MEASUREMENT AND EVALUATION OF PHYSİOLOGICAL COMPONENTS OF PROFESSIONAL SOCCER PLAYERS OF MKE ANKARAGÜCÜ, PETROLOFİSİ AND ŞEKERSPOR SOCCER TEAMS

A Master's Thesis

Presented by

HAYRETTİN GÜMÜŞDAĞ

to

the Graduate School of Social Sciences

of Middle East Technical University

in Partial Fulfillment For the Degree of

MASTER OF SCIENCE

in

PHYSICAL EDUCATION AND SPORTS

MIDDLE EAST TECHNICAL UNIVERSITY
ANKARA
February, 1994

Approval of the Graduate School of Social Sciences.

Prof.Dr.Haluk KASNAKOĞLU
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Sciences.

Assoc.Prof.Dr. Hülya GÖKMEN
Chairman of the Department

We certify that we have read this thesis and that in our opining it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science in Physical Education and Sports.

Assoc.Prof.Dr. R. Gül TİRYAKİ
Supervisor

Examining Committee in Charge :

Assoc.Prof.Dr. Kemal TAMER

Assoc.Prof.Dr. Fehmi TUNCEL

TABLE OF CONTENTS

Page

Page

page

ABSTRACT

MEASUREMENT AND EVALUATION

OF PHYSIOLOGICAL COMPONENTS

OF PROFESSIONAL SOCCER PLAYERS OF MKE

ANKARAGÜCÜ, PETROLOFİSİ, AND ŞEKERSPOR

SOCCER TEAMS

GÜMÜŞDAĞ, Hayrettin

M.S. Physical Education and Sports

Supervisor : Assoc. Prof.Dr. Gül TİRYAKİ

February, 1994, 71 pages.

Scope and Method of Study: The purpose of this study was to find and to compare the anaerobic power, aerobic power, percent body fat, flexibility, grip strength, speed, height, and weight of the soccer players of MKE Ankaragücü, which is the first league team, Petrolofisi which is the second league team, and Şekerspor which is the third league team in Türkiye Professional soccer league during 1992-93 spring season. 16 professional soccer players from each team of a total 48 trained healthy professional male soccer players aged 18-30 years old, served as subjects.

A total of 7 physical fitness variables were recorded for the purpose of this study. 7 physical fitness variables results were compared among the first leauge, second leauge and third leauge professional soccer teams. Results were tested by using the one way Anova for significance of differences among these teams at .05 confidence level.

Findings and Conclusions: The differences in the means of percent body fat, height, VO2 max, 50 m dash and flexibility were not found statisticaly significant between first league, second league and third league professional soccer teams at .05 confidence level. But, there were significant differences in the means of weight and anaerobic power between first league and second league soccer teams. There were also significant differences in the means of vertical jump between first and second league teams and first and third league soccer teams. The differences in the means of right and left grip strength were found to be significant between first and third league and second and third league soccer teams. However, the difference in the means of left and right hand grip strengths were not found statistically significant between first and second league teams. And there were no significant differences in the means of weight, vertical jump, anaerobic power between second and third league professional soccer teams at .05 confidence level.

Science code :

ÖZ

MKE ANKARAGÜCÜ, PETROLOFİSİ VE ŞEKERSPOR PROFOSYONEL FUTBOL TAKIMLARININ FİZYOLOJİK ÖZELLİKLERİNİN ÖLÇÜLMESİ VE DEĞERLENDİRİLMESİ

GÜMÜŞDAĞ Hayrettin

Yüksek Lisans Tezi, Beden Eğitimi ve Spor Bölümü

Tez Yöneticisi : Doç. Dr. Gül TİRYAKİ

Şubat, 1994, 71 Sayfa

Çalışmanın Amacı ve Metodu: Bu çalışmanın amacı 1992-93 İkinci yarı sezonunda Türkiye birinci lig takımı MKE Ankaragücü, İkinci lig takımı Petrolofisi ve üçüncü lig takımı Şekerspor'un aerobik gücü, anaerobik gücü, vücut yağ yüzdesi, esneklik, pençe kuvveti, hız, boy ve kilolarını bulmak ve birbirleriyle kıyaslamaktır. Her bir takımdan 18-30 yaşları arasında 16 profesyonel erkek futbolcu olmak üzere toplam 48 antrenmanlı ve sağlıklı futbolcu denek olarak alındı. Bu testin amacı için 7 fiziksel uygunluk testi yapıldı. Sonuçlar MKE Ankaragücü, Petrolofisi ve Şekerspor profesyonel futbol takımları arasında karşılaştırıldı. Sonuçlar one-way analysis of variance (ANOVA) ile .05 aralığında test edildi.

Bulgular ve Sonuçlandırma : Birinci, ikinci ve üçüncü lig profesyonel futbol takımları arasında vücut yağ yüzdesi, boy, max VO2, 50 m koşu ve esnekliklerinde .05 önem aralığında bır farklılık bulunmadı.

Fakat, birinci lig ve ikinci lig takımlarının kilolarında ve anaerobik güçlerinde farklılık bulundu. Birinci lig ve ikinci lig, birinci ve üçüncü lig futbol takımlarının dikey sıçramalarında önemli farklılık saptandı. Yine birinci ve üçüncü lig, ikinci ve üçüncü lig futbol takìmlarìnìn sağ ve sol el pençe kuvvetlerinde önemli bir farklılık bulundu. Oysa birinci ve ikinci lig futbol takımlarının sağ ve sol el pençe kuvvetinde önemli bir farklılık görülmedi. İkinci lig ve üçüncü lig futbol takımlarının kilolarında, dikey sıçramalarında, anaerobik güçleri arasında önemli bir farklılık görülmedi.

Bilim Kodu :

ACKNOWLEDGEMENTS

A special indebtedness to acknowledge to my thesis advisor Assoc. Prof.Dr. Gül TİRYAKİ for her asistance in the planning, carrying out and writing of this thesis. Indebtedness is also expressed to the other members of thesis committee, Assoc.Prof.Dr. Kemal TAMER and Assoc. Prof.Dr. Fehmi TUNCEL, for their assistance and suggestions in writing of this thesis.

Special thanks are offered to MKE Ankaragücü, Petrolofisi and Şekerspor soccer players and trainers.

I would also like to thank Tarık ÜSTÜN, Şeref ÇİÇEK, Sezgin TURAN, and Semih YİĞİT, for their help and encouragement; Mürvet ÖZYURT for her excellent typing.

LIST OF TABLES

CHAPTER I

INTRODUCTION

The sport of soccer is a dynamic game of total fitness, a game which requires a great deal of intelligence as well as mental and physical roughness on the part of the participants.

The following characteristics of the soccer player make this unique sport the World's favorite (Wade, 1979). Through active participation, physical strength and the development of speed and endurance are achieved. Total body coordination is enhanced through vigorous participation during games as a result of running at different speed, executing several types of kicking and heading the ball. Full active participation by every player on the field throghout the game is appreciated. Because of full participation by every player, understanding, cooperation, and appreciation of each player's hard working by others are developed among the team members. Although there is enough contact in a game of soccer to satisfy the need for competetion and agressiveness among participants, there is a minimum of hazard to the life of the player or risk to his physical well being. Soccer is financially economical and requires little equipment (Thomas, 1970).

Success in soccer is dependent upon a variety of factors. These include the physical charecteristics and physiological capacities of the players, their level of skill, their degree of motivation, and the tactics employed by them against opposition. Many of these factors are not easily measured objectively. However, some factors can be tested by

using standardized testing methods and can provide useful information for coaches (Mosher, et al., 1985).

There is evidence that physical and physiological characteristics of soccer players can be used by coaches to modify training programs and to help player for his game strategy. The modern game of soccer relies on the ability of all players to attack and defend whenever necessary. Therefore, it is important that all players must achieve a high level of performance in the basic skill of kicking, passing, trapping, dribling, tackling, and heading. Because of the above facts, it is necessary to analyze the physical charecteristics and determine the specific requirements for optimal performance (Armbruster, 1975).

The trend in modern day soccer is to expand the responsibilities of each player. No longer does a full back only defend and a striker merely attack. Each player must assume a multiple role, due to the increased fluidity of the game. With the increased overlapping of functions, the physical demands on each player on the field have increased. So again, the trend in modern soccer is toward expansion of a players physiological functions which will enable players to execute a greater number of sprints at high intensity.

Soccer is a dynamic game. It is a ninety minute fast-paced activity. Therefore, soccer players must also develop and maintain high levels of endurance to meet the game's demands on the cardiorespiratory system. This becomes more important for professional soccer players to withstand the high intensity of eight months season with one or two games each week. It is also important for the coach to know his players level of fitness and their physiological limitations. So, he can assign his players to different positions and can plan training for them depending on their needs (Armbruster, 1975).

Soccer player must also sprint with or without the ball from a few meters to 50-60 meters during the game. This kind of work places a great demand on the players anaerobic capacity. Therefore in addition to having high levels of endurance, soccer players must have high levels of anaerobic work capacity (Armbruster, 1975). More specifically, each player must have the capability to perform increased numbers of short, fast bursts of running, interspersed with jogging and walking. Thus anaerobic power is now recognized as vital to success in soccer (Mosher, et al., 1985). For this reason, soccer has not, in the past, required the same level of physical endurance or aerobic power in the players as required in long distance runner, cross country skiers or athletes engaged in similar events requiring continuous, long-lasting effort of near maximal intensity (Astrand an Rodahl, 1986).

There is no doubt that most of soccer techniques and movements require a high level of strength. Strength training makes a soccer player more powerful in the aspect of performance which requires power. Especially, the muscle group of quadriceps, gastrocnemius, and hamstrings are very important for development of explosive force used in jumping , kicking, and turning (Wade, 1979).

Strength balance between the limb decreases the likelihood of injuries. The muscle group of the quadriceps, gastrocnemius, and hamstrings are very important for development of the explosive force used in jumping, kicking, and turning. Players should posses a high capacity to sustain a contraction which is required for balance and the ball control.

It is fact that soccer involves a series of explosive movements and hard contacts in variety of body positions. The potential for injury is always present. An increase in flexibility will minimize the severity of injuries. Therefore flexibility of the soccer player is also important as well

as anaerobic and aerobic power (Oberg et al., 1984).

The use of skinfolds and body composition techniques on soccer players have been largely directed toward estimating the amount of fat in the body . The importance of fat as a tissue in athletes lies in its paucity rather than its abundance. In most sports, minimum levels of fat are sufficient for optimal performance. Whereas increased levels may hinder athletes from reaching their potential. This is especially noticable in sports where the body has to be projected as injuring movements, or propelled against gravity over long distances as in distance running. In such sports excess fat weight has a negative influence on performance (Carter and Yuhasz, 1984).

According to the points explained above, it may be useful to document measurement and evaluation of physical and physiological components of professional soccer players of different league such as MKE Ankaragücü which is the first league team, Petrolofisi which is the second leaque team, Şekerspor which is the third leauge team in Türkiye professional soccer league in 1992-93. Since these data can be used to modify training programs and assist individual game strategy.

Statement of the Problem

The problem of this study was to compare the physical and physiological charecteristics (flexibility, speed, strength, percent body fat, aerobic and anaerobic power, height and weight) of professional soccer players of MKE Ankaragücü , Petrolofisi , and Şekerspor teams during second half of 1992-93 season.

Sub Problems

1.To determine the selected fitness variables (flexibilty, speed, strenght, percent body fat, aerobic and anaerobic power, height and weight) of MKE Ankaragücü, Petrolofisi and Şekerspor professional teams' players.

Delimitations

1. The subjects for this study consisted of 48 professional soccer players who played for the MKE Ankaragücü, Petrolofisi, and Şekerspor team during the 1992-93 second half season.

2. Subjects were highly trained and active however, their training status could be different.

Limitations

1. The acquisition of subjects from a group of volunteers and not by a random sampling prevents generalization beyond the study sample.

2. There was no attempt to control diet, sleeping , and any extra activities of subjects prior to testing .

3. Subjects were chosen from professional soccer players.

4. Neither the weather nor the motivational state of each athlete during testing could be controlled. Different degrees of effort by the subjects might have been exerted. This may affect the results.

Assumptions

1. Subjects followed the instructions given about the tests.

2. Subjects were highly motivated and exerted a maximum effort on all tests.

3.Subjects participated in their regular training programs .

Null Hypothesis

1. There were no significant differences in strength among the soccer players of MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams.

2. There were no significant differences in speed among the soccer players of MKE Ankaragücü, Petrolofisi, and Şekerspor professional soccer teams.

3. There were no significant differences in flexibility among the soccer players of MKE Ankaragücü, Petrolofisi, and Şekerspor professional teams.

4. There were no significant differences in percent body fat among the soccer players of MKE Ankaragücü, Petrolofisi, and Şekerspor professional teams.

5. There were no significant differences in aerobic power among the

soccer players of MKE Ankaragücü, Petrolofisi, and Şekerspor professional teams.

6. There were no significant differences in anaerobic power among the soccer players of MKE Ankaragücü, Petrolofisi, and Şekerspor professional teams.

7. There were no significant differences in height and weight among the players of MKE Ankaragücü, Petrolofisi, and Şekerspor professional teams.

Significance of the study

The main purposes of this research were; to find the physical and physiological charecteristics of professional soccer players of MKE Ankaragücü, Petrolofisi, and Şekerspor professional teams; to compare the various physical fitness variables among these teams; to establish new data for the next training session to be more succesfull.

The success in soccer is dependent upon variety of factors. These include the physical characteristics and fitness of the players, their level of skill, their degree of motivation and the tactics employed by them against oppositon. Many of these factors are not easily measured objectively. However, some factors can be tested by using standardized testing methods and can provide useful information for coaches.

Comparatively little scientific information is available concerning the physiological and physical characteristics of the professional soccer players. There is evidence that physical and physiological charecteristics of soccer players can be used by coaches to modify training programs and to help player for his game strategy. The modern game of soccer relies on the ability of all players to attack and defend whenever necessary.

Therefore, it is important that all players must achieve a high level of performance in the basic skill of kicking, passing, trapping, dribling, tackling, and heading (Armbruster, 1975).

Because of the above facts, it is necessary to analyze the physical charecteristics and determine the specific requirements for optimal performance.

CHAPTER II

LITERATURE REVIEW

The sport of soccer demands a very high work output from its players. Players must go through a vigorous training regime to increase their cardiovascular fitness and muscular strength during pre-season and maintain a high level of total fitness throghout the season to be succesful and to avoid injuries.

Several researchers have attempted to determine the total distance covered during 90-minute competition. Wade (1962) reported a range of 1,600- 5,486 m. of 229-1829 m. at walking, and of 1,371 - 3,658 m. at jogging pace. Vinnal (1973) determined the total distance covered by Russion players to be up to 17 km during a match. Zelenka et al., (1967) concluded that Czechoslavakino players covered 11.5 km total distance; players run more than 6 km mostly in 5-10 m. runs. Since most researchers did not eleborate on how they reached such conclusions, figures for total distance covered should be treated cautiously.

Thomas and Reilly (1973) studied work rate during soccer competetion. The movements of players were divided into walking, backing , and running; running was subdivided into three intensity levels of jogging, cruising , and sprinting. They determined the overal distance covered by outfield players during competetion ranged from 7, 069 to 10, 921 m., with a mean of 8,680 m. of that distance, 36% was covered by jogging, 24.8% by walking , 20.5% by cruising, 11.2% by sprinting , and 6.7% by backing. only .26% to 4% of the total distance was covered in possession of the ball by outfield players.

Aerobic Power of Soccer Players

One of the most important components of physical fitness for soccer players, is aerobic power. Aerobic power is the largest amount of oxygen that one utilizes under the most strenuous exercise. Because maximum oxygen uptake generally summarizes what is going on in the oxygen transport system during maximum or exhaustive exercises 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 can be expressed in milimeters of oxygen per kg of body weight per minute (ml/kg/min.).

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 (max Vo_2) from the 12-minute performance test.

Raven et al., (1976) studied a North American Soccer league team with a playing staff of 13 English and 5 United States Nationals with a mean age of 25.6 years; the oldest was 32 and the youngest was 19 years of age. They reported a mean of 58.4 ml. kg. min. max Vo_2 for the 18 players.

Whiters et al., (1977) reported a mean max Vo_2 of 62.0 ml.kg.min. for 5 Australian National level soccer players. The same researchers reported mean max Vo_2 of 72.0 ml.kg. min. for the hockey players, and the 58.5 ml.kg.min. for the basketballers.

Astrand and Rodahl (1977) reported the mean max vo_2 of 58.6 ml/kg/min. for a group of 50 top Swedish soccer players. The highest value reported was 69 ml/kg/min. These authors noted that since soccer enables players to pause between bursts of physical effort, the same level of aerobic power is not required in the players as in long distance runners, cross-country skiers, or athletes in events requiring continious long-lasting effort of near maximal intensity.

Ziyagil (1988) reported the cooper test results of nineteen Konyaspor professional soccer players who had mean max VO_2 of 51.0 ml. kg. min.

Gündüz (1989) reported mean max VO_2 of 48.77 ml.kg.min. for sixteen Turkish National B-Youth Soccer players.

The intensity of exercise is clearly indicated by the amount of oxygen consumed or energy expanded. Maximum oxygen consumption is the best indicator of any individuals ability to withstand different level of work intensities. A player with a high level of oxygen consumption is more likely to perform better for a long time at a high intensity level whereas a player with a low level of oxygen consumption is more likely to fall apart during a match with a high intensity. Therefore, maximum oxygen consumption of each player provided the coach with variable information about his training regimen.

Anaerobic Power of Soccer Players

During intense activity of short duration, especially in the initation of attacks and short sprints, the energy is derived from the already present stores of intramuscular ATP and PC energy system. For instance exercise of longer duration, in the implementation of soccer actions, energy is mainly generated from the anaerobic reactions of glycogen.

The amount of energy obtained by the aerobic process during exercise is determined by measuring the oxygen uptake during exercise. However the amount of energy obtained by anaerobic processes is approximated by measuring the amount that the metabolism is increased above resting values by following exercise (oxygen debt) and by measuring the difference between blood lactate and the highest value observed during or after exercise.

Sherry et al., (1983) reported that anaerobic power has not been so clearly defined or tested. Perhaps the most widely used test of anaerobic power was developed by Margaria and modified by Kalaman. The Margaria-Kalaman anaerobic power test is an effective predictor of explosive sports performance. Because of the extensive involvement of body weight in the calculation of anaerobic Power, it has been labelled a mass-power test rather than a speed power test, although the need for sprint speed up the stairs is obvious.

There are other tests purported to asses anaerobic power include the vertical jump, standing broad jump and short spring runs, of which the 50 m dash appears to be most popular. Of these, only Vertical jump is easily converted to units of power using the Lewis nomogram.

Fox (1976) reported the vertical jump power of Margaria-Kalaman power tests can be used interchangeably where the major concern is power developed through quick movement, short sprints or jumps can be employed. It should be noted that the effect of body weight on the vertical jump and Margaria-Kalaman power test can be minimized by expressing the power compenent to body weight.

The vertical jump test of anaerobic power can be used to determine anaerobic power of the legs. Leg power is an important factor in soccer to jump, head to ball , or perform fast starts. For this reason, the researchers

choose vertical jump test to measure the anaerobic power.

Fox and Mathews (1976) reported that energy for goalkeepers, wings, and strikers is derived from ATP-PC-LA system is 80% and LA-O_2 system is 20% ,while the energy for half backs is derived from ATP-PC-LA system is 60%, LA-O_2 system is 20% and O_2 system is 20% . Therefore anaerobic training seems to be more important than aerobic.

Cochrane and Pyke (1976) reported the vertical jump test results for Australian Soccer players; 48.3 cm for three defenders, 50 cm for four midfielders, 50.3 cm for four attackers, and 52 cm for one goalkeeper. The mean value of 49.9 cm was reported for the whole squad tested.

Raven et al., (1976) reported the vertical jump test results of 16 professional soccer players of a North American Soccer League that the mean value was 52.8 cm with a range of 54-40.6 cm.

Sherry et al., (1983) reported the vertical jump test results of 12 professional Engilsh soccer players that the mean value was 43.8 cm. Same researcher also reported following mean vertical jump test results according to different sports; 55.9 cm for 14 football players ; 56.0 cm for 10 basketballers; 44.6 cm for 6 wrestlers.

Ziyagil (1988) reported the vertical jump results of nineteen Konyaspor professional soccer players who had mean value of 56.71 cm.

Gündüz (1989) tested sixteen Turkish National B-Youth soccer players by using vertical jump test and a mean score of 53.87 cm was found.

Flexibility of Soccer Players

Flexibility may be defined as the functional capacity of the joint to move through a full range of movement. It involves the joints of the body and the degree to which these joints are capable of moving through their normal range of motion. The tendons and ligaments that surrounds the joints determine how well this objective can be accomplished. Limited flexibility is usually result of restricted elasticity of the muscles and tendons (Bucher, 1983).

During a soccer match, there are many explosive movements and hard contacts in a variety of body positions and the potential for injuries are related to the lack of flexibility in the back of the leg (hamstring), hips and lower back. For this reason, the sit and reach test was preferred to measure back and leg flexibility of the subjects. Flexibility can be effected by many factors such as; activity, sex, age, temperature, and ischemia which refers to the localized tissue anemia due to obstruction of inflow or arterial blood (Kanungsukkasen 1983).

Oberg et al., (1984) measured the flexibility of 180 Swedish soccer players by using goniometer and flexometer. They found that soccer players were in general, more flexible than nonsoccer players and goalkeepers were found to be more flexible than the other players. This should be explained in two ways; either by selection of more flexible players for goalkeepers or by the effect of special training for goalkeepers with more emphasized on flexibility exercise. In a report by Toda (1970), the mean sit and reach test score was 27.6 cm for 379 Indonesion male soccer players.

Ziyagil (1988) measured the flexibility of nineteen Konyaspor professional soccer team's players. Their mean value was 28.24 cm.

In a report by Gündüz (1989), the mean sit and reach test score was 28.71 cm for sixteen Turkish National B-Youth soccer team players.

Strength of Soccer Players

Strength can be defined as the ability to develop force against a resistance in a single contraction of restricted duration (Atha, 1981). Power is the result of applied strength, and it is also defined as the ability to move a resistance at speed. There is no doubt that most of soccer techniques and movements require a high level of strength. Strength training makes a soccer player more powerful in the aspect of performance which require power. The resistance with which the player concerned are; (1) his own body weight (2) the ball (3) the varying resistances produced by different grounds and climatic conditions. Examples of circumtances in which a player exerts power against the above resistances as follows; (1) when jumping to head the ball or the save in the case of a goalkeeper, (2) when running quickly, particularly from a standing or near stationary start, (3) when changing direction or turning , (4) when kicking the ball powerfully, (5) when playing on heavy grounds or against strong winds. The need of a soccer player to posses an extremely high level of strength is quite appereant (Wade, 1979).

Like in other sports, strength plays an important role in soccer. Among other measurements of strength, grip strength serves as an indicate of gross body strength. Value 50.4 kg of grip strength of 31 English professional soccer players was reported by Thomas (1972). This is similar to results for scuba divers, tennis players, fencers, gymnasts and swimmers. Raven et al., (1976) used one repetition maximum bench press as a field test of fitness of professional soccer players and found a mean value of 73 kg .

Using cable tensiometry, isometric strength of leg muscle of English professional soccer players was tested (Relly, 1975). No significant limb differences were found.

Thomas (1977) reported the grip strength of thirtyone English professional soccer player that the mean value 50.4 kg. This is similar to results for scuba divers, tennis players, fencers, gymnasts, and swimmers.

Ziyagil (1988) reported the right grip strength of nineteen Konyaspor professional soccer team's players. The mean value was 64.17 kg, and left grip strength was 61.71 kg.

Current research finding indicates that soccer players are not above average in static muscular strength. The reason for that might be inadequate attention is being paid to resistance training in training methods (Raven, 1976).

Percent Body Fat of Soccer Players

There is considerable evidence that excess fat limits performance. The resistance to rapid contraction within the muscle is provided by deposits of fat. Fat accumulates between bundles of muscle fibers and hinders their action (Unites and Dintiman, 1979).

Cochrane and Pyke (1976) reported a mean percent body fat of 10.8% for 12 members of an Australian soccer squad while a mean percent body fat of 9.59% for 18 professional players is obtained by Raven et al., (1976).

According to Pollack and Coworkers (1976), the soccer player had a greater percent of body fat (10.65 %) than elite distance runners (9.59 %). As a result, researchers agree that the percent body fat of soccer players is approximately 10%.

Weight and Height of Soccer Players

Although height and weight as a physical size do not create a problem for a good soccer player, studies of the contributes of height and weight of athletes provide a yardstick against which objective clinical assesments of individual subjects may be made.

Cochrane and Pyke (1976) reported that the following mean values for twelve members of an Australian soccer squad; 23.8 yeras of age, 75.8 kg of weight, 178.6 cm of height.

The following results were obtained by Raven et al., (1976) on 18 professional soccer players; of a North American soccer league age 26 years, height 176 cm and weight 75.5 kg.

Physical size, height and weight of professional players are not significiantly different from the normal population. In general, defenders tend to be taller and heavier than midfield players, attackers are found to be a heterogeneous group. Goalkeepers are tallest and heaviest among all players (Pollack, 1976)

Yamaner (1987) reported the following mean values for fifteen Gençlerbirliği Junior Team's players: 20 years of age, 66.42 kg of weight, 170.6 cm of height.

Ziyagil (1988) reported the following mean values for nineteen Konyaspor professional team's players: 26.4 years of age, 72.03 kg of weight, 174.3 cm of height.

Gündüz (1989) reported the following mean values for sixteen Turkish National B-Youth soccer players: 67.90 kg of weight, 172.21 cm of height.

CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to compare the aerobic power, anaerobic power, flexibility, strength, speed , height and weight of soccer players of MKE Ankaragücü, Petrolofisi, and Şekerspor professional soccer teams during 1992-93 spring season.

The procedures followed during this course of research were organized under the following headings; (1) sampling (2) methods (3) testing procedures (4) statistical analysis.

Sampling

16 subjects from each team of a total 48 trained healthy male professional soccer players aged 18-30 years were asked to volunteer to participate in this study.

Methods

The measurement of subjects were taken at METU and each team's training area. The researcher explained the purpose and significance of the study to the subjects.

The sequence of events were followed; 1) the collection of personal

data, 2) height and weight measurement, 3) skinfold measurement, 4) flexibility measurement, 5) vertical jump measurement, 6) 50m dash measurement, 7) 12 minutes run measurement.

Testing Procedures

Measurement of Height and Weight

All subjects were weighted in kg on a lever scale weighting machine without footwear, and wearing only shorts. Height was measured in meters on a measuring scale fitted with a sliding headpice that was brought down to touch the top of the had. The weight and height scale were readjusted and checked for accuracy before each measurement. The subject were asked to stand as erect as possible with their heads poise to look straight ahead during height measurement.

Measurement of Skinfold

The anatomical landmarks for selected skinfold sites were marked. Then the skinfold was picked up between thumb and forefinger, and pulled away from the underlying tissues. The caliper jaws were applied at exactly the level marked. The measurement was read within the first two or three seconds after the full pressure of the jaws is applied. The measurement was made according to the method suggested by Behnke and Wilmore (1974).

The right side of the body was used when the skinfold measurements were taken. The subjects stood erect.

The anatomical landmarks for selected skinfold sites were;

1. Chest Skinfold: fold, over the lateral border of the pectoralis major,

medially to the axilla, diagonally between the sholder and the opposite hip.

2. Subscapula Skinfold: fold parellel to the axillary border at the inferior angle of the scapula.

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

4. Triceps Skinfold: Fold parellel to the length of the arm midway between the acromial and olecranon processes on the posterior portion of the arm.

5. Biceps Skinfold: Vertical fold on the anterior midline of the upper arm, halfway between the acromion and olecranon process.

6. Suprailliac Skinfold: Vertical fold on the midaxillary line midway between 12 th rib and the illiac crest.

Prediction of Percent Body Fat: Percent body fat was determined by the equation of Green (1970). Total percent body fat (%) =(sum of six skinfolds x 0.097) + 3.64

six skinfolds=Biceps, Triceps, Chest,Thigh, Subscapula, and Suprailiac.

Measurement of Flexibility

The subject sat with knees extended and feet about shoulder width apart and againts the box. Subject bent the trunk forward and downward and moved the hands, palmsdown, as far forward as possible. Subject

reached with both hands and hold this position. The scores were recorded in millimeters, and were determined by the location of the fingertips. The test was done twice with the better result counting as the score.

Measurement of Anaerobic Power

The vertical jump test was used to determine explosive leg power. Subject stood straight close to the board, with one foot in front of the other. The index fingers of both hands were chalked with magnesium. The subject reached as high as possible with heels keep on the floor and made mark on the board with his chalked fingers. Then he executed three jumps from a crouched positon, making a mark each time on the board. The distance from the top of the highest jump mark was recorded as score. Measurement was taken to the nearest one centimeter in order to determine subject's leg power, the Lewis nomogram was used (Fox et al., 1988).

Measurement of Aerobic Power

Maximum aerobic power was measured by using Cooper's 12 minutes run test. The 12 minutes run test was performed at the 400 meters running tract of METU football Stadium or subject's training field. The intention of the 12 minutes test was the run of the longest possible distance in exactly 12 minutes.

The subjects were notified of the time as they pass the start line during running. Subjects immediately stopped after exactly 12 minutes by the test administrators whistle. Maximum oxygen uptake was computed by the following equation of Balke (1961). Max vo2 = 33.3+ (x-150) X 0.178 ml.kg.min., where x=the distance covered in one minute.

Measurement of Grip Strength

The Naragansett hand dynanometer was used to measure the force of the hand's muscular contraction. It was placed in the palm of the hand with the dial facing the palm. The subjects were asked to squeeze as tightly as possible with the hand and arm away from the body. The hand or the upper arm did not push against any other object or against any part of the body. Three trials were taken with each hand, and the highest was recorded on the appropriate form.

Measurement of Speed

Speed was measured by 50 meters sprint. The subject ran 50 meters as fast as possible. This test was performed at the 50 meters running track. The runnig was started while the subjects were standing at the start line. When the test began, the researcher operated the stopwatch and at the end of the 50 meters, he stopped it, each time was recorded in seconds.

Statistical Analysis of Data

In this research, an analysis of variance (ANOVA) was used to test for significance of differences among MKE Ankaragücü, Petrolofisi, and Şekerspor professional soccer tams. Differences in physical fitness variables were tested for statistical significance at .05 confidence level. The statistical treatment was accomplished by statistical package for social sciences (SPSS) system in the department of Statistics at METU.

CHAPTER IV

RESULTS

The purpose of this study was to find and compare the anaerobic power, aerobic power, percent body fat, flexibility, grip strength, speed, height, and weight of MKE Ankaragücü, which is the first league team, Petrolofisi which is the second league team, and Şekerspor which is the third league team in Türkiye professional soccer league during 1992-93 spring season.

16 professional soccer players from each team of a total 48 trained healthy professional male soccer players aged 18-30 years old, served as subjects. A total of 7 physical fitness variables were recorded for the purpose of this study. 7 physical fitness test results were compared among MKE Ankaragücü, Petrolofisi, and Şekerspor professional soccer teams.

Results were tested by using of one way ANOVA, for significance of differences among MKE Ankaragücü, Petrolofisi and, Şekerspor professional soccer teams. Differences in physical fitness variables were tested for statistical significance at .05 confidence level.

Means, medians, trimmed means, standard deviations, standard errors of a mean, maximum and minimum values, lower and higher quartile of heights, weights, percent body fats, aerobic powers, anaerobic powers, flexibilities, speeds and grip strengths of the professional soccer

players of MKE Ankaragücü is presented in Table I, of Petrolofisi is presented in Table II, and of Şekerspor is presented in Table III.

Table-I: PHysical Fitness Variables of (1993) MKE ANKARAGÜCÜ Professional Soccer Players

VARIABLES	N	MEAN	MEDIAN	TRMEAN	STDEV	SEMEAN	MIN	MAX	Q1	Q3
Percent Body Fat (%)	16	77.57	7.64	7.54	0.75	0.75	6.60	9.07	6.88	8.08
Height (cm)	16	178.75	177.50	178.57	3.84	0.96	174.00	186.00	175.25	182.00
Weight (kg)	16	74.81	74.00	75.14	6.64	1.66	60.00	85.00	70.00	81.50
Vertical Jump (cm)	16	64.81	66.00	65.00	4.64	1.18	55.00	72.00	60.50	68.00
VO2 (Ml.kg.min)	16	51.57	51.91	51.64	3.17	0.79	45.16	57.00	48.92	53.54
Lewis Nomogram (kg.m.sec)	16	133.00	131.50	133.36	13.32	3.33	104.00	157.00	126.50	144.50
50m Dash (sec)	16	6.79	6.82	6.80	0.23	0.59	6.37	7.20	6.59	7.01
Flexibility (cm)	16	28.78	28.25	29.25	6.23	1.56	15.00	36.00	24.50	34.00
Grip Strength (kg) Right Hand	16	51.00	50.00	50.86	7.45	1.86	36.00	68.00	45.00	55.50
Left Hand	16	47.06	45.50	46.79	7.59	1.90	34.00	64.00	41.25	51.75

Table I shows MKE Ankaragücü professional soccer team's mean percent body fat was 7.577 %, standard deviation was 0.755, standard error of a mean was 0.755, minimum and maximum values were 6.608 % and, 9.072 % respectively.

Table-II: Physical Fitness Variables of (1993) PETROLOFİSİ Professional Soccer Players

VARIABLES	N	MEAN	MEDIAN	TRMEAN	STDEV	SEMEAN	MIN	MAX	Q1	Q3
Percent Body Fat (%)	16	7.10	7.16	7.13	0.41	0.10	6.14	7.65	6.89	7.47
Height (cm)	16	177.69	177.50	177.57	3.42	0.85	172.00	185.00	175.25	179.50
Weight (kg)	16	69.56	68.50	69.57	4.13	1.03	63.00	76.00	67.00	73.50
Vertical Jump (cm)	16	54.06	54.50	53.64	5.73	1.43	46.00	68.00	49.25	56.75
VO2 (Ml.kg.min)	16	51.13	51.47	51.23	2.00	0.50	46.65	54.21	50.35	52.69
Lewis Nomogram (kg.m.sec)	16	113.25	114.00	112.71	11.17	2.79	96.00	138.00	103.50	120.00
50m Dash (sec)	16	6.94	6.86	6.91	0.42	0.10	6.37	7.96	6.66	7.09
Flexibility (cm)	16	28.00	27.50	27.93	4.58	1.14	21.00	36.00	24.00	31.50
Grip Strength (kg) Right Hand	16	51.62	50.50	51.71	5.00	1.25	42.00	60.00	48.50	55.00
Left Hand	16	46.62	46.00	46.14	5.58	1.40	40.00	60.00	41.25	50.75

Table II shows the mean, standard deviation, standard error, minimum and maximum values of percent body fat variables for Petrolofisi professional soccer team's were 7.10 %, 0.41, 0.10, 6.14 %, and 7.65 % respectively.

Table-III: Physical Fitness Variables of (1993) ŞEKERSPOR Professional Soccer Players

VARIABLES	N	MEAN	MEDIAN	TRMEAN	STDEV	SEMEAN	MIN	MAX	Q1	Q3
Percent Body Fat (%)	16	7.23	7.34	7.24	0.53	0.13	6.16	8.21	6.91	7.58
Height (cm)	16	178.75	178.00	178.86	5.94	1.48	168.00	188.00	174.00	184.00
Weight (kg)	16	72.69	73.50	72.79	6.54	1.63	60.00	84.00	68.25	78.75
Vertical Jump (cm)	16	57.00	56.00	56.57	7.48	1.87	48.00	72.00	50.50	62.75
VO2 (Ml.kg.min)	16	51.25	50.35	51.16	2.11	0.52	48.87	54.80	49.61	53.32
Lewis Nomogram (kg.m.sec)	16	121.31	123.00	121.79	15.20	3.80	92.00	144.00	108.50	130.50
50m Dash (sec)	16	6.73	6.70	6.72	0.19	0.04	6.40	7.10	6.60	6.87
Flexibility (cm)	16	31.06	31.50	30.92	3.83	0.95	26.00	38.00	28.00	43.00
Grip Strength (kg) Right Hand	16	57.81	57.50	57.64	5.48	1.37	50.00	68.00	54.25	60.75
Left Hand	16	52.69	51.50	52.71	4.73	1.18	44.00	61.00	48.50	57.25

Table III shows Şekerspor professional soccer team's mean body fat was 7.23 %, standard deviation was 0.53, standard error was 0.13, minimum and maximum values were 6.16 % and, 8.21 % respectively.

Means, standart deviations, standard errors of mean, minimum and maximum values of percent body fat of MKE Ankaragücü, Petrolofisi, and Şekerspor professional soccer teams are presented in Table IV.

TABLE IV

MEANS, STANDARD DEVIATIONS, STANDARD ERRORS, MINIMUM AND MAXIMUM VALUES OF PERCENT BODY FAT OF MKE ANKARAGÜCÜ, PETROLOFİSİ AND, ŞEKERSPOR PROFESSIONAL SOCCER TEAMS.

TEAMS	N	MEAN	STDEV	SEMEAN	MIN	MAX
MKE ANKARAGÜCÜ	16	7.57	0.75	0.75	6.60	6.07
PETROLOFİSİ	16	7.10	0.41	0.10	6.14	7.65
ŞEKERSPOR	16	7.23	0.53	0.13	6.16	8.21

F = 2.73 P = 0.07 => P>.05

Comparisons among three professional soccer teams' mean percent body fat are shown in table IV.

In this study, the mean percent body fat of MKE Ankaragücü professional soccer team (7.57 %) was higher than Şekerspor professional soccer team (7.23 %) and Petrolofisi professional soccer teams (7.10 %). However, no significant differences were obtained in percent body fat values among MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams.

Means, standard deviations, standard errors of a mean, minimum and maximum values of "height" of MKE Ankaragücü, Petrolofisi, and Şekerspor professional soccer teams' are given in Table V.

MKE Ankaragücü professional soccer teams' mean height was 178.75 cm, standard deviation was 3.84, standard error was 0.96, minimum and maximum values were, 174 cm and 186 cm respectively.

The mean, standard deviation, standard error of a mean, minimum, and maximum values of height values for Petrolofisi professional soccer team's were 177.69 cm, 3.42, 0.85, 172 cm and 185 cm respectively.

Şekerspor professional soccer teams' mean height was 178.75 cm, standard deviation was 5.94, standard error was 1.48, minimum and maximum height values were 168 cm and 188 cm respectively.

TABLE V

MEANS, STANDARD DEVIATIONS, STANDARD ERRORS, MINIMUM AND MAXIMUM VALUES OF HEIGHT OF MKE ANKARAGÜCÜ, PETROLOFİSİ AND, ŞEKERSPOR PROFESSIONAL SOCCER TEAMS.

TEAMS	N	MEAN	STDEV	SEMEAN	MIN	MAX
MKE ANKARAGÜCÜ	16	178.75	3.84	0.96	174	186
PETROLOFİSİ	16	177.69	3.42	0.85	172	185
ŞEKERSPOR	16	178.75	5.94	1.48	168	188

F = 0.29 P = 0.74 => P>.05

The results showed that, MKE Ankaragücü, and Şekerspor soccer teams' mean height were same and little higher than Petrolofisi soccer team.

An Analysis of one way Anova test revealed that there were no significant differences in mean height values among three teams.

MKE Ankaragücü professional soccer team's mean weight was 74.81 kg, standard deviation was 6.64, standard error was 1.66, minimum and maximum mean weight values were 60 kg and 85 kg.

Petrolofisi professional soccer team's mean weight was 69.59 kg,standard deviation was 4.13, standard error 1.03, minimum weight value was 63 kg and maximum was 76 kg.

The mean, standard deviation, standard error, minimum and maximum values of weight variables for Şekerspor professional soccer

team were 72.69 kg, 6.54, 1.63, 60 kg and 80 kg respectively.

Means, standard deviations, standard errors, minimum and maximum mean weight values of MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams are given in Table VI.

TABLE VI

MEANS, STANDARD DEVIATIONS, STANDARD ERRORS, MINIMUM AND MAXIMUM VALUES OF WEIGHT OF MKE ANKARAGÜCÜ, PETROLOFİSİ AND, ŞEKERSPOR PROFESSIONAL SOCCER TEAMS.

TEAMS	N	MEAN	STDEV	SEMEAN	MIN	MAX
MKE ANKARAGÜCÜ	16	74.81	6.63	1.66	60	85
PETROLOFİSİ	16	69.56	4.13	1.03	63	76
ŞEKERSPOR	16	72.68	6.53	1.63	60	84

(*) F = 3.22 P = 0.04 => P<.05

Table VI showed that MKE Ankaragücü professional soccer team had the highest mean weight with 74.81 kg, Şekerspor soccer team had the mean weight with 72.68 kg. And Petrolofisi had the lowest mean weight with 69.56 kg.

As a result, there was a significant difference in mean weights between MKE Ankaragücü and Petrolofisi soccer teams (P<.05).

Means, standard deviations, standard errors, minimum and maximum mean values of vertical jump of MKE Ankaragücü, Petrolofisi, and Şekerspor professional soccer teams are presented in Table VII.

MKE Ankaragücü professional soccer team' mean vertical jump was 64.81 cm, standard deviation was 4.74, standard error was 1.18, minimum and maximum values were 55 cm and 72 cm.

Petrolofisi soccer team mean vertical jump was 54.06 cm, standard deviation was 5.73, standard error was 1.43, minimum and maximum mean values were 46 cm and 68 cm respectively.

Şekerspor professional soccer team mean vertical jump was 57 cm, standard deviation was 7.48, standard error was 1.87, minimum value was 48 cm and maximum value was 72 cm.

MKE Ankaragücü professional soccer team had the highest vertical jump value of 64.81 cm, Şekerspor soccer team had 57 cm and, Petrolofisi soccer team had the lowest value of 54.06 cm.

TABLE VII

MEANS, STANDARD DEVIATIONS, STANDARD ERRORS, MINIMUM AND MAXIMUM VALUES OF VERTICAL JUMP OF MKE ANKARAGÜCÜ, PETROLOFİSİ AND, ŞEKERSPOR PROFESSIONAL SOCCER TEAMS.

TEAMS	N	MEAN	STDEV	SEMEAN	MIN	MAX
MKE ANKARAGÜCÜ	16	64.81	4.73	1.18	55	72
PETROLOFİSİ	16	54.06	5.73	1.43	46	68
ŞEKERSPOR	16	57.00	7.48	1.87	48	72

(*) F = 13.31 P = 0.00 => P<.05

As a result, the mean vertical jump scores of MKE Ankaragücü was significantly higher than those of Petrolofisi and Şekerspor professional soccer teams. But, there was no significant difference between the of means of vertical jump scores of Şekerspor and Petrolofisi soccer teams.

The vertical jump scores also were evaluated by using Lewis Nomogram in order to determine anaerobic power of the subjects.

The means, standard deviations, standard errors, minimum and maximum mean anaerobic power of MKE Ankaragücü, Petrolofisi, and, Şekerspor professional soccer teams are presented in Table VIII.

MKE Ankaragücü soccer team's mean anaerobic power values was 133 kg.m.sec., standard deviation was 13.32, standard error was 3.33, minimum and maximum values were 104 and 157 kg.m.sec.

Petrolofisi soccer team's mean anaerobic power was 113.25 kg.m.sec., standard deviation was 11.17, standard error 2.79 minimum and maximum values were 96 and 138 kg.m.sec. respectively.

Şekerspor soccer team's mean anaerobic power was 121.31 kg.m.sec., standard deviation was 15.20, standard error was 3.80, minimum and maximum values were 92 and 144 kg.m.sec.

TABLE VIII

MEANS, STANDARD DEVIATIONS, STANDARD ERRORS, MINIMUM AND MAXIMUM VALUES OF ANAEROBIC POWER OF MKE ANKARAGÜCÜ, PETROLOFİSİ AND, ŞEKERSPOR PROFESSIONAL SOCCER TEAMS.

TEAMS	N	MEAN	STDEV	SEMEAN	MIN	MAX
MKE ANKARAGÜCÜ	16	133.00	13.32	3.33	104	157
PETROLOFİSİ	16	113.25	11.17	2.79	96	138
ŞEKERSPOR	16	121.31	15.20	3.80	92	144

(*) F = 8.88 P = 0.00 => P<.05

Şekerspor professional soccer team had higher mean anaerobic power than Petrolofisi soccer team and had lower mean anaerobic power than MKE Ankaragücü professional soccer team.

One way Anova test indicated that there were significant differences in anaerobic power between MKE Ankaragücü-Şekerspor and MKE Ankaragücü-Petrolofisi professional soccer teams. But there was no significant difference between the anaerobic power of Şekerspor and Petrolofisi soccer teams.

The means, standard deviations, standard errors, minimum and maximum mean values of max VO2 of MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams are presented in Table IX.

MKE Ankaragücü soccer players' mean VO2 max was 51.57 ml.kg.min., standard deviation was 3.17, standard error was 0.79, minimum and maximum mean value were 45.16 and 57.00 ml.kg.min., respectively.

Petrolofisi soccer players' mean VO2 max was 51.13 ml.kg.min., standard deviation was 2.00, standard error was 0.50, minimum and maximum mean values were 46.65 and 54.21 ml.kg.min., respectively.

Şekerspor soccer players' mean VO2 max was 51.25 ml.kg.min., standard deviation was 2.11, standard error was 0.52, minimum and maximum mean values were; 48.87 and 54.80 ml.kg.min., respectively

TABLE IX

MEANS, STANDARD DEVIATIONS, STANDARD ERRORS, MINIMUM AND MAXIMUM VALUES OF VO2 MAX POWER OF MKE ANKARAGÜCÜ, PETROLOFİSİ AND, ŞEKERSPOR PROFESSIONAL SOCCER TEAMS.

TEAMS	N	MEAN	STDEV	SEMEAN	MIN	MAX
MKE ANKARAGÜCÜ	16	51.57	3.17	0.79	45.16	57.00
PETROLOFİSİ	16	51.13	2.00	0.50	46.65	54.21
ŞEKERSPOR	16	51.25	2.11	0.52	48.87	54.80

F = 0.13 P = 0.87 => P>.05

The results showed that there were no significant differences among the VO2 max values of MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams at .05 confidence level.

According to Cooper's (1968) fitness clasification, the results showed that the three teams' VO2 max scores were very good. (between 46.50 and 52.40 ml.kg.min).

Means, standard deviations, standard errors, minimum and maximum mean values of 50 m. dash of MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams are given in Table X.

MKE Ankaragücü professional soccer players' mean 50 m dash was 6.79 sec, standard deviation was 0.23, standard error was 0.59, minimum and maximum mean values were 6.37 sec., and 7.20 sec.,

Petrolofisi soccer team's mean was 6.94 sec., standard deviation was 0.42, standard error was 0.10, minimum value was 6.37 sec and maximum value was 7.96 sec.

And the means, standard deviations, standard errors of mean, minimum and maximum values of Şekerspor soccer team were 6.37 sec., 0.19, 0.04, 6.40 sec. and, 7.10 sec.

TABLE X

MEANS, STANDARD DEVIATIONS, STANDARD ERRORS, MINIMUM AND MAXIMUM VALUES OF 50 m DASH OF MKE ANKARAGÜCÜ, PETROLOFİSİ AND, ŞEKERSPOR PROFESSIONAL SOCCER TEAMS.

TEAMS	N	MEAN	STDEV	SEMEAN	MIN	MAX
MKE ANKARAGÜCÜ	16	6.79	0.23	0.59	6.37	7.20
PETROLOFİSİ	16	6.94	0.42	0.10	6.37	7.96
ŞEKERSPOR	16	6.73	0.19	0.04	6.40	7.10

F = 2.07 P = 0.13 => P>.05

Analysis of one way Anova test revealed that there were no significant differences in 50 m dash results among the MKE Ankaragücü, Petrolofisi, and Şekerspor professional soccer teams.

The means, standard deviations, standard errors, minimum and maximum values of mean flexibility of MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams are given in Table XI.

MKE Ankaragücü soccer team's mean flexibility was 28.78 cm, standard deviation was 6.23, standard error was 1.56, minimum and maximum values were 15 cm and 36 cm respectively.

Petrolofisi soccer team's mean flexibility value was 28 cm, standard deviation was 4.58, standard error 1.14, minimum mean value was 21 cm and maximum value was 31.06 cm.

Şekerspor soccer team's mean flexibility was 31.06 cm, standard deviation was 3.83, standard error was 0.95, minimum mean walue was 26 cm and maximum mean value was 38 cm.

TABLE XI

MEANS, STANDARD DEVIATIONS, STANDARD ERRORS, MINIMUM AND MAXIMUM VALUES OF FLEXIBILITY OF MKE ANKARAGÜCÜ, PETROLOFİSİ AND, ŞEKERSPOR PROFESSIONAL SOCCER TEAMS.

TEAMS	N	MEAN	STDEV	SEMEAN	MIN	MAX
MKE ANKARAGÜCÜ	16	28.78	6.23	1.56	15	36
PETROLOFİSİ	16	28.00	4.57	1.14	21	36
ŞEKERSPOR	16	31.06	3.83	0.95	26	38

F = 1.63 P = 0.20 => P>.05

Table XI shows that Şekerspor soccer team was slightly more flexible than MKE Ankaragücü, Petrolofisi and Şekerspor soccer teams.

No significant differences were obtained in mean flexibility values among MKE Ankaragücü, Petrolofisi and Şekerspor soccer teams.

The means, standard deviations, standard errors, minimum and maximum values of mean grip strength of MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams are presented in Table XII.

MKE Ankaragücü soccer team's mean right grip strength was 51 ± 7.45 kg, left grip strength was 47.06 ± 7.59 kg.

Petrolofisi soccer team's mean right grip strength was 51.62 ± 5.00 kg, left was 46.62 ± 5.58 kg.

Şekerspor soccer team's mean right grip strength was 57.8 ± 5.48 kg, left grip strength was 52.69 ± 4.73 kg.

TABLE XII

MEANS, STANDARD DEVIATIONS, STANDARD ERRORS, MINIMUM AND MAXIMUM VALUES OF GRIP STRENGTH OF MKE ANKARAGÜCÜ, PETROLOFİSİ AND, ŞEKERSPOR PROFESSIONAL SOCCER TEAMS.

TEAMS	N	MEAN	STDEV	SEMEAN	MIN	MAX
Right Hand Grip		51.00	7.45	1.86	36	68
MKE ANKARAGÜCÜ	16					
Left Hand Grip		47.06	7.59	1.90	34	64
Right Hand Grip		51.62	5.00	1.25	42	60
PETROLOFİSİ	16					
Left Hand Grip		46.62	5.58	1.40	40	60
Right Hand Grip		58.81	5.48	1.37	50	68
ŞEKERSPOR	16					
Left Hand Grip		52.69	4.73	1.18	44	61

(*) F = 6.16 P = 0.00 (for Right Hand Grip) => P<.05

(*) F = 4.93 P = 0.01 (for Right Hand Grip) => P<.05

Test indicated that Şekerspor had higher right and left hand grip strength values than MKE Ankaragücü and Petrolofisi. There were significant differences in right and left hand grip strength between MKE Ankaragücü-Şekerspor, and Petrolofisi-Şekerspor soccer teams. But there were no significant differences in right and left grip strength between MKE Ankaragücü and Petrolofisi soccer teams.

CHAPTER V

DISCUSSION

The purpose of this study was to find and compare the anaerobic power, aerobic power, percent body fat, flexibility, grip strength, speed, height, and weight of MKE Ankaragücü, which is the first league team, Petrolofisi which is the second league team, and Şekerspor which is the third league team in Türkiye professional soccer league during 1992-93 spring season.

A total of 7 physical fitness variables were recorded for the purpose of this study. 7 physical fitness test results were compared among MKE Ankaragücü, Petrolofisi, and Şekerspor professional soccer teams.

The results of one-way analysis of Variance (ANOVA) indicated that significant differences were found in physiological characteristics (weight, anaerobic power and grip strength) of MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams. However, no significant differences were found in percent body fat, height, VO2 max, 50 m dash, and flexibility of MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams.

A review of literature indicated that athletes participating in endurance-type sports had 8 to 10 percent body fat on the average. The results of other studies conducted on soccer players are in agreement with these results. (Puga , Ramos and Lomba et al., 1991)

Pollock and Coworkers (1976) reported that the soccer player had a greater percent body fat than elite distance runners. Same researchers agree that the percent body fat of soccer players is approximately 10 %. However, MKE Ankaragücü, Petrolofisi and Şekerspor teams have lower percent body fat than Pollack and Coworkers (1976) results. The endurance type of training program which these three teams followed may have an effect on this result.

According to Cureton (1982), cardiorespiratory capacity is related to the degree of body fatness, that is body fatness negatively affects maximum oxygen uptake. And increase in body weight causes an increase in fat depots in the body which affects the percent body fat. There were no significant differences in percent body fat among MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams. According to Buskirk's classification of skinfold measurement for male athletes, the percent body fats of MKE Ankaragücü, Petrolofisi and Şekerspor soccer teams were acceptable.

Yamaner (1987) found the mean percent body fat of Gençlerbirliği Junior soccer team with 6.75 %. And Ziyagil (1989) found the mean percent body fat of Konyaspor professional soccer team with 7.03 %. Both Gençlerbirliği and Konyaspor soccer teams had a lower mean percent body fat values than MKE Ankaragücü, Petrolofisi, and Şekerspor professional soccer team's mean percent body fat. Age might have on effect on lower mean percent body fat values of Gençlerbirliği and Konyaspor soccer teams. Although, MKE Ankaragücü soccer team had the highest mean percent body fat, but this difference was not statistically significant ($P < .05$.) As a result MKE Ankaragücü soccer players' physique was larger than others. This small differences might be caused by teams' exercise levels.

Many researchers reported that exercise decreases body fat (Bray, 1983; Noble, 1986). However, proper diet also important factor together with exercise (Blue Cross Association, 1973).

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 (13.40 %). These results were greater than MKE Ankaragücü, Petrolofisi and Şekerspor soccer team's mean percent body fat. The application of routine training program by soccer teams might have an effect on these results.

Body mass is often a decisive factor in the constitution of players and contributes greatly to functional performance. Any increase in body mass attributed solely to total body fat will be disadvantageous and reduce performance. It is suggested that for functional purposes relative amounts of total body fat and free fat mass are more important than body mass itself. The logic of this is that the greater the free fat mass the greater the potential for strength, speed, power, aerobic and anaerobic fitness, all are necessary prerequisites for optimal physical fitness in soccer players. All soccer players should identify the optimal status of body composition bearing in mind their playing positions.

Roberts (1978) indicated that 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. Yamaner (1987) found that the mean height of Gençlerbirliği junior soccer team was 171.56 cm. And Ziyagil (1989) found the mean height values of Konyaspor professional soccer team was 177.33 cm. Kandeydi and Ergen (1982) presented data about mean height of 179 cm which was same as MKE Ankaragücü and Şekerspor soccer teams.

According to the data from the United States Public Health Service and Nutrition Examination Survey, (McArdle et al., 1981) the average

height for 18-24 years old males were 185 cm which was higher than MKE Ankaragücü, Petrolofisi and Şekerspor soccer teams. Kanungsukkasen (1983) reported that nutrition, environmental factors and genetic factors are the determinant of height and weight. In this study, MKE Ankaragücü, Petrolofisi, and Şekerspor professional soccer teams' mean height were same as Konyaspor mean height values and higher mean height than Gençlerbirliği junior soccer team's mean height. The reason for this difference is probably the age of Gençlerbirliği junior soccer team. It was lower than those of other teams.

According to the data from the United States Public Health Service and Nutrition Examination Survey, (McArdle et al., 1981) the average weight for 18-24 years old males were 85 kg which was higher than MKE Ankaragücü, Petrolofisi and Şekerspor soccer teams. Yamaner (1987) found that the mean weight values of Gençlerbirliği Junior soccer team with 66.42 kg (mean age was 20.47 years) which is lower than MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams. In this point, age could be effective on weight of soccer players.

The vertical jump test was used to determine anaerobic power of three professional soccer teams. Leg power is an important factor in soccer to jump, head the ball or perform fast starts. It is established that soccer is not a typical aerobic sport. It involves anaerobic alactic power for maximal efforts of 1 to 10 s duration, the anaerobic capacity for strenuous exercises during 20 to 45 s (ATP-PC + anaerobic glycolysis) and the lactic acid tolerance for heavy exercise lasting 1 to 8 min (anaerobic glycolysis and O_2 system). Above 10 minutes and at submaximal exercise, the aerobic pathway becomes predominant (Skinner and Morgan, 1984).

Ziyagil (1989) found that the vertical jump results of Konyaspor soccer team was 56.71 cm. This indicated that there was big difference in mean vertical jump values between MKE Ankaragücü (64.81 cm) and Konyaspor. However, Konyaspor, Şekerspor and Petrolofisi soccer teams had approximately same mean vertical jump scores. Since MKE Ankaragücü soccer team did more plyometric training during season, this type of training program could have an effect on higher vertical jump

scores.

The vertical jump score also was evaluated by using Lewis Nomogram in order to determine anaerobic power of the subjects. Ziyagil (1989) found that Konyaspor professional soccer players' mean anaerobic power with 119.06 kg.m.sec. This score was lower than MKE Ankaragücü soccer players (133 kg.m.sec.). But approximately same as Şekerspor and Petrolofisi soccer players (121.31 and 113 kg.m.sec.). MKE Ankaragücü soccer team trained plyometric training program during season. This could be result of higher anaerobic power value.

MKE Ankaragücü soccer players reported perceived benefits of the additional plyometric training and increased enjoyment. Future work should examine the efficacy of plyometrics introduced pre-season and as replacement for rather than supplemental to selected elements of the normal training prescription. A more extended period of study is recommended to evaluate both the performance enhancement and injury risk reduction of this regimen and alternative forms of plyometric training. Due to the stretch-shortening loads employed during intense actions such as sprinting and jumping during games play, it is thought that plyometric training would be of benefit to soccer player. (Doyle and Reilly et al., 1991)

According to Bompa (1986) a high aerobic capacity, positively transfers to the anaerobic capacity. If an athlete improves his/her aerobic capacity the anaerobic capacity will also improve since the athlete will be able to function longer before reaching an O2 debt, and will recover more quickly after building up an O2 debt.

A large anaerobic capacity is therefore of great importance for success in sports with short bursts of intense exercise. In line with this idea, the sprint-trained subjects, who had competed at a high level in anaerobic types of sports for 5 years or more, had a 30 % larger anaerobic capacity compared with untrained and endurance trained subjects. This

higher anaerobic capacity may be due to training, genetic factors or a combinations of both (Astrand and Rodahl, 1987).

Soccer players have to travel approximately 10 km during a game (Ekblom, 1986), and also need to sprint repeatedly. In other words, they must do both short duration maximal exercise and moderate endurance exercise. Both aerobic and anaerobic energy delivery systems make up a soccer player's physical fitness. Therefore, these results suggest that soccer players require the use of both anaerobic and aerobic capacity, and especially require the use of the ATP-PC system. The reason is that soccer players must immediately recover or restore their ATP and CP during a short interval in order to succeed.

Gündüz (1990) found that Turkish National B-Youth soccer team players mean VO2 max was (48.77 ml.kg.min.) lower than MKE Ankaragücü, Petrolofisi, and Şekerspor soccer teams. Yamaner (1987) tested Gençlerbirliği junior soccer team, and he found its mean VO2 max was 54.58 ml.kg.min. This result was higher than MKE Ankaragücü, Petrolofisi and Şekerspor soccer teams. Ziyagil (1989) found the similar results for Konyaspor 51.00 ml.kg.min. Similar to those of MKE Ankaragücü, Petrolofisi, and Şekerspor soccer teams (51.57, 51.13, 51.25, ml.kg.min.). This difference may have been depend on Gençlerbirliği junior soccer team's endurance type of training program during season.

The physiological significance of the relationship between performance and aerobic power in soccer player remains controversial. Previous studies have demonstrated that aerobic power was not necessarily a performance limiting factor (Faina et al., 1988), while other studies showed that maximal oxygen uptake could be related to the distance covered during the game (Reilly, 1986). The present data shows mean VO2 max values similar to those found in the literature (Reilly et al., 1988).

Moreover, the duration of the match is an important factor and

necessitates great muscular aerobic capacity. It is thought that a value of 65 ml/kg/min VO2 max is required for top level plays. (Tomas et al., 1991) So, since the results of VO_2 max is of the teams this study much lower than this value, their training program should be rearranged.

Researchers (McArdle et. al., 1981; Astrand and Rodahl, 1986) agree that the maximal aerobic power is influenced by heredity, state of training, age, sex, and body composition. Same researchers suggested that aerobic power can be increased with training.

Astrand and Rodahl (1986) indicate that soccer players have relatively moderate levels of endurance capacity. With some exceptions, maximal oxygen uptake of soccer players was significantly below the levels found in endurance athletes. Soccer players have to enhance their VO2 max capacity because of duration of soccer game. Each player must have the capability to perform increased numbers of short, fast bursts of running, interspersed with jogging and walking.

This study showed that the VO2 max values for MKE Ankaragücü, Petrolofisi and, Şekerspor professional soccer teams were in high category according to the Cooper's Classification. The mean values of VO2 max found in this study were same as with those reported in the literature (52-50 ml. kg.min) for professional soccer players (Reilly, 1990). However those values are much lower then the VO2 max 165 ml/kg suggested for top soccer players (Tomas et al, 1991).

Soccer requires frequent sprints with high intensity during 90 minutes of play with short rest periods. As a result, speed as a part of physical fitness of soccer player has become important. Yamaner (1987) found that Gençlerbirliği junior soccer team had a mean 50 m dash of 6.50 sec which is better mean value than those of MKE Ankaragücü, Petrolofisi and, Şekerspor soccer teams 6.79, 6.94, 6.73, rescpectively. Here are, age, state of training, weight, height and body composition are effective on speed. Gençlerbirliği junior team's mean age was 20.47. Ziyagil (1989) found the higher mean 50 m dash results for Konyaspor with 7.34 sec. and mean age was 26.42. This result was much slower than

those of MKE Ankaragücü, Petrolofisi and Şekerspor soccer teams.

Sprint training is important factor to develop speed (ATP-PC system) and muscular strength. Especially, MKE Ankaragücü and Şekerspor soccer teams were applied sprint training in their training programs. This application may have played important role at this higher result.

Soccer players need to have a good range of motions at the joints. Because sudden stops, takeoffs, turns and jumps are beign seen in soccer always. Gündüz (1990) and Ziyagil (1989) found the similar mean flexibility values of Turkish National B-Youth soccer team (28.71 cm) and Konyaspor soccer teams (28.24 cm). These results were approximately same for MKE Ankaragücü and Petrolofisi (28.78 cm and 28.00 cm), but lower than that of Şekerspor soccer team (31.06 cm).

Flexibility, the range of motion about a joint, is related to health, and, to some extent, to athletic performance. Regularly scheduled programs involving stretching exercises (2 to 5 days per week, 15 to 60 min. per day) will improve flexibility within a few week. Bucher, (1983) pointed that flexibility can be also affected by activity, age, sex, temperature, ischemia, and irregular body proportion.

Strength training can contribute to better performance in many physical activities particularly if speed or power are essential. Grip strength of soccer players was measured by using handgrip dynamometer. Both isometric and isotonic forms of strength training can produce improvements in many motor and sports performances. Although the evidence is at times conflicting, it is generally accepted that progressive weight-training programs are superior. Exercise programs designed to strengthen muscles primarily involved in a particular sport can be used as supplements to regular practice in effectively improving the athlete's skills and motor fitness.

Thomas (1977) reported that 31 English professional soccer players'

mean grip strength was 50.4 kg. This result was smaller than Şekerspor soccer team's mean hand grip values. Physical strength decreases with age. English professional soccer players were much older than Şekerspor soccer players.

Ziyagil (1989) reported that the mean right hand grip of Konyaspor soccer team' was 64.17 kg and left hand grip 61.72 kg which was higher mean hand grip value than those of MKE Ankaragücü, Petrolofisi, and Şekerspor soccer teams. Konyaspor soccer team might have worked about strength training in a week in their training program more than MKE Ankaragücü, Petrolofisi and Şekerspor soccer teams.

In conclusion, the results of this study confirm the finding obtained with transverse studies demonstrating that the performance of a team depends on also other factors (e.g. technical and tactical) beside physiological capacities.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Most coaches believe that it is necessary to analyze the physical characteristics and physiological capacities of soccer players in order to determine the specific requirements for optimal performance. These data can be useful not only to modify training programs but also to understand physiological status of players as well as to establish new data for comparison by future investigation.

Based on these facts, the purpose of this study was to find and to compare the anaerobic power, aerobic power, percent body fat, flexibility, grip strength, speed, height and weight of MKE Ankaragücü, which is the first league team, Petrolofisi, which is the second league team and, Şekerspor, which is the third league team in Türkiye professional soccer league during 1992-93 spring season.

This data gives us some clues about the physiological characteristics of Turkish professional soccer players. So trainer or coaches can improve their training programs by using these data.

One-way analysis of variance (ANOVA) was used to test for differences among MKE Ankaragücü, Petrolofisi and, Şekerspor professional soccer teams. Differences in physical fitness variables were tested for statistical significance at .05 confidence level.

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

1. The differences in the means of percent body fat were not statistically significant among MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams at .05 confidence level. The null hypothesis was accepted.

2. The differences in the means of height were not statistically significant among MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams at .05 confidence level The null-hypothesis was accepted.

3. The differences in the means of weight were statistically significant between MKE Ankaragücü and, Petrolofisi soccer teams at .05 confidence level. The null-hypothesis was rejected.

4. The differences in the means of weight were not statistically significant between MKE Ankaragücü-Şekerspor and Petrolofisi-Şekerspor professional soccer teams at .05 confidence level. The null-hypothesis was accepted.

5. The differences in the means of vertical jump were significant between MKE Ankaragücü-Petrolofisi and MKE Ankaragücü-Şekerspor professional soccer players at .05 confidence level. The null-hypothesis was rejected.

6. The difference in the means of vertical jump was not statistically significant between Petrolofisi and Şekerspor professional soccer teams at .05 confidence level. The null-hypothesis was accepted.

7. The means of anaerobic power of MKE Ankaragücü was statistically higher than those of Petrolofisi and Şekerspor professional soccer teams at .05 confidence level. The null-hypothesis was rejected.

8. There was no significant difference in the means of anaerobic power between Petrolofisi and Şekerspor professional soccer teams. The null-hypothesis was accepted.

9. The differences in the means of VO2 max were not statistically significant among MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams at .05 confidence level. The null-hypothesis was accepted.

10. The differences in the means of 50 m dash were not statistically significant among MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams at .05 confidence level. The null-hppothesis was accepted.

11. The differences in the means of flexibility were not statistically significant among MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams at .05 confidence level. The null-hppothesis was accepted.

12. The mean of right hand grip strength of Şekerspor was significantly higher than those of MKE Ankaragücü and Petrolofisi professional soccer teams at .05 confidence level. The null-hypothesis was rejected.

13. The differences in the means of right hand grip strength was not statistically different between MKE Ankaragücü and Petrolofisi soccer

teams at .05 confidence level. The null-hypothesis was accepted.

14. The mean of left hand grip strength of Şekerspor was significantly higher than those of MKE Ankaragücü and Petrolofisi professional soccer teams at .05 confidence level. The null-hypothesis was rejected.

15. The difference in the means of left hand grip strength was not different between MKE Ankaragücü and Petrolofisi professional soccer teams at .05 confidence level. The null-hypothesis was accepted.

RECOMMENDATIONS

There is no doubt that more studies are needed to assess the effectiveness of training programs on anaerobic capacities, flexibility, strength, speed of MKE Ankaragücü, Petrolofisi and Şekerspor professional soccer teams.

It is recommended that more team should be participated in further studies. This will give researchers great chance to compare other local or foreign soccer teams.

It is recommended that this study should be applied during pre-season, post-season and, off season.

It is recommended that physical fitness variables of soccer players should be directly measured by using standardized test procedures under same test conditions.

It is recommended that physical fitness variables of soccer players should be tested during the game for accuracy, validity and reliability of the test.

REFERENCES

Agnevik, G. Football, Idrottsfysiology, repport no. 7, Trygy-Hansa, Stockholm, 1970.

Astrand, P.O. and Rodahl K. Textbook of Work Physiology. McGraw-Hill Book Company: Singapore, 1987.

Atha, J. "Strengthening Muscle". Exerc. Sport. Sci. Rew. 9: 1, 1981.

Armbruster, David A. et. a. Basic Skills in Sports for Men and Women. The C.V. Mosby Company: Saint Louis, 1975.

Balke, B., "Cardio-pulmonary and metabolic Effects of Physical Training" Health and Fitness in the Modern World, The Athletic Institute and ACSM, 1961.

Barbara, N.K., "Simple Reacting Time of Selected Top-class Sportsmen and Research Students." The Research Quartedly, 32, 409-412, 1961.

Bucher, C.A. Foundation of Physical Education and Sports. St. Louis: The C.V. Mosby Company, 1983.

Burke, E.J. "Validity of Selected Laboratory and Field Tests of Physical Working Capacity." Research Quarterly, 1976, Vol. 47., pp. 95-104.

Carter, L. and Yuhasz, M. "Skinfolds and Body composition of Ollympic Athlets." Medicine Sport Science. Vol. 18, pp. 144-182, 1984.

Clanville, B. Soccer. New York: Crown Publishers, 1968.

Cochrane, C. and Frank Pyka. "Physiological Assesments of the Australian Soccer Squad." The Australian Journal for Health, Physical Education and Recreation. September, 1976, pp. 21-25.

Cooper, K.H. "A Means of Assessinhg Maximal Oxygen Intake." Journal of American Heart Associaton, 1968, 203, 135, 138.

Devries, H. Physiology of Exercise. California: Brown Company, 1980.

Fox, E.L. and Mathews, D.K. The Physiological Basis of Physical Education and Athletics. New York: 1988, p. 674, 422-423.

Golden, H.P., Vaccaro, P. "The Effects of Endurance Training Intensity on the Aanaerobic threshold." Journal of Sports Medicine, Vol. 24, 1984, pp. 205.

Green, H.J. Laboratory Manual on the Principles of Measurement in Human Performance. Univeristy of Waterloo, canada, 1970.

Gündüz, H. "Physical and Physiological Characteristics of 1989 Turkish National 13-Youth Soccer Team Players. " (Unpublished Master's Thesis, METU, 1990).

Hickson, R.C., FACSM, B.A., Duerak, 1988. "Strength training and performance in endurance trained subjects". Medicine Science Sports Exercise, Vol., 29: s. 86.

Hole, J.W. Human Anatomy and Physiology. New York: Mosby Company, 1978.

Karpovich, P.V., and Sinning W.E. Physiology of muscular Activity. Philadelphia: W.B. Saunders Co., 1971.

Kanungsukkasem, V. "A Measurement and Comparison of Selected Physical Fitness Components and Antropometrical Characteriscis of American Middle Eastern and East and Southeast Asian Male Students at Oklahoma State University." (Unpulished Ed.D. Dissertation Oklahoma State University, 1983).

Komi, P.V., H. Rusko, J. Vos and V. Vihko. "Anaerobic Performance Capacity in Athletes." Acta. Phyiol. Scand. 100: 107-104 19977.

Jousselin, E., et. al. "Maximal Aerobic Power of French Top Level Competitors" Journal of Sports Medicine, Vol. 24, 1984.

Mathews, Donald K. and Fox, Edward L., The Physiological Basis of Physical Education and Athletics, W.B. Saunders Company, Philadelphia, 1976.

McArdle, W.D., F. katch, and V.L. Katch. Exercise Physiology. Philadelphia: Lea and Febiger 1980.

Mosher, R.E. et. al. "Internal Training: The Effects of a 12 Week Programme on Elite, Pre-pubertal male Soccer Players." The Journal of Sport Medicine. Vol. 25., 1985.

Noble, Bruce J., Physiology of Exercises and Sports, USA, Mosby-Mirror, 1986.

Ogawa, Y. takahashi, and S. kato. "On the Reaction Time of Sportsmen Engaged in Various Sports." Japanesse Journal of Physical Fitness. 13: 90, 1964.

Oberg, B., Ekstrand, J. Müller, M., and Gillquist, J. "Muscle Strength and Flexibility in Different Positions of Soccer Players." Journal of Sports Medicine. Vol. 5. No. 4, pp. 213-216, 1984.

Pollock, M.L. et. al. "Working Capacity, Cardiorespiratory, and Body Composition Characteristics of World Class Middle and Long Distance Runners." The Physiologist. 18 (3): 355, 1976.

Raven, P.B., L.R. Getman, M.L. Pollock, and R.H. Cooper. "A Physiological Evaluation of Professional Soccer Players." British Journal of Sports medicine. Vol. 10, 1976, pp. 209-216.

Rhodes, E.L., et.al. "The Physiological Profiles of the Canadian Olympic Soccer Team." Canadian Journal of Applied Sports Sciences, Vol. 1, 31-36, 1986.

Saltin, B. and Astrand, P.O., 1987. "Maximal oxygen uptake in a athletes". Journal Applied Phsiology, 23: 353-358.

Sherry, E., Beckenholdt, M.A. and J.L. Mayhew. "Specifity Among Anaerobic Power Tests in Male Athletes." Acta. Physiol. Scand. 100: 107-104, 1977.

Tamer, K., 1990. "Twelve-Minute Run-Walk Test (Cooper)". Measurement of Physical Fitness Components of Physical Education and Sports Department of Middle East Technical University, pp. 92.

Tamer, K., Measurement of Physical Performance, METU, Ankara, 1989.

Toda, Yoshiaki, et. al. "Studies on Physical Fitnes of Inhabitants in Surabaja, Indonesia." Kobe Journal of Medical Science, 1970, 16: 155-157.

Unitas, J. and Dintiman, G. Improving Health and Performance in Athlete. New Jersey: Prentice Hall Inc., 1979.

Vinnai, G. Football Nania. London: Ocean Books, 1973.

Vogelsinger, Hubert. How to Start in Soccer. Four Winds Press: New York, 1967.

Wade, A. The F.A. Guide to Training and Coaching. Heineman: London, 1979.

Wells, K.F. and E.K. Dillion. "sit and Reach, A Test of Back and Leg Flexibility." The Research Quarterly. 1952. 23: 115-118

Whiters, R.G., D, Roberts, and G.J. Davies. "The Maximum Aerobic Pofer, Anaerobic Power and Body Composition of South Australian Male representatives in Athletics, Basketball, Field Hockey, and Soccer." Journal of Sports Medicine, 17: 391-400, 1977.

Williams, C., Reid, R.M. and coutts, R. "Observations on the Aerobic Power of University Rugby Players and Professional Soccer Players" British Journal of Sports Medicine, vol. 7, 1973, pp. 390-391.

Wilmore, C.H. "The Assesments of and Variation in Aerobic in World Class Athletes as Related to Specific Sports." The American Journal of Sports Medicine, Vol. 12., No. 2., p. 120, 1984.

Yamaner, F. "Gençlerbirliği Ümit Futbol Takımının Çeşitli Fiziki Kapasitelerinin Ölçümü ve Değerlendirilmesi." (Unpublished Master's Thesis, Gazi University, 1987).

Ziyagil, A. "Physical and Physiological Characteristics of Konyaspor Professional Soccer Players" (Unpublished Master's Thesis, METU, 1985).

Zelenka, V., seliger, V. and Ondrej, O. "Specific function Testing of Young Football Players". Journal of Sports Medicine. 7: 143-147, 1967.

APPENDICES

APPENDIX A

THE RAW SUBJECT DATA

TABLE A-I

PHYSIOLOGICAL MEASUREMENTS OF MKE ANKARAGÜCÜ PROFESSIONAL SOCCER PLAYERS

Subjects n=16	Height (cm)	Weight (kg)	Vertical (cm)	VO2 max (ml/kg/min)	Lewis Nomogram	50m Dash (sec)	Plexibility (cm)	Grip Strength Right H. - Left H. (kgs)	Percent Body Fat (%)
1-TE	183	76	58	53-62	128	6.79	27	45 - 45	7.15
2-GA	180	82	60	48-13	140	7.02	34	54 - 51	7.81
3-BG	182	83	65	51-10	148	6.85	34	50 - 40	8.17
4-AY	176	70	55	53-32	115	6.59	24	45 - 41	6.84
5-AP	181	85	70	45-16	157	7.20	36	54 - 43	9.07
6-SS	182	82	69	46-65	150	7.05	15	50 - 52	8.89
7-CA	179	73	65	57-00	130	6.37	20	58 - 48	7.41
8-HS	175	70	72	53-32	131	6.73	29.5	59 - 53	6.80
9-SG	176	74	67	51-84	134	6.49	34	52 - 59	7.71
10-EÇ	184	78	59	52-58	132	6.85	36	45 - 46	7.73
11-HK	176	60	62	55-55	104	6.69	32	36 - 34	6.60
12-MK	176	74	67	51-10	134	6.55	24	50 - 44	7.57
13-TÜ	174	70	66	53-77	126	6.61	26	68 - 64	8.21
14-EY	175	68	68	51-84	124	6.99	36	50 - 41	6.60
15-HÇ	186	80	68	51-99	146	6.89	26.5	56 - 50	6.89
15-FD	175	72	66	48-20	129	7.10	26.5	44 - 42	7.71
MEAN	178.75	74.81	64.81	51.57	133	6.79	28.7	51 - 47.06	7.57
STDEV	3.84	6.64	4.74	3.17	13.32	0.23	6.2	7.45- 7.59	0.75

TABLE A-II

PHYSIOLOGICAL MEASUREMENTS OF PETROLOFİSİ PROFESSIONAL SOCCER PLAYERS

Subjects n=16	Height (cm)	Weight (kg)	Vertical (cm)	VO2 max (ml/kg/min)	Lewis Nomogram	50m Dash (sec)	Plexibility (cm)	Grip Strength Right H. - Left H. (kgs)	Percent Body Fat (%)
1-TG	172	69	55	52-73	113	7.00	34	50 - 40	6.70
2-NÜ	177	72	57	51-10	120	7.30	28	45 - 47	7.50
3-KN	178	71	56	50-35	118	6.50	23	50 - 45	6.97
4-GA	176	70	62	52-21	122	6.77	26	51 - 41	6.89
5-MA	175	68	56	52-58	112	6.65	36	52 - 51	6.99
6-İE	183	74	52	48-13	118	6.93	30	50 - 45	7.59
7-Aİ	180	64	46	52-88	96	6.59	29	42 - 40	6.89
8-AU	175	63	48	51-84	97	6.80	30	55 - 51	6.14
9-MA	178	76	55	51-99	125	6.96	26	60 - 60	7.53
10-VS	176	67	54	50-35	109	7.13	23	50 - 40	7.18
11-AD	182	75	52	50-50	120	6.37	27	55 - 49	7.65
12-İA	185	76	68	52-28	138	6.70	021	60 - 50	7.32
13-İA	178	68	47	50-50	103	7.76	35	47 - 45	7.38
14-YU	176	65	49	53-19	101	6.29	24	56 - 53	6.51
15-HU	178	67	50	46-65	105	7.96	24.55	56 - 47	7.28
16-FŞ	174	68	58	48-87	115	6.77	32	48 - 42	7.13
MEAN	177.69	69.56	54.06	51.13	113.25	6.94	28.00	51.62- 46.62	7.10
STDEV	3.42	4.13	5.73	2.00	11.17	0.42	4.58	5.00- 5.58	0.41

TABLE A-III

PHYSIOLOGICAL MEASUREMENTS OF ŞEKERSPOR PROFESSIONAL SOCCER PLAYERS

Subjects n=16	Height (cm)	Weight (kg)	Vertical (cm)	VO2 max (ml/kg/min)	Lewis Nomogram	50m Dash (sec)	Flexibility (cm)	Grip Strength Right H. - Left H. (kgs)	Percent Body Fat (%)
1-MG	186	76	54	48-87	124	7.10	38	54 - 48	7.54
2-DA	174	68	72	53-32	127	6.40	34	64 - 50	7.59
3-MT	184	79	68	54-80	144	6.50	36	60 - 48	7.86
4-EŞ	183	80	48	49-61	122	6.90	26	60 - 55	8.21
5-ST	188	84	60	53-32	144	6.70	34	68 - 59	7.61
6-DY	178	73	63	52-58	128	6.50	36	50 - 44	7.53
7-MKG	174	69	52	48-87	110	6.70	32	56 - 51	7.32
8-OB	168	60	48	52-88	92	6.71	28	60 - 54	6.91
9-ŞÇ	176	64	58	50-35	108	6.60	26	59 - 55	6.97
10-LA	172	66	53	48-87	119	6.78	29	61 - 58	7.19
11-MY	182	74	62	49-61	129	6.74	28	50 - 48	6.91
12-ED	172	66	50	49-61	103	6.60	32	50 - 52	7.46
13-SE	185	79	65	53-32	141	6.72	31	55 - 51	6.37
14-HT	184	78	58	50-35	131	6.70	32	66 - 61	6.70
15-CB	176	69	48	54-06	105	7.05	26	56 - 51	7.36
16-BA	178	70	53	49-61	113	6.98	29	56 - 58	6.16
MEAN	178.75	72.69	57.00	51.25	121.31	6.73	31.06	57.81- 52.69	7.23
STDEV	5.94	6.54	7.48	2.11	15.20	0.19	3.83	5.48- 4.73	0.53

TABLE A-IV

SKINFOLD MEASUREMENTS OF MKE ANKARAGÜCÜ PROFESSIONAL SOCCER PLAYERS

tes Of infolds bjects 16	Biceps (mm)	Triceps (mm)	Thigh (mm)	Illiac (mm)	Subscapula (mm)	Chest (mm)	Abdomen (mm)	Percent Body Fat (%)
TE	6.0	4.0	7.2	5.0	7.0	7.0	9.4	7.15
GA	7.2	5.0	9.0	7.0	9.2	5.6	6.0	7.81
BG	7.0	6.0	7.0	8.0	10.4	8.4	9.0	8.17
AY	6.0	5.0	7.0	4.0	6.0	5.0	7.0	6.84
AP	9.6	6.0	10.4	10.4	9.0	11.0	14.0	9.07
SS	10.2	8.0	9.0	6.0	9.6	9.0	9.0	8.89
CA	7.4	5.6	7.0	7.4	6.0	5.5	8.0	7.41
HS	5.4	4.6	5.0	7.0	6.0	4.6	6.4	6.80
SG	7.0	6.0	8.0	6.0	8.2	6.0	6.6	7.71
EÇ	9.0	3.0	7.0	7.0	7.2	9.0	9.0	7.73
HK	5.0	5.0	4.4	4.6	6.6	5.0	6.0	6.60
MK	6.0	6.0	8.0	6.0	8.0	6.6	7.0	7.57
TÜ	5.0	9.0	8.2	8.0	9.0	8.0	9.0	8.21
EY	5.0	4.0	6.0	4.6	7.0	4.0	4.4	6.60
EÇ	6.6	5.0	6.4	5.6	5.0	5.0	7.0	6.89
FD	5.0	6.0	8.0	6.0	8.6	8.4	9.0	7.71

TABLE A-V

SKINFOLD MEASUREMENTS OF PETROLOFİSİ PROFESSIONAL SOCCER PLAYERS

Sites Of Skinfolds Subjects n=16	Biceps (mm)	Triceps (mm)	Thigh (mm)	Illiac (mm)	Subscapula (mm)	Chest (mm)	Abdomen (mm)	Percent Body Fat (%)
TG	6.0	4.0	5.0	4.6	7.0	5.0	6.0	6.70
NÜ	7.0	5.0	7.0	6.0	8.8	6.0	7.4	7.50
KN	6.0	4.0	8.0	6.0	6.4	4.0	7.0	6.97
GA	6.0	5.0	5.6	5.4	7.0	4.6	6.0	6.89
MA	6.6	3.6	5.4	5.0	7.0	7.0	7.0	6.99
İE	7.0	6.0	8.0	5.2	8.6	6.0	8.0	7.59
Aİ	5.0	4.8	8.0	4.8	7.0	4.0	6.0	6.89
AU	6.0	3.0	4.0	4.6	4.2	4.0	6.6	6.14
MA	7.0	5.0	9.0	6.2	8.0	5.0	8.0	7.53
VS	4.4	4.6	5.8	5.0	8.0	6.0	8.0	7.18
AD	8.0	4.4	9.0	5.0	9.0	6.0	8,0	7.65
İA	6.0	5.0	8.8	5.0	9.0	4.2	6.0	7.32
İA	6.0	6.0	6.0	6.6	9.0	5.0	7.0	7.38
YU	5.0	4.0	5.0	5.6	5.0	5.0	6.0	6.51
HU	5.6	5.6	8.8	6.0	6.6	5.0	10.0	7.28
FŞ	6.0	5.0	4.8	6.0	8.2	6.0	7.0	7.13

TABLE A-VI

SKINFOLD MEASUREMENTS OF ŞEKERSPOR PROFESSIONAL SOCCER PLAYERS

Sites Of Skinfolds Subjects n=16	Biceps (mm)	Triceps (mm)	Thigh (mm)	Illiac (mm)	Subscapula (mm)	Chest (mm)	Abdomen (mm)	Percent Body Fat (%)
MG	7.2	6.2	7.0	6.0	8.0	5.8	10.2	7.54
DA	7.0	7.0	8.2	6.4	5.8	6.4	9.0	7.59
MT	6.4	7.0	8.0	6.2	9.0	7.0	8.4	7.86
EŞ	7.6	7.2	8.4	7.4	8.4	8.2	9.0	8.21
ST	7.2	6.2	7.4	6.4	8.0	6.0	12.0	7.61
DY	6.0	6.6	7.4	6.0	8.2	6.0	6.8	7.53
MKG	5.8	6.0	8.0	6.4	5.8	6.0	7.6	7.32
OB	4.0	6.2	6.2	6.8	5.4	5.2	8.8	6.91
ŞÇ	5.2	6.0	5.8	6.2	5.4	5.8	6.2	6.97
LA	4.2	6.4	6.2	6.0	7.8	6.0	9.0	7.19
MY	3.6	5.6	6.0	6.8	5.6	6.2	6.6	6.91
ED	5.4	6.0	8.0	6.2	8.4	5.4	6.4	7.46
SE	4.2	5.0	5.8	5.0	4.0	4.2	6.2	6.37
HT	5.0	5.2	5.2	6.0	5.2	5.0	6.0	6.70
CB	5.8	5.6	7.0	6.0	7.8	6.2	6.0	7.36
BA	4.2	4.6	5.0	3.2	4.2	4.8	7.2	6.16

APPENDIX B

SUBJECT INFORMATION SHEET

SUBJECT INFORMATION SHEET

TEAM :

NAME :

AGE :

WEIGHT (kg) :

HEIGHT (cm) :

HAVE LONG HAVE YOU BEEN PLAYING SOCCER :

12 MIN. RUN AND WALK TEST (COOPER) (m) :

BICEPS SKINFOLD (mm) :

TRICEPS SKINFOLD (mm) :

THIGH SKINFOLD (mm) :

ILLIAC SKINFOLD (mm) :

SUBSCAPULA SKINFOLD (mm) :

CHEST SKINFOLD (mm) :

ABDOMINAL SKINFOLD (mm) :

VERTICALJUMP (cm) : (1).....(2) ..... (3).....

50m DASH (Sec : (1).....(2) ..... (3).....

SIT AND REACH TEST (cm) : (1).....(2) ..... (3).....

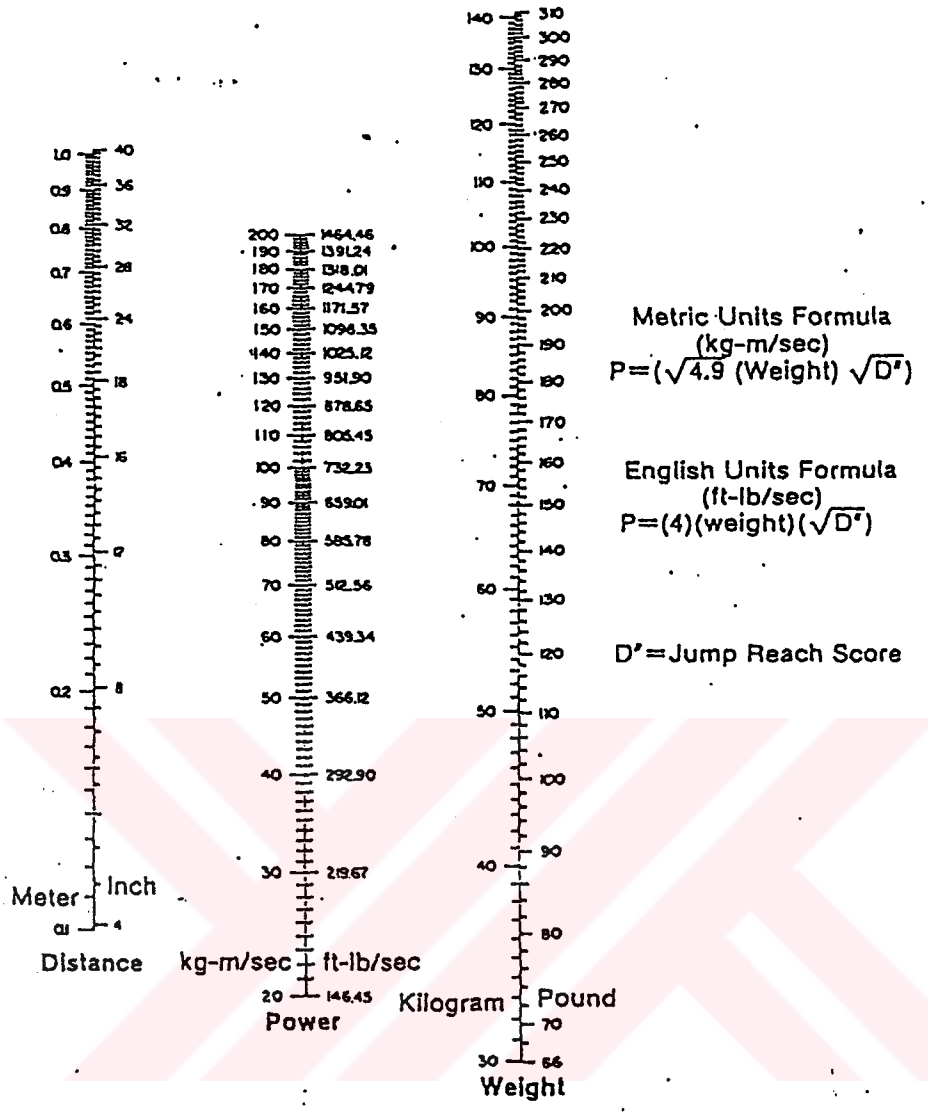
RIGHT GRIP STRENGTH (kg) : (1).....(2) ..... (3).....

LEFT GRIP STRENGTH (kg) : (1).....(2) ..... (3).....

APPENDIX C

THE LEWIS NOMOGRAM, COOPER'S FITNESS CLASSIFICATION,ANDCLASSIFICATION OF SKINFOLD MEASUREMENTS

THE LEWIS NOMOGRAM FOR DETERMINING ANAEROBIC POWER FROM JUMP-REACH SCORE AND BODY WEIGHT



The Lewis Nomogram. A person's power output can be determined by knowing the score on the jump reach and the body weight.

TABLE C-II

Cooper's Fitness Classification: Men

Category	Measure 0^2ml/kg/min	Age 13–19	20–29	30–39	40–49	50–59	60+
I. Very Poor		< 35.0	< 33.0	< 31.5	< 30.2	< 26.1	< 20.5
II. 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
III. Fair		38.4–45.1	36.5–42.4	35.5–40.9	33.6–38.9	31.0–35.7	26.1–32.2
IV. 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
V. Excellent		51.0–55.9	46.5–52.4	45.0–49.4	43.8–48.0	41.0–45.3	36.5–44.2
VI. Superior		> 56.0	> 52.5	> 49.5	> 48.1	> 45.4	> 44.3

TABLE C-III

Classification of Skinfold Measurements for Male Athletes*

Classification		Triceps (mm)	Subscapular (mm)	Abdomen (mm)	Sum (mm)
Lean	<7% fat	≤7	<8	<10	<25
Acceptable	7-15% fat	7-13	8-15	10-20	25-48
Overfat	>15%	>13	>15	>20	>48

*From Buskirk.[9]