A STUDY OF THE SELECTED PHYSICAL FITNESS COMPONENTS OF TURKISH ELITE MALE LONG DISTANCE RUNNERS

By

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CHAPTER I

INTRODUCTION

The metabolic support and energy requirements of all-out performance in distance running events is a function of the length of the race and thereby the intensity at which the events is run. Long distance running e.g. 3000m, 5000m, and 10000m neccessitates a relatively greater amount of earobically derived energy whereas in middle distance running e.g. 800m, and 1500m anaerobically derived energy plays a more dominate role. It has been estimated that aerobic energy accounts for only 40 % or less for the total energy utilized in the 800m race (Joussellin, et.al, 1984). While on the other hand it may account for 80 % or more of the total energy in a 10000m race (Boileau, et. al,1984).

To perform competitively in national and international races, long distance runners must have a high maximal oxygen uptake and be able to sustain a high percentage of the maximal oxygen uptake (VO_2 max) for prolonged periods. The VO_2 max of the long distance runners was significantly higher than the value for the middle distance groups.Running economy has also been suggested

as an important factor influencing success in distance running. Other factor known to separate elite runners from less succesful ones is their muscle composition for long distance runners.

Training brings runners to a desired state of fitness and proficiency.

The term "Physical Fitness" is interpreted in many different ways. Three principal approaches to physical fitness are 1. Apprasial of physiques 2. Apprasial to physical fitness, 3. Apprasial of motor fitness.

If these three approaches are broken down into greater specifity, physical fitness is taken distinct characteristics of a healthy and good posture. Organic capacity takes on characteristics such as fit glands, digestive system, nervous system, cardiovascular and respiratory system. The motor fitness approach is characterized by capacity in a variety of motor abilities such as balance, power, aerobic capacity, strength and body composition.

Technical aspects, psychological aspects, physiological aspects, which include the all aspects of physical fitness may be altered to certain extent.

Also, physical fitness variables depend on cultural and environmental factors which influence the state of variables that are stated above.

In general, the most important characteristics to look

for in the long distance runners include, 1. The runners willingness to work load, 2. A positive and competitive attitude, 3. Belief in the coach, 4. Good leg speed, 5. Strong upper body should be able to clean and bench press one and one-half time of his body weight, 6. Controlled foot placement, 7. Smooth knee lift, 8. Arms that reach out rather than sway side-to-side, 9. Overall relaxed running style 10.Good flexibility (Gambertte, 1981).

If one or more physiological parameters can be shown to be related to success in long distance running, beginning runners might be able to direct their training efforts towards their weaknesses.It may also be possible, within limitations to predict an individual's present capacity and therefore, give him a realistic training program.

Statement of the Problem

This study investigated the body composition, aerobic capacity, anaerobic power, flexibility, vital capacity and systolic and diastolic blood pressures of Turkish elite long distance male runners.

Sub-problems of the Study

1. The results of Body Composition, Aerobic Capacity, Anaerobic Power , Flexibility, Vital Capacity and Blood Pressure of 3.000m, 5.000m, and 10.000m runners groups were compared.

2. Age, Weight, Height, Blood Pressure, Body Composition, Aerobic Capacity, Anaerobic Power, Flexibility,

Vital capacity and Running time variables were cheched to see the relationships of these variables within each group.

3. The results were compared with the norms of the other countries where data was available.

Limitations

The subjects were male long distance runners who had been at least once a member of the Turkish National Team during the years of 1985, 1986, 1987 and 1988.

Assumptions

1. It was assumed that the subjects understood the test instructions.

2. The subjects were at their best physical fitness level at the time of testing for this study.

3. It was assumed that the subjects gave their best effort during testing.

Null-Hypothesis

1. There were no significant difference between the means of the 3.000m, 5.000m, and 10.000m groups in the following variables:a)Age ,b) Weight,c) Height,d) Resting Heart Rate, e) Systolic Blood Pressure, f) Diastolic Blood Pressure,g) Flexibility,h) Body Fat,i) Vital Capacity j) Aerobic Capacity , k) Anaerobic Power.

2. There were no high correlation among the following variable of the 3.000m, group : Age, Weight, Height, Resting Heart Rate, Systolic Blood Pressure, Diastolic Blood Pressure, Flexibility ,Body Fat ,Aerobic Capacity Anaerobic Power,Running Time.

3. There were no high correlation among the following variables of the 5.000m runners group : Age, Weight, Height, Resting Heart Rate ,Systolic Blood Pressure ,Diastolic Blood Pressure, Flexibility, Body Fat ,Vital Capacity,Aerobic Capacity,Anaerobic Power,and Running Time.

4. There were no high correlation among the following variables of the 10.000 runners group : Age, Weight ,Height, Resting Heart Rate, Systolic Blood Pressure, Diastolic Blood Pressure, Flexibility, Body Fat, Vital Capacity, Aerobic Capacity ,Anaerobic Power,and Running Time.

Significance of the Study

Physical fitness plays important role on performance in all sports. But, among its components aerobic capacity, body composition, anaerobic power, flexibility, vital capacity, and blood pressure are especially important for performance in long distance running.

To train long distance runners and be succesful in international competititons, the level of the athletes in these components should be known in order to be able to train better and compare these athletes state with other countries.

This study was also significant because it was the first one done and will trigger a lot of critisism about the long distance runners and their training methods in Turkey starting the realization of the importance of this kind of studies. In return, a new impetus will be given to the scientific research.

Definition of Terms

Aerobic: The process of using energy in the presence of oxygen.

Anaerobic: The process of using energy in the absence of oxygen.

Blood Pressure: The driving force that moves blood through the circulatory system. Systolic pressure is obtained when blood injected into arteries, diostalic pressure is obtained when the blood returned from the arteries.

Cardiorespiratory Endurance: The ability of the lungs and heart to take in and transport adequate amounts of oxygen to the working muscles.

Energy: The capacity or ability to perform work.

Flexibility: The range of motion of a joint or series of joints.

Heart Beat: A pulsation or throb resulting from contraction of the heart or the passage of blood through a vessel.

Kilogram Meters (kgm): A unit of work.

Maximal Oxygen Consumption: The maximal rate at which oxygen can be consumed per minute.

Muscular Endurance: The ability of the muscle group to perform repeated contraction against a light load for an extended period of time.

Oxygen Cost: The amount of oxygen above resting values, required to perform a given amount of work.

Oxygen System: An aerobic system in which ATP is manufactured when food (principally sugar and fat) is broken down.

Power: Performance of work expressed per unit of time.

Work: Application of a force through a distance.

CHAPTER II

REVIEW OF RELATED LITERATURE

Age, Weight, and Height

Yamazaki and Juniehiro (1977) studied effect of anaerobic capacity and power on the performance of long distance runners. The subjects' mean height, weight and age were 172.3 cm, 59.5 kg and 21.0 yr. respectively.

Tanoka and Madsuure (1981) studied the correlation of maximal oxygen uptake and aneorobic threshold as compared with middle and long distance performances. The researchers founded mean values of Age, Weight, and Height as 20.7 yr, 64.0 kg, and 178.1 cm. respectively.

Powers and Dodd (1983) investigated ventilatory threshould, running economy, and distance running performance of trained athletes. Nine experienced male distance runners were used as subjects in this study. The subjects' height, weight, and age were 175.5 ± 2.2 cm, 66.4 ± 2.3 kg and 26.1 ± 2.3 yr. respectively.

Boileau and Meyhew (1984) studied physiological characteristics of elite middle and long distance runners. The subjects were 74 nationally recognized distance runners. The subjects' mean height, weight and age were 21.7 ± 2.8 yr., 68.7 ± 5.9 kg and 181.4 ± 5.3 cm. respectively.

Hirakoba and Katsumi(1983) investigated respiratory and

circulatory adjustment during prolonged exercise in endurance runners . In this study Age, Height, Weight were demonstrated as 20.6 ± 1.4 yr., 170.8 ± 3.2 and 60.0 ± 3.9 kg. respectively.

Svedenhag and Sjodin (1982) investigated physiological characteristics of elite male runners in and off-season. Five of the runners were long distance runners with mean age 23 yrs. weight 65.5 kg, and height 174.2 cm, all of whome were members of the Swedish National Track and Field Team.

Willams and Nute (1983) studied some physiological demands of a half-maraton race runners. Age, weight, and height of the runners, were 27.4 years, 62.3 kg and 173.2 cm respectively.

Joussellin and Barnaut (1984) investigated Maximal Aerobic Power of french top level competitors. Average values of height, weight, and age were 175.1 cm, 66.5 kg and 22.2 yr. respectively .

Tharp. et, al. (1986) studied cardiac dimensions in elite young track and field athletes. Study was to compare young sprint and distance runners for changes in their cardiac dimensions with increased age (12-18 years) or surface are (1-2 m^2) Subjects were 73 male athletes competing in the 1983 National Age Group Track and Field Association Championship. The mean weight was found as 46.6 ± 1.8 kg.

Kenney and Hodgson (1985) investigated variables predictive of performance in elite middle-distance runners.

The mean age and weight of the 5000 m runner subjects were 21.4 ± 1.0 years and 64.5 ± 2.4 kg. The ages and weights of 3.000m runners averaged to 22.0 ± 1.5 years and 71.9 ± kg.

Cisar. et, al. (1988) investigated the effect of endurance training on metabolic responses and the prediction of distance running performance. The mean age, weight, height of the subjects were 26.2 ± 5.8 yrs. 72.2 ± 2.1 kg. and 177.0 ± 5.3 cm. respectively.

Body Composition

Gambertte (1981) in his study founded average percent body fat values for track and field distance runners as 7 %, sprinters and jumpers as 8 % , and throvers as 15 % .

Tanoka and Madsuura (1981) investigated correlation of maximal oxygen uptake and anaerobic threshold by comparing middle and long distance performances. In this study average values of the fat % for the long distance runners was found as 8.5 %.

Boileou and Meyhew (1984) investigated physiological characteristics of elite middle and long distance runners. The subjects were 74 nationally recognized distance runners. In this study, the percentage of body fat was measured by using hydrostatic weighting test. The average percentage value of the body fat for long distance runners was found as 8.6 ± 3.1 % .

Fujimaki and Ogava (1983) investigated physiological characteristics of midlle-aged and old runners who competed in the international 10 km.run The average values of body fat was 6.1 ± 2.5 mm. and subscapular averaged to 11.8 ± 5.21 mm for the long distance runners.

Kenney and Hodgson, (1985) investigated variables predictive of performance in elite middle-distance runners. Average body fat of the subjects was found as 8.8 % .

Pate and Barnes (1985) done a study of physiological comparison of performance-matched female and male distance runners.Male subjects were eight adult distance runners. Body density of the subjects was assessed via hydrostatic weighting and was transformed to percentage of the body fat by using the equation of Siri. The percentage of the body fat was found as 9.9 % .

Cisar. et. al, (1988) in their investigation of the effect of endurance training on metabolic responses and the prediction of distance running performance found the body fat average values of the athletes as 8.3 ± 2.0 % .

Blood Pressure

Fujimaki and Ogava (1983) investigated physiological characteristics of middle-aged and old runners who competed in the international 10 km.race. Resting blood pressure of the runners averaged 120 ± 12.0 mmHg in systolic and 78 ± 10.0 mmHg in diostole.

Hartung and Spires (1982) investigated physiological measures and maraton running performance in young and middle-aged males. In this study, two groups of marathon runners voluntered as who were novice runners (age=23.9 years) and second group was made up of 46 experienced middle-aged runners (age=45.9 years). Systolic and diastolic blood pressure of the athletes were found as 114.4 mm Hg and 72.3 mm Hg in average respectively.

Adeniran , et . al, (1988) investigated effect of different running programmes on body fat and blood pressure in schoolboys aged 13-17 years. A total of 65 untrained male secondary school students voluntered to participate . Resting blood pressure was measured between 8.00 a.m. and 10.000 a.m. using accoson's stethoscope and mercurial manometer. The mean systolic and diastolic blood pressure of the athletes were found as 104.8 ± 12.9 mm Hg and 66.7 ± 10.3 mm Hg respectively.

Vital Capacity

Yamazaki and Juniehiro (1977) investigated effect of anaerobic capacity and power on the performance of long distance runners. In this study VE average was calculated during treadmill running which was found 167.1 ± 7.3 l/min. O_2 pulse of the athletes averaged to 22.8 ± 2.7 ml and O_2 removel of the athletes averaged to 42.8 ± 2.9 ml/L.

Boileau and Meyhew (1984) investigated physiological

characteristics of elite middle and long distance runners. In this study, the subjects were 74 nationally recognized distance runners. The VE average result of the long distance runners was 4.9 ± 0.4 L/min.

Ready, (1982) investigated physiological characteristics of male and female distance runners. This investigation was to obtain physiological profiles of highly ranked distance runners in the province. Seven male athletes were evaluated on selected measure related to performance. Their vital capacity was measured with a spirometer. It was found as 4.9 L/min.

Svedenhag and Sjodin (1982) studied physiological characteristics of elite male runners, in and off-season. Five long distance runners were member of the Swedish national track and field team. He found the average value of VE as 177 ± 6 (L/min. BTPS).

Hirakoba and Katsumi(1983) studied the difference between endurance runners and normal men in respiratory function during prolonged exercise. According to researchers, the endurance training may improve the magnitude of the respiratory and circulatory "drift" which appears to become a limiting factor to endurance performance.

Aerobic Capacity

Yamazaki and Juniehiro (1977) investigated effect of anaerobic capacity and power on the performance of long

distance runners. Twelve runners were subjected to 3 experimental series of treadmill running. Running at the intensity corresponding to 90 % of maximal oxygen uptake for 14 min, VO_2 max average was found as 71.1 ± 1.2 ml/kg .min.

Tanoka and Madsuura (1981) investigated a correlational analysis of maximal oxygen uptake and anaerobic threshold as compared with middle and long distance performances. Twenty-seven distance runners, 16-26 years of age including an olympic runner, underwent a multistage- incremental treadmill test for the assessment of submaximal and max. work capacity. Average value of the max. O_2 uptake of distance runners was found as 70.1 ± 6.6 ml/kg.min.

Wright et. al, (1982) investigated cardiac output in middle aged runners. The VO_2 was measured by PWC 170 method. Average value of the VO_2 was found as 68.2 ml/kg.min.

Gambertte. (1981) demonstrated average value of the oxygen uptake of the 20 yr. Athletes as 45 ml/ kg. min,for the distance runners as 60 ml/kg.min, for the college dist. runners as 70 ml/kg.min, and for the world class athelets as 75 ml/kg.min.

Boileau and Meyhew (1984) investigated physiological charactesitics of elite middle and long distance runners. In this study the subjects were 74 nationally recognized distance runners. Maximal oxygen uptake was measured by treadmill test. The VO_2 average value of long distance

runners was found as 76.9 ± 5.0 ml/kg.min.

Hartung and Spires (1982) investigated the relationship of physiological measures and maraton running performance in young and middle-aged males. In this study two groups of marathon runners volunteered as subjecsts. First group was composed of 25 mostly young, university students who were novice runners (age=23.9 years) and second group was made up of 46 experienced middle-aged runners (age = 45.9 years). Maximal oxygen uptake was measured by open circuit analysis of expired air during treadmill running for novice runners. Mean oxygen uptake was found as 68.7 ml/kg.min.

Powers and Dodd (1983) investigated ventilatory threshold, running economy and distance running performance of nine experienced male distance runners. The runners were selected on the basis of competitive running experience. The subjects averaged VO2 was found as 68.6 ml./kg. min on running treadmill test.

Ready . (1982) investigated physiological characteristics of male and female distance runners.There were seven male (age=23.4 yr) athletes among the subjects.In this study oxygen uptake was determined from a continous graded treadmill test. The average oxygen uptake values was found as 5.09 l.min or 76.0 ml/kg.min.

Hirakoba and Katsumi (1983) studied respiratory and circulatory adjustments during prolonged exercise of endurance runners. Maximal oxygen uptake value of the athletes was averaged to 66.4 ml/kg. min.

Svedenhag and Sjodin (1982) investigatied physiological characteristics of elite male runners in and off-season. Five long distance runners were member of the swedish national track and field team and participated in treadmill tests.Average VO_2 max. was found as 64.8 ± 0.1 ml/kg.min.

Willams and Nute (1983) studied some physiological demands of a half-marathon race runners.Average Max. VO_2 for the runners was found as 74.2 ml/kg.min.

Jousselin. et. al, (1984) investigatied maximal aerobic power of French top level competitors. The averaged aerobic capacity of the long distance runners was found as 75.9 ± 4.6 ml./kg.min.

Kenney and Hodgson (1985) investigated variable predictive of performance in elite middle-distance runners. The aerobic capacity results of the 3.000m,and 5.000m runners were averaged to 74.4 ± 1.3 ml/kg.min and 72 ± 1.3 ml/kg.min. respectively.

Pate and Barnes (1985) studied physiological comparison of performance-matched female and male distance runners. Subjects were eight male adult distance runners. Oxygen uptake max. was estimated by running on treadmill test.Mean VO_2 was found as 55.8 ± 4.7 ml/kg.min.

Ramsbottom. et. al, (1987) investigated determinants of five kilometer running performance in active man and women. Maximal oxygen uptake was determined by direct method on treadmill for the men. It was found as 57.6 ± 4.2 ml/kg.min.

Anaerobic Power

Yamazaki and Juniehiro (1977) investigated effects of anaerobic capacity and power on the performance of long distance runners. Subjects were twelve long distance runners. Anaerobic power was measured by the running treadmill test. Anaerobic power average value of athletes was found as 69.2 ± 3.6 Kcal/kg.hr.

Tanoka and Madsuure (1981) investigated the correlation of maximal oxygen uptake and anaerobic threshold as compared with middle and long distance performances. In this study, twenty-seven distance runners, 16-26 years of age including an olympic runner, underwent a multistage-incremental treadmill test for the assessment of maximal work capacity. The average value of the anaerobic threshhold was found as 52.8 ml/kg.min.

Kenney and Hodgson (1985) investigated variables predictive of performance in elite distance runners. In this study, a total of 13 athletes were tested, (eight 5.000m runners and five 3.000 m runners). At the time of testing, all 13 were actively in training for their respective events for the 1984 Olympic Games, as part of the USOC olympic development programme . Anaerobic threshold values of the athletes were measured by running treadmill test. The anaerobic threshold average values of 3.000 m and 5.000m runners were found as 58.0 ± 2.1 ml/kg.min and 62.2 ± 2.1

ml/kg.min. respectivly.

Cisar, et. al, (1986) investigated the effect of endurance training on metabolic responses and the prediction of distance running performance. Thirty-two young adult (age=26.3 ± 5.9 yr) male volunteers served as subjects for the 14 week endurance training study before they were accepted into the study. Anaerobic treshhold was calculated by running treadmill test. The average value of anaerobic treshhold of athletes was found as 43.6 ± 0.81 ml/kg.min.

CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to measure the body composition, aerobic capacity, anaerobic power, flexibility, vital capacity , and systolic and diastolic blood presures of male turkish national track and field team's of 3.000m, 5.000m, and 10.000m runners and make comparative analysis among these groups.

Selection of Subjets

The subjects of this study were twenty nine 19-32 years old turkish male long distance runners who represented Turkey at least once in international platform during the years of 1985-1988 in 3.000m, 5.000m, and 10.000m track and field events. Out of the 29 subjects 9 were 3000m runners, 10 were 5000m runners, and 10 were 10000 m. runners .Volunteer elite long distance runners of Izmir and Ankara regions participated for this study.

General Test Procedures

Tests for this study were performed in Ankara and

Izmir. Testing took place at Middle East Technical University and Ege University physiology laboratories respectively. The subjects were tested during the middle of competition season when their performances were supposed to be at maximum level.

Measurement of Aerobic Capacity

Equipment:

Bicycle Ergometer, Stethoscope, Stopwatch or clock.

Testing Procedure:

1. The bicycle ergometer was ridden for 5 minutes or until subjects heart rate stabilized for two consecutive minutes.

a. Pedaled at rate of 20 kph on the speedometer or 50 pedal rpm by metronome.

b. Subject started pedalling at a resistance of 3(900 kpm).

2. Subjects heart rate were checked during the last 15 sec. of each minute of the ride. This 15 sec. reading was multipled by 4 to get a per minute reading and recorded.

3. Heart rate stabilized at a level between 120 and170 beats per minute. If it did not get up to 120 in 2 minutes the resistance was increased by 1/2.If it went up over170 in 3 minute or less the resistance was decreased by 1/2. The ride was continued until 2 consecutive similar heart rates were recorded.

4. Predicted oxygen intake levels and fitness classification wer obtained from Astrand tables.

Measurement of Body Composition

Equipment:

Harpenden Skinfold Caliper

Testing Procedure:

1. The thumb and forefinger of the left hand were placed far enough apart so that a full fold could be pinched up firmly and clearly from the underlying tissue.

2. The fold was then held firmly between the fingers while the measurement was being made.

3. The calipers were applied to the fold below the fingers so that the pressure at the point measured was exerted by the caliper faces, not by the fingers. Readings to the nearest 1/2 mm were adequate.

4. Skinfolds were measured on the male at the midpoint of the thigh on the front of the leg, and at the lower tip of the scapula on the back. The skinfold measurements were used in the following formula to calculate the percent body fat values (Gambertte, 1981).

Body Density :1.1043-(0.001327 x thigh)

-(0.00131 x scapula)

Calculation of Body fat Percentage:

$$\% \text{ Fat}: \frac{4.570}{\text{Body D.}} - 4.142 \times 100$$

Total Body Fat: % Fat x Body Weight

Lean Body Weight: Body Weight - Total Body Fat

Measurement of Anaerobic Power

Equipment:

Margaria-Kalamen Staircase, clock.

Testing Procedure:

The subject standed 6 meters in front of a staircase. When was ready, he ran up the stairs as rapidly as possible, taking three stairs each step. Switchmats were placed on the third and ninth stairs. (An average stair was about 174 mm high). A clock started as the person steped on the first switchmat (on the third step) and stoped as he steped on the second switchmat (ninth step). Time was recorded to hundredth of a second. The test was administered ten times and the best score was recorded. Power output was computed in the following manner:

$$P = \frac{W \times D}{T}$$

in which

P - Power

W - Weight of person

D - Vertical height between first and last test stairs

T - Time for first to last test stairs

Measurement of Flexibility

Equipment:

Sit and Reach Bench

Testing Procedure:

After a short warming period, the subject sat on the floor with the legs straight, and feet about shoulder width apart, and the feet against the box. The subject bend the trunk forward and downward and moved the hands, palms down, as far forward as possible. The subject reached with both hands and held this position.The score was recorded in centimeters.

Measurement of Vital Capacity

Equipment:

Spirometer

Testing Procedure:

The subject was told to stand in front of the instrument and to take the breathing tube in one hand.After placing a nose clip on the subject's nose, he was asked to take a maximal inhalation while being continually exhorted,

persisting almost until he felt he could burst. He was then told to close his lips around the mouthpiece ensuring that no leak of air occurred, and to exhale into the machine. When a static vital capacity was being measured, time was of no importance, and the subject was urged to breathe out and out and out, until he could no longer go on. When a forced vital capacity or forced expiratory volume measurement was being made, the record/return buton on the machine was depressed before the start of the expiration.

Measurement of Blood Pressure

Equipment:

Sphygmomanometer, Stethoscope.

Testing Procedure:

1. The sphygmanometer cuff was placed around the left upper arm just above the elbow.

2.While the blood pressure was being measured the stethoscope was placed over the branchial artery that passes over the elbow.

3.The pressure cuff was inflated up to 180 mmHg during rest and up to 200 mmHg during exercise.

4.The pressure was released slightly at a rate of approximately 2to 3 mmHg per. second.

5.When the first sound was heard, systolic blood

pressure was recorded as mmHg.

6.When the gradual ndecrease in sound was sharpened then diastolic blood pressure was recorded as mmHg.

7.The researcher took two measurment and average of the measurment were the score.

Statistical Analysis of The Data

In this study, the results of body composition, aerobic capacity, anaerobic power, flexibility, vital capacity, and blood pressure of 3.000m, 5.000m, and 10.000m groups were compared among each other by using ANOVA. In this comparison the 0.05 degree of freedom were taken for the significance in differences. An eye-ball comparison was done between the results of the subjects of this study and their counterparts from other countries. Also MANOVA technique was used to see the correlations among the variables with-in each group of subjects.

CHAPTER IV

RESULTS AND DISCUSSION

The subjects were male Long distance runners who had been at least once a member of the Turkish national team during years of 1985, 1986, 1987 and 1988.

A total of 29 experienced male long distance runners voluntarily participated in the study. The subjects were grouped as follows.

(1) Nine 3.000 m runners

(2) Ten 5.000 m runners

(3) Ten 10.000 m runners

The following physiological characteristics measurements were taken; Age, Weight, Heights, Blood Presure, Flexibility, Body Fat, Vital Capacity, Aerobic Capacity and Anaerobic Power.

Blood pressure was calculated in terms of millimeters of mercury (mm.Hg) by using Sphygmanometer. Flexibilty was measured by the sit and reach test. Body fat was determined by using the Skinfold Calipper. Vital Capacity measured by using Spirometer. Aerobic capacity was calculated by using bicycle ergometer test. Anaerobic power was measured by Margaria, Koleman test.

The means, standard deviations and standard error of the variables were calculated. Analysis of variance was

TABLE I

THE MEAN, STANDARD DEVIATION AND STANDARD ERROR OF PHYSIOLOGICAL CHARACTERISTICS OF TURKISH ELITE MALE LONG DISTANCE RUNNERS

	(3.000M RUNNERS)		(5.000M RUNNERS)		(10.000M RUNNERS)		TOTAL	
	X	SD ± SE	X	SD ± SE	X	SD ± SE	X	SD ± SE
A(yr)	22.6	3.6±1.1	21.8	2.5±0.8	25.8	3.4±3.4	23.4	3.0±1.5
W(kg)	61.2	3.7±1.2	61.2	5.9±1.8	59.0	7.1±2.3	60.4	5.5±1.7
H(cm)	174.3	4.1±1.4	172.8	6.1±2.0	170.1	8.5±2.8	172.4	6.2±2.0
R.H.R (b.min)	49.6	4.1±1.3	49.5	3.7±1.1	42.3	3.9±1.3	47.1	3.9±1.2
S.B.P. (mmHg)	112.1	6.4±2.0	109.0	4.4±1.6	105.1	4.8±1.6	108.7	5.2±1.7
D.B.P. (mmHg)	70.4	4.2±1.3	68.5	4.3±0.3	68.5	2.4±0.8	69.1	3.6±0.8
F(cm)	22.4	5.6±1.8	23.5	3.7±1.1	23.3	5.4±1.8	23.0	4.6±1.5
B.F %	6.1	0.8±0.2	5.6	1.0±0.3	5.6	0.8±0.2	5.7	0.9±0.2
V.C.(ml /kg.min)	5320	369.0±124.5	5321	394.0±124.5	5823.3	425.1±141	5488	396±130.2
A.C.(ml /kg.min)	58.9	5.4±1.7	57.5	7.5±2.3	62.5	5.4±1.8	59.6	4.3±1.9
A.P. Kg/m.sec	153.2	10.7±3.3	135.7	18.0±5.7	134.8	18.7±6.3	141.2	15.3±5.1
D.Time	8.33	1.3±0.2	14.56	3.4±1.7	29.53	5.6±1.9		

X =Mean
SD=Standard deviation
SE=Standard error

TABLE II

BODY SIZE, BODY COMPOSITION AND MAXIMAL OXTGEN INTAKE MEAN VALUES OF PREVIOUSLY REPORTED SAMPLE OF DISTANCE RUNNERS

Source	type of runner	N	Natio.	Ht (cm)	Wt (kg)	F%	VO2 (ml/kg.min)
Sattin and Astrand (1967)	MD.LD	8	Mix	180.8	65.1	--	77.5
Dansels and Oldridge (1970)	MD.LD	6	A	182.7	68.5	--	74.4
Costil. et.al. (1973)	LD	4	E	171.8	58.3	5.7	78.6
Koeslog and Jloan (1976)	LD	11	SA	180.2	75.3	--	67.8
Pollock (1977)	MD.LD	11	A	175.9	63.1	5.0	78.8
Rusko. et.al. (1978)	LD	8	F	177.0	66.2	8.4	78.1
Conley .et.al.	LD	24	A	178.9	64.6	9.9	76.9
Costill and Fox (1969)	MAR	6	A	175.6	63.7	4.0	71.4
Pollock (1978)	MD.LD	8	A	176.8	62.7	4.3	74.1
Boileau.et.al. (1983)	LD	32	A	177.0	63.4	5.6	76.9
Present Study	LD	29	T	172.4	60.4	5.7	59.6

Nationality of runners with= A= American, E= English, F= Finish, Mix= Sample of several nationalities,SA= South Africa.

used to determine the significance of differences among the groups for each of the variables. Prior to the analysis a 0.05 level of significance was established. Also MANOVA technique was used to see the relationship among the variables within each group.

The mean values of the physiological characteristics of the turkish national male long distance runners and various countries male long distance runners are presented in the Table I an II.

The turkish elite male long distance runners mean age was found as 23.4 yr.It was nearly same to the other countries long distance runners.

The mean values of the weight and height of the turkish elite male long distance runners were (60.4 kg and 172.4 cm) lower than the other countries male long distance runners.

The mean value of the resting heart rate of the turkish elite male long distance runners was found as 47.1 b/min . However, the mean value of world class runners was nearly 38.0 b/min. (Hirakoba and Katsumi 1983).

The mean values of systolic blood pressure and diastolic blood pressure of the turkish long distance runners were 108.7 mmHg and 69.1 mmHg. But mean blood pressure of the japaneese runners were 144.3 mmHg in systolic and 86.2 mmHg in diastolic (Fujimaki, 1983). It indicated that the systolic blood pressure and diastolic blood pressure of the

turkish elite long distance runners were lower than the japaneese runners.

The mean value of the flexibility of turkish elite male long distance runners was found as 23.0 cm.

The mean value of the body fat of turkish elite male long distance runners was found as 5.7 % which was higher than the finish male long distance runners (8.4 %) and the japaneese long distance runners (61 %).Turkish and british long distance runners had same body fat % average. But, it was lower than the american male long distance runners value (5.0 %) .

The mean value of vital capacity of the turkish elite male long distance runners was found 5488 ml/kg.min which was lower than the other countries runners (158.5 lt/min).

The mean value of aerobic capacity of turkish elite male long distance runners was found as 59.6 ml/kg.min which was lower than the value of japoneese (71.3 ml/kg.min), americans (74.5 ml/kg.min) and brittish (78.6 ml/kg.min).

The F ratio's and groups that are significantly different for each physiological characteristics are shown in Table III. Table IV. Table V. Table VI. Table VII. Table VIII. Table IX. Table X. Table XI.

TABLE-III

RESULTS OF AGE

	D.F	Sum of Squares	Mean Squares	F. Ratio
Between Groups	2	86.6	43.8	4.2
Within Groups	26	278.8	10.7	
Total	28	366.5		

		Groups		
Groups	Mean(yr)	1	2	3
1. 3.000m	22.6			
2. 5.000m	21.8			*
3. 10.000m	25.8			

* Denotes of groups significantly different at the .05 level.

TABLE-IV

RESULTS OF WEIGHT

	D.F	Sum of Squares	Mean Squares	F. Ratio
Between Groups	2	30.0	15.0	0.4
Within Groups	26	857.2	32.9	
Total	28	887.2		

No two groups are significantly different at the 0.05 level

TABLE- V

RESULTS OF HEIGHT

	D.F	Sum of Squares	Mean Squares	F. Ratio
Between Groups	2	84.6	42.3	0.9
Within Groups	26	1158.5	44.5	
Total	28	1243.2		

No two groups are significantly different at the 0.05 level.

The mean, standard deviation and standar error values of age, weight and height variables for the 3.000m runners were X=22.6 yr, SD=3.6, SE±1.1; X=61.2 kg, SD=3.7, SE±1.2; X=174.3cm, SD=4.5, SE±1.1 respectively.

The mean, standard deviation, and standard error values of Age, weight, and height variables for the 5.000m runners were X=21.8yr, SD=2.5, SE±0.8; X=61.2kg SD=5.9, SE±1.8; X=172.8cm, SD=6.5, SE±2.0 respectively.

The mean, standard deviation, and standard error values of Age, weight, and height variables for the 10.000m runners were X=25.8yr, SD=3.4, SE±3.4; X=59kg, SD=7.1, SE±2.3; X=170.1cm, SD=8.5, SE±2.8 respectively.

There were no significant differences in the weight and height variables amoung the three groups of runners at 0.05 the confidence level

There was no significant difference in the

age variable between the 3.000m and 10.000m groups at 0.05 the confidence level.

There was a significant difference in the age, variable between the 5.000m and 10.000m groups at 0.05 confidence level. The mean age value of 5.000m runners was lower than 10.000m runners.

There was no significant difference in the age variable between the 3.000m and 5.000m groups at 0.05.the confidence level.

TABLE-VI

RESULTS OF RESTING HEART RATE

	D.F	Sum of Squares	Mean Squares	F. Ratio
Between Groups	2	323.3	16.4	10.2
Within Groups	26	408.9	15.7	
Total	28	732.2		

		Groups		
Groups	Mean(b/min)	1	2	3
1. 3.000m	49.6			*
2. 5.000m	49.5			*
3. 10.000m	42.3			

* Denotes of groups significantly different at the .05 level.

The mean, standard deviation and standard error values of resting heart rate variable for the 3.000m runners were

X=49.6 b.min, SD=4.1, SE±1.9.

The mean standard deviation and standard error values of resting heart rate variable for the 5.000m runners were X=49.5 b.min, SD=3.7, SE±1.1.

The mean, standard deviation and standard error values of resting heart rate valiable for the 10.000m runners were X=42.3, b.min, SD=3.9, SE=±0.3.

There was no significant difference in the resting heart rate variable between the groups of runners of 3.000m and 5.000m at 0.05. the confidence level.

There was a significant difference in the resting heart rate variable between the groups of runners of 3.000m, and 10.000m at 0.05 the confidence level.

There was a significant difference in resting heart rate variable among the groups of runners of 5.000m and 10.000m at 0.05 confidence level . The mean values of Resting heart rate value of both 3.000m and 5.000m runners were higher than 10.000m runners.

TABLE-VII

RESULTS OF SISTOLIC BLOOD PRESSURE

	D.F	Sum of Squares	Mean Squares	F. Ratio
Between Groups	2	391.5	195.7	6.9
Within Groups	26	731.7	28.1	
Total	28	1123.3		

Groups	Mean (mmHg)	Groups 1	2	3
1. 3.000m	112.1			*
2. 5.000m	109.0			
3. 10.000m	105.1			

* Denotes of groups significantly different at the .05 level.

The mean, standard deviation, standard error values of sistolic blood pressure variable for the 3.000m runners were X=112.1 mmHg, SD=6.4, SE±2.0 respectively. The mean, standard deviation, standard error values of sistolic blood pressure variable for the 5.000m runners were X=109.0 mmHg, SD=4.4, SE±1.6 respectively.

The mean, standard deviation, standard error values of sistolic blood pressure variable of the 10.000m runners were X=105.1mmHg, SD= 4.8, SE±1.6 respectively.

There was no significant differences between the mean the sistolic blood pressure values of 3.000m 5.000 m. groups of runners at 0.05 confidence level.

There was no significant difference in the mean values of the sistolic blood pressure between the groups of runners of 5.000m and 10.000m at 0.05 confidence level.

There was a significant difference in the mean values of the sistolic blood pressure variable between the groups of runners of 3.000m and 10.000m at 0.05 confidence level

The mean value of sistolic blood pressure of 3.000m runners was higher than 10.000m runners.

TABLE-VIII

RESULTS OF DIASTOLIC BLOOD PRESSURE

	D.F	Sum of Squares	Mean Squares	F. Ratio
Between Groups	2	91.9	45.9	3.1
Within Groups	26	380.9	14.6	
Total	28	472.8		

		Groups		
Groups	Mean(mmHg)	1	2	3
1. 3.000m	70.4			*
2. 5.000m	68.5			
3. 10.000m	68.0			

* Denotes of groups significantly different at the .05 level

The mean, standard deviation and standard error values of diastolic blood pressure variable for the 3.000m runners, 5.000m runners and 10.000m runners were X=70.4 mmHg, SD=4.2, SE±413; X=68.5 mmHg, SD=4.3, SE±0.3; X=68.0mmHg, SD=2.4, SE±0.8 respectively.

There was no significant difference in the mean values of diastolic blood pressure variable between the groups of runners of 3.000m and 5.000m at 0.05 confidence level.

There was no significant difference in the mean values of diastolic blood pressure variable between the groups of runners of 5.000m and 10.000m at 0.05 confidence level.

There was a significant difference in the mean values of diastolic blood pressure variable between the groups of runners of 3000m and 10000m at 0.05 confidence level. The mean value of diastolic blood pressure of 3000m runner was higher than 10000m runners.

TABLE- IX

RESULTS OF FLEXIBILITY

	D.F	Sum of Squares	Mean Squares	F. Ratio
Between Groups	2	6.9	3.4	0.1
Within Groups	26	658.9	25.3	
Total	28	665.8		

No two groups are significantly different at the 0.05 level.

The mean standard deviation, standard error values of flexibility variable for the 3.000m, 5.000m and 10.000m group runners were X=6.1cm, SD=0.8, SE±0.2; X=5.6cm, SD=1.0, SE±0.3 and X=5.6cm, SD=0.8, SE±1.8 respectively.

There were no significant differences in the mean values of flexibility among all 3 groups at 0.05 confidence level.

TABLE- X
RESULTS OF BODY FAT

	D.F	Sum of Squares	Mean Squares	F. Ratio
Between Groups	2	1.7	0.8	1.0
Within Groups	26	21.4	0.8	
Total	28	23.2		

No two groups are significantly different at the 0.05 level.

The mean, standard deviation, standard error values of body fat variable for the 3.000m, 5.000m and 10.000m runners were X=6.1 %, SD=0.8, SE±0.8; X=5.6 %, SD=1.0 SE±0.3 and X=5.6 %, SD=0.8, SE±0.2 respectively.

There were no significant differences in the mean values of body fat of the athletes amouhg all among three groups of runners at 0.05 confidence level.

TABLE- XI

RESULTS OF VITAL CAPACITY

	D.F	Sum of Squares	Mean Squares	F. Ratio
Between Groups	2	1567811.2	783905.6	5.006
Within Groups	26	4071802.5	156607.7	
Total	28	5639613.7		

		Groups		
Groups	Mean(ml/kg.min	1	2	3
1. 3.000m	5320			*
2. 5.000m	5321			*
3. 10.000m	5823			

* Denotes of groups significantly different at the .05 level.

The mean, standard deviation, standard error values of respiratory function variable for the 3.000m 5.000m, 10.000m runners were X=5320 ml/kg/min. SD=369.0, SE±116.8; X=5321, ml/kg/min, SD=394.0, SE±124.5 and X=5823.3 ml/kg/min, SD=425.1, SE±14.7 respectively.

There was no significant difference in the mean values of vital capacity variable between the groups of runners of 3.000m and 5.000m at 0.05 confidence level.

There was a significant difference in the mean values of vital capacity of athlets between the groups of runners of 3.000m, 10.000m at 0.05 confidence level. The mean value of vital capacity of 3.000m runners was higher than 10.000m runners.

There was a significant difference in the mean values of vital capacity variable between the groups of runners 5.000m and 10.000m at 0.05 confidence level.

The mean values of vital capacity of 5.000m runners was lower than 10.000m runners.

TABLE-XII

RESULTS OF AEROBIC CAPACITY

	D.F	Sum of Squares	Mean Squares	F. Ratio
Between Groups	2	110.2	55.1	1.4
Within Groups	26	1010.1	38.8	
Total	28	1121.6		

No two groups are significantly different at the 0.05 level.

The mean, standard deviation and standard error values of the aerobic capacity variable for the 3.000m, 5.000m and 10.000m runners were X=58.9 ml/kg.min, SD=5.4, SE±1.7; X=57.5 ml/kg.min, SD=7.5, SE±2.3 and X=62.2 ml/kg.mgn, SD=5.4, SE±1.8 respectively.

There was no significant difference in the mean values of aerobic capacity of the athletes among three groups of runners 3.000m, 5.000m and 10.000m at 0.05 confidence level.

TABLE-XIII

RESULTS OF ANAEROBIC POWER

	D.F	Sum of Squares	Mean Squares	F. Ratio
Between Groups	2	2111.7	1055.8	4.0
Within Groups	26	6784.1	260.9	
Total	28	8895.8		

		Groups		
Groups	Mean(kgm/sec)	1	2	3
1. 3.000m	153.2			*
2. 5.000m	137.7			
3. 10.000m	134.8			

* Denotes of groups significantly different at the .05 level.

The mean, standard deviation and standard error values of the anaerobic power variable for the 3.000m, 5.000m and 10.000m runners were X=153.2 kg.m/sec, SD=10.7, SE±3.3; X=137.7 kg.m/sec, SD=18.0, SE±5.7 and X=134.8 kg.m/sec, SD=18.7, SE±6.2 respectively.

There was no significant difference in the mean values of anaerobic power variable of the athletes between the

groups of runners of 3.000m, 5.000m at 0.05 confidence level.

There was no significant difference in the mean values of anaerobic power of the athletes between the groups of runners of 5.000m, 10.000m of at ·0.05 confidence level.

There was a significant difference in the mean values of anaerobic power of the athletes between the groups of runners of 3.000m and 10.000m at 0.05 confidence level. The mean values of anaerobic power of 3.000m runners was higher than 10.000m runners.

The Correlation of Physiological Characteristics Variables Within each one of the 3.000m, 5.000m and 10.000m groups are shown in Table XIV,XV and XV. respectively.

Intercorrelations among the predictor variables and the running time for the 3000m runner gruop are presented in Tab le XIV. There were many significant correlations.Height had highest correlation with weight (r=0.842).Resting heart rate was found to be correlated positively with S.B.P=(r=0.592), D.B.P.(r=0.509) and negatively vital capacity (r=-0.580).Aerobic capacity was found to be correlated negatively with S.B.P (r=-0.591)and D.B.P(r=-0.538) and positively with vital capacity (r=0.516).

The intercorrelations among the predictor variables and running time for the 5000m.runner gruop are presented in Table XV There were many significant correlations .A

negative correlation was found between height and body fat (r=-0.549).Weight was found to be correlated with height (r=0.762) pp and body fat (r=0.505). A positive correlation was found between D.B.P. and resting heart rate (r=0.704). Vital capacity was found to be negatively correlated with D.B.P (r=-.0.542). Also anaerobic power had a high correlation with aerobic capacity (r=0.543).

The Intercorrelations among the predictor variables and running time for the 10.000m runner gruop are presented in Table XIV. There were many significant correlations. Age was found to be negatively correlated with resting heart rate (r=-0.756), S.B.P (r=-0.699) and flexibilty (r=-0.542). A positive relationship was found between aerobic capacity and age (r=0.731). Weight was found to be correlated with height (r=0.945) and vital capacity.Also resting heart rate was hihgly correlation negatively with vital capacity (r=-0.726) and aerobic capacity (r=-0.746) Aerobic capacity was found to be negatively correlated with S.B.P (r=-0.618). Vital capacity was found to be correlated with D.B.P (r=-0.585) and percent body fat (r=-0.561)negatively and with aerobic capacity positively (r=0.707).

TABLE XIV

INTERCORRELATIONS AMONG SELECTED PHYSIOLOGICAL CHARACTERISTICS AND RUNNING TIME FOR THE 3000 M. RUNNERS GROUP

Variable	Ag	Wt	Ht	RHR	SBP	DBP	Flex.	%BF	VC	AC	AP	T
Ag (yr)	1.000											
Wt (kg)	-0.131	1.000										
Ht (cm)	-0.268	0.842*	1.000									
RHR(Min)	-0.420	0.235	0.146	1.000								
SBP(mmHg)	-0.269	-0.094	-0.094	0.592*	1.000							
DBP(mmHg)	-0.181	-0.178	-0.073	0.509*	0.569*	1.000						
FLEX.(CM)	-0.191	0.094	0.114	-0.026	0.147	-0.083	1.000					
%BF	0.188	0.267	-0.011	0.226	0.082	0.069	0.002	1.000				
VC(ml/kg.min)	0.132	0.165	0.159	-0.580*	-0.407	-0.429	0.154	0.054	1.000			
AC(ml/kg.min)	0.280	0.293	0.125	-0.301	-0.591*	-.538*	-0.103	0.157	0.516*	1.000		
AP(kg/m .sec)	-0.160	0.292	0.329	0.192	0.303	0.150	0.231	-0.013	-0.112	0.161	1.000	
Time(min)	0.454	-0.052	-0.135	-0.486	0.398	0.248	0.197	0.030	0.186	0.227	-0.474	1.

* denotes the pair of groups highly correlated (r>0.5) with each other.

TABLE XV

INTERCORRELATIONS AMONG SELECTED PHYSIOLOGICAL CHARACTERISTICS AND RUNNING TIME OF THE 5.000 M. RUNNERS GROUP

Variable	Ag	Wt	Ht	RHR	SBP	DBP	Flex.	BF	VC	AC	AP	T
Ag (yr)	1.000											
Wt (kg)	0.134	1.000										
Ht (cm)	-0.108	0.762*	1.000									
RHR(Min)	-0.136	0.481	0.253	1.000								
SBP(mmHg)	-0.030	0.101	-0.176	0.204	1.000							
DBP(mmHg)	-0.203	0.322	0.105	0.724*	0.268	1.000						
FLEX.(cn)	-0.390	0.505*	0.465	0.464	0.269	0.106	1.000					
%BF	0.500	-0.067	-0.549*	0.121	-0.066	-0.015	-0.225	1.000				
VC(ml/kg.min)	0.469	0.110	-0.079	-0.235	0.082	-0.542*	0.141	0.482	1.000			
AC(ml/kg.min)	0.182	0.411	0.244	-0.043	-0.278	-0.396	0.423	0.347	0.415	1.000		
AP(kg/m .sec)	-0.171	0.409	0.309	-0.154	0.270	-0.166	0.498	-0.317	-0.091	0.543*	1.000	
Time(min)	0.253	0.262	0.345	0.012	0.169	0.172	0.361	-0.177	-0.248	0.232	0.406	1.0

* denotes the pair of groups highly correlated (r>0.5) with each other.

TABLE XVI

INTERCORRELATIONS AMONG SELECTED PHYSIOLOGICAL CHARACTERISTICS AND RUNNING TIME OF THE 10.000 M. RUNNERS GROUP

Variable	Ag	Wt	Ht	RHR	SBP	DBP	FLEX.	%BF	VC	AC	AP	T
Ag (yr)	1.000											
Wt (kg)	0.061	1.000										
Ht (cm)	0.277	0.945*	1.000									
RHR(Min)	-0.756*	0.053	-0.049	1.000								
SBP(mmHg)	-0.699*	-0.166	-0.208	0.495	1.000							
DBP(mmHg)	0.000	-0.307	-0.197	0.025	0.093	1.000						
Flex.(cm)	-0.542*	-0.223	-0.438	0.496	0.446	-0.191	1.000					
%BF	-0.369	0.497	-0.503	0.382	0.092	0.265	-0.019	1.000				
VC(ml/kg.min)	0.499	-0.073	-0.091	-0.726*	-0.410	-0.585*	-0.093	-0.561*	1.000			
AC(ml/kg.min)	0.731*	0.163	0.238	-0.746*	-0.618*	-0.207	-0.354	-0.183	0.707*	1.000		
AP(kg/m .sec)	0.062	0.226	0.152	0.123	-0.012	0.111	0.377	0.273	-0.006	0.421	1.000	
Time(min)	-0.034	0.043	0.043	-0.346	-0.098	0.471	-0.142	0.280	-0.158	0.006	0.097	1.0

* denotes the pair of groups highly correlated (r>0.5) with each other.

CHAPTER V

CONCLUSIONS AND RECOMMENDATION

Through the years, certain physiological characteristics have been recognized to be of importance for high performance in long distance running events. Therefore, track and field coaches and researchers aim at developing the highest level of physiological, fittness in his or her athletes, in order to achive a trained state.

I hope that this study proves to be a valuable tool in our nation's developmental effort in the great sport of track and field.

The mean values of the 3000m runners group of the age, weight, height,resting heart rate, systolic blood pressure,diastolic blood pressure,flexibility, body fat, vital capacity,aerobic capacity and anaerobic power of the turkish elite male long distance runners were found as 22.6(yr),61.2 (kg),174.3 (cm),49.6 (b.min),112.1 (mmHg),70.4 (mmHg), 22.4(cm), 6.1(%), 5320 (ml/kg.min),153.2(kg/m.sec) respectively.

The mean values of the 5000m.runners group of the age, weight, height, resting heart rate,systolic blood pressure, diastolic blood pressure,flexibility, body fat, vital

capacity, aerobic capacity and anaerobic power of the turkish elite male long distance runners were found as 21.8 (yr),6I.2(kg),172.8(cm),49.5(b.min),109.0(mmHg), 68.5 (mmHg), 23.5 (cm), 5.6(%),5321.5(ml/kg.min),57.5(ml/kg.min),135.7(kg /min.sec) respectively.

The maen values of the 1000m runnersgroup of the age, weight, height,resting heart rate, systolic blood pressure,diastolic blood pressure,flexibility, body fat, vital capacity, aerobic capacity and anaerobic power of the turkish elite mate long distance runners were found as 25.8 (yr),59.0(kg) 170.1(cm), 42.3(b.min),105.1(mmHg),68.5(mmHg), 23.3 (cm), 5.6 (%), 5823.3 (ml/kg.min), 62.5 (ml/kg.min) and134.8(kg/min.sec) respectively.

The maen values of the total runners of 3 groups of the age, weight, height,resting heart rate, systolic blood pressure, diastolic blood pressure, flexibility, body fat, vital capacity ,aerobic capacity and anaerobic power of the turkish elite male long distance runners were found as 23.4 (yr),60.4(kg)172.4(cm),47.1(b.min),108.7(mmHg), 69.1(mmHg), 23.0(cm), 5.7(%),5488(ml/kg.min), 59.6(ml/kg.min), 141.2(kg /min.sec) respectively.

1. There were no significant difference in the Age between 3.000m and 5.000m groups and between 3000m and 10000m groups .But, there was significant difference at 0.05 level between 5.000m and 10.000m groups. Therefore,the null hypothesis 1.a wasrejected.

2. There were no significant differences in the Weight among 3.000m,5.000m,and 10.000m groups. The null hypothesis 1.b was accepted.

3. There were no significant difference in the Height among 3.000m, 5.000m, 10.000m groups. The null hypothesis 1.c was accepted.

4. There was no significant difference in the Resting Heart Rate between 3.000m and 5.000m groups. But ,there were significant differences between 3.000m and 10.000m groups and between 5.000m and 1.0000m groups at 0.05 level.The null hypothesis 1.d was rejected.

5. There were no significant difference in the S.B.P. between 3.000m and 5.000m, groups and 5.000m and 10.000m groups. But,there was a significant difference at 0.05 level between 3000m and 10000m groupa. The null hypothesis 1.e was rejected.

6. There were no significant difference in the D.B.P. between 3.000m and 5.000m groups and 10.000m and 5.000m groups But,there was a significant difference at 0.05 level between 3.000m and 10.000m groups. The null hypothesis 1.f was rejected.

7. There were no significant differences in the Flexibility among 3.000m, 5.000m and 10.000m groups. The null hypothesis 1.g was accepted.

8. There were no significant difference in the Body Fat among 3.000m,5.000m and 10.000m groups.The null hypothesis 1.h

was accepted.

9. There was no significant difference in the vital capacity between 3.000m and 5.000m groups.But,there were significant differences between 3.000m and 10.000m groups and 5.000m and 1000m groups The null hypothesis 1.ı was rejected.

10. There were no significant difference in the aerobic capacity among 3.000m, 5.000m, 10.000m groups. The null hypothesis 1.j was accepted.

11. There were no significant differences in the anaerobic power between 3.000m and 5.000m groups and 5000m and 10.000m groups. But,there was a significant differece at 0.05 level between 3.000m and 10.000m groups.The hypothesis 1.k was rejected.

12.Among the variables of 3.000m runners group, there were high correlations (r›0.5) between Weight and Height,R.H.R and S.B.P, R.H.R and D.B.P.,R.H.R. and vital Capacity, S.B.P.and D.B.P.,S.B.P. and Aerobic Capacity; D.B.P. and Aerobic Capacity; Vital Capacity and Aerobic Ca pacity.Between other pair of variables, there were not high correlation. The null hypothesis 2 was rejected.

13. Among the variables of 5.000m runners group, there were high correlations (r=›0.5) between Weight and Height, Weight and Flexibility, Height and Percent Body Fat. R.H.R and D.B.P.,D.B.P. and Vital Capacity and Aerobic Capacity and Anaerobic Power. Between other pair of variables, there were not high correlation. The null hypothesis 3 was

rejected.

14. Among the variables of 10.000m. runners group,there were high correlations (r=›0.5) between Age and R.H.R., Age and S.B.P., Age and Flexibility, Age and Aerobic Capacity,S.B.P. and Aerobic Capacity,D.B.P. and Vital Capacity,Percent Body Fat and Vital Capacity,and Vital Capacity and Aerobic Capacity.Between other pair of variables, there were no high correlations. The null hypothesis 4 was rejected.

Recommendations

It was determined that more studies are needed to determine the effects of physiogical characteristics on athletes performances during the race. Several recommendations could be made with regard to further study. These recommendations are as follows.

1. When investigating elite groups it would be advantageous in the future to use similar subjects as a control.

2. It was recommended to accomplish the study over when the athletes reaches high level of performance.(This study should be done two weeks before the race.)

3. In future studies a larger group should be used.

4. The physiolegical charecteristic of the athletes should be measured directly.

5. Physiological variables on performance should also

be analyzed by using multiple regression analysis.

6. It is recommended that, within such a group of athletes possesing equally-high aerobic capacities, age (experience), low body weight, and high anaerobic power are important attribufutes for successful performance.

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APPENDIX

TABLE XVI

ROW DATA OF THE PHYSIOLOGICAL CHARACTERISTICS FOR

THE TURKISH NATIONAL 3000 m. RUNNERS (n=9)

SUB. No.	AGE	WEIGHT (Kg)	HEIGHT (cm)	R.H.R (min)	S.B.P mm/Hg	D.B.P mm/Hg	Flexi-bility	B.Fat %	R.F.ml /kgmin	A.C.ml /kgmin	A.P.	TyME min
1	20	66	179	48	98	66	09	6.5	6060	70	160.6	8.30
2	17	58	178	50	113	78	25	5.0	5430	52	139.8	8.40
3	23	62	171	52	116	70	26	7.7	5310	53	140.4	8.31
4	23	60	170	58	110	70	19	6.3	5040	65	135.1	8.45
5	20	64	179	44	106	66	29	5.2	6270	59	159.4	8.29
6	24	60	170	48	106	68	21	5.5	5420	61	158.8	8.30
7	29	56	169	44	110	70	24	6.3	4840	58	152.2	8.49
8	28	56	170	52	120	78	21	6.4	4920	56	164.2	8.50
9	21	64	179	48	116	70	22	5.7	5730	56	161.8	8.30

TABLE XVII

ROW DATA OF THE PHYSIOLOGICAL CHARACTERISTICS FOR

THE TURKISH NATIONAL 5000 m.RUNNERS (n=10)

SUB. no.	AGE (Yr)	WEIGHT (Kg)	HEIGHT (cm)	R.H.R (min)	S.B.P mm/Hg	D.B.P mm/Hg	Flexi-bility	B.Fat %	R.F.ml /kgmin	A.C.ml /kgmin	A.P.	Time min
1	20	72	184	54	110	72	26	4.2	5080	61	172.4	14.40
2	24	62	168	52	110	70	20	6.5	4960	50	129.8	14.49
3	22	62	169	48	110	60	24	6.5	6010	68	146.4	14.31
4	24	64	176	56	106	70	23	7.3	5595	63	108.4	14.46
5	26	58	171	46	110	65	22	6.2	5230	57	136.4	14.50
6	20	60	170	46	108	68	24	6.2	5160	68	146.6	15.00
7	20	56	179	52	116	70	25	5.0	5220	51	144.2	14.51
8	18	56	172	48	100	68	22	4.2	4810	50	124.2	14.32
9	24	64	179	48	116	70	22	5.7	5730	56	161.8	14.40
10	20	50	161	48	114	70	20	6.0	5240	48	116.7	14.37

TABLE X1X

ROW DATA OF THE PHYSIOLOGICAL CHARACTERICTICS FOR

THE TURKISH NATIONAL 10000 m. RUNNERS (n=10)

SUB. No.	AGE yr	WEIGHT (Kg)	HEIGHT (cm)	R.H.R (min)	S.B.P mm/Hg	D.B.P mm/Hg	Flexi-bility	B.Fat %	R.F.ml /kgmin	A.C.ml /kgmin	A.P. k.m	TIME min
1	24	62	171	44	98	66	28	4.9	5470	61	134.4	29.58
2	26	68	182	40	100	66	25	6.2	5820	63	135.9	29.49
3	22	51	161	46	108	64	29	4.8	5980	60	133.8	29.36
4	25	65	177	50	106	68	25	6.5	5160	61	158.1	30.10
5	24	50	162	44	110	74	28	6.0	5380	50	127.3	30.40
6	24	61	173	40	106	70	23	6.9	5810	66	140.3	29.43
7	34	66	178	38	100	64	18	5.9	6420	68	129.4	29.38
8	28	50	159	39	96	66	13	4.4	6060	64	95.2	29.35
9	26	58	170	40	104	62	29	5.0	6480	69	158.8	29.29
10	23	66	179	49	108	60	25	6.8	5585	60	108.4	30.50