MEASUREMENTS AND COMPARISON OF SELECTED PHYSICAL FITNESS COMPONENTS OF 18 TO 20 YEARS OLD MALE STUDENTS ATTENDING THE FACULTY OF MEDICINE AND THE DEPARTMENT OF PHYSICAL EDUCATION AND SPORTS AT SELÇUK UNIVERSITY

by
HASAN AKKUŞ

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ENSTİTÜ :ORTA DOĞU TEKNİK ÜNİVERSİTESİ SOSYAL BİLİMLER ENSTİTÜSÜ, ANKARA.
ÇALIŞMA BAŞLIĞI:SELÇUK ÜNİVERSİTESİ BEDEN EĞİTİMİ BÖLÜMÜ VE TIP FAKÜLTESİNDEKİ 18-20 YAŞLARINDAKİ ERKEK ÖĞRENCİLERİN SEÇİLMİŞ FİZİKSEL DEĞİŞKENLERİNİN ÖLÇÜMÜ VE KIYASLANMASI.
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ANA SAHA :BEDEN EĞİTİMİ VE SPOR

ÇALIŞMA METODU VE ALANI:Bu çalışmanın amacı, Selçuk Üniversitesi Beden Eğitimi Bölümü ve Tıp Fakültesindeki 18-20 yaşlarındaki erkek öğrencilerin seçilmiş fiziksel uygunluk değişkenlerinin ölçüm ve kıyasını yapmaktı. Seçilen fiziksel uygunluk değişkenleri sırasıyla; boy ve kilo, dinlenme kalp atım sayısı, dinlenme diastolik kan basıncı ve dinlenme sistolik kan basıncı, vücut yağ yüzdesi, esneklik, reaksiyon zamanı, pençe kuvveti, anaerobik güç ve aerobik güçten oluştu. Çalışmadaki denekler Selçuk Üniversitesi 1988-89 akademik yılında 18-20 yaşlarında Beden Eğitimi Bölümünden 35 adet, Tıp Fakültesinden 35 adet erkek öğrenciden ibaretti.

Beden Eğitimi Bölümü ve Tıp Fakültesi öğrencileri arasındaki farklılığın, fizyolojik değişkenler açısından belirlenmesinde t-testi kullanıldı.

BULGULAR VE SONUÇLAR: Bu çalışmanın sonunda aşağıdaki bulgular edilmiştir. Beden Eğitimi Bölümü öğrencilerinde; ortalama boy ve kilo 175.08±4.36 cm., 68.94±8.71 kg., ortalama dinlenme kalp atım sayısı 68.65±4.88 atım/dk., ortalama dinlenme diastolik ve sistolik kan basıncı 82.3±10.9 mmHg 118.0±17.1 mmHg, ortalama vücut yağ yüzdesi 11.64±3.00, ortalama esneklik 32.88±6.10 cm., ortalama ışığa karşı el reaksiyon zamanı 18.58±3.2 1/100 sn., ortalama sese karşı el reaksiyon zamanı 20.59±2.51 1/100 sn., ortalama ışığa karşı ayak reaksiyon zamanı 22.00±2.39 1/100 sn., ortalama sese karşı ayak reaksiyon zamanı 23.7±2.78 1/100 sn., ortalama sağ el pençe kuvveti 33.34±7.31 kg., ortalama sol el pençe kuvveti 33.13±7.41 kg., ortalama anaerobik bacak gücü 108.20±13.55 kg.m/sn., ortalama maksimum oksijen kapasitesi 43.66±5.38 ml.kg/dk. idi.

Tıp Fakültesi öğrencilerinde; ortalama boy ve kilo 168.88±5.44 cm., 66.81±7.14 kg., ortalama dinlenme kalp atım sayısı 86.14±12.6 atım/dk., ortalama dinlenme diastolik ve sistolik kan basıncı 79.5±10.3 mmHg 126.1±14.8 mmHg, ortalama vücut yağ yüzdesi 15.67±4.97, ortalama esneklik 31.78±6.73

cm., ortalama ışığa karşı el reaksiyon zamanı 22.79±3.7 1/100 sn., ortalama sese karşı el reaksiyon zamanı 22.60±3.27 1/100 sn., ortalama ışığa karşı ayak reaksiyon zamanı 22.10±3.35 1/100 sn., ortalama sese karşı ayak reaksiyon zamanı 25.3±3.13 1/100 sn., ortalama sağ el pençe kuvveti 29.14±4.11 kg., ortalama sol el pençe kuvveti 28.20±3.90 kg., ortalama anaerobik bacak gücü 84.71±11.46 kg.m/sn., ortalama maksimum oksijen kapasitesi 40.84±4.06 ml.kg/dk. idi.

Beden Eğitimi ve Tıp Fakültesi öğrencileri arasında ağırlık ve esneklik hariç bütün diğer değişkenlerde anlamlı farklılıklar bulundu.

DANIŞMANIN ONAYI :.........................

NAME, SURNAME :Hasan Akkuş **DATE OF DEGREE**:February,1990
INSTITUTION :Social Sciences Institute of Middle East Tecnical University, Ankara.
TITLE OF THE STUDY:MEASUREMENTS and COMPARISON of SELECTED PHYSICAL FITNESS COMPONENTS of 18 to 20 YEARS OLD MALE STUDENTS ATTENDING THE FACULTY OF MEDICINE AND THE DEPARTMENT OF PHYSICAL EDUCATION AND SPORTS AT SELCUK UNIVERSITY.
PAGE in STUDY :98
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SCOPE AND METHOD OF THE STUDY:The purpose of this study was to measure and compare the selected physical fitness components of 18-20 years old male students attending the Faculty of Medicine and the Department of Physical Education and Sports at Selcuk University. Physical fitness components were height and weight, resting heart rate, resting systolic and diastolic blood pressure, percent body fat, flexibility, reaction time, hand grip strength, anaerobic leg power (vertical jump), aerobic power (12 m. run). The subjets in this study were 35 male students from Department of Physical Education and Sports and 35 male students from Faculty of Medicine at Selcuk University in the academic years of 1988-89.

The t-test was used to determine the differences of physical fitness components between the subjets of physical education and sports and the subjects the Faculty of Medicine.

FINDINGS AND CONCLUSIONS: At the and of this study, following results were found: For the subjets from the Department of Physical Education and Sports; the mean height and weight 175.08±4.36 cm., 68.94±8.71 kg., the mean resting heart rate 68.65±4.88 beat/min., the mean resting diastolic and systolic blood pressure 82.3±10.9 mmHg 118.0±17.1 mmHg, the mean percent body fat 11.64±3.00, the mean flexibility 32.88±6.10 cm., the mean reaction time hand light 18.58±3.2 1/100 sec., the mean reaction time hand sound 20.59±2.51 1/100 sec., the mean reaction time foot light 22.00±2.39 1/100 sec, the mean reaction time foot sound 23.7±2.78 1/100 sec., the mean hand grip strength right 33.34±7.31 kg., the mean hand grip strength left 32.13±7.41 kg., the mean anaerobic leg power 108.20±13.55 kg.m/sec., the mean maximal oxygen capacity 43.66±5.38 ml.kg/min.

For the subjects from the Faculty of

Medicine; the mean height and weight 168.88±5.44 cm., 66.81±7.14 kg., the mean resting heart rate 86.14±12.60 beat/min., the mean resting diastolic and systolic blood pressure 79.5±10.3 mmHg 126.1±14.8 mmHg, the mean percent body fat 15.67±4.97, the mean flexibility 31.78±6.73 cm., the mean reaction time hand light 22.79±3.74 1/100 sec., the mean reaction time hand sound 22.60±3.27 1/100 sec., the mean reaction time foot light 22.10±3.35 1/100 sec, the mean reaction time foot sound 25.3±3.13 1/100 sec., the mean hand grip strength right 29.14±4.11 kg., the mean hand grip strength left 28.20±3.90 kg., the mean anaerobic leg power 84.71±11.46 kg.m/sec., the mean maximal oxygen capacity 40.84±4.06 ml.kg/min.

In all variables, there were significant differences between the subjets from the Department of Physical Education and Sports and the subjets from the Faculty of Medicine except for weight and flexibility.

ADVISER'S APPROVAL: ....

I certify that this thesis is satisfactory for the award of the degree of Master of Science.

Assist.Prof.Dr. Kemal TAMER
(Supervisor)

Assist.Prof.Dr. Gazanfer DOGU
Member of Examining Committee

Assoc. Prof.Dr. Emin ERGEN
Member of Examining Committee

Certified that this thesis conforms to the formal standards of Institute of Social Sciences

Assoc.Prof.Dr. Sabri KOC
Director of the Institute

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I. INTRODUCTION

"Since the last century, industrialization has rapidly changed the environment. In most cases, changes were for the better but they have also created major problems. One of them is sedentary life-style that leads to various diseases and syndromes of modern life. Such as obesity, high neuromuscular tension, low fitness level and cardiovascular diseases which are the cause of more than one death in every second in most industrialized countries" (Astrand and Rodahl, 1977).

Years ago, people believed that physical fitness was merely freedom from diseases and "Charles Atlas Man" was the symbol of superb physical fitness. Today, this concept is not true that modern physical fitness is the ability of the body and its responses to work and stress (Kash, 1968).

As it is known that men are created for action not for rest and researchers advise that in order to overcome effects of sedentary living, the solution is to make exercise which has specific purpose; that is, the training of the heart, circulatory, muscular and associated systems. The primary goals of physical fitness program is to serve in order to support and improve the normal physiological balance of an individual. Astrand reported that three and five half-hour periods of exercise per week are sufficient to built up and maintain good physical fitness which is the basic need of modern men and women (Astrand, 1977).

Measurement of selected physical characteristics and physiological capacities of male students helps to determine the progress being made in meeting objectives. It aids in discovering the needs of the participants. It identifies strength and weakness of participants and instructors, aids in curriculum planning and shows where emphasis should be placed. It also gives direction and helps to supply information for guidance purposes (Bucher, 1983).

Physical fitness is defined as a condition of the body in which all systems are functioning at their top capacity and efficiency. It is made up of many components. These are strength, power, cardiovascular function, body composition, flexibility, coordination. In recent years considerable attention has been given to the subjects of physical fitness, particularly as to what kind of physical fitness is most important for the general public. It has been indicated that health related fitness is concerned with the following basic components; cardiovascular function, body composition, strength and flexibility. It has been also indicated these basic components are essential for performance related physical fitness

(LaPlace, 1972).

Physiologists, cardiologists and other members of the medical profession have accepted the concept of physical work capacity (PWC) as an indication of a person's level of physical fitness. Physical work capacity is defined as the capacity of an individual to obtain a maximum level of metabolism or work. An individual's physical work capacity is ultimately depends on one's capacity to supply oxygen to the working muscle. It is measured by a technique that determines maximum oxygen uptake (Verducci, 1980) which is defined as the highest oxygen uptake the individual can attain during physical work while breathing air at sea level (Astrand and Rodahl, 1977).

Physical activity is dependent upon the production of energy by the body. To create energy, the respiratory and circulatory systems must produce and deliver the basic energy ingredients-oxygen and carbohydrates, fat-to parts of the body where energy is being produced. Oxygen is inhaled into the lungs and enters the blood stream where it is pumped by the heart throughout the body. Once it reaches the tissue, oxygen is replaced by the waste material, carbondioxide, which is returned to the lungs and exhaled. The amount of oxygen delivered depends on the lung' capacity, the number of red corpuscles and the heart's pumping efficiency (LaPlace, 1972).

Maximum oxygen uptake indicates how well various physiological functions can adjust to increasing metabolic demands of exercise and work. In many muscular activities, oxygen uptake shows a roughly linear increase as the work load increases. During the first few minutes of exercise, oxygen uptake increases until a steady state is reached in which the oxygen uptake corresponds to the exercise demands. This steady state roughly coincides with adaptations of pulmonary ventilation, heart rate, and cardiac output. Oxygen uptake gradually decreases on cessation of exercise as the oxygen dept is reduced. The maximal oxygen uptake is probably the best laboratory measure of a person`s physical fitness (Astrand and Rodahl, 1977).

Maximal oxygen consumption is also closely correlated with heart volume, total hemoglobin, lean body weight and active tissue. Studies have shown that the maximal oxygen consumption per unit of active tissue in athletes is higher than sedentary subjects. This suggests that oxygen transport and muscular systems of the athlete are qualitatively and quantitatively superior to those of the untrained individuals. The higher oxygen consumption of the trained individual is not only in relative muscle mass but also seems to be related to greater capacity of the heart and lungs to deliver oxygen and of the muscle to utilize oxygen (Rarick, 1973).

Maximal aerobic power is widely used as a criterion of cardiorespiratory fitness and as a predictor of endurance peformance (Costil et al., 1973; Astrand and Rodahl, 1977). Investigations with athletes have shown that the highest values for max VO2 ml/kg min-1 were obtained by distance runners and cross-country skiers suggesting that a high maximal aerobic power level is a prerequisite for performance in endurance events (Saltin and Astrand, 1967).

Energy production can take place with oxygen (aerobic) or without (anaerobic). Physical power output which does not exceed the ability of the body to supply sufficient oxygen is called aerobic work. Muscular work which exceeds the aerobic capacity of the body is called anaerobic work. Lactic acid, the end production of glucose metabolism, is produced during anaerobic work, causing muscular pain and interfering with muscle contraction. Heavy breathing and pounding heart following physical activity usually indicate a temporary condition known as oxygen dept, during which the demand for oxygen exceeds the body`s ability to supply it. The more physically fit the individual is, the greater his aerobic capacity (LaPlace, 1972).

Distance runs have long been used as field test for cardiovascular fitness. Cooper`s 12 min. run became a popular measure for many fitness program (Dorociac and Nelson, 1983). According to Sparling and Cureton (1983), the 12 min. run is widely used as a field test of "cardiovascular fitness" or "cardiorespiratory endurance" in adults and adolecents.

Maximum oxygen uptake is affected by body size; sex and age; heart volume, stroke volume and total hemoglobin; environment, training and disease (Rarick, 1973).

Doolitte and Bigbee (1968) investigated the distance covered in 12 minutes as an indicator of cardio-respiatory endurance and reported that the distance covered during 12 min. run test was a higly reliable and valid indicator of cardiorespiratory fitness. On the other hand, Cooper (1968) tested 115 United States Air Force male officers and airmen on a 12 minutes run test and max VO2 test. The correlation of the run with the oxygen uptake test data was r=.89.

Body composition is concerned in part with the obesity of the individual. In measuring this aspect of body composition, the total body weight is divided into components; lean body weight (e.g. muscle, bone and vital organs) and fat body weight. Underliying assumption is that total body weight aquals lean body plus fat body weight. The higher the percentage of fat body weight in relation to lean body weight, the higher the degree of obesity (Verducci, 1976).

Reaction time represents an important consideration in an individual`s performance in physical activity, not only in physical education and sports but also in daily living. While reaction time is but one of a number of determinants of the caliber of performance in physical activity. In many cases it may spell the difference between success and failure or even between life and death in emergencies (Kanungsukkasem, 1983).

The term reaction is applied to the occupied in the control nervous system in that complex response to a prearranged stimulus in which the brain as the spinal cord comes into play. It is sometimes called the personal equation. The time occupied by transmission along the nerves has to be deducted and the remainder is the reaction time. Reaction time is the interval of time that begins with the application of stimulus and ends with initial, ensuring muscle action.

If the mass to be moved is large, the reaction time is longer than if the mass is small. Thus, finger reaction time is shorter than leg reaction time, because included in the measurement is time for the muscle contraction to move the mass of the limb involved. Since more motor units must be activated to move the heavier leg than the lighter finger. this has led to use of the concept of premotor time is the time that elapsed from one set of the signal to initiation of the muscle action potential, and motor time is the time remaining for the actual response to be initiated (Clarke, 1975).

Men react faster than women and both sexes react most quickly between the ages of 21 and 30 (Morehouse and Miller, 1963).

There are great individual differences among persons. Numerous studies have shown that athletes have a faster reaction time than nonathletes (Karpovich and Sinning, 1971). Practice has little effect on shortening reaction time.

Muscular strength is defined as the contraction force of muscles. Strength is prerequisite to muscle movement. The components of motor performance depend on some degree of strength, since they all depend on some degree of muscle action. The greater the contraction of a muscle, the greater the force exerted, and the greater the strength. Strength can be increased through training (Verducci, 1980).

People need strength to perform their usual daily routines. The amount needed will differ from one person to another person depending on the type of activity each is engaged in. A person who spends the day sitting behind a desk will not need as much strength to perform his daily reutine as will a person who spends the day in the redwoods. Both, however, should have sufficient time to carry them through their daily routines with minimum fatique. They should have enough additional strength to engage in an active and fulfilling leisure and to be able to function at a high level of efficiency in times of emergencies (Verducci, 1980).

Flexibility refers to the range of motion of body joints. The greater the range of motion, the greater flexibility of a specific joint tends to be related to such factors as the ligaments, muscles, tendons and bones of a joint. Limited flexibility is usually the results of restricted elasticity of the muscles and tendons. In some instances, excessive amounts of fat may also restrict the range of motion of a specific joint (Verducci, 1980).

Measurement helps to determine where instructional emphasis should be placed and which procedures are effective and ineffective. It is also used to help person to determine their own progress in respect to physical education practices, as a basis for giving grades, and as a means of interpreting programs to administrators and the public in general.

The information provided by measurement techniques can also be used in other ways. Findigs can be used for determining a person`s exercise tolerance and for grouping individuals according to similar mental, physical and other traits that will ensure better instruction. Measurement yields information that can be used as an indicator of a person`s achievement in various skills and activities. It provides information that can be used to predict future performance and development. It affords data on attitudes that determine whether or not the participant has proper motivation and focuses attention on future action that should be taken in the program.

Although it may be difficult to change the health habits of adults, schools and colleges can and should educate young people about their health and fitness. This is not only essential from individual`s point of view but also in view of national postures (Bucher, 1983).

Therefore, the level of physical fitness of every Turkish citizen should be our constant concern. It is the duty of physical educators to establish norms for the different populations in Turkey.

Statement of the Problem

The problem was to find out physiological capacities and characteristics of 18 to 20 years old male students attending the Faculty of Medicine and the Department of Physical Education and Sports at Selçuk University. The purpose of this study was to measure and compare the resting heart rate, resting diastolic and systolic blood pressure, height and weight, percent body fat, reaction time, hand grip strength, flexibility, maximum oxygen uptake (VO2 max), vertical jump of 18 to 20 years old male students attending the Medical Faculty and the Department of Physical Education and Sport at Selçuk

University.

Assumptions

1. The subjects followed all the test instructions

2. The subjects represented all of the 18 to 20 years old male students attending the Faculty of Medicine and the Department of Physical Education and Sports at Selçuk University.

3. The subjects made maximum effort on test performance.

4. The 12 min run test used for the prediction of max VO2 was aplicable for assesing of the maximum oxygen uptake of this group.

5. The formula of the skinfold measurement and equation used for prediction of the percent body fat was valid for the subjects of this study.

Limitations

1. This study was limited to the 18 to 20 years old male students attending the Medical Faculty and the Department of Physical Education and Sports at Selçuk University during the academic years of 1988-89.

Hypothesis

1. There were no significant differences of the following variables between the male students of Faculty of Medicine and the Department of Physical Education and Sports at Selçuk University.

a. Weight

b. Height

c. Resting heart rate

d. Resting diastolic blood pressure

e. Resting systolic blood pressure

f. Percent body fat

g. Flexibility

h. Reaction time

i. Hand grip strength

j. Vertical jump

k. Maximum oxygen uptake

Significance of the Study

Physiological capacities and characteristics of the individuals are different from one person to another. Physical fitness can not be measured with one test. It is necessary to know the capacities and characteristics of different people in order to indicate their peculiarities in Turkey.

Despite the nationwide popularity of the students, there is a little scientific information which is avaliable concerned the physiological characteristics of Turkish students.

The main purpose of this study was to indicate physiological capacities and characteristics of university students and help the physical educators and coaches to get an idea about students performance level. Findings may also indicate the physical fitness level of Turkish University students. In addition, it was also important to learn more knowledge about the physiological capacities and characteristics of Turkish people. The results might be compared with other nation's norms to understand the level of physiological capacities of the Turkish people. The final importance of this study was to establish new data for comparison with future investigations.

Definition of Terms

1. Physical fitness: The ability to perform muscular work satisfactorily under specified condition.

2. Aerobic power: The highest oxygen uptake the individual can attain during exercise engaging large muscle groups while breathing at sea level. This is expressed in millimeters of oxygen per kilogram of body weight per minute (ml.kg.min.).

3. Anaerobic Power: The maximal ability of the anaerobic systems (ATP-PC+Lactic Acid) to produce energy.

4. Blood Pressure: It is quantitative measurement of the pressure of the blood against the inner walls of the vessels.

5. Systolic Blood Pressure: Active phase of the heart beat when the heart muscle contracts, forcing more blood into the arteries and raising pressure to its highest

level.

6. **Diastolic Blood Pressure:** The resting phase of the heart beat when the pressure within the arteries falls to the lowest level.

7. **Hypertension:** High blood pressure. Increased blood pressure above the normal range.

8. **Heart Rate:** The numbers of ventricular beats per minute.

9. **Strength:** The contraction force of muscle.

10. **Flexibility:** The capacity of a joint to move through a normal range of motion.

11. **Reaction Time:** The elapsed time between the presentation of the stimulus and the movement of the body, or body part(s).

Description of Instruments

1. **Reaction Timer:** It is an instrument which is used to measure one`s reaction time against the light and sound.

2. **Skinfold Caliper:** An instrument which is used to measure the amount of fat under the skin in millimeters. A constant pressure of 10 g/sq mm. is exerted by the caliper`s jaws throughout their range of motion.

3. **Sphygmomanometer:** A device used to indirectely monitor blood pressure. It consists of a compression bladder enclosed in an unyielding cuff, an inflation bulb,

a mercury manometer from which the applied pressure is read, and a control exhaust to deflate the system.

4. Stethoscope: A listining device to amplify heart sounds.

5. Handgrip Dynamometer: An instrument which is used to measure handgrip strength (static).

II. REVIEW OF LITERATURE

Physical activity relates to physical fitness. According to Morrehouse and Miller (1976) "Physical fitness is the quality of the whole body in terms of its state of adaptation to physical activity". A physically fit person does not mean just being healthy. This means that he is not overly fat, has a strong skeleton, has neuromuscular strength, has strong connective tissues and has good circulorespiratory endurance.

Generally speaking, there have been two main approaches to the assesment of physical performance: (1) physical fitness test with scoring of actual performance in situations that presents basic performance demand, and (2) studies of cardiopulmonary function at reset and/or during axercise (Astrand and Rodahl, 1986).

The physical development objective of physical education is also known as physical fitness, physical conditioning, organic development or biological development. This objective has been basic fpr physical education for thousands of years. Furthermore this objective is basic for the optimum development of vital organs (Voltmer and Esslinger, 1967).

Physical fitness is rather an important factor in sports. It gives an idea to the coaches and physical educaters about the physical state and the capability of participants in any sports branch. But physical fitness is not a formation by itself as it covers many properties and can not be measured with one test. Physical test in an exercise or under stress conditions, measure the ability of the body and include parameters like oxygen uptake test of air exchange in the lungs, the volume of heart stroke, blood pressure and pulse rate (Kasch and Boyer, 1968).

The improvement of human physical functioning has always been a primary goal of physical education programs. When programs have primarily addressed themselves to increase the participants muscular strength, endurance and cardiovascular efficiency and to reduce adipose tissue in the body, they have been called "conditioning programs," "fitness programs," or "physical training programs."

Physical educators, exercise physicologists, and phsicians have proposed many tests to demonsrate the effects of such programs. These tests have generally been labeled "motor fitness tests," "physical fitness tests," and cardiovascular tests." Additional tests have been developed by state departments of physical educations as well as many colleges and universities (Kirkendall et al., 1987).

The term motor fitness became popular during World War II as the military services developed tests to evaluate the capacity of military personal for vigorous work

(Mathews, 1978). Motor fitness is thought to be a limited dimension of general motor ability. Elements of motor fitness include muscular endurance, muscular strength, power, flexibility, coordination, balance and agility. These elements of motor fitness are usually reflected in motor performances such as running, jumping, dodging, climbing, swimming, lifting weights and carrying loads for a prolonged period of time. The President's Council on Physical Fitness and sports defines physical fitness as "the ability to carry out daily tasks with vigor and alertness, without undue fatique, with ample energy to enjoy leisure time pursuits, and to meet unforeseen emergencies" (Clarke, 1971).

Height and Weight

Studies of the attributes of height and weight in the population provide a yardstick against which objective clinical assesments of individual subjects may be made. In addition, these attributes from part of several anthopometric indices for the definition and comparison of physiques in different population groups. Moreover, height and weight measurements are still considered by many as one of the simplest and best means for determining the general health and nutritional status during the growth period of life.

Height is a familiar normal physical measurement.

It is generally accepted as an example of a multifactorial character rsponding to both genetic and environmental influences, its genetic component being polygenic and acting partly through endocrine systems and hormonal action (particularly growth hormone), carbonhydrate metabolism, rate and timing of growth processes, and other such functional variables, and its environmental components including nutrition, disease, diurnal rhythm, postural habits, as well as other less obvious factors (Roberts et al., 1978).

In general, it has been recognized that environmental factors are stronger determinants of growth than are genetic attributes. Of the environmental factors, nutrition is the single most important determinant (Miller and Payne, 1959).

Researchs on characteristics of height and weight in different populations offer a standart or a norm. Those norms can be used for scientific assessments. For example. those norms is used at anthroppometric studies as indices for the definition and comparision of physiques. In addition, height and weight measurements can be used to calculate body surface area and scientific gravity of the subject (Ricci, 1970). Furthermore, height and weight are still determined for the general health and nutritional status during the growth period of life (Mathews, 1973).

Weight also increase with age in the technicallyadvanced countries. For example, although in 1955 an average American woman of 55.5 years was 0.2 inches shorter, she weighted 22.0 lbs. more than a woman 30 years younger (Hathaway and Foard, 1966).

The relationship between stature, weight and physical efficiency was studied by Setlzer (1946) in several group of Harvard college students. Height, weight and physical fitness scores were obtained before and after the training period to determine the relationship of these variables. The physical fitnes tests in this study were pack test, step test and treadmill test. The data indicated a virtual absence of relation between stature and weight with physical fitness indices derived from the pack test and step test in a group of aviation cadets before and after a severe physical training period. In spite of the low coefficient values there were suggestions that before training, the extremely shortt individuals with stature below 165 centimeters showed a slight tendency to have rather low physical fitness indices, and the individuals with low physical fitness indices tended more frequently to be above the mean in body weight. The data also indicated that the subjects who were stocky, and thick-set in body build tended to have low physical fitness indices before training. However, the relation disappeared when the individuals approached their optimum state of physical efficiency.

Berry (1965) collected data on height and weight of 863 college men between the ages of 18 and 28 years from two colleges in Nagpur, Central India. The data were presented in the form of 3rd, 10th, 15th, 50th, 90th and 97th percentile of height, weight and weight for height. The height and weight for these men were representative of the parameters of college men of this age group in Central India for that period. Comparing with height and weight white Americans both in average height and weight, the mean height this study was less by 3 inches (65.66 inches and 68.6 inches) and mean weight at age 18 by about 41 lb. 108 and 149 lb.) compared with British young men in Central India were lighter about 30 lb. (50th percentile, 108 lb. and 138 lb.) and less in height by more than 5 inches (65 inches and 69 inches). While a young man in the United Kingdom with 69 inches height (50th percentile) and 130 lb. weight, a young college man of the same height in Central India weighed only 126 lb. and an American college man with his height 68.6 inches, weighed 141 lb. The results showed that these young men in the study were not only shorter and lighter but also weighed les than British young men and much less than American college men for every inch of height. Berry suggested that at least partt of this poorer height and weight was due to poor economic conditions which resulted in under nutrion and illhealth.

In many countries, man and woman have been growing taller in recent generations. They also have ben improving im athletic performance. Besides the increasing in such bodily dimensions as height and weight at all ages from birth to adulthood, the maturation of certain physiological functions, notably those connected with sexual maturity, is also accelarated. Boys now reach their maximal height at an earlier age than they did a generation ago. The rapid increase in height and weight that accompany by puberty, generally occurs earlier in girls than in boys, but is at any rate subject to individual variation. Thus, the peak height velocity may in extreme cases occur in a nine year old girl and in a sixteen year old boy. Since this adolescent growth spurt has a profound effect on physical performance. It is a fact that in spite of the general increase in height and weight of olympic athletes durşng the last thirty years, their body proportions are remerkably constant. It may therefore be assumed that even with the increased dimensions, the present-day taller athletes are geometrically no different from those of earlier generations. When the size of the oxygen transporting organs is the limiting factor, the taller athlete should consequently be able to deliver 13 percent more oxygen to this muscles pr unit of time than the smaller athlete (Astrand and Rodahl, 1986).

There are height and weight differences between male and female. In the age of 15 years, the boys begins his growth spurt and maintains the height advantage from females. In general females top growing in the height between the ages fo 18 and 20 years, whereas males continue to grow until the age of 20 to 23 years. The mean height of female is 10-15 cm shorter than that of male. In weight the boys catches up and surpasses the girl at the age of 15 years and continues; when he reaches maturity, he has a weight advantage approximately 12 kg. Center of gravity, which is important in physical education and sport, has been found that the mean of it in man is located at a point 56.7 % his weight above ground, whereas woman's mean center of gravity is at 56.1 % of her height (Klafs and Lyon, 1978).

Blood Pressure

Blood pressure refers to the pressure of the blood against the inner walls of the arterials. Like body temperature, it can be determined easily and quickly, and is a general indication of a person's health. In a young adult, the heart discharges blood into the aorta at a pressure of about 2.7 lbs. per square inch. This pressure decreases gradually as the blood flows through the circulatory system. By the time the blood reenters the heart, its pressure is nearly zero (LaPlace, 1972). The highest pressure obtained is called the *systolic pressure* and lowest the *diastolic pressure*. As blood is enjected into the arteries during ventricular systole, the pressure increases to a maxsimum (systolic pressure); as blood drains from the arteries during ventricular diastole, the pressure decreases to a minimum (diastolic pressure) (Mathews and Fox, 1977).

In a young adult male, systolic pressure displaces about 120 mm of mercury, and diastolic pressure displaces about 80 mm of mercury. This is usually written as 120/80 mmHg. The reading for a young adult female is usually aboult 110/70 mmHg. An infant′s systolic reading is about 105 mmHg. Blood pressure normally increases with advancing age, although the factors influencing it are so various that it is difficult to establish an average value for any one person.

There exists, however, a range of normal blood pressure for any individual: blood pressure normally varies at different times within a day, and from year to year. Among the factors affecting blood pressure are age, weight, level of activity, and emotional state. For example, within a person′s normal range, blood pressure is higher after strenuous exercise or during periods of anxiety. Blood pressure is normally lowest when a person is sleeping (LaPlace, 1972).

For individuals whose arteries have become "hardened" because fatty materials have deposited within their walls (or because the vessel′s connective tissue layer has thickened) or whose arterial system offers excessive resistance to blood flow in the periphery due to nervous strain or kidney malfunction, systolic pressure at rest may be as high as 250 or even 300 mm Hg. The diastolic or run-off pressure may also be elevated above 90 mm Hg. Such high blood pressure, called hypertension, imposses a chronic, excessive strain on the normal funtioning of the cardiovascular system (McArdle et al., 1981).

Hypertansion refers to high blood pressure, both systolic and diastolic. High blood pressure is associated with variety of circulatory diseases and, as such, it has been estimated that 12 percent of all persons die as a direct results of hypertension (Guyton, 1971).

It has been estimated that one out of every five five persons will have abnormally high blood pressure sometime during their lives. Presently, more than 20 million Americans have systolic pressures over 140 mm Hg or diastolic pressures over 90 mm Hg. Uncorrected chronic hypertension can lead to heart failure or stroke. Because elevated blood pressure can progress unnoticed for many years, yet can be effectively treated by medications that reduce extracellular fluid volume, it is prudent to recommend that blood pressure be chacked at periodic intervals (McArdle et al., 1981).

Both systolic and diastolic blood pressure can be significantly lowered with a regular program of exercise.

These results have been observed with normotensive (Choquette et al., 1973) and hypertensive (Terjung et al., 1973) subjects at rest. A reduction in mean arterial pressure during submaximal exercise testing has also been observed in healty middle-aged men following endurance training (Hartley et al., 1969).

McArdle (1981) reported that the average resting systolic pressure of seven middle-aged male patients decreased from 139 to 133 mm Hg following 4 to 6 weeks of interval training. In addition, at similar submaximal exercise levels, systolic pressure fell from 173 to 155 mm Hg. Whereas diastolic pressure was also reduced from 92 to 79 mm Hg. Consequently, mean arterial blood pressure during exercise was reduced by approximately 14 % following training.

Many factors operate to regulate blood pressure within the human body, such as age, sex, emotion, diurnal variation, ingestion of blood, posture. Arterial pressure can be shown to be directly proportional to be output of heart (i.e., volume of blood per unit time) and peripheral resistance. Factors controlling cardiac output (heart rate and stroke volume) are also significant for blood pressure (Astrand, 1986).

The normal blood pressure varies considerably from one individual to anotherr. It was reported that 20 years old females systolic blood pressure was 100-130 mm Hg;

diastolic blood pressure was 60-85 mmHg. At the same age, males systolic pressure was 105-140 mmHg; diastolic pressure was 62-80 mmHg. In addition, females systolic pressure was 102-135 mmHg; diastolic blood pressure was 60-80 mmHg at the age of 30 years. At the same age males systolic blood pressure was 10-145 mmHg; diastolic was 68-92 mmHg (Haupt et al., 1972).

Reaction Time

Reaction time represents an important consideration in an individual's performance in physical activity, not only in physical education and sports but also in daily living. While reaction time is but one of a number of determinants of the caliber of performance in physical activity, in many cases it may spell the difference between succes and failure or even between life and death in emergencies.

Singer (1975) stated that reaction time involves an integration of the higher centers of the nervous system, perception of the stimulus (a noise, light, or the like) and the initiation of the appropriate movement. It is the elapsed interval of time from the presentation of stimulus to the initiation of a response. A reflex is usually nonvolitional, involving the lower centers of the nervous system. It is an automatic responce, predictable, and does not require perceptability.

Physiologists and experrimental physiologists have investigated and suggested theories about the internal mechanism activated during a response to the light or sound stimuli. For example, Botwinic and Thompson (1966) proposed that reaction time be thought of as involving premotor and motor time. Premotor time includes the time elapsed from the stimulus presentation to the muscle firing, and motor time describes the point when the muscle fires to the actual response. They also indicated that premotor and reaction time werre highly related while no direct relationship could be discerned between motor and reaction time.

Reaction time is classified as being either simple or complex. Simple reaction time includes the interval between a prearranged signal and a predetermined response. Complex reaction time may take several forms: discrimination (response to one of several stimuli), cognitive (response after recognition of stimulus) and choice (specific responses to particular stimuli) (Ricci, 1967).

Singer (1975) emphasized that reaction time does not seem to be an inherent constant response to a stimulus. Rather, it varies with the existence of the following certain conditions: (1) type of stimulus, (2) the strengh and/or duration of the stimulus, (3) the readiness for response, (4) practice, (5) age, and (6)the physiological state of the subject.

If the mass to be moved is large, the reaction time is longer than if the mass is small. Thus, finger reaction time is shorter than leg reaction time, because included in the measurement is time for the muscle contraction to move the mass of the limb involved. Since more motor unit must be activated to move the heavier leg than the lighter finger. This has led to use of the concept of premotor and motor reaction time. The premotor time is the time that elapses from the onset of the signal to initiation of the muscle action potential, and motor time is the time remaining for the actual responses to be initiated (Clarke, 1975).

Fulton (1971) studied the effects of sex, age and sexual maturation on reaction time of males and females at age 9, 11, 13, 15 and 17. The mean reaction times showed that females tended to be faster then males, and reaction time decreased markedly with age in females. Males improved in reaction time at all ages (9, 11, 13, 15 and 17 years old), but females tended to level off between the age of 15 and 17. The 9 years olds were significantly different in reaction time than all other age groups. More mature subjects at the same age (either at the age of 9, 11, 13, 15 or 17) tended to have faster reaction time.

Botwinick and Thompson (1866) suggested that simple reaction time (SRT) and discrimination reaction time (DRT), rather than being simple a function of age, might also be a function of an individual's physiological condition, i.e., physical fitness level. They found in their study that young athletes' times were significantly faster than young non-athletes' times. Assuming that athletic participation results in higher level of fitness, they suggested that physical fitness is a factor that determines age differences in neuromuscular parameters.

Cooten et al., (1971) studied the immediate effects of smoking cigarettes on the simple reaction time of college male smokers. The subjects were 15 Georgia Southern College males with smoking histories (10 to 30 cigarettes daily) ranging from six months to 5 years. During each experimental session, the subjects were given 20 trials to measure simple reaction time prior to smoking. Each subject then smoked one cigarette and was instructed to inhale each puff. Another 20 trials were given immediately after smoking and again 5 minutes, 25 minutes, 40 minutes, and 55 minutes afterwards. The results indicated that the mean reaction time immediately following cigarete smoking was significantly slower ($p < .05$) than on all other test intervals. The test-retest reliabilities after smoking were lower (.50 to .78) than those under the control condition (.67 to .84). Cigarette smoking impedes simple reaction time for a short period. They concluded that smoking immediately before performing a motor skill requiring quick reaction would probably reduce the performance level.

Ferguson tested 20 white varsity track athletes from Oklahoma State University and black varsity track athletes from Langston University. He compared them in reaction time, movement time and time in the 60 yard dash. The black athletes demostrated faster reaction and movement times; but when these data were subjected to statistical analysis, they did not reveal signifficant differences between the black and white athletes (Singer, 1972)

Bucher (1979) reported that alcohol depressed the central nervous system. It facts that the higher brain centers is lost, reaction time is slowed, and physical and emotional pain are reacted to more slowly.

Body Composition

Physical fitnes includes not only motor and cardiovascular fitness but may also reflect the degree to which an individual is free of disease or symptoms that may indicate a pending health problem. One such problem reaching serious levels in our affluent, sedentary society is obesity. Mayer (1968) found that an increased level of obesity is positively related to morality rates and is also one of the underliying conditions of most aspects of heart disease, including hypertension, atherosclerosis, and hypercholesterolemia. Thus physical educators must be able to estimate participants' obesity levels in order to counsel individuals into taking appropriate remedial action.

It must be emphasized that in many cases height-weight tables do not provide an accurate estimate of obesity. This is because an overweight individual is not necessarily obese. Football players and lumberjacks are generally much taller and heavier than the "average" values found on age-weight tables, but they are not obese. In fact, in most cases they are quite lean and have desirable body compositions with lean-to-fat rations. In other words, only a small percentage of their body weight is fat. Hence estimates of percent body fat are more accurate and appropriate indicators of obesity than height-weight tables (Kirkendall et al., 1987).

Differences in performance between the male and female can be partially explained by the greater percentage of fat contained in the female body. Body weight of the adult male averages 15 percent fat. While the female contains about 23 per cent fat. Fat cells do not manufactura ATP for use by the muscles; their primary purpose is to store lipids. Consequently, the greater percentage of fat is detrimental (performance-wise) in two ways: (1) the cells do not contribute toward energy production, and (2) it costs energy to move the fat. For example, a girl weighing 60 kilograms would possess approximately 13.8 kilograms of fat, while the male of the same weight would possess 9 kilograms of fat. During performance, the female would be carriying 4.8 kilograms more of non-energy-producing tissue than her male contemporary.

Health problems associated with obesity are far reaching. Respiratory problems are quite common along the obese. They have difficulty in normal breathing, a greater incidence of respiratory infection, and a lower exercise tolerance. Lethargy, associated with increased levels of carbon dioxide in the blood, polyenthymia (increased red blood cell production) because of lowered arterial blood oxygenation, are commonly found in obese persons. These can lead to blood clothing (thrombosis), enlargement of the heart, and congestive heart failure. Hypertension and atherosclerosis have also been linked to obese individuals, as have metabolic and endocrine disorders, such as impaired carbohydrate metabolism and diabetes. Obesity has also been associated with an increased risk of gallbladder disease, digestive diseases, and nephritis. More importantly, the mortality rate of the obese is substantially higher than for people of normal weight (Pollock et al., 1978).

Obesity is defined as the condition where the individual is 20 to 30 percent overfat. That is, one's total fat weight greatly exceeds considered normal for the body weight. Normally, the fat weight is expressed as a pertentage fo the individual's total body weight (Kanungsukkasem, 1983) According to Pollock et al., (1978) the upper limit of ideal weight for men would include no more than 16 to 19 percent fat and for women, 22 to 25 percent fat.

The causes of obesity are many and are ofen quite complex. Pollock et al., (1978) stated that obesity has been linked with genetic factors, physiological and physiological trauma. Hormonal imbalances, emotional trauma (anxiety and depression) and alterations in various mechanism that regulate or control body stability have all been shown to be eithr directly or indirectly related to the onset of obesity. Environmental factors such as cultural habits, inadequate physical activity, and improrer diets have also been shown to contribute to the problem of obesity and probably constitue the primary cause for the majority of obese population.

In an excellent review on "Economics and Fatness," Garn and Clark (1974) have shown that "the poorer are fatter and the richer the leaner...", and noted that "female outer fatness can be notable". In seeking an explanation they concluded that dietary quality can not be the explanation for fatness in females and leanness in males. Other aspects of poverty and affluence must be explored to provide the answers.

The contribution of socio-economic factors to the development of body fat was further demostrated by Ashcroft et al., (1966). They found that in rural areas Jamaican men lost 4.5 kg of body weight from age 25 to 55, and women gained only 0.5 kg over the same period. However, in an urban environment, the men gained 2.7 kg and the women 8.2 kg. An equally dramatic example was provided by Evans and Prior (1969), also compared body eights and weight/height indices for Polinesians living at subsistence (coconut, toro and fish) on Pukapuka with the town dwellers of Rarotonga (who were eating mainly Europan-type food). On Pukapuka, the men gained 2.9 kg. from 25 to 65 years, and the women lost 0.99 kg. However, on Rarotonga, the men gained 4.67 kg. and the women 14.47 kg.

The general procedures used to evaluate body composition are: 1) direct, and 2) indirect. Direct technique requires the injection of chemicals that are selectively observed by different body compartments. Indirect technique is presented thre following procedures for assessing body composition. The first describes the application of Archimedes´ principle to underwater eighing. With this method, percent body fat is computed from body density. The other procedures involve the prediction of body fat from skinfold and girth measurements.

The best procedure is to use an underwater weighing technique to determine body density and to calculate percent body fat. However, this approach is not practical for mass testing and requires extensive equipment. Several approaches use antropometric measurements, body circumferences, or skinfold measurements that predict percentage of fat in the body. The most common method involves measuring the body fat thikcness using skinfold calipers.

Considerable data are available concerning the average body composition of various groups of men and women for different ages and fitnes levels. The best that can be done is to present the mean values of body fat young and older men and women. It is evident from the mean values that with increasing age body fat increases in both sexes. A more sedentary life style and concomitant reduction in the level of daily physical activity would also cause the relative increase in body fat. Studies have shown that percent body fat values fo young men ranged from 10.3 to 15.2 (McArdle et al., 1981).

Exercise training will normalize the relationship between mean body mass and fat. When a reducing diet plus exercise programming work together, you lose not only weight, but flabby fat, and can achieve todays ideal of firm, healty good looks (Zohman, 1974). According to Cureton (1969) physical fitness depends upon the increase in circulatory respiratory capacity, strenght and reduction of fat consistent programs of exersize over long periods of time and for all of life seem to be a much sounder aproach than periods of dieting alone without exercise.

Mathews and Fox (1976) explained that in swimming the performance of women is closer to that of men than in running. In swimming, sex differences in body composition tend to be advantageous to the female, whereas in running, the men have the advantage. In water, the greater body fat of the female leads to less body drag, which in turn, leads to less energy expenditure per unit of distance swim. In other words, women swimming over the same distance as men require 20 percent less energy per unit body weight. However in running, the extra body fat of the female becomes a burden of the fact that it increases the work load. It is analogous to running while carrying a backpack full of bricks.

Fat is an essential nutrient and one third of the total caloric intake each day is made up from fats. It is seen that under resting conditions about two thirds of the good fuel is ocnributed by fats (Zohman, 1974).

In Turkey, there was a few study conducted about body fat of Turkish population. Açıkada (1982) examined 20-23 yeras age group who were athletes-males and females, and nonathlates-males and females. Males athletes and nonathletes had less mean value of percent body fat (mean= 9.1; 13.45) than female athletes and non athletes (mean= 19.34; 20.1). Then, Kandeydi and Ergen (1982) investigated physiological and functional comparison of physical education and medical students at the ages of 19-23. The results were 10.47 percent body fat for physical education students and 13.40 percent body fat for medical students. In addition, Doğu (1983) who tested 18 to 25 year old Turkish males through skinfold method in order to establish an equation to predict percent body fat. The results indicated that mean body fat value was 14.06 percent. Zorba (1986) also measured 18-25 years old Turkish males using Doğu`s technique. The mean body fat result was found as 11.7. Moreover, Yamaner (1987) and Ziyagil (1989) were also studied fitness variables of Turkish professional soccer players. Two researchers found slightly different values on body fat percent. The former mean was 6.75 and the latter mean was 7.03 percent of body fat.

Grip Strength

In a rewiev of the literature the area of strength was often studied and clearly defined. Cureton (1951) descibed strength as a complex human quality involving will power, the number of muscle fibers that can be brought into the act, and the nutritive state of the muscle involved, all developed into coordinated effort against the particular strength; speed and endurance are not primary considerations.

Rogers (1934) made some very positive statements about the relationship between strength tests of maximum effort and various aspects of physical fitness. For instances; the positive and very high relation of strength to general health, physical fitness, or capacity for activity can hardly be questioned. With no strength there can be no physical activity; moreover, when muscular strength is low, all other life functions are handicapped. One can hardly see as much, hear as much, meet as persons, or contribute as much to social life when one in continually fatiqued by the most necessary activities of life-eating, digestion, attention to environment, and the physical movements incident upon travel from one group of surrounding to another. Practically every change in the condition or functioning of the vital organs has a corresponding change in thecondition or functioning of voluntary muscles. It is prime function of respiration, circulation, digestion, elimination and even celebration, to maintain the effectiveness of muscle as means of locomotion and manipulation.

McCloy (1938) supported this position with a slightly different viewpoint: Each individual is required to carry or support his bodily weight from morning to night. He must do this with the musculatura he has. It is known that a muscle that is too weak for its task works at a lower efficiency than does one that is adequately developed. Hence, an individual who is markedly underdeveloped is working inefficiently, so far as his muscles are concerned, and is suffering greater fatique, both locally and generally. He has less energy with which to approach his tasks, suffers more from fatique toxemia, and works under a greater nervous strain. Hence, in addition to its indications as to general medical condition, the strength tests in the form of physical fitness index tell much about the individual`s general fitness for living and working.

The grip tests when properly administered indicate the maximal voluntary force an individual can exert with the finger flexor. It is a simple measure of human strength, highly reliable and related to physical fitness and other motor traits. It is also closely associated with biological growth (Jones, 1949).

Bookwalter (1950) stated that grip strength is one of the most reliable dynamometrical measures of human strength. It is a relatively economical measure, is easily administered and is a direct measure of applied force. Accordingly, grip strength is a likely component of strength batteries, a strength item in a "fitness" battery, or single item reasonably representative of total body strength.

Mosher and Care (1982) assessed the physical fitness level of students. They also measured grip strength of the students at the grade 11. Female students grip strength mean was 53.1 kg; standart deviation was 5.6 kg. Male students mean grip strength was 53.1 kg; standart deviation was 8.4 kg. As a results, the students at the grade 11 level exceeded the mid-point of the acceptable range.

Thomas and Reilly (1979) investigated physical levels of English League Soccer Players throughout the competitive season, (for 37 weeks). Measurements were done at the beginning of the seasons, at the mid seasons and the at the end of the season. Right mean grip strength was 49.1, 47.8, 47 kg; left grip mean strength was 47.7, 47.2, 45.6 kg during the mentioned above respectively. Results showed that slightly increases have been reported during the seasons.

Hayden et al., (1986) measured the grip strength of 31 women and 9 men. These participants averaged 35.9 years of age. Their grip strength measured before and after an aerobic fitness program. The fitness program for life provided a variety of repetitive isorythmic activities (e.g., running, dancing, etc.) through participation in 12 weeks of classes which met three times weekly. Each 60 minutes class opened with warm-up activities, moved through more vigorous exercises for 20 to 35 minutes, and ended with a warm down phase. The average grip strength was found 29.5 kg before aerobic program, and 34.4 kg after the aerobic program.

McArdle et al., (1983) investigated the right and left grip strength of seven male and four female. All subjects were selected that they were involved in personal conditioning programs and exercised on a regular basis. Men`s average age was 25.9 kg; women`s average age was 22.5 kg. Their average right grip strength was found 45.3 kg; left grip strength was found 39.5 kg.

Clarke (1986) analysed both males and females. The average ages were 26 and 26.5 years for 14 males and 15 females respectively. All were physically active. The pattern of fatigue resulting from systematically variying the intercontraction rest interval was examined in the subjects employing a hand grip fatigue exercise of 5 min duration. The contraction was maintained for 3 second, and the rest interval varied between 1,2,3 and 4 second, the order randomly assigned each subject. The results showed that no significant differences existed in initial maximum grip strength for either males or females over the four testing conditions, the female subjects (24 kg) were significantly lower than males (39 kg) in initial grip strength.

No significant differences were found between the grip strength of the Indian and Anglo-Saxon students` grip strength was 47 kg, Indian students grip strength was 46 kg. But, Heyward et al., (1986) concluded that gender differences in upper and lower body strenght are function of differences in lean body weight and distiribution of muscle and subcutaneous fat in the body segments.

Flexibility

Flexibility may be defined as the functional capacity of the joint to move through a full range of movement. It is usually interpreted as the range of motion of a paticular joint, measured in degrees. Flexibility is a highly specific quality; full range of motion in one joint is no indication of the status of other joints of the body. Extensibility of the soft tissue, ligaments and especially of the muscle and the anatomical structure of the joint help to determine the degree of the flexibility. Cureton (1965) reported that good flexibility was a concomitant of gradual and through body conditioning. It is raugh indication of physiological youthfulness, an important characteristic of tissue and healthy blood vessels.

Falls et al., (1980) described flexibility as one of the components of health-related fitness. In the physical education and sport context, flexibility refers to the degree to which a joint may move through its maximal possible normal range of motion. The determining factor in joint range of motion is the extensibility of the associated connective tissue in and around the joint (tendons and ligaments). Any restriction in the normal extensibility of a joint`s connective tissue defines a flexibility problem.

Good back flexibility is one indication that a person has no serious impairment of the joints and tissues involved. Maurice et al., (1976) indicated that the habitual exerciser had a small decrease in trunk flexion and an improvement in trunk extension, whereas the non-exerciser had deterioration in both trunk flexion and extension. They further indicated that one of the principal reasons why tension builds and is reflected in low back pain is that members of the civilized society are constantly prevented from expressing the natural response to innatural strains on their systems. This failure to respond by physical outlets prevent the underexercised muscles from getting rid of their tension and chronic complaints, such as low back pain ensue.

Flexibility can be affected by many factors such as; (1) activity, (2) sex, (3) age, (4) temperature (5) ischemia.

Activity

It has been found by McCue (1953) that active individuals tend to be more flexible than inactive individual. This is in accord with well-known fact that connective tissues tend to shorten when they are maintained in a shortened position.

Sex

The results of two investigations agree that among elementary school age children girls are superior to boys in flexibility (Kirchnes and Glines, 1957 and Philips, 1955). It is likely that this difference exists at all ages and throughout adult life.

Age

The results of many tests indicated that elementary school age children become less flexible as they grow older, reaching a low point in flexibility between 10 and 12 years of age (Buxton, 1957). Fron this age upward flexibility seems to improve toward young adulthood, but it never again achieves the levels of early childhood. Dynamic flexibility apparently grows steadily poorer from childhood on with inceasing age, (Wright and Johns, 1960).

Temperature

Wear (1963) investigated the relationship between dynamic flexibility and temperatures and concluded that dynamic flexibility is improved 20 percent by local warming of a joint to 113° F, and it is decreased 10 to 20 percent by cooling to 65° F. Devries (1980) indicated that static flexibility is probably similarly affected by temperature changes.

Ischemia

According to Wright and Johns (1960), dynamic flexibility is markedly reduced by arterial occlusion for 15 minutes. The physiology underlying this phenomena has not been elucidated, but it would appear to have important implications for the study of joint disease.

There is some controversy concerning the effect of body build on flexibility. Wear (1963) found that the Sit and Reach test was significantly related to excess trunk plus arm length over leg length. The relationship of trunk plus arm length to leg length in the ability to perform the Toe Touch Test has been studied by Broer and Galles (1968). The results indicated a relationship of reach length to leg length is not an important factor in performance of this test for person with average body builds. It was indicated, however, that persons with extreme body builds, a longer trunk plus longer arm measurement in relation to shorter legs would have an advantage in theperformance of the Toe Touch Test. It might be concluded from this study that filexibility scores could be affected by irregular body proportion.

As far as the author could find in the literature, there has been only one study from the Indonesian population that reported the results of the Sit and Reach Test. It seemed fitting to examine this study.

Toda et al., (1970) studied the physical fitness of inhabitants in Surabaja, Indenosia. The Sit and Reach Test was one of the fitness variables which was investigated. The total number of subjects were 750 persons, 379 of whom were male, 371 were female and about 12 percent of them were children. For males between the age group of 20 and 24 years old, The mean of the Sit and Reach Test was 10.9 inches with standart deviation of 5.5 and for females in the same group, mean of the Sit and Reach Test was 9.6 inches with standart deviation of 5.49. In that study, the authors also compared the results of Indenosian with the Japanese norm. The comparision showed that means and standart deviation of the Sit and Reach Test for male and female Japanese between the age group of 20 and 24 years old was 14.9 inches with standart deviation of 5.62, and 15.5 inches with standart deviation of 4.84. These results were higher than Indenosian`s results in both sexes.

Anaerobic Power

All-out exercise for up to 2 minutes duration is prowed mainly by the immediate and shor-term energy systems. Both systems operate anaerobically because their transfer of chemical energy does not require molecular oxygen. Generally, there is greater reliance on anaerobic energy for fast movement or when there is resistance to movement at given speed. At the initiation of movement performed at high or low speed, the stored phosphates, ATP and CP provide immediate energy for muscle contraction. After the first few seconds of movement an increasingly greater proportion of energy is generated by the short-term energy transfer reactions of glycolysis. As exercise continues a greater demand is then placed on the aerobic metabolic pathways for purpose of ATP resynthesis (McArdle et al., 1981).

Performance tests that apparently cause maximal activation of the ATP-CP energy system have been devoloped to provide practical "field test" to evaluate the capacity of this immediate means for energy transfer (Karlsson and Saltin, 1970). These tests are generally referred to as power tests; power in this context is defined as the time-rate of doing work, or work accomplished per unit of time.

One of the anaerobic power tests and/or strength tests is Vertical Jump Test. The purpose of this test is to estimate the explosive isotonic strength of the extensor muscle of the legs and feet. A reliability coefficient of 0.90 on test-retest was reported by Fleisman (1964).

Anaerobic power and capacity were more highly correlated with the vertical jump and long jump than with the dash and run times. Correlations with the dash and run were strengthened when power and capacity were expressed relative to body weight than with age (Tharp et al., 1985).

Ramadan and Byrd (1987) reported that anaerobic power of soccer players has been measured at 116, 106 and 103 kgm/sec, in young amateurs, college players, and young nationals. All of these values appaer intermediate in comparison with other groups of athletes, falling between extremes of 147 kgm/sec for American college football players and 97 kgm/sec for marathon runners. They also measured anaerobic power of the 18 members of the 1982 Kuwaiti World Cup Soccer Team. The mean anaerobic power was found 119.6 kgm/sec.

Kaczkowsi et al., (1982) found that both the percentage of fast twich (FT) fibers and the relative FT fiber area correlated significantly with the maximal anaerobic power. Kaczkowski et al tested nine active subjects between the ages of 19 and 21 years maximal anaerobic power and capacity were assessed using Wingate Anaerobic Test. The maximal anaerobic power was found as 918 watt.

Beckenholdt and Mayhew (1983) measured physical characteristics of the fifty male athletes (average age:20 years). They represented the following five athletic teams; football, soccer, baseball, basketball and wrestling. Their anaerobic power scores were 147, 106, 127, 134, 122, 128 kgm/sec. respectively.

Astrand (1986) reported that smoking impair the performance. If the current trends continue, even athletes participating in events primarily requiring skill will be required to undergo strenous physical training which taxes the oxygen-transporting systems to a considerable degree. In addition Astrand and Rodahl (1986) represented valuable information about the effect of alcohol on the ability to perform one activity of 9,400 joule and another of 96,700 joule as fast as possible. The first type of activity could be performed in 12 to 15 second, simulating a 100 meter sprint in its effect on the organism, whereas the latter, lasting about 5 min simulated a 1,500 meters run. A blood concenration of alcohol of up to 100 mg percent did not significantly affect the ability to perform this kind of maximal exercise.

Aerobic Power

Maximum oxygen uptake (aerobic power) is the largest amount of oxygen that one can utilize under the most strenuous exercise. Because maximum oxygen uptake generally summarizes what is going on in the oxygen transport system (including cellular utilization) during maximum or exhaustive exercise and can be measured rather easily, it has been used as the measurement of most representative of cardiorespiratory fitness. The investigators concluded that the distance covered during the 12 minute run-walk was highly reliable and valid indicator of cardiorespiratory fitness and maximum oxygen uptake correlated .90 with the 12-minute run-walk (Verducci, 1980). Aerobic capacity is expressed in millimeters of oxygen per kg of body weight per minute (ml/kg/min). Because a large person generally has more muscle mass, and thus the capability of burning more oxygen.

Cooper (1968) tested 115 United States Air Force male officers and airmen on a 12-minute run and on a maximum oxygen uptake test. The correlation of the run with the oxygen uptake test data was .897. Cooper indicated that the significance of this relationship makes it possible to estimate with accuracy the maximum oxygen uptake from the 12-minute performance test.

Doolittle and Bigbee (1968) investigated the distance covered in 12 minutes as an indicator of cardiorespiratory fitness and compared it with the 600-yard run-walk. A reliability coefficient of .94 was obtained for the 12-minutes run with 153 ninth-grade boys. Nine subjects performed a maximum oxygen uptake test and the 600-yard run-walk test. maximum oxygen uptake correlated .90 with the 12-minute run-walk and .62 with the 600 yard run-walk. The investigator concluded that the distance covered during the 12-minute run-walk was a highly reliable and valid indicator of cardiorespiratory fitness and that it was to be refered to the 600-yard run-walk.

More and more people are accepting the fact that aerobic exercise is essential to a healthy cardiocascular ststem. Some of the benefits of aerobic exercise include the ability to utilize more oxygen during strenuous exercise, a lower heart rate at rest, the production of less lactic acid, and greater endurance. Also, many exercise physiologists have found that it reduces blood pressure and changes blood chemistry. It also improves the efficiency of heart. More evidence is needed to substantiate the belief by some persons that aerobic is responsible for the development of supplemental blood vessels to the heart, which would be helpful in the event of a heart attack, and also that such exercise results in increasing the size of coronary arteries and thus assisting the flow of blood to the heart when the artery is narrowed by a clot or arherosclerosis (Bucher, 1979).

There is for each individual a measurable upper limit of oxygen uptake, which correlates with ability to do work. This depends on body build and composition and is affected by other factors, in thefollowing patten (Morehouse, 1972).

1. Sex; is lower in women.

2. Age; varies inversely with age. The maximum oxygen uptake of the 75-years-old man is only one half that of a 17-years-old youth; yet boy and girls of 13 to 16 do not change maximal oxygen volume by training.

3. Size; varies directly with stature (height) and body surface area.

4. Weight; varies directely with body weight.

5. Lean body mass; maximal oxygen volume correlates .63 with body weight, .85 with fat-free body weight, and .91 with active tissue mass.

6. Bed rest; is reduced 17 % by enforced bed rest

for 3 week.

7. Semistarvation; is reduced 3 % by prolonged semistarvation.

8. Altitude; is reduced 26 % at an altitude of 4000 m.

9. Geography; is lower in resident of temperature or tropical areas than at circumplar regions.

Jousselin et al., (1984) measured the maximal aerobic power of French top level competitors. All subjects (both male and females) tested belonged to national teams (sportwomen mean age: 21 years; sportsmen mean age: 22 years). Results showed that maximal aerobic power is higher in sport activities of longer duration. VO2 max is relatively low for sprinters (52.0 ml/min/kg); higher in middle distance running (71 ml/min/kg); and very high in long distance running (81 ml/min/kg). In addition, highest VO2 max is found in tall subjects; decathlon, modern pentathlon, cyclist, rowing, for men (VO2 max superior to 4.8 L/min) and volleyball, heptathlon, rowing, basketball for women (VO2 max superior to 3.5 L/min). On the contrary, lowest VO2 max is found in small subjects; boxing, sprinting for men (inferior to 4 L/min), table tennis and sprinting for women (VO2 max inferior to 3 L/min). Moreover he found that when the VO2 max per body weight was considered, high and low values oppose sports in which the energy requirement is predominant (as road cyclist, middle and long distance running) to technical sports (as volleyball or sprinting); respectively VO2 max over 70 under 54 ml/min/kg. Joussellin also found same findings for women; sports with high energy requirement show high VO max (middle long distance running: over 60 ml/kg/min) technical sports show lower VO2 max (volleyball, sprinting, table tennis under 53 ml/min/kg).

During maximal exercise with an oxygen uptake of about 3 liters/min and a cardiac output of about 21 liters/min no difference was observed when the results *before and after alcohol consumption were compared.* Maximal heart rate, stroke volume, arteriovenous oxygen difference, and calculated peripheral resistance were also unaffected. During submaximal exercise, on the other hand, the heart rate was on an average of 12 to 14 beats higher per minute in the alcohol experiments. In the latter case the cardiac output was greater while the stroke volume was unaffected. The oxygen uptake during submaximal exercise was slightly higher after alcohol consumption, but arteriovenous difference was nevertheless reduced (i.e., the cardiac output was more elevated than would be expected from the increased oxygen uptake) (Astrand, 1986).

II. METHODS AND PROCEDURES

Selection of Subjects

For this study 35 subjects were randomly selected from 18 to 20 years old male students who were attending the Faculty of Medicine and 35 subjects were randomly selected from 18 to 20 years old male students who were attending the Department of Physical Education and Sports at Selçuk University during the academic years of 1988-89.

The personal data from each subjects concerning subject`s name, age, smoking, alcohol and exercise habits were collected before testing.

Test Administration

The researcher explained the purpose and significance of the study to subjects.They were advised to;

1) dress in shorts and sport shoes,

2) eat only light meals and not to eat at all for at least two hours preceding the test,

3) avoid smoking and drinking coffee and tea 1 hour before testing, and

4) avoid strenous physical activity on the test day.

After preparing laboratory room at the Department of Physical Education and Sports at Selçuk University, the subjects were notified and came to the laboratory room as scheduled.

The sequence of the test was as follows: 1) the collection of data, 2) height and weight measurements, 3) resting heart rate measurements, 4) resting arterial blood pressure measurements, 5) skinfold measurements, 6)reaction time measurements, 7) flexibility measurements, 8) hand grip strength measurements, 9) vertical jump tests, 10) 12 minutes run tests (aerobic power).

Measurement of Height and Weight

Equipment:

Height and weight scale

Procedure:

Height and weight were measured by a scale. The scale was checked for accuracy with a normal weight and readjusted before each measurement. The subject were asked to wear minimum clothing on (T-shirt and short). Weight was measured to the last completed 0.1 of a kilogram and height was measured to the last completed centimeters. The subjects had to stand as erect as possible with their eyes looking straight ahead during height measurement.

Measurement of Resting Heart Rate

Equipment:

1. Stethoscope
2. Watch or clock with sweep second hand (stopwatch).

Procedure:

Resting heart rate was recorded while the subject was sitting on a bench. The stethoscope was placed on the third intercostal space on the left side of the sternum and heart beats were counted for one minute and then the result was recorded.

Measurement of Resting Arterial Blood Pressure

Equipment:

1. Stethoscope
2. Sphygmomanometer

Procedure:

Resting blood pressure was measured while the subject was in a sitting possition.

1) The deflated cuff was wrapped around the left arm at the heart level.

2) Stethoscope was placed below the crease of the elbow over the brachial artery.

3) The pressure cuff was inflated up to 180 mmHg during rest.

4) The pressure was released slowly at a rate of two to three mmHg per second.

5) As the pressure fell, the researcher listened for the first thumping sound through the stethoscope when the first sound was heard, the manometer was read and this reading was the systolic blood pressure.

6) Researcher continued to deflate the cuff slowly. When

the sound disappeared, he took another reading and this reading was the diastolic blood pressure.

Skinfold Measurements

Equipment:

1. Skinfold caliper

Procedure:

The skinfold was grasped two thicknesses of skin and subcutaneous fat between thumb and index finger. The caliper jaws were compressed the skinfold which was pulled from the underlying tissues. The measurement was recorded within 3 to 5 seconds after the pressure of the jaws were applied.

The right side of the body was used when the skinfold measurements were taken. The subject was standing erect.

The anatomical landmark for selected skinfold sites were:

Abdominal Skinfold: Horizontal fold adjacent to the umbilicus.

Thigh Skinfold: Vertical fold on the anterior portion of the thigh midway between the hip and knee joints

Percent body fat was determined by using the equation of Doğu (1983) which was developed to predict the percent body fat of 18 to 25 years old Turkish males.

$$\% \text{ Body Fat} = 2.662566 * .5819738 X1 + .2770687 X2$$

Where: X1= Abdominal skinfold measurement

X2= Thigh skinfold measurement

Measurement of Reaction Time

Equipment:

1. Reaction timer

Procedure:

The reaction timer consisted of an electronic circuit with two switches, one to was operated by researcher and the other by the subject. When the test was started, the researcher was close his switch. This were immediatelly start a timing device and give the required stimulus to the subjects. The stimulus were be auditory by means of a buzzer and visual by means of an electric bulb. When the subjects hears and-or sees the stimuli, he were stop device as quickly as possible. This were repeated 10 times and the average of the last 5 trial were recorded. Extreme values were eliminated.

Measurement of Flexibility

Equipment:

1. Sit and Reach measuring instrument.

Procedure:

The subject sat on the floor with the legs extended and reach as far forward as possible. The subject sat with knees extended, feet about shoulder width apart and against the box. Subject bent the trunk forward and downward and moved the hands, palmsdown, as far as possible. Subject reached with both hands and held this possition. The scores were recorded in centimeters, and were determined by the location of the fingertips.

Measurement of Grip Strength

Equipment:

1. Handgrip dynamoneter.

Procedure:

Grip strength was measured while the subject was standing erect and loking straight forward, the arm at the side slightly away from the body. The subject held the dynamometer with width of the palm on the base of the fingers. The dynamometer was tightened once, sharply and as hard as possible without moving the arm. The score was read from the scale on the dynamometer which registers the score recorded as a kilograms. This procedures were applied five times for left hand and right hand.

Measurement of Anaerobic Power

Equipment:

1. The jump board and magnessium.

Procedure:

The vertical jump test was used to determine explosive leg power. Anaerobic power was measured while the subject stood straight close the board, with one foot in front of the other. The index finger of both hands were chalked with magnessium. The subject reached as high as possible with heels kept on the floor and made a mark on the board with his chalked fingers. Then he executed three jumps from a crouched position, making a mark each time on the board. The distance between the top of the reached point and the top of the highest point jumped was recorded as score. In order to determine subject`s leg power the Lewis nomogram was used (Fox et al., 1988).

Measurement of Aerobic Power

Equipment:

1. Stopwatch
2. Running Track

Procedure:

Maximum aerobic power was estimated by using Cooper`s 12 minutes run test. The 12 min. run test was performed at the 400 meters athletic track of Atatürk Spor Center in Konya. The intention of the 12 minutes run test was to run the longest possible distance in exactly 12 minutes.

The subjects were notified of the time as they passed the start line during running. Subjects immediatelly stopped after exactly 12 minutes, by the test administrators whistle. Maximum oxygen uptake was computed by the following equation of The American College of Sports Medicine (1975).

VO2(ml/kg/min)=Speed (m/min) * 0.2 ml/kg.min+3.5(ml/kg/min)

Statistical Analysis of Data

T-test was used to compare the selected physical fitness values of the Physical Education and Sports` male students with the Faculty of Medicine male students. The 0.05 confidence level was accepted to test the significance of the study.

IV. RESULTS AND DISCUSSION

35 of 42 male students who were attending the department of physical education and sport and 35 of 45 male students who were attending the faculty of medicine at Selcuk University during the academic year of 1988-89, participated in this study to measure and compare of selected physical fitness components. The students who participated were 18 to 20 years old. Subjects were divided into two groups according to their department in school. The purpose was to examine differences among groups, from physical fitness components stanpoint which were: Weight and height, resting systolic and diastolic blood pressure, reaction time of hand light, reaction time of hand sound, reaction time of foot light, reaction time of foot sound, right and left hand grip strength, flexibility, anaerobic power (vertical jump), aerobic power (max VO2), resting heart rate and percent body fat.

Table 1 shows the mean and standart deviation (SD) of physical fitness variables of both male students who were attending the physical education and sport and the faculty of medicine at Selcuk Universty during the academic year of 1988-89.

Table I

Physiological Characteristics of the Department of Physical Education and Sports Students and the Faculty of Medicine Students

Variables	Physical Education Students N	Mean	SD	Medical Faculty Students N	Mean	SD
Age (years)	35	19.2	± 1.36	35	19.1	± 1.4
Height (cm)	35	175.08	± 4.36	35	168.88	± 5.44
Weight (kg)	35	68.94	± 8.71	35	66.81	± 7.14
Rest. Sis.Blood Pres: (mmHg)	35	118.0	± 17.1	35	126.1	± 14.8
Rest.Dias.Blood Pres: (mmHg)	35	82.3	± 10.9	35	79.5	± 10.3
Reac.Time Hand Light: (second)	35	.1858	± .32	35	.2279	± .374
Reac.Time Hand Sound: (second)	35	.2059	± .251	35	.226	± .327
Reac.Time Foot Light: (second)	35	.22	± .239	35	.221	± .335
Reac.Time Foot Sound: (second)	35	.237	± .278	35	.253	± .313
Hand Grip Str. Right: (kg)	35	33.34	± 7.31	35	29.14	± 4.11
Hand Grip Str. Left (kg)	35	32.13	± 7.41	35	28.20	± 3.90
Flexibility (cm)	35	32.88	± 6.10	35	31.78	± 6.73
Anaerobic Power (kg.m.sec)	35	108.20	±13.55	35	84.71	±11.46
Aerobic Power Max VO2 (ml/kg/min)	35	43.66	± 5.38	35	40.84	± 4.06
Resting Heart Rate (beats per min)	35	68.65	± 4.88	35	86.14	±12.60
Percent Body Fat (%)	35	11.64	± 3.00	35	15.67	± 4.97

$P<0.05$

Height and Weight

Mean, standart deviation (SD) and t table values of height and weight of the male students from the department of physical education and sport (PES) and the faculty of medicine (MF) at Selcuk University are presented in table II.

Table II

Comparision of Height and Weight of Physical Education and Sport Students (PES) and Medical Faculty Students (MF)

	PES Students			MF Students			
Variables	N	Mean	SD	N	Mean	SD	t table
Height	35	175.08	± 4.36	35	168.88	± 5.44	5.25*
Weight	35	68.94	± 8.14	35	66.81	± 7.14	1.16

* Significant ($P < 0.05$) differences

The results showed that physical education and sport students had higher mean height values than medical faculty students 175.88 ± 4.36 and 168.88 ± 5.44 respectively. In addition, analysis of t test revealed that there were significant differences in weight between the male students of PES and the male students of MF (t=5.25) at 0.05 confidence level.

The results also showed that PES students had higher body height than MF students (68.94>66.81). But both scores were found to be very close to eachother. Therefore, there were no significant differences in weight between the male students of PES and the male students of MF (t=1.16) at 0.05 confidence level.

According to the data from the United States Public Health Service and Nutrition Examination Survey, (McArdle et al., 1981) the average height and weight for 18-24 years old males were 185 cm. and 85 kg. respectively.

Kandeydi and Ergen presented data about height and weight values of physical education male students. They had mean weight of 71 kg and mean height of 179 cm. which was slightly higher than the PES students of this study.

Bucher (1979) reported that students who do not smoke grow more in height and weight. Moreover, nutrition, environmental factors and genetics factors are the determinant of growth (Kanungsukkassem, 1983).

Blood Pressure

Means and standart deviations of resting systolic and diastolic blood pressures values of male students of both the department of physical education and sport (PES) and the medical faculty (MF) are shown in table III.

Table 3 exposes that the medical faculty students had higher resting systolic blood pressure than the department of physical education and sport students had (126.1 mmHg>110.8 mmHG). Therefore, the significant differences in resting systolic blood pressure was found between the male students of medical faculty and the male students of department of physical education and sport students (t= -4.012) at 0.05 confidence level. On the other hand, the department of physical education and sport male students had higher resting diastolic blood pressure than the medical faculty male students had (82.3 mmHg > 79.5 mmHg). Besides, there was significant differences in resting diastolic blood pressure between the male students of department of physical education and sport and the male students of the medical faculty (t=1.113) at confidence level of 0.05.

Table III
Resting Systolic and Diastolic Blood Pressure Peculiarities of PES Students and MF Students

PES Students					
Rest. Syst. Blood Pressure:			Rest.: Diastolic Blood Pressure		
N	Mean	SD	N	Mean	SD
35	110.8	17.11	35	82.3	10.9
MF Students					
N	Mean	SD	N	Mean	
35	126.1	14.8	35	79.5	10.3
t= -4.012 *		(* Significant P<0.05)	t= 1.113 *		

It may be caused by subject`s cigarette smoking level. Appendix B shows that 37% of PES students smoked cigarette persons. Whereas, 57% of Medical Faculty students smoked cigarette (see Appendix C).

Hirsch et al., (1985) reported that smoking cigarette constricts the blood vessels and may raise blood pressure. Consequently, the resting systolic and diastolic blood pressures increase with increasing the number of the smoking cigarette.

In addition, blood pressures might also be affected by exercise levels because Appendix B and C show that the department of physical education and sports male students were attending the exercises more than the faculty of medicine male students (97% and 51% respectively). According to Stone et al., (1983) and Bandyopadhyay (1984) dealing with such exercise activites decrease blood pressure.

Bandyopadhyay (1984) measured systolic and diastolic blood pressures of two groups of studendts (Group 1) they participated in endurance activities was called endurance group; Group 2 they participated speed activities was called speed group) from department of physical education at Kalyani University in India. Mean resting systolic and diastolic blood pressures were 121.1 and 74.1 mm Hg for endurance group; 114.6 and 65.4 for speed group. When two major students are compared the results showed that PES students of Selçuk University had slightly lower SBP, but slightly higher DBP values.

Reaction Time

Table IV shows the mean and standart deviaions of reaction times of the male students of the department of physical education and sport and the male students of the faculty of medicine.

TABLE IV

Mean and Standart Deviations of Reaction Times of Male Students of PES and Male Students of MF

PES Students N	PES Students Mean	PES Students SD	MF Students N	MF Students Mean	MF Students SD
Reaction Time Visual Hand (sec)					
35	0.1858	0.03	35	0.2279	0.03
t=-5.05* (* Significant P<0.05)					
Reaction Time Auditory Hand (sec)					
35	0.205	0.02	35	0.226	0.03
t=-2.88* (* Significant P<0.05)					
Reaction Time Visual Foot (sec)					
35	0.22	0.02	35	0.25	0.03
t=-4.43* (* Significant P<0.05)					
Reaction Time Auditory Foot (sec)					
35	0.23	0.02	35	0.25	0.03
t=-2.38* (* Significant P<0.05)					

The results showed that the male students of the department of physical education and sports (PES) hand reaction time against light was .186 sec. The male students of the medical faculty (MF) students` hand reaction time against the light was .2279 sec. MF male students` hand reaction time against light was slower than the male students of PES had (.18<.22). When the results were compared with eachother there were significant differences between the male students of the faculty of medicine and the department of physical education and sports in the hand reaction time against the light (t= -5.05 *) at 0.05 confidence level. In the hand reaction time against the sound, the department of physical education and sports male students had shorter reaction time than the male students of the medical faculty (.20<.22). In addition, there were significant differences between the male students of PES and the male students of MF (t= -2.88 *) at confidence level of 0.05 in the hand reaction time against the sound. Table IV also shows that in the reaction time of foot against light, the male students of department of physical education and sport were faster than the male students of medical faculty (.22<.25). Therefore, the significant differences between the male students of PES and the male students of MF were found in the foot reaction time against the light (t= -4.43) at 0.05 confidence level. Table V indicates that the male students of the faculty of medicine had slower foot reaction time against the sound than the male students of department of physical education and sport (.253>.237). Because of this there were significant differences between the male students of MF and the male students of PES in the foot reaction time against the sound (t= -2.38) at the confidence level of 0.05. As it would be expected that all reaction times of the department of physical education and sports male students were faster than the male students of faculty of medicine. Singer

(1972) has reported that reactions to auditory stimuli was faster than reactions to visual stimuli.

Cotten et al (1971) reported that cigarette smoking impedes simple reaction time for a short period. Moreover, Talland (1963) reported that alcoholic subjects were more variable as well as slower in reaction time. On the other hand, Astrand (1986) reported that tolerance of alcohol varied greatly from one individual to another.

Consequently, the male students of PES had faster reaction times than the male students of Medical Faculty. This may be the reason of their higher exercise levels. Appendix B and C show that the male students of physical education and sports participated in exercise more than the male students of medical faculty. Tweit et al ., (1963) studied reaction times and exercise level. They concluded that physically active subjects had faster reaction times than inactive subjects. They were also concluded that reaction time was not dependent on muscular strength.

Body Composition

Percent body fat values of male students of physical education and sport (PES) and the male students of medical faculty (MF) were presented in table V.

The male students of physical education and sport had 11.64 percent body fat and standart deviation of 3.00. The male students of medical faculty had 15.67 percent body fat and standart deviation of 4.97.

Table V
Comparision of Percents Body Fat of Male Students of Physical Education (PES) and Male Students of Medical faculty (MF)

	PES Students			MF Students		
	N	Mean	SD	N	Mean	SD
Percent Body Fat	35	11.64	3.00	35	15.67	4.97

t= -4.11 * (* Significant $P<0.05$)

The percent body fat of male students of medical faculty was higher than the percent body fat of male students of physical education and sport (15.67>11.64). Also significant differences between the percent body fat of male students of physical education and sport and the percent body fat of male students of medical faculty was found (t= -4.11 *) at confidence level of 0.05. This differences might be caused by subjects exercise levels. Male students of PES were more active than the male students of MF. Many researhers reported exercise decresase body fat (Bray, 1983; Sinning and Wilson, 1984; Noble, 1986). However, proper diet also important factor together with exercise (Blue Cross Association, 1973). In addition, Doğu (1981) measured 18-25 year old Turkish males, the percent body fat was found as 14.06. Furhermore, Kandeydi and Ergen (1982) compared percent body fat of Turkish male physical education and medical students. Mean percent body fat of physical education students (10.47) was less than that of the medical students (13.4).

Hand Grip Strength

The mean and standart deviation values of hand grip strength of male students of both the department of physical education and sport and the faculty of medicine are listed in table VI.

Table VI
Comparison of Hand Grip Strength of Physical Education and Sport' Male Students and Medical Faculty Male Students

	PES Students			MF Students		
Variables	N	Mean	SD	N	Mean	SD
Hand Grip Strength Right (kg)	35	33.34	7.31	35	29.14	4.11
t= 2.95 * (* Significant P<0.05)						
Hand Grip Strength Left (kg)	35	32.13	7.41	35	28.20	3.90
t= 2.77 * (* Significant P<0.05)						

The results showed that the male students of physical education and sport had higher right hand grip strength (33.34>29.14). The PES students' left hand grip strength was measured 32.13 kg. It was higher than the male students' left hand grip strength of medical faculty (28.20). Also, the significant differences were found in hand grip strength of right between the male students of physical education and sport and the male students of medical faculty (t=2.95 *) at 0.05 confidence level. In addition, there were significant differences between the male students of physical education and sport and the male students of medical faculty in right hand grip strength (t=2.77*) at confidence level of 0.05. It might be caused by their exercise levels. Appendix B and C show that 97 % of the male students of Physical Education and Sport participated in exercises. Whereas, 51 % of the male students of Medical Faculty participated in exercises.

Many researcher reported (McArdle et al., 1983; Clarke, 1986; Hayden et al ., 1986) that grip strength is higly related with strength and exercise. Similar results were also found by Ağaoğlu (1989) in his master thesis.

Flexibility

The mean and standart deviations of flexibility measurement of both male students of physical education and sport and male students of medical faculty are shown in table VII.

Table VII

Comparison of Flexibility of the Male Students of Physical Education and Sport and Male Students of Medical faculty

PES Students			MF Students		
N	Mean	SD	N	Mean	SD
35	32.88 (cm)	6.10	35	31.78 (cm)	6.73
t= 0.58					

Table 25 shows that the male students of physical education and sport were slightly more flexible than the male students of medical faculty (32.88cm.>31.78cm.). But there were no significant differences of flexibility between the male students of physical education and sport and the male students of medical faculty (t=0.58) at 0.05 confidence level.

Anaerobic Power

Anaerobic power of male students of physical education and sport and male students of medical faculty was measured using vertical jump test. Significant differences between the male students of physical education and sport and the male students of medical faculty were found (t=7.82) at confidence level of 0.05 (see table VIII). The male students of physical education and sport had 108.2 kg.m.sec. anaerobic power. The male students of medical faculty had less anaerobic power than phsical education and sport's male students (108.2>84.71).

Table VIII

Comparision of Anaerobic Power of Physical Education and Sport's Male Students and Male Students of Medical faculty

PES Students			MF Students		
N	Mean	SD	N	Mean	SD
35	108.2(kg.m.sec.)	13.55	35	84.7(kg.m.sec)	11.46

t=7.82 * (* Significant $P<0.05$)

This might be caused by subjects' heavies weight and higher lean body weight. It was indicated that the male students of physical education and sport had higher body weight than the male students of medical faculty (see table II). Whereas, the male students of medical faculty were fatter than the male students of physical education and sport (see table VI). Tharp et al., (1984) concluded that the anaerobic power and capacity were found to be significantly correlated with age, weight, lean body weight and body surface area. Tharp et al ., (1985) in another study found that the anaerobic power and capacity were more strongly correlated with weight than with age.

The differences among anaerobic power values caused by the many factors such as: age, weight, lean body weight and body surface area (Tharp et al., 1985 and Kackowski et al., 1982). Assmussen and Boje (1948) concluded that a blood concentration of alcohol up to 100 mg percent did not significantly effect the ability to perform short time maximal effort.

Aerobic Power

Aerobic power (VO2 max) was measured with the twelve minute run test. The male students of physical education and sports had higher mean VO2 max (43.66 ml/kg/min) than the male students of medical faculty (40.84 ml/kg/min). There were significant differences between the male students of physical education and sport and the male students of medical faculty (t=2.47) at 0.05 confidence level.

Table IX shows the male students of PES and male students of MF of aerobic power´s means, and standart deviations.

Table IX

Comparison of Max VO2 of Male Students of Physical Education and Sport and Male Students of Medicine Faculty

PES Students			MF Students		
N	Mean	SD	N	Mean	SD
35	43.66(ml/kg/min)	5.38	35	40.84(ml/kg/min)	4.06

t=2.47 * (* Significant P<0.05)

The differences betwwen the male students of physical education and sport and the male students of Medical Faculty may be caused by subjects smoking cigarette and their exercise levels. Appendix B and C show that the male students of Faculty of Medicine smoked more than the male students of Physical Education and Sport (57 % and 37.1 % respectively). Appendix B and C also show that the male students of Physical Education and Sport were more active than the male students of Medical Faculty (97.1 % and 51 % respectively).

VO2 Max is limited by the capacity of circulatory and respiratory systems to supply oxygen to the working muscles (Morehouse,1972). But those systems are impaired by cigarette smoking (Jones et al., 1970).

Aerobic power was increased with exercise or training (Burket et al., 1985), (Golden and Vaccaro, 1984), (Hunter et al., 1987). In addition, McArdle (1981) reported that exercise or training elevated aerobic power.

Resting Heart Rate

Resting heart rates' mean, standart deviations of male physical education and sports students and that male students of medical faculty, and comparison of them are listed in table X.

Table X

Comparison of Resting Heart Rate of PES Students and Male Students of MF

PES Students			MF Students		
N	Mean	SD	N	Mean	SD
35	68.65 (beats per min)	4.88	35	86.14 (beats per min)	12.6
t=7.64 * (* Significant P<0.05)					

Table X indicates that the resting heart rate of male students of physical education and sport were 68.65 beats per minute. And the resting heart rate of male students of medical faculty was 86.14 beats per minute. Results also indicated that the resting heart rate of male students of medical faculty had higher resting heart rate than male students of physical education and sporteducation and sports (86.14>68.65). Thus the significant differences were found between the male students of physical education and sport and the male students of medical faculty (t=7.64) at 0.05 confidence level. This may be caused by differences found in cigarette smoking and exercise levels of subjects (see Appendix B and C). However, Klafs and Lyon (1978) reported which the nicotine that is inhaled stimulates the secretion of adrenaline and nonadrelanine, resulting in general vasoconstriction, increased heart rate, and increased respiration. In addition, Devries (1972) reported that physically fit and athletically trained individual had lower heart rate.

V. CONCLUSIONS AND RECOMMENDATIONS

The physical fitness components measured in this study reflects the physical fitness status of male students of physical education and sport and the male studenst of medicine faculty, the ages of whom 18 to 20 at Selçuk University during the academic years of 1988-89. Physically fit individuals mat have an optimal level of health, performance and appearence further more they may be protected from some injuries and serious diseases. Therefore, people must possess a good level of physial fitness in order to maintain a healthy life. The male students of physical education and sport have to have higher physical fitness level to achieve skills in physical activity courses in their curriculum than the male students of medicine faculty. As a results, to measure and compare physical characteristics of male students of physical education and sports and male students of medicine faculty provided an idea about their levels.

Because of the high interest on physical fitness state of youth nowadays, the purpose of this study was to measure and compare height, weight, blood pressure, reaction time, percent body fat, grip strength, flexibility, anaerobic power, aerobic power, and resting heart rate of both male students of physical education and sports and male students of medicine faculty who were 18 to

20 ages old.

A total of 70 male students were tested. 35 of whom were from the department of physical education and sport and 35 of whom were from the faculty of medicine at Selçuk University during the academic year of 1988-89.

Conclusions

Within the limit of this study and based on the null-hypothesis stated, the following conclusions were made:

1. The differences in the means of weight were not found statistically significant between the male students of physical education and sport and the male students of medicine faculty at the 0.05 confidence level. ***The null-hypothesis was accepted.***

2. The differences in the means of height were found statistically significant between the male students of physical education and sport and the male students of medicine faculty at confidence level of 0.05. ***The null-hypothesis was rejected.***

3. The differences in the means of resting systolic and diastolic blood pressure were found statistically significant between the male students of physical education and sport and the male students of medicine faculty at 0.05 confidence level. ***The null-hypothesis were rejected.***

4. The differences in the means of visual hand and foot reaction times were found statistically significant between the male students of physical education and sports and the male students of medicine faculty at the 0.05 confidence level. ***The null-hypothesis were rejected.***

5. The differences in the means of auditory hand and foot reaction times were found statistically significant between the male students of physical education and the male students of medicine faculty at the confidence level of 0.05. ***The null-hypothesis were rejected.***

6. The differences in the means of percent body fat were found statistically significant between the male students of physical education and sport and the male students of medicine faculty at 0.05 confidence level. ***The null-hypothesis was rejected.***

7. The differences in the means of right hand grip strength and left hand grip strength were found statistically significant between the male students of physical education and sport and the male students of medicine faculty at 0.05 confidence level. ***The null-hypothesis were rejected.***

8. The differences in the means of flexibility were not found statistically significant between the male students of physical education and sport and the male students of medicine faculty at 0.05 confidence level. ***The null-hypothesis was accepted.***

9. The differences in the means of anaerobic power were found statistically significant between the male students of physical education and sport and the male students of medicine faculty at 0.05 confidence level. ***The null-hypothesis was rejected.***

10. The differences in the means of resting heart rate were found statistically significant between the male students of physical education and sport and the male students of medicine faculty at 0.05 confidence level. ***The null-hypothesis was rejected.***

11. The differences in the means of aerobic power were found statistically significant between the male students of physical education and sport and the male students of medicine faculty at 0.05 confidence level. ***The null-hypothesis was rejected.***

12. The mean VO2 max values of the students of physical education and sports was 43.66 ml/kg/min. This value was good according to the Cooper`s fitness classification (see Appendix D).

13. The mean VO2 max values of the students of medicine faculty was 40.84 ml/kg/min. This value was fair according to the Cooper`s fitness clasification (see Appendix D).

RECOMMENDATIONS

1. More studies need to be done on students using the same test procedures. This will give reseachers great chance to compare the university students in Turkey.

2. Large numbers of students should be included in the study rather than limiting the study with small numbers of students.

3. In Turkey, the same studies should be used to determine the physiological capacities and characteristics of university students with effect of environmental change and the effects of different habits such as nutrition, life sytle etc.

4. Longitudinal study shoul be done on the same students while attending university.

5. Different department and faculty's students should be included in the study.

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APPENDIX A

THE PERSONAL DATA

1. Surname and Name .... Date.........
2. Date of Birth ....
3. Height (cm) ....
4. Weight (kg) ....
5. Resting Heart Rate (beats per min) ....
6. Resting Systolic Blood Pressure (mmHg)...............
7. Resting Diastolic Blood Pressure (mmHg)...............
8. Max. VO2 (ml/kg/min) ....
9. Thigh Skinfold (mm) ....
10. Abdominal Skinfold (mm) ....
11. Vertical Jump (cm)........(1).........(2).........
12. Sit and Reach Test (cm)........(1).........(2).........
13. Hand Grip Strength (kg)........

    Right Hand.........(1).........(2).........

    Left Hand ....(1).........(2).........
14. Reaction Time (sec).............
    a. Left Hand (sound)....(1)...(2)...(3)...(4)...(5)...
    b. Right Hand (sound)....(1)...(2)...(3)...(4)...(5)...
    c. Left Foot (sound)....(1)...(2)...(3)...(4)...(5)...
    d. Right Foot (sound)....(1)...(2)...(3)...(4)...(5)...
    e. Left Hand (light)....(1)...(2)...(3)...(4)...(5)...
    f. Right Hand (light)....(1)...(2)...(3)...(4)...(5)...
    g. Left Foot (light)....(1)...(2)...(3)...(4)...(5)...
    h. Right Foot (light)....(1)...(2)...(3)...(4)...(5)...

The Personal Data Form

Surname and Name.........................Date............

Date of Birth ....

Adress ....

Home Phone ....

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1. Do you currently smoke?...if so, What?...number/day....
   if not, have you ever smoked?...if yes,What...no/years.

2. Do you ever drink alcohol?.............................
   if yes, approx. no: less than 1 day....1-2 per day.....

3. Do you participate in any exercise on a regular basis?.
   indicate no.of times/weekly participation:.............
   walking.....jogging....swim....basketball...handball...
   soccer.....other (name)................................

4. What is your estimate of your current physical fitness?
   excellent........good.....fair.....poor.....

5. What is your estimate of your current medical condition?
   excellent........good.....fair.....poor.....

6. Have you ever been told that you have any form of heart disease?.......................

7. Have you ever been told that you have diabetes?........

8. Do you consider yourself to be overweight?.............
   if so, how many kg.? ....

9. Do you have any medical conditions (other than heart diseases or diabetes) that might affect your exercise performance?..
   if so, what?...

10. Are you currently taking any kind of medication?.......
    if yes, is it non-prescription?........................
    if so , name..........if yes, is it prescription?.....
    if yes, give name if possible.........................

APPENDIX B

RAW DATA OF PES STUDENTS

VARIABLES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	19	180	85	N	N	4	11	6.5	.15	.21	.25	.23	31.6	32.6	30.5	39	52.6	62	2950	55	7.2	7.2	8.85
2	20	174	60	N	N	3	109	8.6	.20	.22	.26	.29	33.4	32	27.9	111	48.5	67	2705	53	6.2	11.2	9.37
3	20	175	66	N	N	4	9.64	7.4	.16	.20	.21	.24	31.1	26	29.6	110	51.8	63	2900	56	6.4	6.4	8.16
4	20	169	66	N	1	3	9.86	7.8	.15	.17	.18	.20	44.2	41	27	102	47.6	66	2650	47	14.6	17.7	16.06
5	19	178	72	N	1	4	9	7	.12	.19	.18	.24	36.3	36	36	115	41.8	69	2300	49	8.2	14.4	11.42
6	20	180	74	N	N	4	9	7	.12	.19	.18	.24	36.3	36	36	115	41.8	69	2300	49	8.2	14.4	11.42
7	18	173	60	1	N	2	8	6.7	.14	.16	.16	.19	29	26	29	102	46.1	64	2560	54	6.2	10.4	9.15
8	19	179	75	2	1	2	12.8	9	.19	.19	.21	.22	36.3	22	32.5	121	46.8	67	2600	51	11.2	12.3	12.59
9	20	172	64	2	N	4	11	8	.19	.18	.20	.22	23	24	29.5	98	55.1	60	3100	46	3.6	7.2	6.75
10	19	174	69	N	N	2	9.36	7.73	.16	.18	.22	.20	24.3	22.7	26	108	41	71	2250	45	10.8	11.3	12.24
11	20	168	67	2	N	4	13	10	.16	.18	.19	.22	38.7	37.6	36.5	98	43.5	73	2400	42	11.4	14	13.17
12	20	181	71	N	1	N	9.50	7.9	.17	.19	.21	.25	33.2	32	28	105	41.8	69	2300	43	11.7	15.3	13.71
13	19	167	59	3	1	4	14	10	.17	.21	.24	.24	41.8	39.8	30.5	86	43	66	2400	40	4.4	7.6	7.33
14	19	174	86	1	N	1	10.1	7.1	.21	.24	.25	.29	33.2	31	26.5	130	39.7	75	2175	47	13.1	14.7	14.36
15	20	176	64	N	N	4	9.70	7	.19	.20	.23	.22	48	45	24	97	36.4	77	1975	49	13	14.3	14.19
16	20	183	67	3	1	4	13.3	9.3	.17	.16	.21	.20	43	42	37	116	38.5	71	2100	56	6.4	13.2	10.05
17	20	176	64	1	1	3	12.5	8.3	.18	.23	.24	.29	30.9	27	38	94	46.4	68	2575	41	6.7	13.1	10.19
18	18	179	85	N	N	1	12	9.05	.18	.18	.21	.25	27.9	27	29	124	38.5	72	2100	44	14.6	15.3	15.39
19	19	174	62	N	N	4	10.7	8.7	.17	.20	.21	.23	36.5	34	36	100	44	70	2430	51	9	13	11.50
20	20	175	79	2	1	3	11	8	.18	.20	.20	.16	40.6	40.3	39	125	43.5	66	2400	49	8.4	10.2	10.38
21	19	171	69	N	N	4	14	10.4	.17	.18	.23	.25	41.6	46.3	31.5	108	4.66	67	2590	47	15.2	16.3	16.02
22	18	177	80	N	N	1	12	9.1	.18	.20	.21	.23	31.6	36.3	37	112	38.5	74	2100	41	10.7	11.4	12.04
23	18	169	57	N	N	2	10	8.7	.12	.21	.17	.24	33.3	31	33	85	42.6	71	2350	40	10	11.2	11.58
24	19	170	57	3	N	3	12	8	.21	.23	.22	.24	29	26.1	29	87	42.2	64	2325	44	8.4	14.6	11.6
25	18	179	65	N	N	3	9.8	7.5	.19	.19	.24	.26	26.6	29.6	37	100	36.8	78	2000	44	8.6	11.4	10.83
26	19	177	76	N	1	1	9.4	7.6	.17	.22	.23	.22	38	37.3	34	122	35.1	80	1900	51	5.96	9.1	8.65
27	19	178	63	N	N	4	10	8.6	.18	.17	.20	.20	38.3	40.6	35	105	41	71	2250	54	10.1	11.2	11.64
28	18	169	57	N	N	3	9.6	7.2	.20	.19	.21	.22	39	34.6	38	81	43.5	66	2400	39	4.8	6.4	7.23
29	18	174	69	N	N	4	9.2	6.25	.21	.20	.23	.23	18.3	15.3	39	118	44.3	63	2750	56	58	9.2	8.59
30	19	180	69	2	N	4	12.3	8.3	.24	.23	.26	.23	39	32.6	19	101	45.1	70	2500	41	15.4	18.1	16.63
31	20	183	73	N	N	4	10.1	7.9	.18	.19	.20	.21	27	24.6	29.5	122	53.1	64	2980	54	5.8	11.2	9.14
32	20	173	60	3	N	4	13.4	9.8	.19	.22	.25	.26	29	28.3	36	104	37.6	74	2050	57	5.4	7.8	7.97
33	18	172	73	N	N	1	13.4	10.1	.24	.21	.24	.25	37.8	37.3	15	111	38.5	64	2100	47	14.3	18.1	16
34	19	170	71	1	N	1	12	8.25	.25	.26	.24	.27	32.8	32	19	106	37.6	69	2050	44	15.9	17.6	16.79
35	18	179	79	N	N	1	14.1	9.35	.25	.26	.21	.24	19	17.9	21.5	128	38.9	71	2125	55	15.3	17.5	16.41

WHERE

1=NUMBER OF SUBJECTS; 2=AGE (years); 3=HEIGHT (cm); 4=WEIGHT (cm); 5=CIGARETTE SMOKING (num./per day); 6=ALCOHOL HABITS (glass./week); 7=REGULAR EXERCISE (num. a week); 8=RESTING SISTOLIC BLOOD PRESSURE (mmHg); 9=RESTING DIASTOLIC BLOOD PRESSURE (mmHg); 10=REACTION TIME VISUAL HAND (sec); 11=REACTION TIME AUDITORY HAND 12=REACTION TIME VISUAL FOOT (sec); 13=REACTION TIME AUDITORY FOOT (sec); 14=HAND GRIP RIGHT STRENGTH (kg) 15=HAND GRIP LEFT STRENGTH (kg); 16=FLEXIBILITY (cm); 17=ANAEROBIC POWERB(kg.m.sec); 18=MAX VO2 (ml/kg/min) 19=RESTING HEART RATE (beats per min); 20=12' RUN (m); 21=VERTICAL JUMP (cm); 22=ABDOMINAL SKINFOLD (mm); 23=THIGH SKINFOLD (mm); 24=FAT PERCENT (%)

APPENDIX C

RAW DATA OF MF STUDENTS

VARIABLES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	19	166	71	4	N	N	14.7	8.3	.246	.23	0.26	.256	24.6	23.7	43	77	31.833	75	1700	24	13.2	17	15.05
2	20	173	79	2	N	N	14	7	.25	.25	0.29	.303	25.6	23.60	33	87	35.166	78	1900	27	16	19	17.23
3	20	167	70	1	N	1	12.7	7.3	.206	.19	0.22	.21	30.3	29.33	38	98	42.666	89	2350	39	79	11	10.30
4	18	170	84	N	N	N	11.5	7	.27	.26	0.28	.283	23.6	25.05	30	91	31.833	85	1700	26	15.5	37	21.93
5	18	176	74	2	1	N	10	7	.25	.24	0.25	.243	27.4	29	40.5	96	38.5	90	2100	32	11	17	13 77
6	19	170	67	N	N	2	12	7	.176	.22	0.23	.236	30	25.66	27	94	43.5	62	2400	39	5.7	9	8.47
7	18	172	66	N	N	N	10	6	.196	.21	0.22	.233	28.7	27.33	36.5	89	72.666	66	2350	37	8.2	15.4	11.70
8	20	171	67	1	1	N	11	7.5	.213	.22	0.24	.25	26.5	26.66	35	84	40.166	76	2200	31	14	27.5	18.42
9	18	176	55	N	N	N	14.3	8.2	.23	.21	0.26	.256	27.6	28	40	67	38.5	105	2100	29	14.6	15.3	15.39
10	20	173	69	N	N	N	12	8	.23	.22	0.24	.256	27	25	36	88	39.333	93	2500	31	16	19.9	17.32
11	19	165	62	3	N	N	10	6.7	.153	.18	0.24	.21	31	30.66	37	84	50.166	70	2800	39	7.2	8.3	17.32
12	18	166	57	2	N	N	13.2	8.6	.24	.23	0.27	.266	21	17	32	65	38.5	96	2100	26	13	17.5	15.07
13	18	167	65	1	N	N	10.6	6	.22	.21	0.26	.21	16	17.66	37.5	77	39.333	84	2150	32	8	18	12.36
14	18	160	53	N	N	1	11	7.7	.17	.20	0.21	.26	32	31 66	27.5	67	41.75	81	2275	31	13	29.5	18.40
15	20	165	67	N	N	2	13	7.5	.291	.3o	0.31	.30	27	24.8	30.5	80	40.16	91	2200	30	32	41	32.64
16	20	162	59	1	N	N	11	7.7	.19	.17	0.20	.21	32	29.6	18	83	45.16	68	2500	37	6.2	10.4	9.15
17	18	163	66	2	N	N	14.2	8.9	.25	.26	0.24	.27	36	34	29	90	42.2	87	2325	33	16.2	24	18.74
18	19	165	67	2	N	N	14.7	8.6	.24	.23	0.26	.23	32	31	29	87	37.66	105	2800	31	15	36.6	21.52
19	20	166	69	1	N	N	12	6	.18	.19	0.20	.21	29	27.6	27	96	40.16	98	2200	31	15	36.6	21.52
20	20	167	71	1	N	1	14.6	8.4	.19	.22	0.25	.26	27.6	27	29.5	93	39.75	98	2175	33	2	20	21.07
21	19	170	74	1	N	2	13.2	8.6	.24	.21	0.24	.25	33	32	30	93	40.16	90	2200	32	14	16.5	15.38
22	19	162	66	1	N	1	14.8	9	.18	.17	0.20	.23	24	22.66	26.5	77	38.5	102	2100	29	11.2	20	14.72
23	19	163	67	N	N	2	13.7	9.4	.21	.20	0.23	.22	31	30	24	87	41	91	2250	34	17.4	27.6	20.43
24	18	166	69	N	N	2	13	9	.24	.23	0.26	.25	29	27.66	25	96	42.66	84	2350	34	12	20	15.18
25	19	171	74	N	N	2	11.7	6	.17	.19	.21	.23	33	29	38.5	97	47.666	75	2650	35	8	24.3	14.05
26	18	176	66	N	N	2	11	7.9	.19	.20	.22	.23	36	33.66	25	82	46.166	66	2560	31	5.9	7.4	8.14
27	20	173	66	1	N	1	13	8	.27	.26	.29	.29	31	28.66	33	79	39.333	94	2150	30	6	29	14.18
28	18	181	74	1	N	1	14	9	.30	.29	.32	.31	29	27.66	43	94	40.166	98	2200	32	19	21	19.53
29	20	171	67	1	N	N	14	8.5	.26	.25	.27	.28	30	31.66	32	65	36.833	104	2000	31	15.2	16.3	16.02
30	19	178	71	N	N	1	11.9	9.6	.22	.21	.24	.23	32	31.66	42	97	45.166	74	2500	37	8.5	21.4	13.53
31	19	180	76	N	N	3	12	9.3	.18	.19	.24	.22	36	34.66	42	104	48.083	74	2675	39	5	7	7.51
32	19	164	66	2	N	1	14.6	8.4	.26	.25	.29	.30	31	29	21	88	38.083	102	2075	37	15.6	22.7	18.07
33	20	166	57	2	N	N	13.2	8.2	.29	.26	.30	.31	29	27.66	24.5	53	39.333	98	2150	36	16.2	25	19.07
34	18	169	60	N	N	2	13	9	.19	.18	.21	.20	31	30.6	28	75	46	66	2550	31	7.3	19	12.17
35	18	161	52	1	N	1	12	9	.26	.25	.27	.27	29	26	22	64	41.41	98	2275	30	8.5	21	13.42

WHERE

1=NUMBER OF SUBJECTS; 2=AGE (years); 3=HEIGHT (cm); 4=WEIGHT (cm); 5=CIGARETTE SMOKING (num./per day); 6=ALCOHOL HABITS (glass./week); 7=REGULAR EXERCISE (num. a week); 8=RESTING SISTOLIC BLOOD PRESSURE (mmHg); 9=RESTING DIASTOLIC BLOOD PRESSURE (mmHg); 10=REACTION TIME VISUAL HAND (sec); 11=REACTION TIME AUDITORY HAND 12=REACTION TIME VISUAL FOOT (sec); 13=REACTION TIME AUDITORY FOOT (sec); 14=HAND GRIP RIGHT STRENGTH (kg) 15=HAND GRIP LEFT STRENGTH (kg); 16=FLEXIBILITY (cm); 17=ANAEROBIC POWER8(kg.m.sec); 18=MAX VO2 (ml/kg/min) 19=RESTING HEART RATE (beats per min); 20=12' RUN (m); 21=VERTICAL JUMP (cm); 22=ABDOMINAL SKINFOLD (mm); 23=THIGH SKINFOLD (mm); 24=FAT PERCENT (%)

APPENDIX D

COOPER'S FITNESS CLASSIFICATION

(maximal Oxygen Uptake ml/kg/min)

MEN

Category:	*Age=13-19*	*20-29*	*30-39*	*40-49*	*50-59*	*60-+*
1. Very Poor	<35.0	<33.0	<31.5	<30.2	<26.1	<20.5
2. Poor	35.0-38.3	33.0-36.4	31.5-35.4	30.2-33.5	26.1-30.9	20.5-26.0
3. Fair	38.4-45.1	36.5-42.4	35.5-40.9	33.6-38.9	31.0-35.7	26.1-32.1
4. Good	45.2-50.9	42.5-46.4	41.0-44.9	39.0-43.7	35.8-40.9	32.2-36.4
5. Excellent	51.0-55.9	46.5-52.4	45.0-49.4	43.8-48.0	41.0-45.3	36.5-44.0
6. Superior	>=56.0	>=52.5	>=49.5	>=48.1	>=45.4	>=44.1

WOMEN

Category	*Age=13-19*	*20-29*	*30-39*	*40-49*	*50-59*	*60-+*
1. Very Poor	<25.0	<23.6	<22.8	<21.0	<20.2	<17.5
2. Poor	25.0-30.9	23.6-28.9	22.8-26.9	21.0-26.4	20.2-22.7	17.5-20.1
3. Fair	31.0-34.9	29.0-32.9	27.0-31.4	26.5-28.9	22.8-26.9	20.2-24.4
4. Good	35.0-38.9	33.0-36.9	31.5-35.6	29.0-32.8	27.0-31.4	24.5-30.2
5. Excellent	39.0-41.9	37.0-40.9	35.7-40.0	32.9-36.9	31.5-35.7	30.3-31.0
6. Superior	>=42.0	>=41.0	>=40.1	>=37.0	>=35.8	>=31.1