# THE ANALYSIS OF THE SELECTED PHYSIOLOGICAL CHARACTERISTICS OF THE TURKISH GRECO-ROMAN AND FREESTYLE NATIONAL CADET TEAMS' WRESTLERS (15-16 YEARS OLD)

by

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Title of the study: THE ANALYSIS OF THE SELECTED PHYSIOLOGICAL CHARACTERISTICS OF THE TURKISH GRECO-ROMAN AND FREE STYLE NATIONAL CADET TEAMS'WRESTLERS (15-16 YEARS OLD)

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Major Field : Physical Education and Sports.

Scope and Method of the Study: The purpose of this study was to measure and analyse the selected physical characteristics of the Turkish National Cadet Team-Wrestlers. Physical characteristics studied were height and weight, resting heart rate, arterial blood pressure, percent body fat, reaction time, flexibility (sit and reach), grip strength, speed (50 m. run), anaerobic leg power (vertical jump), aerobic power (12 m. run) and vital capacity. The subjects in this study were 58 cadet wrestlers who were invited to the national camps for the 1989 World Championships. 30 of the subjects were free style wrestlers out of which 11 of them made the team.28 of the subjects were Greco-Roman wrestlers out of which 11 of them made team.

The t- test was used to determine the differences of physiological variables between the Greco-Roman and free style wrestlers and also between the wrestlers who made and who couldn't make the turkish national cadet teams.

Findings and Conclusions: At the end of this study, following results were found: The mean ages was 15.70 $\pm$0.9. The mean height and weight were 167.4 $\pm$9.24 cm., 63.3$\pm$15.0 kg. The mean percent body fat was 7.85 $\pm$2.03. The mean heart rate was 68.25 $\pm$7.45 beats. The mean systolic blood pressure was 106 $\pm$10.7mm/Hg. The mean diastolic blood pressure was 69.66 $\pm$9.27 mm/Hg.The mean grip strength was 33.67 $\pm$7.42 kg. The mean V02 max. was 49.69 $\pm$4.02 ml/kg/min. The mean speed (50 m. run )was 7.84 $\pm$0.41 sec.The mean reaction time was 18.36 $\pm$3.34 1/100 sec. for hand and 21.47 $\pm$1.37 1/100 sec. for foot. The mean anaerobic leg power was 96.35 $\pm$24.9 kg-m/sec.The mean vital capacity was 4.72 $\pm$0.92 l/min.

In all variables, there were no significant differences except in aerobic power where in free style the wrestlers who made the teams had higher values than the wrestlers who couldn't make the teams and the Greco-Romen wrestlers had higher values than the free style wrestlers.

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Çalışma Başlığı: TÜRKİYE GREKO-ROMEN VE SERBEST YILDIZ MİLLİ TAKIM GÜREŞCİLERİNİN SEÇİLMİŞ FİZYOLOJİK KARAKTERİSTİKLERİNİN ANALİZİ

Sayfa Sayısı : 78

Ana Saha : Beden Egitimi ve Spor

Çalışma Metodu ve Alanı : Bu çalışmanın amacı , Türk milli yıldız güreş takımlarının seçilen fiziksel karakteristiklerinin ölçüm ve analizini yapmaktı. Seçilen fiziksel karakteristikler sırasıyla; Boy ve kilo, dinlenme kalp atım sayısı, arteryal kan basıncı, vücut yağ yüzdesi, reaksiyon zamanı, esneklik, pençe kuvveti,hız, anaerobik güç,aerobik güc ve vital kapasiteden oluştu. Çalışmadaki denekler 1989 yılı Dünya sampiyonası için kampa çağrılan 58 adet yıldız güreşçiydi.Bunlardan 30' u serbest stil güreşen ve içlerinden 11 'i milli takıma giren güreşçilerdi. Deneklerin 28 i ise Greko-Romen stil güreşçilerden oluştu ve bunlardanda 11 i Greko-romen milli takıma girdi.

Serbest ve Greko-romen takımlar arasındaki farklılığın ve milli takıma giren ve giremeyen güreşçiler arasındaki farklılığın, fizyolojik degişkenler açısından belirlenmesinde t - test kullanıldı.

Bulgular ve Sonuçlar : Bu çalışmanın sonunda aşağıdaki bulgular elde edilmiştir: Tüm gurupları içeren güreşçilerde; ortalama yaş 15.70 ± 0.9 , ortalama boy ve kilo 167.4 ±9.24 cm., 63.3 ± 15.0 kg., ortalama vücut yağ yüzdesi 7.85 ± 2.03., ortalama dinlenme kalp atım sayısı 68.25 ±7.45 atım.,ortalama sistolik kan basıncı 106 ± 10.7 mm/Hg., ortalama diastolik kan basıncı 69.66 ± 9.27 mm/Hg.,ortalama pençe kuvveti 33.67 ± 7.42 kg., ortalama maksimal oksijen tüketimi 49.69±4.02 ml/kg/dak.,ortalama hız 7.84 ± 0.41 sn., ortalama esneklik 30.47 ± 3.7 cm., ortalama reaksiyon zamanı 18.36 ± 3.34 1/100 sn. (el icin), 21.47 ± 1.37 1/100 sn. (ayak için)., ortalama anaerobik ayak gücü 96.35 ± 24.9 kg-m/sn., ortalama vital kapasite 4.72 ± 0.92 1/dak. idi.

Guruplar arasında,aerobik güç hariç diğer değişkenlerde anlamlı bir farklılık yoktu. Serbest stilde milli takıma giren güreşçilerin aerobik güçleri, giremiyenlere göre anlamlı olarak daha yüksekti. Aynı şekilde Greko-Romen stil güreşçilerin aerobik güçleri serbestçilere göre daha yüksek değerde idi.

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# CHAPTER I

# INTRODUCTION

"Wrestling may be defined as a bodily strike between two persons to establish victory over each other, on the mat of certain dimensions, according to the FILA (International Amateur Wrestling Federation) rules,without any tool,using their skill,capability,strength and intelligence"(Pehlivan,1984). Petrov (1987) defined wrestling as a hand to hand combat between two competitors, subject to certain rules, during which each competitor tries to control the movements of the other through complex technical-tactical moves and by using all their physical and psychological potentials.

Modern Olympic and World Amateur Wrestling Championships are conducted in two seperate style: Frestyle and Greco-Romen. "In Frestyle,a wrestler is permitted to apply a hold on his opponent's legs and to use his legs to trip or throw his opponent and to apply holds . Greco-Romen wrestling is identical to Frestyle wrestling except that holds on the body below the waist and use of the legs to hold or trip an opponent are prohibited"(Webster,1976).

The weight classes in international cadet (15-16 year old) championships are: 38-40 kg, 43 kg, 47 kg, 51 kg, 55 kg, 60 kg, 65 kg, 70 kg, 76 kg, 83 kg and 83+ kg. According to the FILA regulations a match duration for cadets is a single bout of 4 min. (Bultein of FILA,1989).

"Wrestling has tremendous benefits on body conditioning and coordination and has additional and applied values. Many scholars, teachers, and artists such as Homer, Plato, Aristotle ,de Feltre, Vittorino,Rabelais, de Montaigne, Guts Muths, Spiess, Locke,Hepel, Dobroljubov, Lesgaft,Sanelburg, etc. over the ages have idealized wrestling as a principal means of physical fitness "(Petrov,1987). Howewer , many factors are related to succesful athletic performance in adolescent populations. With respect to high school wrestling, recent articles by Johnson and Cisar (1987) have described and quantified the contribution of body composition,body build and muscular strength characteristics to successful participation. The normal maturational changes in this age group can have a profound influence on these and other factors associated with athletic performance. According to Terry and Cisar (1988), the improved wrestling performance which normaly occurs during high school is,in part a function of maturational and training induced changes in body composition and muscular strength as well as improved technique.

The effect of wrestling on fitness are increased work productivity , the capacity to work physically and intellectually, life expectency and the biological improvement of generations.

In some countries, the preparation of children starts from 8 to 10 years of age. A number of wrestlers have performed in worldwide competitions from the ages of 19 to 22 years.

It has been noted that the age of wrestlers who perform in high level athletics competitions has been decreasing,as well as their athletic longitivity. Children are more eager to learn and are more adaptive than adults. They train even when they are not required to do so and attain quick and tangible results.When looking at the efficiency of training session,we must not only judge the temprorary progress in the development of young athletes,but also their physiological state,their health,their capacity to work and athletic results acquired when an adults (Petrov,1987).

Wrestling is an ardious sport that places extreme stress on the skeletal muscles and cardiovascular system. One might liken a wrestling match to running a series of all out sprints performed in six minutes while pushing against resistance equal to ones body weight. The sprints may vary randomly from 10 to 200 m with only a few seconds of rest in between. Adding hand weighth would produce fatique similar to that of six-minute match. Thus,preparing for a season of competitive wrestling demands careful planing so that all three metabolic energy systems; phosphagen (anaerobic) , glycolytic (anaerobic),and oxidative (aerobic) are used (Johnson and Cisar,1987).

Even if the wrestler learn techniques of wrestling he will often find it hard to apply them on an opponent with great physical strength in a real bout. This shows that his techniques and physical strength are not balanced. Beginners tend to learn only techniques but if he wants to become an outstanding wrestler he should try to develop both the technical skill and physical

fitness equaly from the beginning (Sasahara,1978).

Wrestling being an exercise of whole body,wrestler must strengten every part of his body-the neck,arms,chest,stomach, back,hips,legs,etc.-and particularly place emphasis on the development of the athletic ability of his body; agility, durability,stability (balance), flexibility, reflex movement, etc. (Gable and Peterson,1980).

To become physically fit for wrestling in general,it requires that a wrestler needs the physical fitness components of aerobic fitness, strength, muscular endurance flexibility and body composition. Also,other attributes of performance(e.g.coordination balance,power,agility, speed, movement time and reaction time) are integral aspect of physical fitness (Gable and Peterson,1980).

Strength, flexibility, energy output, neural and humaral regulatory mechanism,techniques and psychological factors can be limitting variables for wrestling performance.Wrestlig success depends greatly on overall body strength,flexibility,skill and stamina (Song and Garvie,1980).

According to Gable and Peterson (1980) a succesful wrestler must have great explosive power, balance, speed, agility, flexibility and fitness.

A wrestler with substantial maximal aerobic power would be encouraged to maintain a high intensity of action during the match. On the other hand, an athlete with superior upper-body strength and anaerobic capacity might be more selective in the

initiation of attacks and be more explosive in the implementation of wrestling action (Sharratt and Taylor, 1986).

Energy out put, flexibility, strength, skill and stamina and motivation are important factors for wrestling success.The rate of increase of physical work capacity in response to training is dependent upon the initial level and the rate of increase is smaller in relatively fit individuals. The initial level of fitness, intensity, frequency, duration of training and age are factors that affect the improvement of aerobic power (Song and Cipriano, 1984).

Wrestling requires significant contributions from both anaerobic and aerobic metabolism for ATP resynthesis (Houston et al,1983).

A high correlation has been observed between wrestling success and aerobic capacity (Hellickson, 1977).

The max. aerobic power of wrestlers is thought to be an important physiological attribute because of its contribution to total body endurance needed for competing in 4-5 matches per day. Also, the aerobic power has been observed to increase as wrestlers train for peak conditioning (Horswill, et all., 1988 ).

Taylor (1979)and Marrin(1980) explained that wrestling is a sport strongly depended on total body strength. Wrestlers have been shown to be the strongest among the athletes.

Muscular strength used during wrestling matches are usually at the isotonic and ouxotonic (mixed) level. The isometric level, frequently accurs in certain holds, in keeping a bridge position etc.

Compared to other sports, wrestling presents in finite possibilities for using the different types of muscular effort. For wrestlers, speed depends to large extent on the quickness of nervous impulses on explosive strength, on muscle flexibility, and on psychological concentration. Speed also depends on the pace at which the holds and other moves used during a match are carried out during training sessions. Today, because of shortened match duration speed has become more important.

The range of flexibility is spesific for a given joint and is dependent upon the musculture surrounding the joint. Given the fact that wrestling involves a series of explosive movements in variety of body positions, the importance of flexibility to the wrestler can not be over emphasized (Gable and Peterson, 1980).

Although the experts interviwed concur that young and growing wrestlers shouldn't compete if their body fat falls below a certain level, they disagree somewhat as to what that level is. The suggestion fall into the 5 % to 9 % range. The 7 % is most often suggested as ideal (Barnes, 1987).

Blood pressure is one of the important factor in wrestling. Both systolic and diastolic blood pressure can be significantly lowered with a regular programme of exercise (Mc Ardle et al.,1981).

Although considerable data are available for elite athletes in some sports, there is no current comprehensive physiological profile of Turkish Cadet National Wrestling Team. But there are considerable data and research about young and cadet wrestlers

of some other countries.

According to the points explained above, the purpose of this study is to establish baseline for the physiological data of the Turkish National Cadet Team-Wrestlers.

## Significance of Study

Physical characteristics are important for all sports, especially in competetive and individual types. Wrestling also requires good physical capacity. Researchers has been shown that, for every sport,initial level of fitness is very important factor in preparing training programs to improve their capacity level to upmost.

Unfortunately, there has been no sufficient scientific information available about the physical capacities of turkish cadet wrestlers. Whereas, wrestling is a traditional sport in Turkey.

Finaly, the study provides unique information on elite wrestlers at an early development level. When this information is rewieved together with the data of elite young and senior wrestlers it will be helpfull to describe the physiological profile of elite Turkish wrestler at all levels. For these reasons,the study of physical fitness components of turkish cadet elite wrestlers will have much more importance.

## Statement of Problem

The purpose of this study was to measure and analyse of

height, weight, resting heart rate, arterior blood pressure, percent body fat, reaction time, flexibility, grip strength, speed, anaerobic power and maximal oxygen uptake (VO2 max.) of Cadet Turkish National wrestlers.

## Subproblems of the Study

1- The subproblem was to compare the selected physiological characteristics of the Turkish Cadet Greco-Roman and Freestyle National Wrestlers (15-16 years old).

2-The selected physiological characteristics of the national cadet wrestlers who made the teams were compared with the ones who didn't make the team for each style during the national camps for 1989 World Championships.

3- The selected physiological characteristics of Turkish National Cadet wrestlers were compared with the wrestlers of other countries where data was available.

## Null-Hypothesis

1. There were no significant differences between the means of free-style and Greco-roman wrestlers in the following variables;
   a) Height
   b) Weight
   c) Resting heart-rate
   d) Sistolic blood pressure
   e) Diastolic blood pressure
   f) Percent body fat

g) Reaction time

h) Flexibility

i) Grip strength

j) Speed

k) Anaerobic power

l) Maximal oxygen uptake

m) Vital capacity

2. There were no significant differences between the means of wrestlers who made and who did not make the National Cadet team in the following variables:

a) Height

b) Weight

c) Resting heart-rate

d) Sistolic blood pressure

e) Diastolic blood pressure

f) Percent body fat

g) Reaction time

h) Flexibility

i) Grip strength

j) Speed

k) Anaerobic power

l) Maximal oxygen uptake

m) Vital capacity

## Limitations

1. This study was limited only to the Turkish National Cadet

wrestlers who participated to the national camps for 1989 World Championships.

2. Subjects were cadet (15-16 years old) wrestlers.

## Assumptions

1. Subjects followed the test procedure.
2. Subjects showed the best performance during the measurements.

## Definition of terms

Aerobic Power : It is defined as an oxygen consumption which is used in one minute for one kg. body weight

Flexibility : It refers to range of motion of body joints.

Reaction time : It refers to the interval of time elapsing from the instant any measurable amount of movement is made in response to the stimulus.

Strength : The maximal one-effort force that can be used against a resistance.

Anaerobic : In the presence of oxygen.

Anaerobic power : The maximal ability of the anerobic systems (ATP-PC+lactic acid) to produce energy.

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

Systolic blood pressure: The blood pressure produced by contracting ventricle during systole.

Diastolic blood pressure: The blood pressure at the moment the heart relaxes in diastole.

Heart Rate : The numbers of ventricular beats per minute.

Vital Capacity : Maximal volume of air forcefully expred after maximal inspration.

**Description of Instruments**

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

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.

Sphygmomanometer : A device used to indirectly monitor blood pressure.It consists of compression bladder enclosed in an unyielding cuff,an iflation bulb,a mercury manometer from which the applied pressure is read,and a control exhaust to deflate the system.

Handgrip Dynamometer: An instrument which is used to measure handgrip strength.

Stethoscope : A listening device to amplify sound.

spirometry : Spirometry is a divece which measures the respiratory capacities.

# CHAPTER II

## REVIEW OF RELATED LITERATURE

There are many definition on about physical fitness. Briefly, it can be described as the ability of the human body and its responses to work and stress (Kash, 1968). Because of the large meaning of the physical fitness, Astrand and Rodahl (1988), generalizate this terms in two ways: 1) the motor fitness concept in which the elements of performance are measured and 2) the physiolopical or aerobic working capacity concept in which capacity for oxygen transport.

Most of the authors also classified the components of physical fitness different ways (Devries, 1980; Gable, 1980; Burke, 1978 etc.). These components can be collected generally into following sections: aerobic power, anaerobic power, strength, local muscular endurance, flexibility, speed, agility, balance, coordination, movement time and reaction time.

Of all sports popular in the world today, wrestling is considered by many individuals to be the most strenuous physically demanding all of fitness components explaned above.

In short, to be a champion, an individual must posses a level of fitness which will enable opponents to perform like a champion while competing (Gable and Peterson, 1980).

In the lights of above facts, this chapter is divided in to the following ten section; 1) Age, Height and Weight, 2) Resting Heart Rate, 3) Arterial Resting Blood Pressure, 4) Body Composition 5) Speed and Reaction Time 6) Flexibility, 7) Grip Strength, 8) Vital Capacity 9) Anaerobic Power 10) Aerobic Power

## Age, Height and Weight

Wrestling is a weight class sport so, increasing the weight and height effect the strength of wrestlers. According to the Terry J. Hous, et al. (1988) while a large portion of the improvements in strength across age were associated with increases in lean tissue, there was an additional "age effect" which could not be accounted for by chances in fat-free weight. Although the mechanism responsible for the "age effect" is unclear, it is possible that neural development contributed to the strength increases across age.

In the report of correlation analysis of the elite juniors, Horswill, et. al, (1989) suggested that the lightest wrestlers were the youngest (r=.39) and leanest (r=.58). The range of body weight in that study was 48.4 to 90.3 kg; no heavyweight wrestlers (100 kg or over) participated in that study.

Some results of different research as were shown in table I.

TABLE I

AGE, HEIGHT, AND WEIGHT VALUES OF

WRESTLERS FROM VARIOUS STUDIES

| Group | Height (cm) | Weight (kg) | Age (yr) |
|---|---|---|---|
| JWC | 169.9±9.6 | 64.4±12.4 | 16.7± .9 |
| JW | 173.6±9.1 | 78.0±18.4 | 19.1±1.0 |
| DC(elite) | 169.9±1.5 | 63.1±2.9 | 17.0±0.2 |
| DC (nonelite) | 167.6±1.6 | 63.4±3.3 | 16.3±0.3 |
| DG | 171.13±0.52 | 64.4±0.86 | 16.4±0.1 |

JWC : Elite Junior Wrestling Camp at Grand Valley (Horswill et al., 1989) N = 39

JW : Junior World Team (Silva et al., 1981); N=15.

DC : Developmental Camps at (GVSU). (Horswill et all., 1989) N=18 elite, 18 nonelite.

DG : Different (4) groups wrestlers (Terry J.Housh et all., 1989) N=195

**Resting Heart-Rate**

Heart rate is to key oxygen transport system. It must continually pump large quantities of blood to all body during the exercise and match. It is effected by many factors. These are;type, intensity and duration of exercise, physical fitness of subject, age, sex emotional state, body temperature, ingestion of food,

posture, heredity and smoking. The heart rate at rest is different from one to another under similar situation (Polock, 1978, Hole, 1978; Astrand and Rodahl, 1986).

According to the tests performed on olympic athletes and others, the trained individuals has lower resting heart rate than the untrained individuals. Many athletes' resting heart rates are 10-30 beats lower than the sedentary individuals. Furthermore, the heart rate of trained persons returns to normal more quickly after exercise than the untrained individuals (Bucher, 1983).

A low beat at rest, may indicate a high aerobic power, but may, on the other hand, be a symptom of disease (Astrand 1977).

Mean resting heart rate value of U.S.A.elite varsity wrestlers was found as 51.3 beats, min.by Song.T.M and Cipriano N.,(1984).

In Baykus (1989) study of the turkish national espoir teams wrestlers physiological charecteristics. The mean resting heart rate of light weight, middle weight and heavy weight groups as 55.66 beats/min, 58.00 beats/min and 56.00 beats/min for free style wrestlers and 58.00 beats/min, 56.66 beats/min and 60.00 for Greco-Roman wrestlers respectively.

## Resting Blood Pressure

Blood pressure is pressure of the blood against the inner walls of the arteries. Systolic and diastolic blood pressure at rest are 120 and 80 mm Hg. respectively. It can increase to 175 and 100 mm Hg. respectively during heavy exercise. (Astrand and Rodahl, 1988).

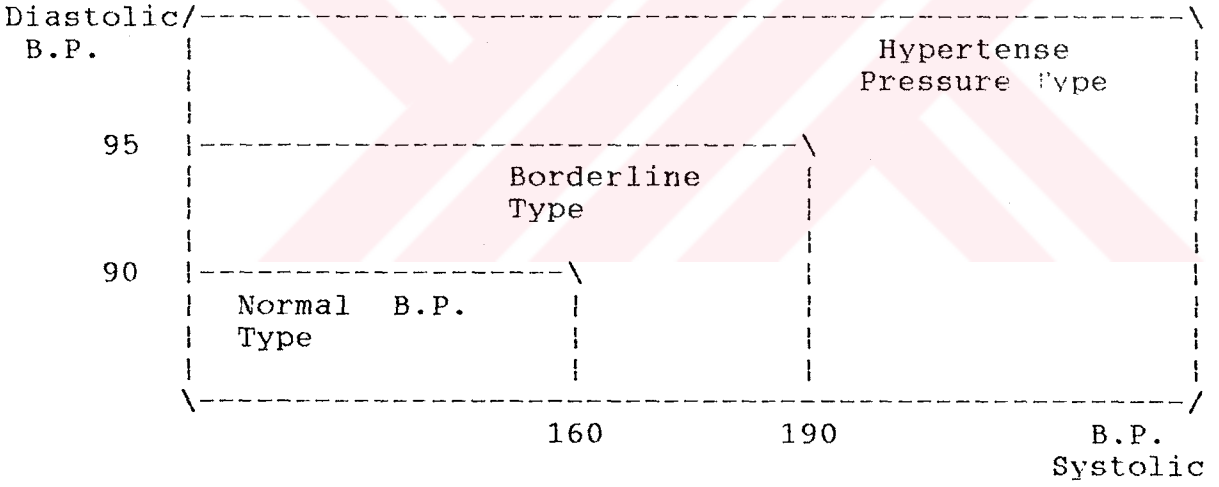
Regular exercise can lower both resting systolic and diastolic blood pressure (Mc Ardle et al.,1980).

Exercise, eating and drinking, smoking, posture, age, sex etc., are effecting factors of blood pressure (Instruction, 1989; Astrand, 1986; Bucher, 1979; Devries, 1977; Morehous, 1971).

Standards for assesment of high or low blood pressures, without regard to age, have been established by the World Health Organization (WHO), as shown in following chart (instruction, 1989).

FIGURE I.

STANDARDS FOR ASSESMENT OF HIGH OR LOW BLOOD PRESSURE




According to the Sharratt et al., (1986) mean values of Canadian free style wrestlers' blood pressures were 119±11 mm Hg for systolic, 77±7 mm Hg for diastolic.

Mean values of resting heart rate and blood pressure of Turkish espoir wrestlers was shown in Table II.

TABLE II
MEAN AND STANDARD DEVIATION VALUES OF BLOOD PRESSURE OF THE LIGHT, MEDIUM AND HEAVY WEIGHT GROUPS' TURKISH FREE STYLE AND GRECO-ROMAN ESPOIR TEAMS' WRESTLERS

| Subj. | N | Blood Pressure Systolic | Diastolic |
|---|---|---|---|
| FREE STYLE | | | |
| L.wt.Groups | 6 | 114.66±7.65 | 76.66±7.21 |
| M.Wt.Groups | 8 | 118.75±6.92 | 78.25±4.71 |
| H.Wt.Groups | 4 | 127.50±10.37 | 77.50±6.40 |
| GRECO-ROMAN | | | |
| L.Wt.Groups | 8 | 117.00±6.41 | 75.25±5.35 |
| M.Wt.Groups | 6 | 125.66±13.70 | 74.66±5.00 |
| H.Wt.Groups | 4 | 123.00±3.82 | 73.00±5.03 |

## Body Composition

Body composition is proportional structure on human body, related with the percentage of body fat (% fat) and lean body mass (L.B.M). If the fat is known and subtracted from the gross weight, the lean body weight is determined. The lean body weight includes bones, muscxles, fluids and organs.

Exersize training can normalize the relationship between lean body mass an % fat. When a reducing diet plus exercise programing work together, subject lose not only weight, but can achive ideal healthy good looks.

It is assumed that there is a close relationship between minnimal skinfold and minimal total body fat, then the degree to

which athletes approach low skinfold values can serve to monitor fat and warn against excessive weight losdt that may effect performance or health (Carter and Yuhasz, 1984).

The fat percentage of wrestlers had been recommended to range from 5 to 9 %. The 7 percent is most often suggested as ideal (Barnes, 1987). The results of the Terry J. et. al, (1988), indicated that yearly training has changing effect on the young wresthers' body composition.

Seven U.S. Olympic class freestyle wrestlers' percent body fat were found 7.6 % of total body fat by the Hellickson (1977).

49 elite Canadian freestyle wrestlers were tested by the Sharratt et. al, (1986). The % fat mean value was 8.2 %. Fat content of Canadian Greco-Roman wrestlers was found to be 14.4 % mean by Taylor et.al.,1979.

20 Jr. freestyle wrestlers who attended the 1978 and 1979 junior world class championships were tested by Fleck (1983). Mean body fat of the subjects was 7.9 % . He reported the mean percant body fat value of 36 elite Greco-Roman wrestlers, as 8.7 .

Horswill et.al., (1989)found the mean percent body fat of elite american junior wrestlers as $7.2 \pm 2.4$.

Terry J.Housh, et.al, (1988) studied the body composition of high school wrestlers across age (4 different groups). Mean fat percentage of first group ($\leq$ 15.0 yr, N=20) was $12.33 \pm 1$, second group (15.01-1600 yr, N=60) was $11.12 \pm 0.60$ third group (16.1-17 year N=52) was $10.59 \pm 0.4$ and fourt group (>17.0 yr; N=63) was $10.59 \pm 0.46$.

According to the Fleck (1983) several wrestling research were done on U.S.A. wrestlers which were shown in table III.

TABLE III

PERCENT BODY FAT VALUES OF U.S.A. WRESTLERS

| Calliber of Athlete | No. | Age (year) | Wt. (Kg) | % Fat | Reference |
|---|---|---|---|---|---|
| Junior World T. | 15 | 19.1 | 78.0 | 7.3 | (Silva, 1981). |
| High School | 29 | 15.9 | (44.5-60) | 4.5 | (Katch, 1975). |
| High School | 37 | 16.7 | (60-71) | 5.3 | (Katch, 1975). |
| High School | 28 | 16.8 | (76.4-94.5) | 11.7 | (Katch, 1975). |
| U.S.State Finalist | 582 | 17..8 | 65.1 | 6.7 | (Tcheng, 1973). |
| Average H.S. | 834 | 15.9 | 64.;7 | 10.2 | (Tcheng, 1973). |

Scott (1987) collected some researches about physiolocigal parameter of USA wrestlers. In his report, 1983 world cup team's wrestlers % body fat was 9.45, the 1986 elite open wrestlers' % body fat was 9.81, the 1986 elite Jr. wrestlers' % body fat was 7.42 and in 1987 youth wrestlers', % body fat was 10.45.

Sandy et. al., (1982) measured 9 to 12 years old 23 experienced wrestlers. Mean percant body fat value of the wrestlers was 13.3.

Sady et. al. (1984) measured 15 high-ability prepubescent wrestlers (Mean age: 11..3). Mean body fat % of the wrestlers was 12.7.

BaykuS (1989) was measured the Turkish national free style and Greco-Roman espoir teams' wrestlers (17-20 years old).

The mean percent body fat of Greco-Roman wrestlers was 12.29 % and free style wrestlers' was 8.5 %.

## Speed and Reaction Time

Speed is defined as the velocity of a body, body part(s), or an object, in one meter/second period of time (unit). The speed may be devided in two components: reaction time and movement time.

Speed tends to be specific for each movement. A subject who posses a high degree of speed on the 100 meter run may posses a low, average, or high degree of speed on a hand reaction test (Verducci, 1980).

Reaction time is the interval between the presentation of a stimulus and the initiation of a response. Movement time is the time between the initial movement of the body, body part(s),or an object and the completion of the movement. Response time is the composite score of reaction time and movement time in the race situation.

Reaction time may be represent an important consideration in an individual's performance in physical activity, moreover wrestling.

Johnson and Nelson (1974) stated that some of the factors which have been found to influence reaction time are the following: The sense organ involved, the intensity of stimulus, the preparatory set, general muscular tension, motivation, practice the response required, fatigue and one's general state of health. Furthermore, speed and reaction time are considered to be largely innate abilities; however, both can be improved through practice and training. Consequently, it would seem only logical that the practice and training would be performed with reaction time and speed of movement combined in a gamelike sequence of movements.

Singer (1972) reported that nonethletes, college wrestlers, outstanding amateur athletic union wrestlers and the japanese amateur wrestling assoclation team were not different in reaction time.

Scott (1987) reported the speed values of various wrestling teams. The values were shown in table IV.

TABLE IV

40 YARD (36.6 M.) DASH VALUES OF VARIOUS U.S. WRESTLERS

| Caliber of Athlete | N | Style (GR-FS) | 40 Yard (sec.) | Range | Reference |
|---|---|---|---|---|---|
| 1983 world cup Wrestlers | 8 | FS. | 5.28 | 4.8-5.9 | (Scott, 1983) |
| Profile of Elite Open Wrestlers | 33 | 25-GR. 8-FS. | 4.29 | 4.6-5.3 | (Scott, 1987) |
| Profile of Elite Jr. Wrestlers | 39 | 25-BS. 13-FS. 1-GR. | 5.36 | 4.7-5.8 | (Scott, 1987) |
| Profile of Develp. Wrestlers | 38 | FS. | 5.45 | 4.8-6.6 | (Scott, 1987) |

In his master thesis BaykuS (1989) measured the speed and reaction time of espoir wrestlers. These values are shown in table V and VI.

TABLE V

MEAN AND STANDARD DEVIATION VALUES OF REACTION TIME OF THE TURKISH FREE STYLE AND GRECO-ROMAN ESPOIR TEAMS' WRESTLERS

| | | Reaction Time | | | |
|---|---|---|---|---|---|
| | | Light | | Buzzer | |
| Subjects | N | Hand | Foot | Hand | Foot |
| FS. | 18 | 18.83±1.98 | 22.72±1.93 | 21.11±2.35* | 25.39±3.70* |
| GR. | 18 | 18.83±1.95 | 23.17±2.77 | 18.78±1.90* | 23.11±2.68* |

* significant difference at .05 confidance level.

TABLE VI

MEAN AND STANDARD DEVIATION VALUES OF SPEED AND FLEXIBILITY OF THE TURKISH FREE STYLE AND GRECO-ROMAN ESPOIR TEAMS' WRESTLERS

| Subjects | N | Speed | Flexibility |
|---|---|---|---|
| Free style | 18 | 7.56±.44 | 29.83±5.02 |
| Greco-Roman | 18 | 7.69±.51 | 31.83±5.54 |

± standard deviation of the mean.

## Flexibility

Flexibility is the range of movement of the joints. It essentially depends on the elasticity of muscles and joint ligaments. Systematic stretching increases the range of movement as well as ability of joints to support a heavier load. It should be noted that most of the foreing great wrestlers had joints and

muscles which were remarkably flexible. Plasticity and flexibility are best developed from the age of 12 to 13 years. Petrov (1987), explained that, if between the ages of 14 to 18 years, flexibility is not maintained and developed through regular appropriate exercises it begins to diminish.

Flexibility enables an individual to move more easily, more gracefully, with a wider range of motion and may help prevent injuries. There appears to be an ideal or optimum range of motion for prevention of injury in various joints.

Sharratt, et.al., (1986) tested 49 elite Canadian freestyle wrestlers. Sit and reach test mean value was found as 15.3±6.1 cm.

Flexibility (sit and reach) values of espoir wrestlers was shown in table VI (BaykuS, 1989).

## Grip Strength

Strength is defined as the maximal force a muscle can exert in a single voluntary effort. The test of performing one maximal muscular contraction on the universal gym machine reflects the instantaneous strength in a wrestling bout.

An isometric contraction is defined as sustained muscular tension without movement, which is determined by hand grip strength. This differs from dynamic strength in which blood flow to the muscle is occluded, leading to increased fatique. Grip strength is useful in the tie-up, however, it is better to "graps" the

opponent and avoid a prolonged grip which quickly fatigues the forearms.

Fleishman (1980) found that static strength, the grip strength, of boys increased through ages 12 to 18 with a given increase in grip strength directly proportional to the increase in age. During 20 to 30 years of age muscle strength is reached to its maximum and at 30 years of age muscle strength starts to decrease until the age of 65 years.

Serfass, et. al., (1984) tested the eleven members of a varsity wrestling team. Measurements were done prior to the beginning of the competitive season. Wrestlers were tested on three occosions in a 6-min fatigue bout during which the subject squeezed a hand dynamometer maximally and then relaxed every other second until a total of 180 contractions had been completed. Testing was administered (1) following a 5 % body weight loss within 3-day period just prior to testing (dehydrated group), (2) after a 5 % body weight loss followed by an attempt to rehydrate to the original weight (Rehydrated group), (3) under a control condition with no weight loss (Control group). Their initial grip strength were 62 kg for control group; 64 kg for dehydrated group; 63 kg for rehydrated group. In addition Singer (1972) reported data about big ten varsity wrestlers. Their, mean right grip strength was 54 kg; mean left grip strenth was 52 kg.

## Vital Capacity

Vital capacity is defined as the maximum volume of air that can

be expired by the lungs. Therefore a large vital capacity represents a larger lung volume and greater availability of oxygen to the blood from the alveolar air sacs in the lungs. (Astrand, P.O. 1986). This capacity has been found to correlate very highly to the height of the athlete (Marrin, et.al., 1980).

Mc Ardle (1981) reported that although some measures of lung function are sensitive indices of the severity of obstructive lung disease, they are of little use in predicting fitness or performance. For example no difference was noted in the average vital capacity values of olympic wrestlers and trained middle-distance athletess and in those of untraind , healthy subjects.

Vital capacity is effacted by body position, strength of the respiratory muscles and distensibility of the lungs and thoracic cage (compliance). In addition a number of disease states decrease capacity as well, including paralysis of respiratory muscles (polio, spinal cord injuries), tuberculosis, chronic asthma, pulmonary cancer, chronic bronchitis, pulmonary vascular congestion and edema. Moreover, it is true that body size is directly proportional to total lung capacity and vital capacity especially and that athletes as a group are generally taller and heavier than are their nonethletic counterparts. However it should be kept in mind that there is very little, if any, correlation between athletic performance and these lung volume lung volumes in young (13 to 17 years old) boys and girls, provided that body size is taken into consideration (Fox et all., 1988).

Training during adolescence will eventually increase the vital

capacity and total lung capacity. After the age of about thirty, the residual volume and functional residual capacity increase and the vital capacity usually decreasses. There are observations from a longitudinal study that well-trained individuals attained the same vital capacity at the age of fourty to fourty-five as twenty years earlier (Astrand, 1986).

Sharratt et.al., measured the vital capacity of elit Canadian freestyle wrestlers. Vital capacity mean value of wrestlers. (N=36) was found as 4.9±1/min.

VC. of Eleven USA elite varsity wrestlers mean value was found as 5.5 1/min by Song et.al.,(1984).

## Anaerobic Power

If the energy is produced in the absence of oxygen in the human body, it is called as anaerobic system.

Energy contributed by the anaerobic system is directly related to the intensity of the performance. For example, if an athlete runs a 400 m. race with a speed of 7.4 m/sec.,the production of energy is 14% aerobic and 86 % anaerobic. While running the same distance with a speed of 8.89 m/sec., the ratio is 7.7 % aerobic and 92.3 % anaerobic (Bomba, 1986).

Wrestling involves short bursts of intense exercises round. Therefore, the build up of lactate can be severe and the better the ability of the muscle to with stand high lactates or prolonged lactate build up, the more efficiently it will operate. Taylor, et

al. (1979) have observed that the lactate response to intense endurance exercise interspersed with brief rest intervals was a good indicator of the anaerobic condition of the wrestlers. Sharratt et.al.,(1986) have demonstrated that a treadmill run at a 20 incline at 8 mph is an excellent indicator for lactate response and anaerobic capacity in trained wrestlers. Maximum values of 141.3 mg % in this procedure were reached after an avarage run of 64 seconds.

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. Power and capacity were more strongly correlated with weight than with age (Tharp et.al., 1985).

Unfortunately, anaeobic power has not been so clearly tested. While the concept of generating a maximum amount of energy in short period of time appears valid, there is no single, widely accepted test to measure this phenomenon (Sherry et.al., 1983).

Vertical jump can be easily converted to units of power using the lewis nomogram.

When using vertical jump test as a test of anaerobic power, it represent only the alactic anaerobic power of the subject's logs.

It should be noted that, the effect of body weight on the vertical jump test can be minimized by expressing the power component to body weight (Fox. 1988).

Anaerobic power parameters of USA wrestlers were collected in table VII.

TABLE VII

ANAEROBIC POWER OF VARIOUS U.S.A. WRESTLERS

| Caliber of Athlete | N | ArmP/Wt. (watts/kg) | LegP/Wt (watts/kg) | LegP (watts) | References |
|---|---|---|---|---|---|
| Elite Jr. Wrestlers | 39 | 6.0 | 8.6 | -- | (Scott, 1987) |
| Developing Wrestlers | 38 | 4.91 | 7.47 | -- | (Scott, 1987) |
| Elite Jr. Wrestlers | 36 | 6.0 | 8.6 | 549 | (Horswill,et.al) and Park.1989) |
| Elite Jr. Wrestlers | 18 | 5.9 | 8.6 | 539.9 | (Horswill,Scott, Galea, 1989) |
| Nonelite Jr. Wrestlers | 18 | 5.2 | 7.4 | 467.1 | (Horswill,Scott, Galea, 1989) |

## Aerobic Power

Maximal oxygen uptake is the maximal volume of oxygen that can be utilized per minute to perform work. This is called as aerobic power (Astrand, 1986). For athletes $VO_2$ max is defined in terms of body weight (ml/kg/min) to partially equilibrate the various wrestling weight classes and to take into account body fat measurement. Although there is a strong genetic component $VO_2$ max. training improves the capacitity to transport oxygen to the muscle cells by increasing cardiac output and the extraction of $O_2$ to the working muscle by increasing the enzymatic potential of the cells and improving peripheral blood supply. (Taylor et.al., 1980).

Aerobic Power depends on body build and composition and is

affected by other factors, in the following pattern (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 are.
4. Weight: varies directly with body weight.
5. Lean body mass: maximal oxygen volume correlates 0.63 with body weight, 0.85 with fat-free body weight and 0.91 with active tissue mass.
6. Bed rest: is reduced 17 % by enforced bed rest for 3 week
7. Semistarvation: is reduced 37 % by prolonged semi-starvation.
8. Altitude: is reduced 26 % at an altitude of 4000 m.
9. Geograph: is lower in residents of temperate or tropical areas than at circumpolar regions.

Maximum oxygen intake is not dependent (varies less than 5 %) on the variables listed below.

1. Food: ingestion of a small meal (750 cal.).
2. Heat: exposure to heat stress up to F.
3. Warm-up: duration of warm-up exercise can vary.
4. Speed of exercise: work ratew can be slow, moderate, or fast.
5. Repetition: Retests show similar results.

A high correlation between wrestling success and aerobic capacity has been observed (Taylor et.al.,1980). "Saltin and Astrand

(1967) have reported the mean $VO_2$ max of 10 wrestlers to be around 58 ml/kg min, that was lower than the values found for athletes in other aerobic sports. It would appear that the minimum values for $VO_2$ max is around 55 ml/kg min for a satisfactory aerobic component in the sport of wrestling"(Taylor et.al., (1980).

The $VO_2$ max, of Canadian freestyle wrestlers were found by Sharratt et al., (1986) as 61.8 ml/kg) min.

Scott (1987) reported the various USA wrestling teams' physical fitness norms. These norms are shown in Table VIII.

TABLE VIII

MAXIMAL OXYGEN UPTAKE VALUES OF VARIOUS U.S.A. WRESTLERS

| Caliber of Athlete | N | Style (GR-FS) | $VO_2$ max (ml/kg/min) | Range | Reference |
|---|---|---|---|---|---|
| World Cup Wrestlers | 8 | FS. | 55.59 | 49.2-59.9 | (Scott, 1983) |
| Elite Open Wrestlers | 33 | 25-GR. 8-FS. | 48.97 | 37.3-56.7 | (Scott, 1987) |
| Elite Jr. Wrestlers | 39 | 25-BS. 13-FS. 1-GR. | 57.21 | 34.5-68.3 | (Scott, 1987) |
| Developed Wrestlers | 38 | FS. | 52.29 | 37.5-63.6 | (Scott, 1987) |

Max $VO_2$ value of 23 childrens (ages: 7 to 9) were found as 44.90 ml/kg/min in pre season and 51.50 ml/kg/min in post season by Clarke, et al., (1984).

Sady et al., (1984) tested at 15 high ability prepubescent

wrestlers. Mean age of these wrestler was 11.3 and $VO_2$ max value was 54.0 ml/kg/min.

Horswill et al., (1989) studied on the 39 elite junior wrestlers (Mean age: 16.7). Mean Max $VO_2$ value of these wrestlers was found as 51.2. ml/kg/min..

Horswill, Scott and Galea (1989) measured the elite and nonelite USA young wrestlers (Age: 17.0, 16.3). The VO2 max. average was for the elite group 52.6+2.0 $ml/kg.min^{-1}$ and 51.5 $\pm$1.4 $ml/kg.min^{-1}$ for the nonelite group.

BaykuS (1989) studied on the National Turkish Espoir wrestlers. The mean $VO_2$ max. of the Turkish espoir wrestlers were presented in Table IX.

TABLE IX

THE MEAN $VO_2$ MAX OF THE TURKISH ESPOIR WRESTLERS

| Subjects | N | $VO_2$ Max. |
|---|---|---|
| F.Style | 18 | 48.01$\pm$3.51 |
| G.Roman | 18 | 43.57$\pm$2.23 |

## CHAPTER III

## METHOD AND PROCEDURES

The purpose of this study was to determine and analyse the level of the physiological characteristics of Turkish national cadet wrestlers. The data were also compared with those wrestlers of foreign countries, where data was available.

### Subjects

Subjects in this study were 58 cadet wrestlers who were invited to the national camps for the 1989 World Championships.

30 of the subjects were free-style wrestlers out of which 11 of them made the team.28 of the subjects were Greco-Roman wrestlers out of which 11 of them made the team.

### Test Administration

The researcher arrived the relevant national wrestling camp and administered the test. The subjects weared shorts, shirt, socks and wrestling shoes. The sequence of events were as follows: (A) The collection of pesonal data (name and age), (B) Height and weight measurments,(C) Resting heart-rate measurements, (D) Arterial blood pressure measurement, (E) Subcutaneous body fat measurement, (F) The reaction time measurement (G) Flexibility measurement, (H) Strength measurement, (I) Vital capacity

measurement (J) Anaerobic power measurement, (K) Speed measurement, (L) The maximum aerobic capacity measurement.

The following precautions were taken before and during the tests: (1) Subjects avoided strenous physical exercises the day before, and mild exercise the day of testing (2) Subjects avoided smoking and taking stimulants such as tea, coffee one hour before testing (3) The subjects made familiarized with test procedure, (4) During testings, it isn't allowed anything in testing room which may effect subjects motivation.

**Height and Weight Measurements**

Equipment: Lever scale weight machine

Procedure:

As the measurements were taken,the subjects only worn wear T-shirt and short. Height was taken while the subject was barefooted or only worn a pair of socks, and worn noting on his head. Measurement was taken on a measuring scale fitted with a sliding head-piece that was able to move up or down to touch the top of the head. While the subjects were standing he hold his body in maximaly erect position after a full inhalation. Height measurement was taken and recorded in centimeters to the nearest centimeter. Weight was measured to the nearest 100 gr.

**Resting Heart-RateMeasurement**

Equipment: Stethoscope, Stopwatch

Procedure:

Heart-rate was recorded while the subject was in sitting position. The stethoscope was placed on the chest wall, there

the heart sounds were heard. Researcher counted the heart sounds for one minute and the results, were recorded.

**Blood Pressure Measurement**

Equipment: Stethoscope,Sphygmomanometer.

Procedure:

1. In a sitting position, the subjects were seated comfortably with the left arm slightly flexed and the fore arm supported at heart level.

2. While the blood pressure was being measured the stethescope was placed over the brachial artery that passe over the elbow.

3. The pressure cuff was inflated up to 180 mm Hg during rest.

4. The pressure was realised slightly at the rate of approximately 2 to 3 mm Hg per second.

5. When the first sound was heard, systolic blood pressure was recorded as mm Hg.

6. When the gradual decrease of sound sharpened then diastolic blood pressure was recorded as mm Hg.

7- The researcher took two measurement and average of the measurements was the score.

**Subcutaneous Body Fat Measurement (Skinfold Measurement)**

Equipment: Harpenten Skinfold Caliper

Procedure:

The skinfold measurement was taken on each subject at seven sites using Skinfold Caliper. Each site was located visually

and marked so that consequent trials of measurement would be at the identical side. Each measurement was repeated until two identical readings were taken in a row. Skinfold measurements were taken on the right side of the body while the subjects were standing erect with arms by the sides as suggested by Brozek (Brozek, 1961).

The skinfold including two layers of skin and subcutaneous fat was lifted from the underlying muscle between the ends of the thumb and the index finger.

**The locations of the skinfold at the seven sites were:**

1. Abdominal Skinfold-horizontal fold adjacent to and approximately five centimeters lateral from the umbilicus.
2. Tricep Skinfold- vertical fold on the posterior midline of the upper form (over triceps), halfway between the acromion and olecranon process.
3. Biceps Skinfold-vertical fold on the anterior midline of the upper arm (over biceps),halfway between the acromion and olecranon process.
4. Subscapular skinfold (back)-fold picked upjust below the inferior angle of the right scapula and parallel to the tension lines of the skin.
5. Supra-iliac skinfold-in the mid-axillary line at the level of the crest of the ilium.
6. Thigh skinfold-vertical fold on the anterior portion of the thigh midway between the hip and knee joints.
7. Chest skinfold-diagonal fold one-half of the distance between the anterior axillary line and nipple.

Percent body fat was predicted by using skinfold equation of Zorba (1989).

Percent Body Fat = 0.99 + 0.0047 x Weight + 0.132 x Sum of sikinfolds measurement from 7 sites.

Seven Sikinfolds = Biceps, triceps, chest, thigh, abdominal, subscapula, suprailiac.

**Reaction Time Measurement**

Equipment: Reaction Timer

Procedure:

Each subject made 10 trials with a visual (ligt) stimulus and 10 trial with an auditory (buzzer) by using hand. The first five trials were accepted as practice time. Times that were extreme from normal range was not recorded. The hand device was placed in his dominant hand with the index finger on the top of the button.A signal of "ready" was given by the researcher upon activation of the timing device. The next five trials were recorded to the nearest 1/100th of a second.

**Flexibility Measurement**

Equipment: Flexibility box.

Procedure:

The purpose of this measuring instrument was to estimate the flexibility of hips, extensor muscles of the back and also the hamstring muscles.

The subject sat on the floor with the knees extended, feet about shoulder width apart, and the feet against the box. The

subject bend the trunk forward and downward and moved the hands, palmsdown, as far forward as posible. The subject reached with both hands and hold this position. The score was recorded in centimeters.

**Grip Strength Measurments**

Equipment: Handgrip dynomometer

Procedure:

Grip strength was measured while the subject was standing erect and looking forward while the arms at the side slightly away from the body. The subject hold the dynamometer which was adjusted to the width of his palm. The dynamometer was squezzed once, sharply and as hard as possible without moving the arm. The score was read from the scale on the dynamometer and was recorded as kilograms.This procedure was applied for both left and right hands.

**Vital Capacity Measurement**

Equipment : Spirometer.

Procedure :

1.The subject sat on the armchair.

2.A diposable pipe was fitted to the pipe of the spirometer.

3.The indicator on the dial was adjusted.

4.The nose clip was placed on the subjects' nose.

5.The subject inspired as much as air he can.

6.Immediately after, the subject placed his lips on the disposable pipe and exhaled the air into the spirometer at a

constant speed (regularly,neither quickly nor slighly) until the air in the lungs was finished.

7.After the expiration the score which is shown by the indicator on the dial, was recorded.

8.Three measurements were taken and at least one minute rest was given to the subjects among the measurements.

9.The best score of the three trial were recorded as the vital capacity of the subject (ml.in ATPS conditions).

10.The score in ATPS conditions was converted to the score in BTPS conditions.

**Anaerobic Power Measurement (Vertical Jump)**

Equipment: Chalk and wallboard marked off in cm.

Procedure:

1. The subject stood in erect position with one side toward to the wall.

2. The subject extended his arm and hand, at the side of the wall, the subject tried to reach to the highest point.

3. That reached points was recorded as the reaching height.

4. Then the subject took a full squat position and jumped as high as possible, and hit the tip of the middle finger to the wall board.

5. The number on the wallboard was recorded.

6. The difference between the reaching height and jumping height was the vertical-jump score. The vertical jump score was converted to the anaerobic power score with the formula of Lewis: Anaerobic Power= $\sqrt{4.9}$ (Weight) $\sqrt{\text{Vertical Score}}$ (Fox,1988).

**Speed Measurement**

Equipment: Stopwatch, a running track

Procedure:

The subject ran 50 meters as fast as possible.The run started while the subject was standing at the start line, when the test begun the researcher started the stopwatch and at the end of the 50 meters, he stoped it, each time was recorded as seconds.

**Maximum Aerobic Power Measurement**

Equipment: 1-Stopwatch 2-Running Track

Procedure:

The 12 minute run test (Cooper's test) were performed at the 400 meters track of stadium. The intention of the 12 minute run test was to run the longest possible distance in exactly 12 minutes. The subjects immediately stoped after exactly 12 minutes, with the test administrator whistle and the distance covered and the last lap was recorded by the test administrator.

**Prediction of Vo2 max. (ml/kg/min)**

Maximal oxygen uptake of subjects were calculated by the equation suggested by American College of Sports Medicine (1975).

VO2(ml/kg/min)=Speed (m/min)x0.2+3.5 ml/kg/min.

**Statistical Techniques**

Descriptive statistics calculation (mean, standart deviation etc.) were done.

The t-test was used to determine the differences of physiological variables between the Greko-roman and Free Style Turkish cadet national wrestlers.

The t-test also was used to determine the differences of physiological variables between the wrestlers who made Turkish National Cadet Teams and wrestlers who couldn't make.

In order to determine the significance of the differences .05 confidence level was used.

# CHAPTER IV

## RESULTS AND DISCUSSION

Totaly, 58 Turkish elite cadet wrestlers (30 free style, 28 Greco Roman) particapated in this study. Eleven members of the free style and Greco-Roman wrestlers were Turkish National wrestler, who went to the World cadet Wrestling Championships in U.S.A. in 1989. 13 physiological variables (age, height, weight, percent body fat, resting heart rate, resting blood pressure, speed, reaction time, flexibility grip strength, vital capacity, anaerobic power and aerobic power were tested for the purpose of this study.

### Comparison of Turkish Free Style and Greco-Roman Cadet Teams' Wrestlers

The Turkish free style cadet team wrestlers' physiological variables were compared with the Turkish Greco-Roman cadet team wrestlers' physiological variables. Table X shows the mean and standard deviation of the physiological variables of the all subjects.

### Age, Height, Weight and Percent Body Fat

The mean and standard deviation of age, height, weight, and percent body fat of the Turkish free style and Greco-Roman cadet wrestlers are shown in Table XI.

TABLE -X

PHYSIOLOGICAL VARIABLES' VALUES OF TURKISH FREE STYLE AND GRECO-ROMAN CADET WRESTLERS

| Variables | FREE STYLE WRESTLERS | | | | GRECO-ROMAN WRESTLERS | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Mean | S.D. | S.E. | N | Mean | S.D. | S.E. |
| Age (year) | 30 | 15.72 | 0.86 | 0.89 | 28 | 15.69 | 0.94 | 0.98 |
| Height(cm) | 30 | 166.9 | 11.2 | 2.10 | 28 | 167.8 | 7.27 | 1.40 |
| Weight(kg) | 30 | 63.8 | 16.0 | 2.90 | 28 | 62.7 | 14.0 | 2.60 |
| Body Fat % | 30 | 7.45 | 2.10 | 0.38 | 28 | 8.25 | 1.97 | 0.37 |
| R.H.R.(beats/min) | 30 | 69.10 | 8.07 | 1.50 | 28 | 67.3 | 6.83 | 1.30 |
| S.B.B.(mm Hg) | 30 | 102.3 | 11.7 | 2.10 | 28 | 110.8 | 9.80 | 1.90 |
| D.B.P.(mm Hg) | 30 | 69.47 | 9.65 | 1.80 | 28 | 69.86 | 8.89 | 1.70 |
| R.T.(1/100 sec) | | | | | | | | |
| Light Hand | 30 | 18.67 | 1.35 | 0.25 | 28 | 18.52 | 1.62 | 0.31 |
| Light Foot | 30 | 21.85 | 1.58 | 0.29 | 28 | 21.48 | 1.19 | 0.22 |
| Buzzer Hand | 30 | 18.45 | 1.86 | 0.34 | 28 | 17.82 | 1.56 | 0.29 |
| Buzzer Foot | 30 | 21.65 | 1.39 | 0.25 | 28 | 20.95 | 1.37 | 0.26 |
| 50 m. Run (sec) | 30 | 7.881 | 0.46 | 0.08 | 28 | 7.811 | 0.37 | 0.07 |
| Flexibility (cm) | 30 | 30.87 | 6.51 | 1.20 | 28 | 30.07 | 7.42 | 1.40 |
| Grip Strn. (kg) Right Hand | 30 | 35.90 | 8.73 | 1.60 | 28 | 33.54 | 7.65 | 1.40 |
| Grip Strn. (kg) Left Hand | 30 | 34.30 | 8.15 | 1.50 | 28 | 30.93 | 7.87 | 1.50 |
| Anaerob.L.Power | 30 | 94.80 | 26.4 | 4.80 | 28 | 97.90 | 23.4 | 4.40 |
| VO2Max(ml/kg/min) | 30 | 48.23 | 3.52 | 0.64 | 28 | 51.56 | 4.43 | 0.84 |
| Vital C. (l/min) | 30 | 4.760 | 0.92 | 0.17 | 28 | 4.691 | 0.92 | 0.17 |

TABLE XI

MEAN VALUES OF AGE, HEIGHT, WEIGHT, AND PERCENT BODY FAT OF THE TURKISH FREE STYLE AND GRECO-ROMAN CADET TEAMS' WRESTLERS

| Subjects | N | Age | Height | Weight | % Body Fat |
|---|---|---|---|---|---|
| Free style | 30 | 15.72±0.86 | 166.9±11.2 | 63.9±16.0 | 7.45±2.10 |
| Greco-Roman | 28 | 15.69±0.94 | 167.8±7.27 | 62.7±14.0 | 8.25±1.97 |

± Standard deviation of the mean

The mean age of the Turkish free style Cadet wrestlers was (15.72 year) slightly higher than the Turkish Greco-Roman cadet wrestlers (18.61 year).

The mean height of the Turkish freestyle cadet wrestlers was (166.9 cm.) slightly lower than the Turkish Greco-Roman cadet wrestlers (167.79 cm.).

The mean weight of the Turkish free style cadet wrestlers was (63.8 kg) slightly higher than the Turkish Greco-Roman cadet wrestlers (62.7 kg.).

The mean percent body fat of the Turkish free style cadet wrestlers was (7.45 %) slightly lower than the Turkish Greco-Roman cadet wrestlers (8.25 %).

There were no significant difference in four variables between the Turkish free style and Greco-Roman cadet teams' wrestlers at confidence level of .05.

Because age ,height and weight of both groups were similar. This made the comparison of other variables between these two groups more meaningfull.

## Resting Heart Rate and Resting Blood Pressure

The mean and standard deviation of resting heart rate and resting blood pressure of the Turkish free style and Greco-Roman cadet wrestlers are shown in Table XII.

### TABLE XII

### MEAN AND STANDARD DEVIATION VALUES OF RESTING HEART RATE AND RESTING BLOOD PRESSURE OF THE TURKISH FREE STYLE AND GRECO-ROMAN CADET TEAMS' WRESTLERS

| Subjects | N | Resting Heart Rate | Resting Blood Pressure Systolic | Diastolic |
|---|---|---|---|---|
| Free style | 30 | 69.10±8.07 | 102.30±11.7 | 69.47±9.65 |
| Greco-Roman | 28 | 67.39±6.83 | 110.75±9.80 * | 69.86±8.89 |

± Standard deviation of the mean
* Signficant difference at .05 confidence level.

The mean resting heart rate of the Turkish free style cadet wrestlers was (69.10 beats/min.) slightly higher than the Turkish Greco-Roman cadet wrestlers (67.39 beats/min).

The mean resting systolic blood pressure of the Turkish free style cadet wrestlers was (102.3 mm Hg) significantly lower than the Turkish Greco-Roman cadet wrestlers (110.2 mmHg).

The mean diastolic blood pressure of the Turkish free style cadet wrestlers was (69.47 mmHg) slgihtly lower than the Turkish Greco-Roman cadet wrestlers (69.86 mmHg).

There were no significant differences in resting heart rate and diastolic blood pressure variables between the Turkish free style and Greco-Roman cadet teams' wrestlers at confidence level of .05. But there was a significant difference in systolic blood pressure between the Turkish free style and Greco- Roman cadet teams' wrestlers at confidance level of .05. Free style value is significantly lower than the Greco-Roman value.

This results showed that; resting heart rate and diastolic blood pressure of two groups are similar. In the sistolic blood pressure free style team is mean was lowew than Greco-Roman team. This results may be due to the psychologic factors,fatique and sleeplessness.

## Speed and Flexibility

Speed and flexibility mean values of the Turkish free style and Greco-Roman cadet wrestlers are presented in Table XIII.

**TABLE XIII**

**SPEED AND FLEXIBILITY VALUES OF THE TURKISH FREE STYLE AND GRECO-ROMAN CADET TEAMS' WRESTLERS**

| Subjects | N | Speed | Flexibility |
|---|---|---|---|
| Free style | 30 | 7.881±0.459 | 30.87±6.651 |
| Greco-Roman | 28 | 7.811±0.373 | 30.07±07.42 |

± Standard deviation of the mean.

Speed of the Turkish free style cadet wrestlers was (7.881 sec.) slightly higher than the Turkish Greco-Roman cadet wrestlers (7.811 sec.).

The mean flexibility of the Turkish free style cadet wrestlers was (30.87 cm.) slightly higher than the Turkish Greco-Roman cadet wrestlers (30.07 cm.).

There were no significant differences in both variables between the Turkish free style and Greco-Roman cadet wrestlers at confidance level of .05.

Because of this insignificant difference in these 2 variables comparison in other variables between these 2 groups will be more meaningfull.

## Reaction Time

The mean and standard deviation of reaction time of the Turkish free style and Greco-Roman cadet wrestlers are shown in Table XIV.

**TABLE XIV**

**MEAN AND STANDARD DEVIATION VALUES OF REACTION TIME OF THE TURKISH FREE STYLE AND GRECO-ROMAN CADET TEAMS' WRESTLERS**

| Subjects | N | Reaction Time | | | |
|---|---|---|---|---|---|
| | | Light | | Buzzer | |
| | | Hand | Foot | Hand | Foot |
| Free style | 30 | 18.67±1.35 | 21.85±1.58 | 18.45±8.86 | 21.6±1.39 |
| Greco-Roman | 28 | 18.52±1.62 | 21.48±1.19 | 17.82±1.56 | 20.95±1.37 |

± Standard deviation of the mean

The mean hand reaction time (light) of the Turkish free style cadet wrestlers was (18.67± 1/100 sec.) slightly higher than the

Turkish Greco-Roman cadet wrestlers (18.52 1/100 sec.).

The mean foot reaction time (light) of the Turkish free style cadet wrestlers was (21.85 1/100 sec.) slightly higher than the Turkish Greco-Roman cadet wrestlers (21.48 1/100 sec.).

There were no significant difference in both variable between the Turkish free style and Greco-Roman cadet teams'wrestlers at confidance level of .05.

The mean hand reaction time (buzzer) of the Turkish free style cadet wrestlers was (18.45 1/100 sec.) slightly higher than the Turkish Greco-Roman cadet wrestlers (17.82 1/100 sec.).

The mean foot reaction time (buzzer) of the Turkish free style cadet wrestlers was (21.65 1/100 sec.) slightly higher than the Turkish Greco-Roman cadet wrestlers (20.95 1/100 sec.).

There were no significant difference in both variable in both variable between the Turkish free style and Greco-Roman cadet teams' wrestlers at confidance level of .05.

Found insignificant differences for both leg and hand reactions were very important to show that in both style both hands and legs reactions are equaly important.

## Grip Strength

The mean and standart deviation of grip strenth of the Turkish free style and Greco-Roman cadet wrestlers are presented in Table XV.

TABLE XV

MEAN AND STANDARD DIVIATION GRŸP STRENGTH
VALUES OF THE FREE STYLE AND GRECO-ROMAN CADET TEAMS WRESTLERS

| Subjects | N | Grip Strength Right | Left |
|---|---|---|---|
| Free style | 30 | 35.90±8.73 | 34.30±8.15 |
| Greco-Roman | 28 | 33.54±7.65 | 30.93±7.87 |

± Standard deviation of the mean.

The mean right grip strength of the Turkish free style cadet wrestlers was (35.90 kg.) slightly higher than the Turkish Greco-Roman cadet wrestlers (33.54 kg.).

The mean left grip strength of the Turkish free style cadet wrestlers was (34.30 kg.) slightly higher than the Turkish Greco-Roman cadet wrestlers (30.93kg.).

There were no significant differences in two variables between the Turkish free style and Greco-Roman cadet teams' wrestlers at confidance level of .05.

This insignificant difference in grip strength between two groups was expected. Because hand holds in both style are equaly vigirous and frequent.

## Aerobic, Anaerobic Power and Vital Capacity

The mean and standard deviation of VO2 max., anaerobic leg power and vital capacity values of the Turkish free style and Greco-Roman cadet wrestlers are presented in Table XVI.

TABLE XVI

MEAN AND STANDARD DEVIATION VALUES OF VO2 MAX., ANAEROBIC LEG POWER AND VITAL CAPACITY OF THE TURKISH FREE STYLE AND GRECO-ROMAN CADET TEAMS' WRESTLERS

| Subjects | N | VO2 Max. | Anae. L.Power | Vital Capacity |
|---|---|---|---|---|
| Free style | 30 | 48.23±3.52 | 94.8±26.4 | 4.76±0.92 |
| Greco-Roman | 28 | 51.16±4.53 * | 97.9±23.4 | 4.69±0.92 |

±Standard deviation of the mean.
*Significant difference at .05 confidance level.

The mean maximal oxygen uptake (VO2 max.) of the Turkish free style cadet wrestlers was (48.23 ml./kg./min.) significantly lower than the Turkish greco-Roman cadet wrestlers (51.16 ml./kg./min.).

There was a significantly difference between the Turkish free style and Greco-Roman cadet teams' wrestlers at confidance level of .05.

This results shows that, mean maximal oxygen uptake of the Greco-Roman wrestlers were better than free style wrestlers. As it is known, aerobic power is one of the important factor for wrestling. Just as, succes of the Greco-Romen team was better than free style in the world wrestling championship in USA.

The anaerobic leg power of the Turkish free style cadet wrestlers was (94.8 kg.-m/sec.) slightly lower than the Turkish Greco-Roman cadet wrestlers (97.9 kg-m/sec.).

The vital capacity of the Turkish free style cadet wrestlers was (4.760 l/min.) slightly higher than the Turkish Greco-Roman cadet wrestlers (4.691 l/min.).

There were no significant differences in both two variable

between the Turkish free style and Greco-Roman cadet wrestlers at confidance level of .05.

Finding significant difference in aerobic power may be due to training differences. Just the opposite of the results free style wrestlers should've had higher aerobic power due to characteristics of the style.

**Comparison of the Turkish National Cadet Wrestlers Between The Ones Who Made the Teams and Who Didn't Make the Teams.**

Both the Turkish free style cadet wrestlers and Greco-Roman cadet wrestlers were grouped into two The first groups' wrestlers made the national teams for 1989 World Championships and the second groups' wrestlers didn't make the national teams. Table XVIII list the means, standard deviations of the physiological variables of the both groups of turkish national free style and Greco-Roman cadet wrestlers.

**Age, Height, Weight and Percent Body Fat**

The mean and standard deviation of age, height, weight and percent body fat of the Turkish free style and Greco-Roman cadet wrestlers (who, made the national teams and didn't make the national teams) are given the Table XVII

TABLE XVII

MEAN VALUES OF AGE, HEIGHT, WEIGHT, AND PERCENT BODY FAT OF THE FREE STYLE AND GRECO-ROMAN TURKISH CADET WRESTLERS WHO MADE THE NATIONAL TEAMS AND WHO DIDN'T MAKE THE NATIONAL TEAMS

| Style | Group | N | Age | Height | Weight | % Body Fat |
|---|---|---|---|---|---|---|
| FR. Style | (team members) | 11 | 15.81±0.86 | 168.7±12.8 | 64.1±15.4 | 6.79±0.76 |
| | (none members) | 19 | 15.63±0.79 | 165.8±10.8 | 63.5±16.8 | 7.83±2.52 |
| G. Roman | (team members) | 11 | 15.63±0.75 | 167.27±8.81 | 63.5±15.4 | 8.21±1.72 |
| | (none members) | 17 | 15.76±0.69 | 168.1±6.36 | 62.2±13.5 | 8.27±2.17 |

± Standard deviation of the mean.

There was no significant differences in age variable between the Turkish free style cadet wrestlers who made the team, (15.81 yr.) and who didn't make the team (15.63 yr.). But,the mean age of the wrestlers who made the team was slightly higher.

There was no significant difference in age variable between the Turkish Greco-Roman cadet wrestlers who made the team, (15.63 yr.) and who didn't make the team (15.76 yr.). But,the mean age of the wrestlers who made the team was slightly lower.

There was no significant difference in height variable between the Turkish free style cadet wrestlers who made the team (168,7 cm.) and who didn't make the team (165.8 cm.).But,the mean height of the wrestlers who made the team was slightly higher.

There was no significant difference in height variable between the Turkish Greco-Roman cadet wrestlers who made the team (167,27 cm.) and who didn't make the team (168.1 cm.).But,the mean height of the wrestlers who made the team was slightly lower.

## TABLE-XVIII

**THE MEAN,AND STANDARD DEVIATION OF PHYSICAL FITNESS VARIABLES OF TURKISH CADET WRESTLERS ACORDING TO THE WRESTLERS WHO MADE THE NATIONAL TEAM AND WHO DIDN'T MAKE THE TEAMS IN 1989**

| Variables | FREE STYLE WRESTLERS | | | | | | GRECO - ROMAN WRESTLERS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TEAM MEMBERS | | | NONE MEMBERS | | | TEAM MEMBERS | | | NONE MEMBERS | | |
| | N | Mean | S.D. | N | Mean | S.D. | N | Mean | S.D. | N | Mean | S.D. |
| Age | 11 | 15.81 | 0.86 | 19 | 15.63 | 0.79 | 11 | 15.63 | 0.75 | 17 | 15.76 | 0.69 |
| Height | 11 | 168.7 | 12.8 | 19 | 165.8 | 10.8 | 11 | 167.3 | 8.81 | 17 | 168.1 | 6.36 |
| Weight(kg) | 11 | 64.1 | 15.4 | 19 | 63.5 | 16.8 | 11 | 63.5 | 15.4 | 17 | 62.2 | 13.5 |
| Body F.(%) | 11 | 6.79 | 0.76 | 19 | 7.83 | 2.52 | 11 | 8.21 | 1.72 | 17 | 8.27 | 2.17 |
| R.H.R. | 11 | 66.1 | 7.85 | 19 | 70.8 | 7.88 | 11 | 65.73 | 7.07 | 17 | 68.5 | 6.65 |
| S.B.P. | 11 | 106.5 | 9.93 | 19 | 99.9 | 12.2 | 11 | 108.9 | 8.25 | 17 | 111.9 | 10.8 |
| D.B.P. | 11 | 73.1 | 10.1 | 19 | 67.4 | 8.99 | 11 | 68.18 | 6.62 | 17 | 70.9 | 10.1 |
| 50 m. R. | 11 | 7.77 | 0.45 | 19 | 7.95 | 0.46 | 11 | 7.75 | 0.38 | 17 | 7.85 | 0.37 |
| R.T.Light H | 11 | 18.61 | 1.42 | 19 | 18.71 | 1.34 | 11 | 18.27 | 1.41 | 17 | 18.68 | 1.76 |
| R.T.Light F | 11 | 21.06 | 1.34 | 19 | 21.72 | 1.72 | 11 | 21.30 | 1.51 | 17 | 21.58 | 0.96 |
| R.T.BuzzerH | 11 | 17.84 | 1.23 | 19 | 18.80 | 2.09 | 11 | 17.63 | 1.80 | 17 | 17.95 | 1.42 |
| R.T.BuzzerF | 11 | 21.50 | 1.49 | 19 | 21.74 | 1.36 | 11 | 20.47 | 1.65 | 17 | 21.55 | 1.10 |
| Flex.(cm) | 11 | 30.73 | 5.92 | 19 | 30.95 | 6.98 | 11 | 31.27 | 8.39 | 17 | 29.29 | 6.87 |
| R.Grip St. | 11 | 36.91 | 9.66 | 19 | 35.32 | 8.37 | 11 | 34.5 | 7.85 | 17 | 32.88 | 7.69 |
| L.Grip St. | 11 | 34.73 | 8.36 | 19 | 34.05 | 8.25 | 11 | 31.5 | 7.78 | 17 | 30.53 | 8.15 |
| VO2 Max. | 11 | 50.09* | 3.46 | 19 | 47.14* | 3.14 | 11 | 51.09 | 4.70 | 17 | 51.21 | 4.39 |
| Anaerob. P. | 11 | 94.4 | 26.0 | 19 | 95.1 | 27.3 | 11 | 99.5 | 26.7 | 17 | 96.9 | 21.9 |
| Vital Cap. (l/min) | 11 | 4.87 | 1.08 | 19 | 4.70 | 0.84 | 11 | 4.71 | 1.01 | 17 | 4.68 | 0.88 |

(*) Significant difference at .05 level.

There was no significant difference in weight variable between the Turkish free style cadet wrestlers who made the team (64.1 kg.) and who didn't make the team (63.5 kg.). But, the mean weight of the wrestlers who made the team was slightly higher.

There was no significant difference in weight variable between the Turkish Greco-Roman cadet wrestlers who made the team (63.5 kg.) and who didn't make the team (62.2 kg.). But, the mean weight of the wrestlers who made the team was slightly higher.

There was no significant difference in % body fat variable between the Turkish free style cadet wrestlers who made the team (6.79 %) and who didn't make the team (7.83 %). But, the mean % body fat of the wrestlers who made the team was slightly lower.

There was no significant difference % body fat variable between the Turkish Greco-Roman cadet wrestlers who made the team (8.21 %) and who didn't make the team (8.27 %). But, the mean % body fat of the wrestlers who made the team was slightly higher.

Similarities between groups in these variables are paralel to the literature.

**Resting Heart Rate and Resting Blood Pressure**

The mean and standard deviation of resting heart rate and resting blood pressure of the Turkish free style and Greco-Roman cadet wrestlers (who, made the national teams and didn't make the national teams) are given in table XIX.

TABLE XIX

MEAN VALUES OF RESTING HEART RATE, AND RESTING BLOOD PRESSURE OF THE FREE STYLE AND GRECO-ROMAN TURKISH CADET WRESTLERS WHO MADE THE NATIONAL TEAMS AND DIDN'T MAKE THE NATIONAL TEAMS

| Style Group | N | Resting Heart Rate | Resting Blood Pressure Systolic B.P | Diastolic B.P |
|---|---|---|---|---|
| FR. Style (team members) | 11 | 66.09±8.85 | 106.45±9.93 | 73.10±10.1 |
| (none members) | 19 | 70.84±7.88 | 99.9±12.2 | 67.37±8.99 |
| GR.Roman (team members) | 11 | 65.73±7.07 | 108.91±8.25 | 68.18±6.62 |
| (none members) | 17 | 68.47±6.65 | 111.9±10.8 | 70.9±10.1 |

± Standard deviation of the mean.

There was no significant difference in resting heart rate variable between the Turkish free style cadet wrestlers who made the team, (66.09 beats/min.) and who didn't make the team (70.84 beats/min). But,the mean resting heart rate of the wrestlers who made the team was slightly lower.

There was no significant difference in resting heart rate variable between the Turkish Gerco-Roman cadet wrestlers who made the team, (65.73 beats/min.) and who didn't make the team (68.47 beats/min.). But,the mean resting heart rate of the wrestlers who made the team was slightly lower.

There was no significant difference in systolic blood pressure variable between the Turkish free style cadet wrestlers who made the team (106.45 mm/Hg) and who didn't make the team (99.9 mmHg). But,the mean systolic B.P. of the wrestlers who made the team was slightly higher.

There was no significant difference in systolic blood

pressure variable between the Turkish Greco-Roman cadet wrestlers who made the team (108.91 mm/Hg) and who didn't make the team (111.9 mm/Hg.). But,the mean systolic B.P. of the wrestlers who made the team was slightly lower.

There was no significant difference in Diastolic blood pressure variable between the Turkish free style cadet wrestlers who made the team, (73.1 mm/Hg.) and who didn't make the team (67.37 mm/Hg.). But,the mean Diastolic B.P. of the wrestlers who made the team was slightly higher.

There was no significant difference in Diastolic blood pressure variable between the Turkish Greco-Roman cadet wrestlers who made the team (68.18 mm/Hg.) and who didn't make the team (70.9 mm/Hg.). But,the mean Diastolic B.P. of the wrestlers who made the team was slightly lower.

Eventhough resting heart rate and resting blood pressure of two groups in bouth style are similar, wrestlers who made the team have slightly lower heart rate and blood pressure values then wrestlers who didn't make the team. Resting heart rate and blood pressure are indicators of performance but the reason of finding only slight differences among these grouos may be due to young age.

**Speed and Flexibility**

The mean and standard deviation of speed and Flexibility of the Turkish free style and Greco-Roman cadet wrestlers (who, made the national teams and didn't make the national teams) was given in Table XX.

TABLE XX

MEAN VALUES OF SPEED AND FLEXIBILITY OF THE FREE STYLE AND GRECO-ROMAN TURKISH CADET WRESTLERS WHO MADE THE NATIONAL TEAMS AND DIDN'T MAKE THE NATIONAL TEAMS

| Style | Group | N | Speed (50 m.run) | Flexibility |
|---|---|---|---|---|
| FR. style | (team members) | 11 | 7.77±0.451 | 30.73±5.92 |
| | (none members) | 19 | 7.95±0.463 | 30.95±6.98 |
| GR.Roman | (team members) | 11 | 7.75±0.38 | 31.27±8.39 |
| | (none members) | 17 | 7.85±0.37 | 29.29±6.87 |

± Standard deviation of the mean.

There was no significant difference in speed variable between the Turkish free style cadet wrestlers who made the team, (7.75 sec.) and who didn't make the team (7.95 sec.). But, the mean speed value of the wrestlers who made the team was slightly lower.

There was no significant difference in speed variable between the Turkish Greco-Roman cadet wrestlers who made the team, (7.75 sec.) and who didn't make the team (7.85 sec.). But the mean speed value of the wrestlers who made the teams was slightly lower.

There was no significant difference in flexibility variable between the Turkish free style cadet wrestlers who made the team (30.73 cm.) and who didn't make the team (30.95 cm.). But the mean flexibility of the wrestlers who made the teams was slightly lower.

There was no significant difference in flexibility variable between the Turkish Greco-Roman cadet wrestlers who made

the team (31.27 cm.) and who didn't make the team (29.29 cm.). But the mean flexibility of the wrestlers who made the teams was slightly higher.

Eventhough these proporties of wrestlers are considired as a choosing criteria, finding insignificant differences in this study may be due to young age of the group.

**Reaction Time**

The mean and standard deviation of reaction time of the Turkish free style and Greco-Romen wrestlers (who made the national teams and who didn't make the national teams) are given in table XXI.

TABLE XXI

MEAN VALUES OF REACTION TIME OF THE FREE STYLE AND GRECO-ROMAN TURKISH CADET WRESTLERS WHO MADE THE NATIONAL TEAMS AND DIDN'T MAKE THE NATIONAL TEAMS

| Style Group | N | Reaction Time | | | |
|---|---|---|---|---|---|
| | | Light | | Buzzer | |
| | | Hand | Foot | Hand | Foot |
| FR. Style (team members) | 11 | 18.61±1.4 | 22.06±1.3 | 17.84±1.2 | 21.50±1.5 |
| FR. Style (none members) | 19 | 18.71±1.3 | 21.72±1.7 | 18.80±2.1 | 21.74±1.4 |
| GR.-Roman (team members) | 11 | 18.27±1.4 | 21.30±1.5 | 17.63±1.8 | 20.47±1.6 |
| GR.-Roman (none members) | 17 | 18.68±1.7 | 21.58±1.0 | 17.95±1.4 | 21.25±1.1 |

± Standard deviation of the mean.

There were no significant difference in hand and foot reaction time (light) variable between the Turkish free style cadet wrestlers who made the team (18.61, 22.06 1/100 ssec.) and who didn't make the team (18.71, 21.72 1/100 sec.). But the mean hand

and foot reaction time (light) of the wrestlers who made the teams were slightly lower. The foot reaction time (light) of the wrestlers who made the team was slightly higher.

There were no significant difference in hand and foot reaction time (buzzer) variable, between the Turkish free style cadet wrestlers who made the team (17.84, 21.50 1/100 sec.) and who didn't make the team (18.80,21.74 1/100 sec.). But the mean hand and foot reaction time (buzzer)of the wrestlers who made the team were slightly lower.

There were no significant difference in hand and foot reaction time (light) variable between the turkish Greco-Roman cadet wrestlers who made the team (18.27, 21.30 1/100sec.)and who didn't make the team (18.68, 21.58 1/100 sec.).But the mean hand and foot reaction time (light) of the wrestlers who made the teams were slightly lower.

There were no significant difference in hand and foot reaction time (buzzer) variable between the Turkish Greco-Roman cadet wrestlers who made the team (17.63, 20.47 1/100 sec.) and who didn't make the team (17.95, 21.25 1/100 sec.). But the mean hand and foot R.T.(buzzer)of the wrestlers who made the teams were slightly lower.

Finding insignificant differences in this study may be due to young age of the groups.

**Grip Strength**

The mean and standard deviation of grip strength of the Turkish free style and Greco-Roman cadet wrestlers (who, made the national

teams and didn't make the national teams) are given in Table XXII.

**TABLE XXII**

**MEAN AND STANDARD DEVIATION VALUES OF GRIP STRENGTH OF FREE STAYLE AND GRECO-ROMAN TURKISH CADET WRESTLERS WHO MADE THE NATIONAL TEAMS AND DIDN'T MAKE THE NATIONAL TEAMS**

| Style Group | N | Grip Strength Right | Left |
|---|---|---|---|
| FR. Style (team members) | 11 | 36.91±9.66 | 34.73±8.36 |
| FR. Style (none members) | 19 | 35.32±8.37 | 34.05±8.25 |
| GR.-Roman (team members) | 11 | 34.50±7.85 | 31.50±8.39 |
| GR.-Roman (none members) | 17 | 32.88±7.69 | 30.53±8.15 |

± Standard deviation of the mean.

There were no significant difference in right and left grip strengh variable between the Turkish free style cadet wrestlers who made the team (36.91, 34.73 kg.)and who didn't make the team (35.32, 34.05 kg.). But the mean grip strenght values of the wrestlers who made the team were slightly higher.

There were no significant difference in right and left grip strengh variable between the Turkish Greco-Roman cadet wrestlers who made the team (34.50, 31.50 kg.) and who didn't make the team (32.88, 30.53 kg.). But the mean grip strenght values of the wrestlers who made the team were slightly higher.

Since all of the wrestlers used for this study were elite cadet wrestlers. This may be cause of finding insignificant differences in grip strengths.

**Aerobic (VO2 max.), Anaerobic Power and Vital Capacity**

The mean and standard deviation of aerobic power, anaerobic leg power and vital capacity of the Turkish free style and Greco-Roman cadet wrestlers (who made the national teams and didn't make the national teams) are given in Table XXIII.

**TABLE XXIII**

**MEAN AND STANDARD DEVIATION VALUES OF VO2 MAX., ANAEROBIC LEG POWER AND VITAL CAPACITY OF FREE STYLE AND GRECO-ROMAN TURKISH CADET WRESTLERS WHO MADE THE NATIONAL TEAMS AND DIDN'T MAKE THE NATIONAL TEAMS**

| Style Group | N | VO2 max. | Anae.leg Power | Vital Capacity |
|---|---|---|---|---|
| FR. Style (team members) | 11 | 50.09±3.46 * | 94.4±26.0 | 4.87±1.08 |
| FR. Style (none members) | 19 | 47.14±3.14 * | 95.1±27.3 | 4.70±0.84 |
| GR.-Roman (team members) | 11 | 51.09±4.70 | 99.5±26.7 | 4.71±1.01 |
| GR.-Roman (none members) | 17 | 51.21±4.39 | 96.9±21.9 | 4.68±0.88 |

± Standard deviation of the mean.
* Significant difference at .05 confidance level.

There was a significant difference in VO2 max. variable between the free style cadet wrestlers who made the team (50.09 ml/kg/min.) and who didn't make the team (47.14 ml/kg/min.).

There was no significant difference in VO2 max. variable between the Greco-Roman cadet wrestlers who made the team (51.09 ml/kg/min.) and who didn't make the team (51.21 ml/kg/min.). But the mean aerobic power of the wrestlers who made the teams was slightly lower.

These results showed that the procedure used to select wrestlers emphasizes the aerobic power which is important for

successful performance in wrestling.

There were no significant difference in anaerobic leg power and vital capacity variables between the free style cadet wrestlers who made the team (94.4 kg-m/sec., 4.87 l/min.) and who didn't make the team (95.1 kg-m/sec., 4.70 l/min.). But the mean anaerobic leg power of the wrestlers who made the team was slightly lower. The mean vital capacity of the wrestlers who made the team was slightly higher.

There were no significant difference in anaerobic leg power and vital capacity variables, between the Greco-Roman cadet wrestlers who made the team (99.5 kg-m/sec., 4.71 l/min.) and who didn't make the team (96.9 kg-m/sec., 4.68 l/min.). But the mean anaerobic leg power of the wrestlers who made the team was slightly lower. The mean vital capacity of the wrestlers who made the team was slightly higher.

Finding insignificant differences in these two variables may be due to young age of the groups and to the fack that all of the wrestlers choosen to the camp were elite cadet wrestlers.

**Comparison of Turkish National wrestlers and Various Countries' Wrestlers**

The mean physiological variables of the Turkish National cadet wrestlers,espoir wrestlers and other countries wrestlers were presented in table-XXIV.

The mean height of turkish cadet wrestlers was (167.4 cm.) almost the same with the elite junior (USA) wrestlers (169.9 cm.). But was lower than the Junior elite wrestler, (169.9

cm), turkish espoir wrestlers (172.2 cm) and USA Junior World team wrestlers (173.6 kg.).

The mean weight of turkish cadet wrestlers was (63.3 kg.) almost the same with the elite, junior (USA) wrestlers (64.4 kg.), elite junior wrestlers (63.1 kg). But was lower than the turkey espoir wrestlers (74.3 kg.) and USA Junior World team wrestlers (78.0 kg.).

The mean percent body fat of turkish cadet wrestlers was (7.85 %) almost the same with the USA junior world team wrestlers (7.3 %) and elite junior USA wrestlers (7.2 %). But lower than the turkish espoir wrestlers (8.41 % ).

The mean systolic blood pressure of the Turkish cadet wrestlers was (106.5 mmHg.)lower than the turkish espoir wrestlers (120.2 mmHg.). The mean diastolic blood pressure of the turkish cadet wrestlers (69.66 mm/Hg) was lower than the turkish espoir wrestlers (76.0 mm/Hg.).

The mean right hand grip strength of Turkish cadet wrestlers was (34.72 kg.) lower than the turkish espoir wrestlers (43.2 kg). The mean left hand grip strength of the turkish cadet wrestlers was (32.62 kg.) lower than the turkish espoir wrestlers.

The mean aerobic power of turkish cadet wrestlers was (49.69 ml/kg/min) almost the same with elite, junior (USA) wrestler (51.2 ml/kg/min) but higher than the elite espoir turkish wrestlers (45.9 ml/kg/mgn). However, elite turkish cadet wrestlers'mean aerobic power value was lower than the USA Junior World team wrestlers (55.0 ml/kg/min) and junior elite wrestlers (52.6 ml/kg/min).

TABLE-XXIV

THE MEAN VALUE OF PHYSIOLOGICAL VARIABLES OF TURKISH NATIONAL CADET WRESTLERS,ESPOIR WRESTLERS AND VARIOUS COUNTRY WRESTLERS

| Country / Variables | Turkey | Turkey | Junior Elite Wrest. | USA Jr. Wrd.Team | USA Elite Jr. Wrest |
|---|---|---|---|---|---|
| N | 58 | 36 | 18 | 11 | 39 |
| Age | 15.70 | 18.7 | 17.0 | 19.1 | 16.7 |
| Height | 167.4 | 172.2 | 169.9 | 173.6 | 169.9 |
| Weight | 63.3 | 76.9 | 63.1 | 78.0 | 64.4 |
| % Body F. | 7.85 | 8.41 | - | 7.3 | 7.2 |
| S.B.P.(mm/Hg) | 106.5 | 120.2 | - | - | - |
| D.B.P.(mm/Hg) | 69.66 | 76.0 | - | - | - |
| Grip St.R(kg) | 34.72 | 43.2 | - | - | - |
| Grip St.L(kg) | 32.62 | 38.8 | - | - | - |
| VO2 Max (ml/kg/min.) | 49.69 | 45.9 | 52.6 | 55.0 | 51.2 |
| Reference | present study 1990 | Baykus 1989 | Horswil et al., 1989 | Silva et. al.,1981 | Horswill et al., 1989 |

These results showed that,the turkish national cadet wrestlers'mean maximal oxygen uptake value was slightly lower and mean percent body fat value was slightly higher than the foreign countries wrestlers in same age category and same status.

When it considered the results of turkish wrestlers together with foreign wrestlers, turkish wrestlers have similar

physiological characteristics with same other countries wrestlers, in the same age category and same status. But, it shouldn't be forgeten that, along besides with this physiological characteristics, technigue and phsychologic factors are most important in wrestling performance.

# CHAPTER V

## CONCLUSION AND RECOMMENDATION

Obviously, it is necessary to analyze the physiological characteristics and capacaties of wrestlers in order to determine the specific requirements for optimal performance. These results can provide physiological data which have been used in prescription of individual training programs.These informations should not only be available to the coaches and contributes to the strategy for individual matches, but also helps to provide new data for comparison in future investigations.

Based on the above facts, the purpose of this study was to determine and analyze age, height, weight, percent body fat, resting heart rate, resting blood pressure, speed reaction time, flexibility, grip strength, aerobic power, anaerobic power and vital capacity of turkish national free style and Greco-Roman cadet wrestlers. A second purpose was to compare the physiological variables of turkish free style and Greco-Roman cadet wrestlers. Third purpose was to compare the physiolocal variables of the turkish national cadet wrestlers who made the Turkish national cadet team and who didn't make the Turkish national cadet team of Word Cadet Wrestling Championships in 1989.

Last purpose of this study was to compare the physiological

variable of the turkish cadet wrestlers with the other country wrestlers where data was available.

A total number of 58 Turkish national cadet wrestlers (30 free style, 28 Greco-Roman) participated in this study.

t test was used by using "Minitab Data Analysis" Computer System to determine:

1. The differences between the turkish free style and Greco-Roman cadet wrestlers for each physiological variables.
2. The differences between the wrestlers who made the turkish freestyle and Greco-Roman cadet teams and who didn't make the turkish free style and Greco-Roman cadet teams for each physiological variables.

For the significant difference .05 confidence level was used.

## CONCLUSION

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

1. There were no significant difference between the turkish free style and Greco-Roman cadet wrestlers in the following variables: height, weight, resting heart rate, diastolic blood pressure, percent body fat, reaction time(light:hand and foot, buzzer:hand, and foot), flexibility, grip strength, speed,anaerobic power and vital capacity. The null hypotheses 1.a,b,c,e,f,g,h,i,j,k,m, were accepted.
2. There were a significant difference between the turkish free

style and Greco-Roman cadet wrestlers in aerobic power and systolic blood pressure. The null-hypotheses 1.d,1 were rejected.

3. There were no significant difference between the Turkish cadet wrestlers who made the turkish free style national team and who didn't make the team in following variables:height, weight, resting heart rate, systolic and diastolic blood pressure, percent body fat, speed, reaction time, (light:hand and foot buzzer:hand and foot), flexibility, grip strength, anaerobic power and vital capacity. The null hypotheses 2. a,b,c,d,e,f,g,h, i,j,k,m, were accepted.
4. There were a significant difference between the Turkish cadet wrestlers who made the turkish free style national team and who didn't make the team in aerobic power variable. The null hypothesis 2.1 was rejected.
5. There were no significant difference between the Turkish cadet wrestlerst who made the turkish Greco-Roman national team and who didn't make the team in following variables:height, weight, resting heart rate, systolic and diastolic blood pressure, percent body fat, speed, reaction time, (light: hand and foot, buzzer: hand and foot),flexibility, grip strength, aerobic power, anaerobic power and vital capacity. The null hypotheses 2. a, b,c,d,e,f,g,h,i,j,k,l,m, were accepted for Greco-Roman wrestlers.

Eventhough all variables used in this study are indicators of performance in wrestling,all variables except aerobic power,showed hemogenity amoung groups. This succest that the procedure used to determine the team members was selective of aerobic power. But it

doesn't mean that other variables were not significant. In most of the other variables team members were better but not statically significant in .05 degree of fredom. Since all wrestlers of this study were the top wrestlers, used degree of freedom probably was not selective enough.

In the 1989 cadet wrestling World Championship in USA, turkish free style national cadet wrestlers won, 3 first places, 3 third places, 3 forth places,1 fift places and 1 seventh place.So, turkish cadet national free style wrestling team was placed second, in cadet World wrestling championship. On the other hand, turkish Greco-Roman national cadet wrestlers won, 5 first places, 2 second places, 2 third places, 1 forth place and 1 fift place. As a result, turkish cadet national Greco-Roman wrestling team was placed first in the cadet Wrestling World Championship 1989 in USA.

When the success of free style and Greco-Roman cadet team wrestlers, in the world championships were taken into consideration it could be seen that Greco-Roman team was successful than free style team. And this trend also showed in the results of this study. Most of the physiological characteristic values (reaction time, grip strength, flexibility, speed and aerobic power) of the Greco-Roman wrestlers were also better than those of the free style wrestlers.

Most of the physiological characteristic values (weight,% body fat,reaction time, speed, resting heart rate, grip strength, aerobic power and vital capacity) of free style and Greco-roman wrestlers who made the national team were slightly better than the wrestlers who didn't make the national team.

## RECOMMANDATIONS

For further studies in the same and/or similar subject matter, several recommendations could be made. These recommentations are as follows:

1. Physiological variables of wrestlers should be measured by using direct methods under the same test conditions.
2. All of the physiological characteristics which effect the wrestlers' performance should be measured and analysed for all wrestling age categories.
3. By the ways of these type of studies norms for physiological characteristics of turkish wrestlers should be developed to be of a value to all coaches overall Turkey.
4. Longitudinal studies should be used to determine effects of different training programs on physiological variables of turkish wrestlers.
5. Effects of physiological variables on performance of turkish wrestlers should be also analyzed. Because their effects may be in different proportions in turkey.
6. Since in all the variables except aerobic power there were no significant differences in .05 degree of freedom but, the results of the team members were better in most most of the variables . This might be due to the fact that all wrestlers of this study were top elite wrestlers. So, .01 degree of freedom should be used to be more selective in further studies of this kind.

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# APPENDIX

## Data Form

Date:.....

1. Surname and Name:.....
2. Date of Birth:.....

3. Height (cm).....
4. Weight (kg) .....

5. Resting Heart Rate (in beats per min).....
6. Resting Systolic Blood Pressure (mmHg).....
7. Resting Diastolic Blood Pressure (mmHg).....

8. 12 min. run test (meter) .....

9. Biceps Skinfold (mm).....
10. Triceps " " .....
11. Thigh " " .....
12. Iliac " " .....
13. Subcapula Skinfold (mm).....
14. Chest Skinfold " .....
15. Abdominal Skinfold " .....

16. Vertical Jump (cm).....(1).....(2).....

17. 50m Dash (Sec) .....

18. Sit and Reach Test (cm).....

19. Handgrip Strength (kg)Right..... Left Hand .....

20. Vital Capacity ..... litre.

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

## PHYSIOLOGICAL CHARACTERISTICS OF TURKISH CADET FREE STYLE WRESTLERS

| SB | GR | HGT | WGT | HR | SBP | DBP | HRV | HRO | FRV | FRO | %FAT | RG | LG | FL | ANP | SPRT | M.VO2 | VC | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | 01 | 172 | 57.5 | 62 | 110 | 080 | 19.9 | 17.4 | 20.7 | 21.3 | 06.37 | 38 | 35 | 35 | 090.0 | 7.15 | 53.28 | 5160 | 7 |
| 02 | 01 | 171 | 63.0 | 60 | 116 | 078 | 17.2 | 16.4 | 22.4 | 21.5 | 06.96 | 32 | 30 | 31 | 097.6 | 7.29 | 55.00 | 4898 | 3 |
| 03 | 01 | 161 | 67.0 | 58 | 106 | 070 | 18.1 | 18.0 | 20.3 | 20.1 | 07.11 | 39 | 39 | 44 | 099.4 | 7.78 | 53.25 | 4945 | 3 |
| 04 | 01 | 171 | 71.0 | 74 | 112 | 084 | 16.9 | 17.0 | 22.4 | 21.8 | 06.41 | 44 | 40 | 28 | 105.4 | 7.83 | 47.08 | 5483 | 1 |
| 05 | 01 | 180 | 77.5 | 68 | 110 | 072 | 17.1 | 17.0 | 23.2 | 23.8 | 07.22 | 49 | 42 | 25 | 122.5 | 7.50 | 47.16 | 5268 | 4 |
| 06 | 01 | 192 | 84.7 | 52 | 098 | 064 | 20.4 | 16.9 | 22.0 | 22.2 | 06.39 | 49 | 48 | 29 | 128.5 | 7.98 | 44.66 | 6665 | 4 |
| 07 | 01 | 182 | 90.0 | 68 | 118 | 072 | 19.2 | 18.3 | 22.0 | 23.9 | 08.78 | 47 | 42 | 36 | 130.6 | 7.45 | 50.20 | 6181 | 5 |
| 08 | 01 | 154 | 46.2 | 72 | 090 | 050 | 17.4 | 17.0 | 21.0 | 19.1 | 06.43 | 29 | 30 | 33 | 064.4 | 8.02 | 48.41 | 3448 | 1 |
| 09 | 01 | 155 | 44.7 | 76 | 116 | 086 | 18.2 | 18.4 | 24.5 | 20.9 | 06.66 | 20 | 20 | 25 | 058.5 | 8.77 | 47.00 | 3440 | 3 |
| 10 | 01 | 158 | 51.0 | 75 | 105 | 078 | 19.4 | 19.3 | 23.6 | 21.9 | 06.16 | 29 | 25 | 25 | 070.5 | 7.60 | 51.00 | 4623 | 1 |
| 11 | 01 | 160 | 53.0 | 62 | 090 | 070 | 20.9 | 20.5 | 20.6 | 20.0 | 06.14 | 30 | 31 | 27 | 070.8 | 8.10 | 54.00 | 3440 | 4 |
| 01 | 02 | 172 | 71.0 | 76 | 092 | 068 | 19.6 | 19.6 | 20.4 | 21.0 | 09.77 | 44 | 40 | 32 | 115.5 | 7.60 | 50.16 | 5913 | - |
| 02 | 02 | 162 | 67.0 | 56 | 106 | 068 | 19.7 | 17.9 | 21.7 | 22.2 | 06.80 | 35 | 35 | 36 | 086.5 | 8.57 | 51.16 | 4031 | - |
| 03 | 02 | 165 | 57.5 | 60 | 087 | 070 | 15.4 | 14.8 | 22.3 | 21.2 | 06.37 | 30 | 29 | 20 | 120.0 | 7.69 | 49.10 | 4300 | - |
| 04 | 02 | 183 | 96.5 | 65 | 130 | 094 | 19.2 | 21.6 | 21.2 | 21.5 | 15.43 | 39 | 40 | 34 | 117.0 | 8.52 | 38.46 | 5375 | - |
| 05 | 02 | 185 | 85.0 | 76 | 110 | 072 | 19.2 | 18.4 | 22.9 | 22.8 | 09.38 | 49 | 48 | 36 | 134.3 | 7.39 | 46.83 | 5698 | - |
| 06 | 02 | 149 | 50.0 | 70 | 110 | 076 | 20.5 | 21.9 | 20.9 | 20.4 | 06.53 | 35 | 32 | 29 | 067.3 | 8.07 | 46.58 | 3655 | - |
| 07 | 02 | 177 | 79.0 | 72 | 104 | 068 | 17.4 | 16.3 | 20.8 | 21.3 | 08.74 | 46 | 40 | 39 | 123.7 | 8.12 | 42.50 | 5300 | - |
| 08 | 02 | 162 | 57.5 | 80 | 108 | 066 | 16.8 | 16.9 | 20.2 | 20.1 | 06.53 | 32 | 35 | 37 | 087.3 | 7.87 | 51.16 | 5698 | - |
| 09 | 02 | 156 | 48.7 | 75 | 092 | 068 | 19.5 | 20.9 | 20.3 | 21.4 | 05.81 | 30 | 29 | 39 | 069.0 | 7.60 | 49.25 | 4300 | - |
| 10 | 02 | 175 | 77.0 | 78 | 096 | 064 | 18.5 | 16.1 | 20.8 | 20.0 | 09.44 | 43 | 45 | 19 | 125.3 | 7.86 | 48.20 | 5913 | - |
| 11 | 02 | 156 | 47.0 | 66 | 105 | 065 | 20.5 | 22.1 | 20.5 | 21.9 | 06.51 | 25 | 23 | 21 | 069.8 | 7.59 | 47.33 | 3763 | - |
| 12 | 02 | 155 | 43.7 | 82 | 098 | 066 | 17.1 | 18.1 | 21.6 | 21.1 | 06.08 | 30 | 30 | 37 | 057.2 | 8.78 | 47.58 | 3763 | - |
| 13 | 02 | 167 | 54.0 | 68 | 080 | 060 | 20.0 | 19.6 | 22.0 | 22.2 | 06.22 | 28 | 28 | 24 | 081.9 | 7.79 | 45.66 | 4139 | - |
| 14 | 02 | 156 | 46.0 | 58 | 090 | 050 | 19.3 | 17.9 | 23.9 | 21.2 | 06.16 | 29 | 27 | 19 | 065.2 | 7.99 | 47.16 | 3978 | - |
| 15 | 02 | 167 | 73.0 | 76 | 110 | 068 | 19.6 | 20.9 | 26.6 | 25.2 | 07.84 | 36 | 40 | 31 | 108.4 | 7.62 | 42.91 | 4730 | - |
| 16 | 02 | 166 | 67.5 | 74 | 087 | 060 | 18.6 | 17.8 | 23.2 | 21.7 | 07.20 | 42 | 40 | 33 | 104.5 | 7.59 | 50.00 | 4730 | - |
| 17 | 02 | 151 | 41.5 | 68 | 084 | 058 | 17.6 | 17.2 | 19.6 | 21.8 | 05.98 | 18 | 15 | 36 | 050.3 | 9.02 | 46.75 | 3763 | - |
| 18 | 02 | 166 | 53.5 | 64 | 100 | 062 | 18.7 | 19.6 | 20.2 | 21.2 | 05.87 | 32 | 29 | 36 | 088.6 | 7.49 | 46.83 | 4300 | - |
| 19 | 02 | 181 | 92.0 | 82 | 110 | 077 | 18.3 | 19.6 | 23.6 | 24.9 | 12.09 | 48 | 42 | 30 | 135.0 | 7.80 | 48.10 | 5913 | - |

SB:SUBJECT; GR: GROUP 01, WRESTLERS WHO MADE THE NATIONAL TEAM;GROUP 02, WRESTLERS WHO DIDN'T MAKE THE NATIONAL TEAM ; HGT: HEIGHT; WGT: WEIGHT; HR:HEART RATE; SBP:SYSTOLIC BLOOD PRESSURE; DBP: DIASTOLIC BLOOD PRESSURE; HRV:HAND REACTION TIME VISSUAL; HRO:HAND R.T.AUDIO; FRV:FOOT REACTION TIME VISSUAL; FRO:FOOT R.T.OUDIO; %FAT: PERCENT BODY FAT; RG: RIGHT GRIP STRENGTH; LG: LEFT GRIP STRENGTH; FL:FLEXIBILITY; ANP:ANAEROBIC POWER; SPRT: 50 M.SPRINT; M.VO2: AEROBIC POWER; VC:VITAL CAPACTY; P:PLACEMENT IN 1989 WORLD CHAMPIONSHIP.

**RAW DATA**

## PHYSIOLOGICAL CHARACTERISTICS OF TURKISH CADET GRECO-ROMAN WRESTLERS

| SB | GR | HGT | WGT | HR | SBP | DBP | HRV | HRO | FRV | FRO | %FAT | RG | LG | FL | ANA.P | SPRT | M.VO2 | VC | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | 01 | 164 | 53.0 | 58 | 098 | 062 | 16.7 | 19.6 | 19.1 | 18.2 | 07.43 | 33 | 28 | 30 | 087.8 | 7.50 | 53.50 | 4635 | 1 |
| 02 | 01 | 174 | 69.0 | 62 | 118 | 064 | 19.2 | 20.4 | 21.2 | 19.0 | 08.29 | 36 | 34 | 39 | 094.2 | 7.70 | 51.83 | 4851 | 5 |
| 03 | 01 | 155 | 59.0 | 60 | 096 | 074 | 20.4 | 18.8 | 20.1 | 20.7 | 08.68 | 32 | 31 | 26 | 091.4 | 8.34 | 52.00 | 3665 | 1 |
| 04 | 01 | 176 | 84.0 | 68 | 125 | 083 | 16.3 | 17.2 | 21.7 | 21.4 | 08.79 | 49 | 45 | 35 | 141.9 | 7.42 | 51.16 | 6899 | 3 |
| 05 | 01 | 170 | 67.5 | 54 | 110 | 070 | 17.0 | 14.7 | 22.5 | 21.3 | 06.84 | 41 | 42 | 43 | 119.5 | 7.10 | 62.66 | 5605 | 1 |
| 06 | 01 | 163 | 49.0 | 64 | 110 | 060 | 20.3 | 19.0 | 21.8 | 20.4 | 06.72 | 24 | 22 | 23 | 068.6 | 8.00 | 52.16 | 3988 | 2 |
| 07 | 01 | 175 | 87.0 | 78 | 104 | 062 | 17.6 | 15.7 | 21.0 | 20.0 | 12.35 | 38 | 34 | 22 | 126.3 | 7.48 | 46.83 | 4743 | 3 |
| 08 | 01 | 176 | 79.0 | 66 | 110 | 070 | 17.4 | 17.5 | 24.2 | 23.6 | 07.44 | 44 | 38 | 46 | 133.1 | 7.50 | 50.33 | 5605 | 1 |
| 09 | 01 | 175 | 62.5 | 70 | 112 | 070 | 18.3 | 18.5 | 22.1 | 21.0 | 09.39 | 28 | 24 | 25 | 092.8 | 8.02 | 50.16 | 4419 | 2 |
| 10 | 01 | 159 | 46.0 | 74 | 105 | 070 | 19.4 | 16.7 | 19.0 | 17.9 | 08.40 | 28 | 25 | 24 | 069.8 | 8.20 | 46.00 | 3773 | 1 |
| 11 | 01 | 153 | 42.0 | 69 | 110 | 065 | 18.4 | 15.8 | 21.6 | 21.7 | 05.96 | 27 | 24 | 31 | 068.7 | 7.96 | 45.33 | 3640 | 4 |
| 01 | 02 | 172 | 75.0 | 72 | 110 | 080 | 18.3 | 18.1 | 21.3 | 19.6 | 09.28 | 42 | 38 | 24 | 120.8 | 7.80 | 47.66 | 4851 | - |
| 02 | 02 | 169 | 58.0 | 66 | 110 | 070 | 17.9 | 19.4 | 21.8 | 22.7 | 06.55 | 26 | 26 | 38 | 086.1 | 8.45 | 52.66 | 4851 | - |
| 03 | 02 | 168 | 70.5 | 68 | 100 | 070 | 17.0 | 15.5 | 19.9 | 20.2 | 08.68 | 36 | 32 | 29 | 108.1 | 7.45 | 51.75 | 4951 | - |
| 04 | 02 | 174 | 82.0 | 66 | 128 | 062 | 20.1 | 19.2 | 22.3 | 21.0 | 08.60 | 46 | 46 | 36 | 116.2 | 7.45 | 50.50 | 6899 | - |
| 05 | 02 | 160 | 56.5 | 72 | 100 | 060 | 17.5 | 16.1 | 21.6 | 20.4 | 07.82 | 30 | 29 | 24 | 092.7 | 7.65 | 47.16 | 3880 | - |
| 06 | 02 | 168 | 58.5 | 74 | 120 | 084 | 16.5 | 16.0 | 21.5 | 20.5 | 07.02 | 33 | 31 | 35 | 090.6 | 7.86 | 49.50 | 4958 | - |
| 07 | 02 | 154 | 41.0 | 64 | 120 | 080 | 16.1 | 15.7 | 21.1 | 20.9 | 08.34 | 18 | 12 | 27 | 057.3 | 8.70 | 52.50 | 2902 | - |
| 08 | 02 | 160 | 49.0 | 78 | 105 | 080 | 21.2 | 17.8 | 23.6 | 22.8 | 07.11 | 31 | 30 | 24 | 074.3 | 8.35 | 49.83 | 3773 | - |
| 09 | 02 | 170 | 54.0 | 66 | 095 | 065 | 19.7 | 17.3 | 20.8 | 20.4 | 06.86 | 29 | 24 | 35 | 082.8 | 7.70 | 52.50 | 4743 | - |
| 10 | 02 | 178 | 83.0 | 74 | 120 | 080 | 20.3 | 18.1 | 21.1 | 21.6 | 09.36 | 42 | 38 | 29 | 129.9 | 7.87 | 45.41 | 5821 | - |
| 11 | 02 | 170 | 66.2 | 62 | 115 | 075 | 17.4 | 19.4 | 21.5 | 22.4 | 08.00 | 32 | 30 | 19 | 094.9 | 7.90 | 53.33 | 4096 | - |
| 12 | 02 | 163 | 55.0 | 60 | 100 | 055 | 22.9 | 19.1 | 22.4 | 22.2 | 07.39 | 20 | 20 | 36 | 082.5 | 7.87 | 56.33 | 4635 | - |
| 13 | 02 | 172 | 48.5 | 54 | 118 | 065 | 19.0 | 20.0 | 22.8 | 23.2 | 06.92 | 42 | 40 | 38 | 101.1 | 7.35 | 63.53 | 4851 | - |
| 14 | 02 | 165 | 62.5 | 70 | 110 | 060 | 18.8 | 19.4 | 21.4 | 19.6 | 08.68 | 34 | 30 | 28 | 102.6 | 7.60 | 50.41 | 5390 | - |
| 15 | 02 | 178 | 88.0 | 78 | 135 | 090 | 18.1 | 18.0 | 21.2 | 21.4 | 15.86 | 38 | 28 | 19 | 144.4 | 7.50 | 45.16 | 4528 | - |
| 16 | 02 | 171 | 61.0 | 64 | 105 | 060 | 17.7 | 17.7 | 22.7 | 21.2 | 07.94 | 32 | 39 | 20 | 087.5 | 7.86 | 53.91 | 4312 | - |
| 17 | 02 | 166 | 49.0 | 76 | 112 | 070 | 19.1 | 18.3 | 20.0 | 21.2 | 06.20 | 28 | 26 | 37 | 075.9 | 8.12 | 48.50 | 40 | |

SB:SUBJECT; GR: GROUP 01, WRESTLERS WHO MADE THE NATIONAL TEAM;GROUP 02, WRESTLERS WHO DIDN'T MAKE THE NATIONAL TEAM ; HGT: HEIGHT; WGT: WEIGHT; HR:HEART RATE; SBP:SYSTOLIC BLOOD PRESSURE; DBP: DIASTOLIC BLOOD PRESSURE; HRV:HAND REACTION TIME VISSUAL; HRO:HAND R.T.AUDIO; FRV:FOOT REACTION TIME VISSUAL; FRO:FOOT R.T.OUDIO; %FAT: PERCENT BODY FAT; RG: RIGHT GRIP STRENGTH; LG: LEFT GRIP STRENGTH; FL:FLEXIBILITY; ANP:ANAEROBIC POWER; SPRT: 50 M.SPRINT; M.VO2: AEROBIC POWER; VC:VITAL CAPACTY; P:PLACEMENT IN 1989 WORLD CHAMPIONSHIP.