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Research Paper

Comparing Factors of Physical Fitness and Determining Their Relationship with Anthropometric Characteristics of Students at Iranian Officer Training Universities

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Abstract

The present study aims at comparing factors of physical fitness and determining their relationship with anthropometric characteristics of first- and second-year students at Iranian officer training universities. To conduct this research, 40 students were selected who in their first and second year of studies at maritime university. Samples were put into two groups of 20 students. The mean and standard deviation of age, height and weight for first-year students were 19.5 ± 1.2, 174.9±4.6, and 70±9.1, and for second-year students were 20.3±.03, 175.6±6.9, and 71±8.7, respectively. Administering physical fitness tests, the sample groups were compared to each other and then anthropometric characteristics of first-year students were measured by anthropometry instrument to compare them with physical fitness factors. To analyze the data, Independent sample T-test were operated and to determine the differences between first and second-year students, concerning investigated factors, and to predict physical fitness factors based on anthropometric characteristics multiple correlation coefficient at the alpha level of .05 was used. As the results showed, comparing endurance of abdominal muscles, flexibility of back muscles, and cardiac endurance and body mass index (BMI), there was no significant differences between first- and second- year students. However, there was a significant difference between these two groups in their shoulders muscles endurance. Also, investigating the relationship between physical fitness factors and anthropometric characteristics, there were direct correlations between cardiac endurance, abdominal muscles endurance, flexibility, fat percentage, fat mass, non-fat mass, weight and BMI.

Keywords: Anthropometry; Body Composition; Physical Fitness; Officer Training University

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1. Introduction

The Holy Quran guides human beings by providing the best model for all aspects of life, until the day of doom. In holy Quran, the words of the creator of all beings, there are versus which emphasize the importance of exercises and strengthening one's body as well as mental and spiritual strength [1]. Sport, exercises and body activities form part of our daily life. Walking the streets, riding the bicycle, walking up and down the stairs, playing different sports and doing some exercises are physical activities we usually do (Gaeeni, 2010). Selecting the slogan "Act for Health" by the World Health

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Organization (WHO) in 2002 shows the importance of exercises and its effect on general health of modern. Modern Physical fitness movement is a recent phenomenon (Talebpour, 2006). Nowadays, the importance and necessity of physical fitness do not need more explanation. Some believes that physical fitness is the physical ability which helps someone to do his or her daily activities while have the enough energy to deal with sudden events. Some suggest that physical fitness refers to the body adjustment with practices and hard physical activities and return to the primary condition quickly and easily. However, the shortest definition belongs to Tomaspi Martin who said that physical fitness means having a healthy life [2]. Physical fitness for health is an important issue in sport physiology which relates to sickness prevention and health improvement [3].

During the history of human being, sport and physical education were used to strengthen military forces. Almost all ancient societies have used physical exercises in order to train their military forces. The first and second World Wars showed clearly the importance of physical fitness in developing military actions. Wood and Hetherington were pioneers of soldier training programs. Nowadays, almost all regular armies use physical exercises in order to improve physical fitness of their soldiers. Countries such as Iran, where had been attacked by different countries during its history and even nowadays due to its strategic and economic importance in the region are always under political, cultural and military threat from colonizer and imperialist countries, must focus on their military power, concerning its role, applicability, and relatively low costs [2].

2. Methodology

The present study is a comparative correlational cross-sectional study.

2.1 Participants

The sample population of the study was students of Imam Khomeini university of Maritime sciences. 1500 students, from 18 to 23 years old, participated in this study.

2.2 Sampling

All the students participated in this study had filled the satisfaction form. 40 completely healthy students randomly were selected and were grouped into two groups, each of which contains 20 students. In this study physical fitness factors including cardio vascular endurance, muscles endurance, flexibility was composed, anthropometric characteristics were measured and compare with each other and its correlation with physical fitness factors were estimated.

2.3 Variables

In the present paper, anthropometric characteristics of the students were considered as our independent variable and physical fitness as the dependent variables.

2.4 Measuring device

2.4.1 Physical fitness tests

In the present study, physical fitness measuring device and standard physical fitness tests were used as the main instruments to collect data. To measure the flexibility, abdominal muscles endurance, upper body muscles endurance, skinfold fat, weight and length, body breadths, and bone breadth of samples V-sit flexometer board/sit and reach test, one-minute sit up test, pushup test, a skinfold caliper device made in the United States, a Digital Scales called Sika 220 made in Germany , Lufkin anthropometric tape made in Mexico, and a bone caliper, made in Iran and licensed by the anthropometric center of the National Olympic Committee were used, respectively.

2.4.2 Flexibility measuring device

To measure the flexibility of samples, V-sit flexometer board/sit and reach test was used.

2.4.3 One-minute sit up test

To measure abdominal muscles endurance of samples, one-minute sit up test was used.

2.4.4 Pushup test

To measure upper body muscles endurance of samples, pushup test was used.

2.4.5 Skinfold caliper

To measure the skinfold fat of samples, slimguide, a skinfold caliper device made in the United States, was used.

2.4.6 weight and length

To measure the weight and length of samples, Sika 220, a digital made in Germany, was used.

2.4.7 Anthropometric tape

To measure body breadths, Lufkin anthropometric tape, made in Mexico, was used.

2.4.8 Bone caliper

To measure bone widths, the bone caliper, made in Iran and licensed by the anthropometric center of the National Olympic Committee, was used.

Statistical operations: Descriptive statistics were used to estimate the variance, distribution and draw graphs. Kolmogorov-smirnov test was conducted in order to investigate the distribution of data, and pearson correlation test was used to analyze the correlation between investigated variables, and independent samples t-test was

performed to investigate the differences between the first- and second-year students, concerning the studied variables, using Cronbach's alpha at the level of .05.

3. Results

3.1 First hypothesis

There is no difference between the first and second-year students of Imam Khomeini university of Maritime Sciences, concerning their cardio vascular endurance.

As shown in table 1, comparing the mean time of the one-mile running test, the first year students were faster. Concerning significance level (P>0.05), our null hypothesis was not rejected. Therefore, in spite of slight difference in students' cardio vascular endurance, it was not statistically significant.

3.2 Second hypothesis

There is no difference between the first and second-year students of Imam Khomeini University of Maritime Sciences, concerning their abdominal muscles endurance.

As shown in table 2 comparing the mean number of sit ups, the second year students performed better. Concerning significance level (P>.05), our null hypothesis was not rejected. Therefore, in spite of slight difference in students' abdominal muscles endurance, it was not statistically significant.

3.3 Third hypothesis

There is no difference between the first and second-year students of Imam Khomeini University of Maritime Sciences, concerning their Muscles of the shoulder endurance.

As shown in table 3, comparing the mean number of push-ups, the second year students over performed the first-year students. Concerning significance level (P<0.05), our null hypothesis was rejected. Therefore, there was a statistically significant difference between the first and second year students' Muscles of the shoulder endurance.

3.4 Fourth hypothesis

There is no difference between the first and second-year students of Imam Khomeini University of Maritime sciences, concerning their flexibility.

As shown in table 4 comparing the mean record of sit and reach test, the first year students performed better. Concerning significance level (P>0.05), our null hypothesis was not rejected. Therefore, in spite of slight difference in students' flexibility, it was not statistically significant.

Table 1. Independent sample T-test comparing samples' cardio vascular endurance

Group	Mean	Mean difference	Sd	df	T	Sig
The first-year students	6.49	0.239	0.134	38	1.786	0.082
The second year-students	6.25					

Table 2. Independent sample T-test comparing samples' abdominal muscles endurance.

Group	Mean	Mean difference	Sd	df	T	Sig
The first-year students	41.75	-0.95	1.91	38	0.497	0.622
The second year-students	42.7					

Table 3. Independent sample T-test comparing samples' Muscles of the shoulder endurance.

Group	Mean	Mean difference	Sd	df	T	Sig
The first-year students	33.95	-6.1	2.45	38	-2.489	0.017
The second year-students	40.05					

Table 4. Independent sample T-test comparing samples' flexibility.

Group	Mean	Mean difference	Sd	df	T	Sig
The first-year students	20.55	0.1	1.762	38	0.057	0.955
The second year-students	20.45					

3.5 Fifth hypothesis

There is no difference between the first and second-year students of Imam Khomeini University of Maritime sciences, concerning the balance between their height and weight or their body mass index (BMI). As shown in table 5, comparing the mean BMI, the first year students gain lower scores.

Concerning significance level (P>0.05), our null hypothesis was not rejected. Therefore, in spite of slight difference in students' BMI, it was not statistically significant.

3.6Sixth hypothesis

There is no significant correlation between cardio vascular endurance and anthropometric characteristics of samples.

Table 6 shows that there are significant correlations between cardio vascular endurance of students and their anthropometric characteristics. The highest correlations were between this factor and femur breadth and body girths (Arm girth relaxed, Arm girth flexed and tensed, and gluteal girth), and the lowest correlations were with humerus breadth, height, and waist girth. There were significant correlation between cardio vascular endurance and subscapular skinfold, Medial calf skinfold, Arm girth relaxed, Arm girth flexed and tensed, and Gluteal girth, Calf girth, and Femur breadth. Concerning significance level (P<0.05), our null hypothesis for above mentioned anthropometric characteristics was rejected, but it was confirmed for other characteristics (P>0.05).

3.7 Seventh hypothesis

There is no significant correlation between abdominal endurance and anthropometric characteristics of samples.

Table 7 shows that there are negative correlations between abdominal endurance of students and their anthropometric characteristics. That is, the more sit ups, the less are anthropometric measures. The highest correlations were between this factor and femur breadth, and the lowest correlations were with suprailiac skinfold and front thigh skinfold. There was significant correlation between abdominal endurance and arm girth flexed and tensed humerus breadth and Femur breadth. Concerning significance level (P<0.05), our null hypothesis for above mentioned anthropometric characteristics was rejected, but it was confirmed for other characteristics (P>0.05).

3.8 Eighth hypothesis

There is no significant correlation between shoulder muscles endurance and anthropometric characteristics of samples.

Table 5. Independent sample T-test comparing samples' BMI.

Group	Mean	Mean difference	Sd	df	T	Sig
The first-year students	22.895					
The second year-students	23.027	-0.132	1.762	38	0.169	0.867

Table 6. The pearson correlation test, comparing the correlation between cardio vascular endurance and anthropometric characteristics of samples

Anthropometric index	Correlation	Sig
Height	0.215	0.346
Triceps skinfold	0.455	0.044
Subscapular skinfold	0.486	0.03*
Biceps skinfold	0.398	0.082
Iliac crest skinfold	-0.089	0.708
Superailiac skinfold	0.398	0.082
Abdominal skinfold	0.435	0.055
Front thigh	0.425	0.062
Medial calf skinfold	0.479	0.033*
Arm girth relaxed	0.542	0.014*
Arm girth flexed and tensed	0.534	0.015*
Waist girth	0.244	0.299
Gluteal girth	0.502	0.024*
Calf girth	0.444	0.049*
Humerus breadth	0.146	0.538
Femur breadth	0.537	0.015*

Table 7. The pearson correlation test, comparing the correlation between abdominal endurance and anthropometric characteristics of samples.

Anthropometric Index	Correlation	Sig
Height	-0.061	0.8
Triceps skinfold	-0.27	0.251
Subscapular skinfold	-0.202	0.393
Biceps skinfold	-0.374	0.104
Iliac crest skinfold	-0.048	0.842
Superailiac skinfold	-0.006	0.982
Abdominal skinfold	-0.059	0.804
Front thigh skinfold	-0.005	0.982
Medial calf skinfold	-0.031	0.897
Arm girth relaxed	-0.356	0.123
Arm girth flexed and tensed	-0.476	0.034*
Waist girth	-0.128	0.59
Gluteal girth	-0.367	0.112
Calf girth	-0.372	0.106
Humerus breadth	-0.646	0.002*
Femur breadth	0.475	0.034*

Table 8. The pearson correlation test, comparing the correlation between shoulder muscles endurance and anthropometric characteristics of samples

Anthropometric index	Correlation	Sig
Height	-0.520	0.019*
Triceps skinfold	-0.391	0.088
Subscapular skinfold	-0.058	0.808
Biceps skinfold	-0.425	0.062
Iliac crest skinfold	-0.082	0.732
Superailiac skinfold	-0.197	0.405
Abdominal skinfold	-0.408	0.074
Front thigh skinfold	-0.413	0.071
Medial calf skinfold	-0.317	0.173
Arm girth relaxed	0.5	0.834
Arm girth flexed and tensed	0.039	0.87
Waist girth	0.145	0.543
Gluteal girth	-0.445	0.044*
Calf girth	-0.067	0.78
Humerus breadth	-0.238	0.313
Femur breadth	-0.258	0.272

Table 8 shows that there are negative correlations between shoulders muscles endurance of students and their anthropometric characteristics, except arm girth flexed and tensed. There were statistically significant correlation between shoulders muscles endurance and height and Gluteal girth. Concerning significance level ($P<0.05$), our null hypothesis for the two above mentioned anthropometric characteristics was rejected, but it was confirmed for other characteristics ($P>0.05$).

3.9 Ninth hypothesis

There is no significant correlation between flexibility and anthropometric characteristics of samples.

Table 9 shows that there are negative correlations between shoulders muscles endurance of students and their anthropometric characteristics, but femur breadth, height and arm girth flexed and tensed. The highest correlation was between this factor and medial calf skinfold, and the lowest correlation was with arm girth flexed and tensed. There were statistically significant correlation between flexibility and triceps skinfold, biceps skinfold, medial calf skinfold, front thigh skinfold, abdominal skinfold. Concerning significance level ($P<0.05$), our null hypothesis for the above mentioned anthropometric characteristics was rejected, but it was confirmed for other characteristics ($P>0.05$).

4. Discussion and Conclusion

The main goal of the present study was to compare different factors of physical fitness and to determine their correlation with anthropometric characteristics of army students. Investigating first- and second-year students, this study tried to evaluate the efficiency of physical exercises and training programs in an attempt to identify the strengths and shortcomings of these programs in

order to make suggestions for optimal programs. Analyzing the correlation between different factors, we found high correlation in several cases. These correlations showed that physical factors overlap with each other. If improving one physical factor (e.g. reduction of fat mass) resulted in other factors' improvement (e.g. flexibility), we can reach our goals spending less time and money.

Table 9. The pearson correlation test, comparing the correlation between flexibility and anthropometric characteristics of samples.

Anthropometric index	Correlation	Sig
Height	0.271	0.248
Triceps skinfold	-0.568	0.009*
Subscapular skinfold	-0.497	0.026
Biceps skinfold	-0.549	0.012*
Iliac crest skinfold	-0.218	0.356
Superailiac skinfold	-0.355	0.124
Abdominal skinfold	-0.590	0.006*
Front thigh skinfold	-0.578	0.008*
Medial calf skinfold	-0.60	0.005*
Arm girth relaxed	-0.048	0.841
Arm girth flexed and tensed	0.005	0.984
Waist girth	-0.088	0.711
Gluteal girth	-0.273	0.244
Calf girth	-0.115	0.630
Humerus breadth	0.064	0.789
Femur breadth	-0.124	0.604

To design exercise or training schedules, overlapping factors should be taken into consideration. Working on overlapping physical factors may cause overpractice and destroy all the efforts done by the trainer and the trainee. On the other hand, concerning these overlapping factors in planning is time-saving and prevents overpractice. If improving one factor does not bring about improvement to other factor, we should focus on both factors in order to reach our goals. Therefore, we can put these factors among those with high correlation, because different energies are involved. As a result, finding the relationship among factors of physical fitness of athletics, concerning variables such as sport they involved in, age, and sex is very important [4]. The results confirmed the first, second, and fourth null hypotheses in comparing factors of physical fitness, namely cardio vascular endurance, abdominal muscles endurance, and flexibility of first- and second-year students. Besides, the differences were not statistically significant. However, the third null hypothesis, on shoulders muscles endurance of two groups of samples, was rejected and showed statistically significant difference. Results on the first, second, and fourth null hypotheses indicated that physical exercises in first and second year of study did not noticeably differ or was not as efficient as needed to create significant difference.

Previous studies have shown significant correlations between factors of physical fitness and variables of age, weight, and BMI [5-7]. However, these variables are almost the same for the samples of this study which resulted in no significant differences. Yanovich (2008) reported that physical fitness of male soldiers underwent no significant changes after a training program, which is in accordance with our findings [8]. Possibly, the similarity of age, BMI, total activity, practices, and energy systems caused this phenomenon. However, our finding is not in accordance with Emami (2009) [9]. They compare first- and last-year students which had different practices and more age differences. Age is an effective factor in physical fitness [5]. Regarding the third hypothesis (on shoulders muscles endurance), our findings are in accordance with Emami (2009), which is probably because of the differences in duties and training programs of first- and second-year students, which leads to an improvement in this part. Carrying military equipment by hands causes the increase of shoulders muscles endurance. The difference in types and times of practices using this equipment may affect shoulders muscles. Doing similar physical exercises (in terms of intensity and volume of training) with different patterns leads to different adjustment [10]. Body mass has an important role in the level of physical fitness and practice doing. Fifth hypothesis compared the ratio of height to weight (BMI) of first and second- year students of Imam Khomeini University of Maritime Sciences which showed no significant difference. This happened due to the fact that at the beginning of employment and volunteers' evaluation, there are some limitations (concerning height and weight) which resulted in similar characteristics. Also, concerning the similarity of physical fitness tests, it was predicted that there were no differences in terms of BMI. We can say that the similarity of training or energy systems involved in practices, the consumed energies are the same and since the type of energy and foods are the same (all students eat at the university's self-service), consequently BMIs are relatively the same. Estimating BMI, the general readiness and fitness are determined. This estimation also helps to design practice schedule for athletics. The high percentage of pure body mass and less fat mass is associated with athletic achievement and health [11]. Studies on the relationship between BMI and aerobic power usually focused on body fat percentage and $VO_{2max.}$ those with, high body fat, while doing aerobic workouts are faced with a kind of weight resulted from the extra fat which leads to their weak performance [12]. Concerning sixth hypothesis, there were significant correlation between cardio vascular endurance and subscapular skinfold, medial calf skinfold, Arm

girth relaxed, Arm girth flexed and tensed, and gluteal girth, calf girth, and femur breadth. Therefore, the null hypothesis on correlation between cardio vascular endurance and the above said factors was rejected ($p<0.05$). in accordance with Lester (2010) and Mirzaei (2010), in our study there was a significant negative correlation between fat percentage and cardio vascular endurance (aerobic power). The reason is probably the fatter mass which forced them to carry extra load in long-time aerobic tests which causes a low performance. In seventh and eighth hypotheses, there were not significant correlations between anthropometric characteristics and BMI with abdominal and shoulders muscles endurance ($P>0.05$). possibly, because of short-time tests, BMI was not effective.

Concerning the fact that samples' BMIs were normal and equal, we may conclude that the changes are because of practice types which resulted in low correlation. Concerning ninth hypothesis, there were statistically significant correlation between flexibility and triceps skinfold, biceps skinfold, medial calf skinfold, front thigh skinfold, abdominal skinfold. Concerning significance level ($P<0.05$), our null hypothesis for the above mentioned anthropometric characteristics was rejected, but it was confirmed for other characteristics ($P>0.05$). Flexibility depends on fat mass as well as muscles mass and Elastic. The higher the fat mass, particulary abdominal fat, the lower flexibility scores were. Consequently, the significant and negative correlations observed, seems to be acceptable. Previous studies have shown significant correlations between factors of physical fitness and variables of age, weight, and BMI [5-7,13]. In the present study, concerning the similarity of these factors, most of the comparisons had shown not-significance slight differences, which shows the direct effects of the above said factors. Also, it seemed that similar activities and the same amount of energy received and used had affected the results. Besides, the correlations indicated that high fat percentage had negative effects on cardio vascular endurance and flexibility, which requires more attention to nutritional and training by the policy maker. Designing precise schedule and proper nutritional program, the best outcome of physical fitness is achievable. We may say that one reason for estimating non-significant differences is the fact that physical exercises in the two groups was not as efficient as needed to create significant difference.

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