take part in this study. The subjects were assigned into two groups namely; group: A (N=30) experimental group and group: B (N=30), Control group. The age of the participants was in the range between 18 and 22 years. The duration of the RT program was 45 minutes per session, twice per week. All the subjects were tested prior to and after the 12 weeks of program. The test procedure was verbally explained and practically demonstrated to all the participants. The doubts of the subjects were clarified. A handout and schedule was circulated to elicit the information and details for the students' daily exercise program and training intensity was facilitated. The blood pressure was tested at the King Fahd University of Petroleum & Minerals, clinic laboratory. The physical variables were tested by the investigators at the physical education department.

Selection of Subjects

To accomplish the purpose of this investigation, a group of 60 males were selected randomly from the classes of Physical Education at King Fahd University of Petroleum & Minerals, Saudi Arabia undergoing a physical education course. The age of the selected participants was between 18 to 22 years. RT program was considered

to be applied on the male participants for 12 weeks, twice weekly, and 45 minutes of training per session. An initial test and post-test was applied to find out the effect of RT on physical and physiological variables among the participants.

Selection of Variables

The various scientific literatures pertaining to the RT and its effects on the selected physical and physiological variables were reviewed using books, journals, periodicals, health magazines, research papers, and online search. Keeping all the shortcomings and challenges in the mind, the following consideration is made with regard to feasibility criteria, availability of instruments, and the relevance of the variables of the present study. This study will be useful for the students to enhance their health and fitness levels.

Table 1. The details of dependent variables of physical and physiological variables

Sl.no	Physical Variables	DEPENDENT VARIABLES
1	Body composition	
2	Explosive power	
3	Muscular strength	
4	Muscular endurance	
5	Flexibility	
	Physiological Variables	
1	Resting pulse rate	
2	Blood pressure	
3	Breadth holding time	
1	Resistance Training Program	INDEPENDENT VARIABLE

Selection of Test

Table 2. The details of the physical variables, test and unit of Measurements

S.no	PHYSICAL VARIABLES	Test	Unit of measurements
1	Body composition	Body mass index (BMI)	Wt in (kgs) / Ht (cm) ²
2	Explosive power	Standing broad jump	Cm
3	Muscular strength	Bench press 1RM	Kilo grams
4	Muscular endurance	Sit-ups (30 sec)	Repetitions (score)
5	Flexibility	Sit and reach test	Cm

Table 3. The details of physiological variables, test and unit of Measurements

S.no	Physiological Variables	Test	Unit of measurements
1	Resting pulse rate	Digital watch	Score per minute
2	Blood pressure	sphygmomanometer	mm.Hg
3	Breadth holding time	Digital watch	Seconds/ minutes

Instrument Reliability

The standard equipment was used to assess the dependent variables. Blood pressure score was taken with the help of (sphygmomanometer) and resting pulse rate was measured at the King Fahd University of Petroleum & Minerals, Clinic, Dhahran. Body mass index (BMI), height and weight were recorded with the help of stationmaster and electronic weighing machine.

Orientation of the Subjects

The investigators had explained the purpose of this study to all the participants. The doubts of the participants were addressed and the important instructions were given to the participants with regard to attendance, their active participation during the entire training program from the pre to post-test.

Training Protocol

The training program was especially designed for this study keeping all the other aspects in the total frame of mind about the student's academic schedule. The RT was given for twelve weeks, two times in a week, 45

minutes each session. 10 resistance exercises were given in the schedule i.e. sitting calf raises, leg extensions, standing leg curls, high pulley front, chest press, incline chest press, preacher curls, sitting triceps extensions, sitting shoulder press, and abductors. The training schedule was started with the general warm up, stretching exercises, and specific warm up with free squats, push-ups and sit-ups exercises were given. During the first and second week, the intensity was 20%, two sets, 25 reps and one minute rest between the sets. In the third, fourth and fifth weeks, the intensity was given with the first set 20% and the second set 40%, 20 repetitions each set, with one minute rest between the sets. In the sixth and seventh weeks, the intensity was 30% first set and 60% second set with 15 reps each set with two minutes rest between each set. In the eighth, ninth and tenth weeks, the intensity was 20% at the first set with 15 reps, 40% at the second set with 12 reps and 80% at the third set with 10 reps, with a rest of three minutes in each set. Lastly, in the eleventh and twelve weeks, the intensity was 20% in the first set with 15 reps + 3 minutes rest, 60% in the second set with 12 reps + 3 min rest, 100% in the third set with 6 reps + 3 min rest, and the schedule will end with the cool down exercise.

Statistical Analysis

The data was analyzed using appropriate statistical methods. For statistical analyses, SPSS-16 was used. Descriptive statistics for data scores were applied to find out the difference from the pre to post-test among the participants. Mean, standard deviation, and ANCOVA were applied to find out the significance. The level of significance was set at 0.05 level of confidence.

RESULTS AND DISCUSSION

Table 4. Mean and Standard Deviation of the Selected Physical Variables for Experimental and Control Group

Selected variables	Groups	Pre-test		Post-test	
		Mean	S.D	Mean	S.D
Body composition	Experimental	23.60	2.61	24.41	2.66
	Control	23.26	2.44	23.17	2.49
Explosive power	Experimental	1.68	0.149	2.11	0.222
	Control	1.65	0.195	1.66	0.192
Muscular strength	Experimental	35.33	5.24	51.96	12.95
	Control	35.33	6.68	35.50	7.11
Muscular endurance	Experimental	20.10	3.53	24.56	3.12
	Control	15.53	4.69	15.60	4.65
Flexibility	Experimental	19.06	7.38	25.46	7.26
	Control	18.00	7.78	18.13	7.86

Table 4 displays the mean and SD values of the experimental group with regard to body composition from the pre to post-test which were (23.60, 2.61) and (24.41, 2.66), respectively. It is evident that the experimental group had an improvement from the pre to post-test with regard to body composition. The control group did not show any improvement in body composition from the pre to post-test. The mean and SD of the experimental group with regard to explosive power from the pre to post-test were (1.68, 0.149) and (2.11, 0.222), respectively. This indicates that the experimental group improved from the pre to post-test. The control group did not show any changes. The mean and SD of the experimental group with regard to muscular strength from the pre to post-test were (35.33, 6.68) and (51.96, 12.95), respectively. The experimental group showed greater performance from the pre to post-test. The control group did not show any changes from the pre to post test. The mean and SD with regard to muscular endurance performance among the experimental group from the pre to post-test were (20.10, 3.53) and (24.56, 3.12), respectively. The experimental group showed an improvement from the pre to post test. No changes were found in the control group from the pre to post-test. The mean and SD with regard to flexibility performance among the experimental group from the pre to post-test were (19.06, 7.38) and (25.46, 7.26), respectively. The experimental group showed an improved performance from the pre to post-test with regard to flexibility. The control group showed no changes from the pre to post-test.

Table 4 A: An Analysis of Co-Variance of the Data on the Selected Physical Variables for the Experimental and Control Group

Variables	Adjusted post mean		Sum of variance	Sum of squares	df	Means squares	F
	Experimental	control					
Body composition	24.24	23.34	Between	12.183	1	12.183	51.7

			With in	13.430	57	0.236	
Explosive power	2.100	1.682	Between	2.603	1	2.603	155.43
			With in	0.954	57	0.017	
Muscular strength	51.96	35.50	Between	4067.26	1	4067.26	145.67
			With in	1591.41	57	27.920	
Muscular endurance	22.56	17.60	Between	280.50	1	280.50	117.03
			With in	136.61	57	2.397	
Flexibility	24.95	18.64	Between	594.81	1	594.81	124.5
			With in	272.29	57	4.777	

Significant at 0.05 level of confidence

As shown in table 4A for body composition, the adjusted post-test mean value for the experimental group and control group are 24.24 and 23.34, respectively. The obtained F-ratio of 51.7 for the adjusted post mean is higher than the required table value of 4.009 at 1 and 57 df at 0.05 level of confidence.

As shown in the above table for explosive power, the adjusted post-test mean values for the experimental group and control group are 2.100 and 1,682, respectively. The obtained F-ratio of 155.43 for the adjusted post mean is higher than the required table value of 4.009 at 1 and 57 df at 0.05 level of confidence.

As shown in table 4A, for muscular strength the adjusted post-test mean values for the experimental and control group are 51.96 and 35.50, respectively. The obtained F-ratio of 145.67 for the adjusted post mean is higher than the required table value of 4.009 at 1 and 57 df at 0.05 level of confidence.

As shown in the above table 4A, for muscular endurance the adjusted post-test mean values for the experimental and control group are 22.56 and 17.60, respectively. The obtained F-ratio of 117.03 for the adjusted post mean is higher than the required table value of 4.009 at 1 and 57 df at 0.05 level of confidence.

As shown in the table 4A, for flexibility the adjusted post-test mean values for the experimental group and control group are 24.95 and 18.64, respectively. The obtained F-ratio of 124.5 for the adjusted post mean is higher than the required table value of 4.009 at 1 and 57 df at 0.05 level of confidence.

The effect of RT on the experimental group was significant in all the selected physical variables i.e. body composition, muscular power, MS, muscular endurance and flexibility. Moreover, the control group did not show any significant changes with regard to the selected physical variables. It is evident that RT is an important tool in improving physical variables among the university students. This is very clear that RT training for two days has shown an encouraging results and in case of doing in four days, it may be more significant in improving the physical status of the participants.

Table 5. The Mean and Standard Deviation of the Selected Physiological Variables for Experimental and Control Group

Selected variables	Groups	Pre-test		Post -test	
		Mean	S.D	Mean	S.D
Resting pulse rate	Experimental	70.90	1.58	66.93	2.77
	Control	69.63	2.31	70.13	1.52
Blood Pressure (Systolic)	Experimental	121.93	3.57	120.30	1.05
	Control	120.17	0.53	120.60	2.22
Blood pressure (diastolic)	Experimental	81.40	2.23	79.03	1.35
	Control	80.36	1.03	80.26	0.868
Breadth holding time	Experimental	47.66	10.69	57.53	10.08
	Control	44.90	7.51	44.91	7.85

The above table shows the analysing data for the selected physiological variables. The mean and SD with regard to resting pulse rate of the participants for the experimental group from the pre to post-test are (70.90, 1.58) and (66.93, 2.77), respectively. The data shows that the experimental group improved from the pre to post-test. The control group did not show any changes from the pre to post-test. The mean and SD of the subjects from the experimental group with regard to blood pressure (systolic) from the pre to post-test are (121.93, 3.57) and (120.30, 1.05), respectively. The blood pressure (systolic) was normal among the participants in the pre and post-test. As a future study, it will be more fruitful if the subjects with high blood pressure are investigated in this regard. The control group did not any significant changes from the pre to post-test. The mean and SD of the experimental group regard to blood pressure (diastolic) are (81.40, 2.23) and (79.03, 1.35), respectively. It is evident that the participants had the diastolic pressure normal in the pre and post-test. The control group did not

show any encouraging changes compared to the experimental group. The mean and SD of the subjects of the experimental group with regard to breadth holding time from the pre to post-test are (47.66, 10.69) and (57.53, 10.08), respectively. The participants of the experimental group did not show greater performance from the pre to post-test. The control group did not show any encouraging changes as compared to the experimental group.

Table 5 A. An Analysis of Co-Variance of the Data on Selected Physiological Variables for Experimental and Control Group

Variables	Adjusted post mean		Sum of variance	Sum of squares	df	Means squares	F
	Experimental	control					
Resting pulse rate	66.42	70.64	Between	242.18	1	242.18	97.08*
			With in	142.19	57	2.495	
Blood Pressure (Systolic)	120.03	120.87	Between	9.214	1	9.214	3.715 ns
			With in	141.36	57	2.480	
Blood Pressure (diastolic)	78.90	80.39	Between	30.265	1	30.265	26.74
			With in	64.50	57	1.132	
Breadth holding time	56.27	46.16	Between	1497.73	1	1497.73	139.97
			With in	609.907	57	10.70	

Significant at 0.05 level of confidence

According to table-5A, for resting pulse rate the adjusted post-test mean value for the experimental and control group are 66.42 and 70.64, respectively. The obtained F-ratio of 97.08* for the adjusted post mean is higher than the required table value of 4.009 at 1 and 57 df at 0.05 level of confidence.

According to table-5A, for Blood pressure (systolic) rate the adjusted post-test mean value for the experimental group and control group are 120.03 and 120.87, respectively. The obtained F-ratio of 3.715 for the adjusted post mean is lower than the required table value of 4.009 at 1 and 57 df at 0.05 level of confidence.

According to table-5A, with regard to resting pulse rate, the adjusted post-test mean value for the experimental group and control group are 78.90 and 80.39, respectively. The obtained F-ratio of 26.74 for the adjusted post mean is higher than the required table value of 4.009 at 1 and 57 df at 0.05 level of confidence.

According to table –5 A, with regard to breadth holding time, the adjusted post-test mean value for the experimental group and control group are 56.27 and 46.16, respectively. The obtained F-ratio of 139.97 for the adjusted post mean is higher than the required table value of 4.009 at 1 and 57 df at 0.05 level of confidence.

The effect of RT on the experimental group is significant with regard to resting pulse rate, blood pressure (diastolic) and breadth holding time compared to the control group. Moreover, the experimental group did not show any significant changes with regard to blood pressure (systolic) compared to the control group because the scores were normal in the pre-test among both groups. This is evident that RT has a positive impact on the university males in improving their physiological variables.

Table 4A indicates that the effect of all the variables i.e. body composition, explosive power, muscular strength, muscular endurance and flexibility is significant. This means that the training was beneficial to all the selected variables. Table 5A indicates that the following selected variables were significant i.e. resting pulse rate, diastolic pressure and breadth hold time. Moreover, systolic pressure is insignificant (no change) since at the initial stage, the scores were normal and in the post-test, there was no chance for further changes.

The following research studies are in agreement with the present study: In a study, it was observed that combining high-load ST with soccer-specific movements might be an effective strategy to improve strength and speed [19]. It was revealed in a study that the moderate velocity RT group has a positive effect to develop the quality of explosive strength ($p = 0.05$) among the adolescent boys compared to the control group [20]. This twelve-week past study had revealed about the cardio-respiratory endurance training, RT, and core ST had significantly improved the selected physical fitness variables among the college athletes [21]. It was shown in this earlier study that the results of this research with regard to muscular strength have improved significantly after the effect of twelve weeks resistance and free weight training program [22]. In this previous study, it was found that the Visual and Kinaesthetic Imagery with Single Limb RT significantly improved self-concept among intermediate level male body builders compared to the experimental Group I (visual imagery training) and Group II (kinaesthetic imagery training), [23, 24]. In this study, it was revealed that the effect of seven-week RT was significant improving the leg explosive strength, and agility among the participants [5]. The result of a previous study showed that the stationary circuit training and the moving circuit training have significant effect ($p = 0.05$) on anaerobic power compared with the control group [25]. In this earlier study, it was revealed

that the effect of weight training was significant on the students' fitness performance. MS, muscular endurance, flexibility (leg press, bench press, sit-ups test and sit and reach test) showed improved performances from the pre to post-test [26]. Interestingly, in one of the past studies, it was found out that the periodized resistance training significantly increases MS compared to periodized aerobic training [27].

CONCLUSION

It is concluded that the effect of RT on the experimental group was significant with regard to all the selected physical variables i.e. body composition, muscular power, MS, muscular endurance and flexibility. Moreover, the control group showed no significant changes with regard to the selected physical variables.

It is also concluded that the experimental group showed significant performance with regard to resting pulse rate, blood pressure (diastolic) and breadth holing and with regard to blood pressure (systolic), no significant difference was observed from the pre to post-test. Furthermore, the control group did not show any changes with regard to the selected physiological variables from the pre to post-test.

This is evident that RT twice a week for 45 minutes per session is beneficial for the improvement of the physical and physiological variables among the participants. The higher number of training sessions in a week i.e. 3 or 4 or 5 days will be more effective in improving overall fitness level among the students.

Recommendations

The following recommendations are suggested based on the outcome of the study:

1. The University students are advised to get involved in RT program to improve and maintain a healthy lifestyle.
2. To improve physical status among the students
3. To improve the physiological functions among the male students
4. Further research studies can be done on obese students with different training protocols.

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