T.C.
YEDİTEPE UNIVERSITY
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DEPARTMENT OF PHYSIOLOGY

EVALUATION OF THE NUTRITIONAL HABITS, PHYSICAL ACTIVITY LEVELS AND ANTHROPOMETRIC MEASUREMENTS IN ADOLESCENT SWIMMERS

MASTER OF PHYSIOLOGY THESIS

AYLİN GÜVEN, PHYSIOLOGY

İstanbul-2021

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DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.

26/04/2021

Aylin GÜVEN

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

#	Number
ADP	Adenosine Diphosphate
AT	Anaerobic Threshold = (AT=1)
ATP	Adenosine Triphosphate
back	Backstroke
BF	Breath Frequency
BMI	Body Mass Index
BMR	Basal Metabolic Rate
brea	Breastroke
Ca^{2+}	Calcium
carbs.	Carbohydrates
Cardiovagal BRS	Cardiovagal baroreflex sensivity
CHO	Carbohydrate
cm	Centimeter
CNS	Central Nervous System
CP	Creatin Phosphate
CPET(-CPX)	Cardiopulmonary Stress Test
CVS	Cardiovascular System
Df	Degrees of Freedon
dO_2/dH	Heart Rate/ Oxygen Increment Graph
EKG	Electrocardiography
end	Endurance
EPOC	Excess Post-Exercise Oxygen Consumption
eq.	Equation
EQCO2	Breathing equivalent for CO_2
EQO2	Breathing equivalent for O_2
ETC	Electron Transport Chain
FINA	International Swimming Federation
fly	Butterfly
glu	Glucose

gr	Gram
H	Hour
Heart Rate	Heart Rate
HR/Vkg	Heart Rate Increment
HRact	Individual Level Heart Rate Response
HRmax	Maximum Heart Rate
HRR	Heart Rate Rezerve (=Pred HRmax-HRact)
kg	Kilogram
L	Liter
Lac	Lactate= Lactic Acid
M	Meter
max	Maximum
MET	Metabolic Unit
mid	Middle/ Medium
min	Minimum
min.	Minute
ml	Milliliter
mmHg	Millimeter of Mercury
O2-Deb	Oxygen debt
O2-Det	Oxygen deficiency
O2-pulse	According to Heart Rate Oxygen Production
P	Power
PAL	Physical Activity Level
PCr/ PC	Phospho Creatine
Phy. Act. Coeff.	Physical Activity Coefficient
Pre	Previously
Pred	Predicted
PYR	Pyruvate
REE	Resting Energy Expenditure
RER	Respiratory Exchange Ratio
RICE	Rest Ice Compression and Elevation
ROS	Reactive Oxygen Species

sec	Second
std	Standard
STD	Standard Deviation
Submax	Submaximal
VCO2	Carbon Dioxide Output
VE	Ventilation per minute
vit	Vitamin
VO_2	Oxygen Uptake
VO_2/kg (O_2/kg)	Oxygen Consumption per body weight (O2/kg)
VO_{2max}	Maximum oxygen uptake
VO_{2peak}	Maximum oxygen value
W	Watt

ABSTRACT

Güven, A. (2020). Evaluation of the Nutritional Habits, Physical Activity Levels and Anthropometric Measurements in Adolescent Swimmers, Yeditepe University, Institute of Health Sciences Department of Physiology, MSc thesis, Istanbul.

The aim of this thesis was to evaluate and descriptions of anthropometric parameters, nutritional habits, physical activity levels, performance parameters, and their relationship in the adolescent sprinter swimmers. Nineteen Turkish adolescent swimmers (7 female, 12 male) belonging to a professional sport club team participated voluntarily in this research. The cardiopulmonary endurance, vertical jump test, maximum heart rate test, T2000 test, anthropometric parameters, physical activity levels and nutritional habits were determined. Soft lean mass and basal metabolic rate were significantly greater in males compared to in females. Females had higher percent of body fat than males. The liquid consumption of swimmers was insufficient. While all athletes had ideal protein consumption, most of them had inadequate carbohydrate and excess fat consumptions. VO_{2peak} and anaerobic power values were significantly higher in males compared to in females. It was concluded that the regular evaluation and follow-up of the health, performance and nutritional status of the athletes is of great importance both for their normal growth and development and their sports performance performances throughout their active sports life. Data of this thesis could be useful for the plan future studies to fill the gaps in complex physiological mechanisms of swimming training and athletic performance.

Key words: Swimming, Cardiopulmonary Exercise Test, Anaerobic Power, Body Composition, Body Weights and Measures

ÖZET

Güven, A. (2020), Yüzücülerin Beslenme Alışkanlıkları, Fiziksel Aktivite Düzeyleri ve Antropometrik Ölçümlerinin Değerlendirilmesi Durumları ile Yüzme Performansları Arasındaki İlişkisinin Değerlendirilmesi, Yeditepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Fizyoloji Anabilim Dalı, Master Tezi, İstanbul.

Bu tezin amacı, adolesan sprinter yüzücülerde antropometrik parametrelerin, beslenme alışkanlıklarının, fiziksel aktivite seviyelerinin, performans parametrelerinin tanımlanması ve bunların ilişkilerinin değerlendirilmesidir. Araştırmaya profesyonel bir spor kulübü takımına mensup 19 Türk ergen yüzücü (7 kadın, 12 erkek) gönüllü olarak katılmıştır. Kardiyopulmoner dayanıklılık, vertikal sıçrama testi, maksimum kalp atım hızı testi, T2000 testi, antropometrik parametreler, fiziksel aktivite seviyeleri ve beslenme alışkanlıkları değerlendirildi. Erkeklerde kas kütlesi ve bazal metabolizma hızı, kadınlara kıyasla anlamlı olarak daha yüksekti. Kadınlarda vücut yağ oranı erkeklere göre daha yüksekti. Yüzücülerin sıvı tüketimi yetersizdi. Tüm sporcular ideal protein tüketimine sahipken, çoğunda yetersiz karbonhidrat ve fazla yağ tüketimi vardı. Erkeklerde VO2peak ve anaerobik güç değerleri kadınlara göre anlamlı olarak daha yüksekti. Sporcuların sağlık, performans ve beslenme durumlarının düzenli olarak değerlendirilmesinin ve takip edilmesinin hem normal büyüme ve gelişmeleri ve hem de aktif spor yaşamları boyunca sportif performansları açısından büyük önem taşıdığı sonucuna varılmıştır. Bu tezin verileri, gelecekte yapılacak yüzme eğitimi ve atletik performansın kompleks fizyolojik mekanizmalarına odaklanan çalışmaların planlamasında yararlı olabilir.

Anahtar kelimeler: Yüzme, Kardiyopulmoner Egzersiz Testi, Anaerobik Güç, Vücut Kompozisyonu, Vücut Kilo Ölçümü

1. INTRODUCTION AND PURPOSE

Exercise is the repetition of a set of activities performed in order to strengthen the muscles (1-3). Energy metabolism and muscle action are essential for exercise physiology. The understanding of energy metabolism in exercise is based on specific parameters. The main goal of metabolism is to produce adenosine triphosphate (ATP) to attain energy.

Primarily, all metabolic reactions start with glycolysis in the cytoplasm. It continues with oxidative pathways that are Krebs Cycle (TCA) and Electron Transfer Chain (ETC) reactions. In strenuous exercises/training, the body needs a great deal of energy in a short period of time, but oxidative reactions take much longer time than desired. When such is the case, the body yields to anaerobic metabolism. The phosphagen system is the first anaerobic mechanism in the muscle that involves short-high-intensity anaerobic exercising. Creatine phosphate (CP) is broken down in the muscle, enabling it to donate its phosphate group to convert adenosine diphosphate (ADP) to produce ATP. Approximately, 5 to 6 mmol of ATP and 16 to 18 mmol of PCr can be stored in muscles (4). The system starts with the degradation of creatine phosphate and continues with ATP degradation. This process takes only ten seconds in muscles (5). After that, the system continues with lactic acid reactions (lactate metabolism).

Muscles are the other significant factor that need exercising. They are divided into three groups: cardiac muscle, smooth muscle, and skeletal muscle. During exercise, skeletal muscles work. Morphologically, a skeletal muscle has a striated structure. It attaches to the skeleton, and it moves voluntarily. Muscles are made of fibers that are classified into two groups: Slow-twitch fibers and Fast-twitch fibers. They can be categorized according to their characteristics like shape and mitochondria number (6).

Exercise indeed regulates the body functions. If metabolism and muscles exercise, then body starts to regulate all of the energy systems. Thus, exercise regulates the cardiovascular system, hormones and neurogenic systems too.

Sport is a competitive physical activity which is governed by a certain set of rules, and which requires practice to attain a level of expertise (7). Sports and exercise have similar effects on the human body. Both improve performance by regulating metabolism. On the other hand, one of the main differences between sports and exercise is that sports push human body to its physiological limits. The other distinction is that sports are based on a competition and they can be performed by an individual or they can be performed by a team. Swimming is a type of individual sport played in the water, consisting of four strokes and five branches.

Swimming engages metabolic activities in the whole body but energy burned by an athlete demonstrates the differences depending on the branch of swimming and distance of race. Also, long and intense practices affect the body's initial energy sources and bioenergetics pathways.

Improvement of performance can occur by the training. Like in the other sports, swimmers train to improve their set of skills. Training aims to improve physical, physiological, biological and biomotoric specialities (9). To show progress in these features, a training schedule consisting of swimming and dry-land training has to be planned.

Only the training program will not increase the performance of the athletes single- handedly. Athletes must have a healthy diet to reach their maximum capabilities both in training and in competition. A healthy diet plan must be programmed in accordance with age, gender, body composition, sports branch and training-competition programs of the athlete in order to achieve consistent performance increase. (10).

1.1. The Purpose of The Thesis

This study aims to investigation the anthropometric specialities, nutritional habits, and performance parameters (aerobic capacity/ anaerobic power) in a group of adolescent sprinter swimmers.

2. GENERAL INFORMATION

2.1. Exercise Physiology

2.1.1. Skeletal muscle physiology

The human body consists of more than 400 skeletal muscles (11), which means that 40% of the body consists of these muscles (12-14). Other muscle groups are the cardiac and smooth muscles, and 10% of the bodyweight is from these muscles (15).

The striated muscle plays three significant roles in everyday life:

1. To provide the movement of the body and locomotion of body functions.
2. To support the posture.
3. To regulate the body temperature.

The fibrous connective tissue attached to the bone by a muscle is called a tendon (16). Skeletal muscles are composed of fibers ranging in size from 10 to 80 micrometers, and these fibers contain myofibers within sarcomeres. Sarcomere is the smallest unit of muscle contraction. Each muscle contraction occurs by actin and myosin filaments contraction via sliding filament theory at sarcomere (16).

Sliding filament theory is mainly based on energy-ion transition reactions that happen at six contracting-stretching cycles. In the cycle, calcium ion (Ca^{2+}) is the main ion that works with actin-myosin filaments by the sarcoplasmic reticulum.

The other essential element of contraction is the troponin-tropomyosin translation that places in a thin filament with actin.

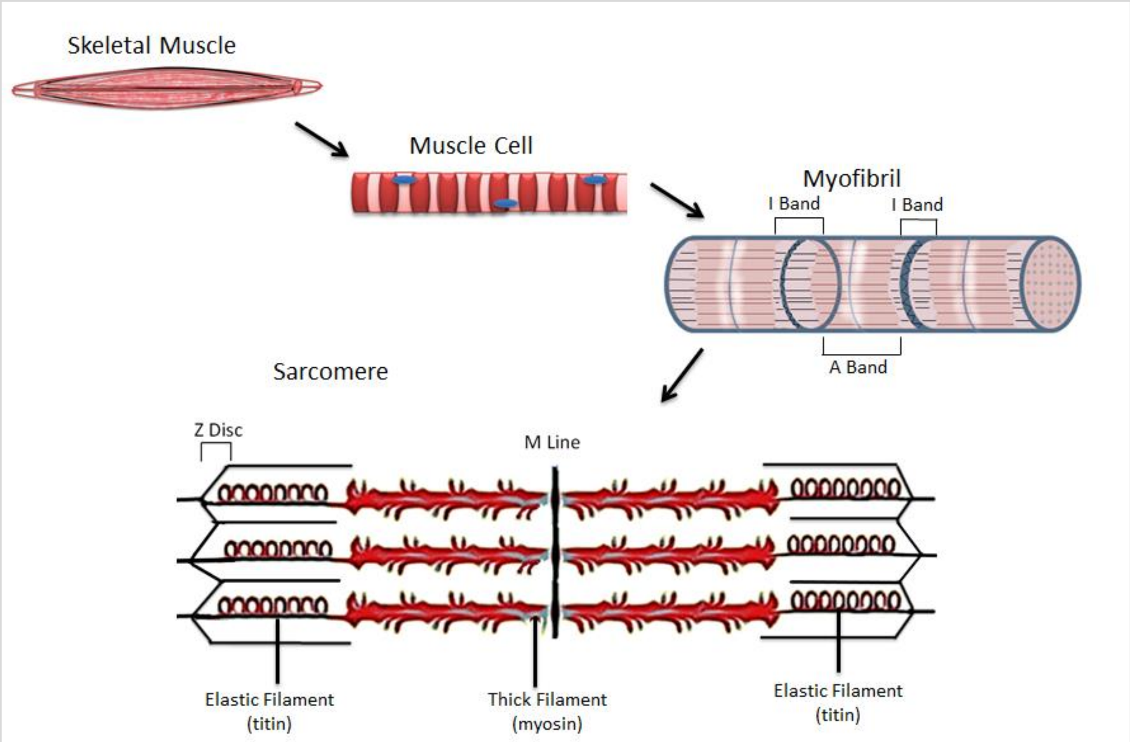


Figure 2.1. Structure of Muscles (modified from reference number 16)

2.1.2. Metabolism of muscle fibers

Vital activity runs on via metabolism. For this purpose, energy is required at intercellular and intracellular structures. Energy can be generated for direct use as well as it can be stored in muscles or kept in fats and liver in the body. The main energy unit is named adenosine triphosphate (ATP).

The muscle system constitutes glycolysis, Krebs cycle, electron transport chain (ETC), Cori cycle, glycogenesis and lactic acid fermentation to generate energy (17).

All metabolic activities start with glycolysis. Glycolysis is an oxidation process in which glucose splits into three-compound pyruvate. Pyruvate can generate energy from the adenosine diphosphate (ADP) phosphorylation to ATP.

Glucose (glu) is the main source of energy for cells. However, other hexose sugars are also used as energy sources but must first be converted into glucose in the body. Also, glycogen -stored in the muscle- can be used as glycolysis but requires to be converted like the other six-carbon sugars.

Glycolysis can be performed at ten parts in the cytoplasm (Figure 2.2.). The first five steps are made of energy investment, and the second-stage causes energy production. The total products of glycolysis are 2 moles of pyruvate, ATP and NADH(eq1) (17).

$$Glucose + 2ADP + NAD^{+} \rightarrow 2PYR + 2ATP + 2NADH \quad (1)$$

In the last stage of glucose reactions, two moles of pyruvate emerge. Subsequent reactions continue with aerobic and anaerobic respiration.

Energy production in aerobic reactions starts with the Krebs cycle. In the Krebs cycle, carbon is oxidized by the acetyl fragment in the mitochondria (18).

Krebs cycle reactions consist of eight steps which convert two moles of FAD^+ to FADH and 10 moles of NAD^+ to NADH for per mole of glucose in total (Figure 2.3.).

The second part of aerobic respiration is the electron transport chain that takes place in the mitochondria. At this stage, oxidative phosphorylation can be seen.

In overall 30-38moles of ATP can be generated from one mole of glucose at aerobic respiration [Table 2.1.] (19).

Anaerobic respiration is another reaction to metabolism like aerobic respiration. Metabolism runs on with lactic acid fermentation (also called as lactate metabolism) in strenuous exercises. Lactate metabolism is named first glycolysis in sports branches like swimming. In this metabolism, pyruvate is reduced into lactate while being oxidized NADH to NAD^+ .

$$PYR + NADH + H^{+} \rightarrow L - Lactate + NAD^{+} \quad (2)$$

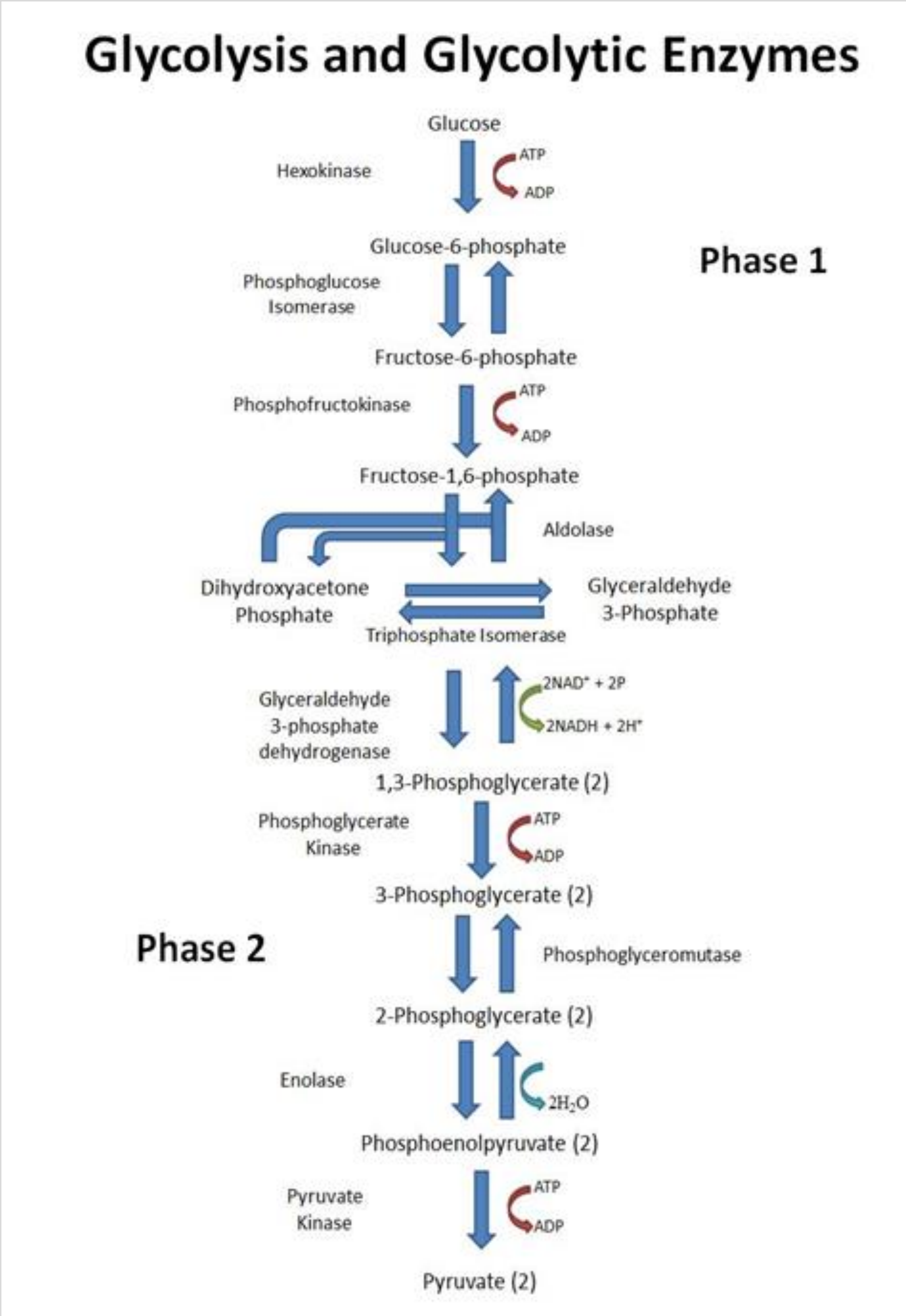


Figure 2.2. Glycolysis Reaction (modified from reference number 17)

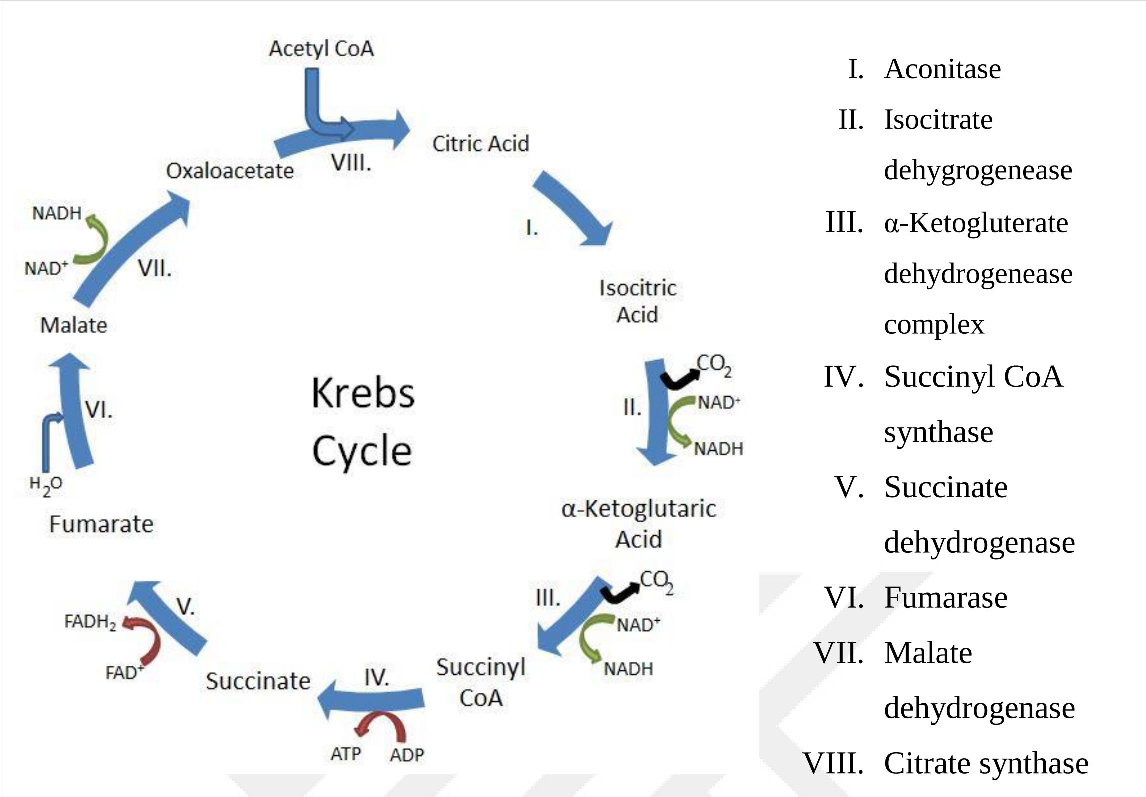


Figure 2.3. Krebs Cycle (modified from reference number 20)

Table 2.1. The Oxidative Production of ATP from glucose (modified from reference number 19)

Location	Reaction	Number of ATP Producing
Cytoplasm	Glucose → Pyruvate	2
Cytoplasm	Glucose → Pyruvate	6
Mitochondria	Pyruvate → acetyl CoA	6
Mitochondria	Isocitrate → α-ketoglutarate	6
Mitochondria	α-ketoglutarate → Succinyl CoA	6
Mitochondria	Succinyl CoA → succinate	2
Mitochondria	Succinate → Fumarate	4
Mitochondria	Malate → Oxaloacetate	6
	Total	38 ATP

The skeletal muscle synthesizes the urgent energy need during rest with anaerobic respiration. It can turn its metabolism into lactated metabolism in strenuous exercises.

Glycogen storages are broken down to continue the glycolysis reactions in skeletal muscle and are followed by lactate metabolism. Lactate metabolism produces energy in the second phosphorylated system, which first produces energy in glycolysis and then comes from energy stores. Also, some studies demonstrate that 50% of the glucose is altered to lactate although all muscle tissue is oxygenated (4).

Lactate is absorbed into the blood by monocarboxylate precursors and then is transported to tissues such as liver and heart for conversion of glucose. (21). The process of the catabolism of lactate and its turning back into glucose is named gluconeogenesis. Since lactate production mainly occurs in muscles, gluconeogenesis happens primarily in the liver. For these reasons, muscle lactate storage capacity is an important factor for athletes. One kilogram of muscle stores about 5 to 6 mmol ATP, depending on the muscle's overall storage capacity (22-24).

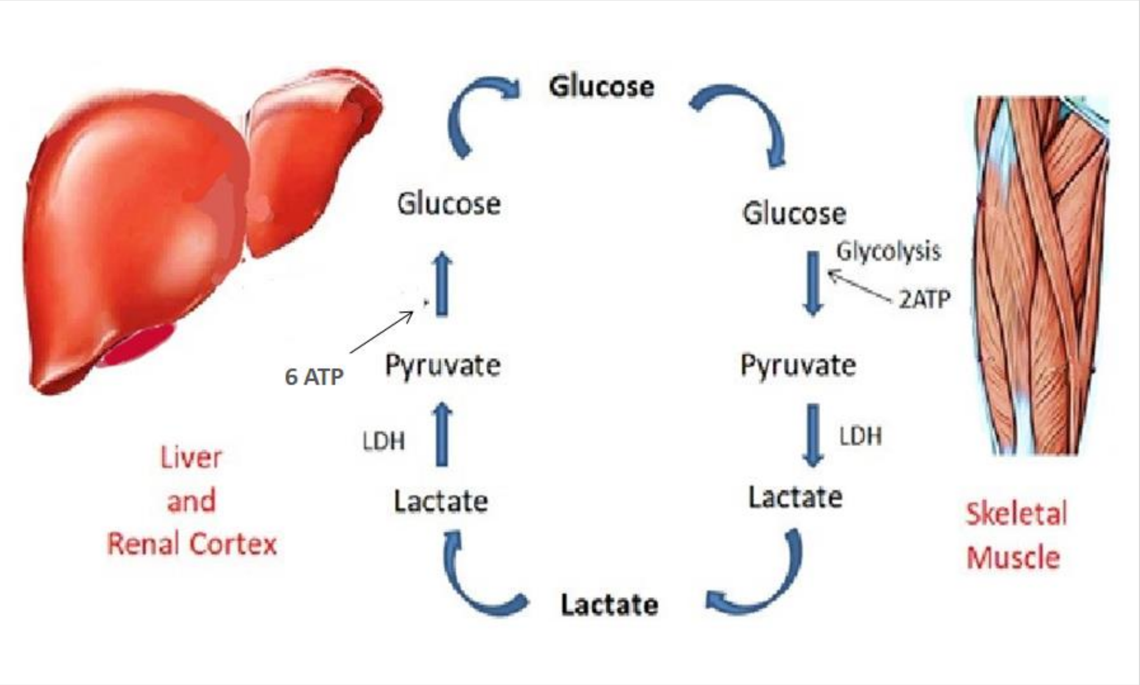


Figure 2.4. Cori Cycle (modified from reference number 20)

2.1.3. Characteristics of skeletal muscle fibers

Skeletal muscle fibers differ depending on their shape and their number of mitochondria.

The properties of muscle fibers are divided into two groups: slow-twitch fibers and fast-twitch fibers. Slow-twitch fibers appear red due to the large number of mitochondria they contain. It also gains a resistant capacity for slow-twitch fibers (24-26).

Fast-twitch fibers are classified into two categories: Type IIx and Type IIa. All types of characteristics of muscle fibers are shown in Table 2.2. (11, 25).

Table 2.2. Human Skeletal Muscle Fibers Characteristics (modified from reference number 11, 25)

	Fast Fibers		Slow Fibers
Characteristic	Type IIx	Type IIa	Type I
Dominant Energy System	Anaerobic	Combination	Aerobic
Mitochondria Number	Low	High/medium	High
ATPase activity	Highest	High	Low
Strength against fatigue	Low	High/medium	High
Exclusive tension	High	High	Medium
Maximum velocity (short time)	Highest	Medium	Low
Yield of performance	Low	Medium	High

2.2. Swimming Energy Systems

2.2.1. Swimming metabolism

Metabolic activities generate energy which is required for the swimming performance. The energy system can be divided into three levels: phosphagen system, glycolytic system and oxidative system.

During exercise, the utilization of energy starts with the phosphagen system in muscles. Then it continues with glycolytic systems in muscles.

Short-high intensity exercise is performed in an anaerobic stage, which begins with the phosphagen system in muscles.

In the phosphagen system, creatine phosphate (CP) and adenosine triphosphate (ATP) are used in the muscles. It can hold about five to six mmol ATP and 16 to 18 mmol PCr per kg of muscle (4).

In the first ten seconds of the exercise, the phosphagen system starts with degradation of creatine phosphate and ATP dehydration.

Phosphagen system:

$$ATP \xrightarrow{myosin\ ATPase} ADP + Pi + Energy + Heat \qquad (3)$$

$$ADP + PCr \xrightarrow{CK} ATP + Cr \qquad (4)$$

The metabolism can continue in aerobic or anaerobic ways depending on the exercise intensity and duration. As stated in "1.2", aerobic respiration occurs with oxygen (oxidative enzymes, VO_2) (26) and anaerobic reactions. In addition, when looking at metabolism, anaerobic reactions usually occur in about forty seconds and then continue through glycolysis pathway (27, 28).

There are two types of reactions in the glycolytic system: fast glucose and slow glucose. In glycolysis, glucose (blood glucose or converting glycogen in muscles) is used.

Anaerobic reactions occur with a lack of oxygen, which causes the formation of lactic acid. At this stage, lactate starts to accumulate (eq. 5, 6).

Fast

$$glucose + 2P + 2\ ADP \xrightarrow{\qquad\qquad} 2\ lactate + 2\ ATP + H_2O \qquad (5)$$

Slow

$$glucose + 2P + 2\ ADP\ + 2NAD\ \longrightarrow\ 2\ lactate + 2\ ATP + H_2O + 2NADH + \mathrm{H} \qquad (6)$$

In the oxidative system, mainly blood sugar and muscle glycogen are preferred as well as fatty acids and proteins can also be used. At this stage, ATP is produced by Krebs cycle, ETC.

Afterwards, glucose is produced from monocarboxylate precursors (gluconeogenesis) (23, 29) and homogenizes regulated.

After hard exercising, lactate backs into the liver and returns to glucose. This process is called as the Cori cycle (30, 31).

2.2.2. Main types of exercise physiology

Exercise can be categorized into two pathways: the aerobic pathway and the anaerobic pathway. Like metabolism, high performance-short time of exercises can occur in anaerobic metabolism, and long-term activity performance training can be categorized into the aerobic pathway.

Exercise can be performed for gaining and increasing the physical parameters of performance. Some determinants can be used to view and increase the parameters of physical performance. In addition to reach the max performance capacity, exercise can also be done to reach the body parameters listed below:

- Endurance
- Strength
- Power

Endurance is the body's ability to resist fatigue in long-term sports activities. It contains glycogen storage in muscle, muscular and cardiovascular endurance. A few months of endurance training results in neuromuscular, metabolic adaptations, endocrine and respiratory system changes: VO_{2max}, waist-hip ratio, lactate threshold, Tip I. muscle fibrils, HDL (high-density lipoprotein/ good cholesterol) value increases significantly (32).

Endurance can be developed with many different methods such as long-meter distance running, hill running, fartlek and interval endurance training.

The muscle can be strengthened depending to its size. Maximum muscle strengthen can be measured at 3-4 kg/cm2 of muscle cross-sectional area contraction. Muscle strengthening is influenced by tissue's physiological properties (Table 2.2.), biomechanical factors, size, aging, gender, types of training, and techniques (32).

Strengthening training starts with motor learning. Then muscle strengthening increases, and hypertrophy appears (32). In addition, strengthening training can be dynamic, static (isometric) or compatible (isokinetic) resistance. Dynamic exercises mainly work with the concentric and eccentric muscle contraction. Isokinetic measurements are made between two extremities. Isometric contraction works with a muscle that provides power without muscle distance changing (32).

The power of muscle contraction shows differences from the strengthening of muscles. The strengths and contraction sizes of the muscles demonstrate differences for each contraction minute (15). Also, coordination and skills are significant for muscle power.

2.2.3. Physiological changes with training

According to the training time and the performing exercises, some physiological adaptation changing can be seen on the body. The adaptations of the exercises occur at nearly 10-12 weeks.

- Cardiovascular changes
- Respiratory changes
- Metabolic changes
- Systematic changes (Homeostatic changes)
- Postural changes

The body capacity increases with doing exercise. With regular exercises, the body capacity can increase, the pulse rate can be regulated, the systolic-diastolic blood pressure can decrease, and the hemoglobin levels in the blood can increase. While performing maximum performance of the exercise, the stroke volume increases, and this causes the cardiac output to increase. Likewise, the oxygen output and transport of oxygen to the exercising muscles are increased. Currently, the maximum VO_2 capacity is seen in good athletes.

The respiratory system, like the cardiovascular system, can vary according to the body size. Lung volume increases, but tidal volume does not change. Subsequently, the pulmonary volume increases, the alveolar-capillary and surface area increases, resulting in a larger diffusion capacity. During maximal exercise, diffusion capacity gets more extensive, but maximum diffusion capacity does not change—also, ventilation rate and ventilation efficiency increase (6, 15).

Metabolism of athletes demonstrates differences according to their racing types and distances. In this type of muscle, muscle hypertrophy can be seen, and according to muscle type, some parameters can change (Table 2.3. - 2.4.).

Regular exercise affects the body's homeostasis. It decreases blood cholesterol and triglyceride level, and body fats. Also, heat acclimation strengthens bones, ligaments, and tendons enhance.

2.2.4. Swimming energy system

Energy metabolism species differ according to the swimming distance and exercise. The relationship between freestyle swimming distance and energy is the link in Table 2.3. (9, 26, 33).

Table 2.3. Metabolic Energy Consumptions (modified from reference numbers 9, 26, 33)

Distance (m)	50	100	200	400	800+
Phosphagen (%) (9,26,33)	95	80	30	20	≤ 10
Glycolytic (%) (9,26.33)	5	15	65	40	20-30
Oxidative (%)(9,26,33)	≤ 5	5	5	40	60-70

Short distances require more anaerobic capacity and long distances require more aerobic capacity as shown in Table 2.3. 50 m and 100 m are short distance swimming meters. As the flotation meter increases, the anaerobic pathway decreases and aerobic capacity increases (the oxidative system increases) (26, 33).

Regarding the verification of training degree, the exercise affects the muscles and is categorized into energy requirements, energy requirements, and bioenergy differences (34).

Training hardness is divided into six stages. The first stage represents the phosphagen system, and it takes nearly 6-8 seconds. In this hardness level, max VO_2 level of the athletes reaches the maximum.

Hardness 2 type of exercises represents the swimming short distance races which take nearly forty seconds of racing (5). In an exercise set, the PC is stored in the muscles for the first ten seconds. After ten seconds, due to phosphagen system disruption, the muscle backup system works. After about 30 seconds, blood sugar or muscle glycogen is predominantly preferred (5). After this, training time and application hardness result in gradually increasing lactate build-up (5, 35). Due to the rigidity of Hardness 2 training, the body needs excessive oxygen consumption after exercise, called EPOC (5).

Fast and slow glycolysis can be seen at Hardness 3 type of exercise. This phase usually lasts 30 seconds to 2 minutes and is performed on anaerobic metabolism. At this stage, a high amount of lactate accumulation can be seen (35).

Hardness 4 types of performance represent both aerobic and moderate exercise strength in this phase, which lasts for 2-3 minutes in exercise (29).

Hardness 5 and 6 types are the members of aerobic metabolism. Cardiovascular performance is mainly seen at Hardness 5 level of exercise. 400 m freestyle and individual medley are the members of this stage. Hardness 5 stages of swimmer require the unique tactics based on muscle and liver glycogen and fat storage used to meet body energy requirements (5).

Six level exercises are almost the same as five level exercises. Also, the six level of stiffness of the exercises is about 95% of the exercises done in oxidative metabolism. This is the reason why blood sugar and muscle glycogen usage are reduced; on the contrary, oil consumption increases (29).

Table 2.4. Practicing Time- Energy Sources Relations (modified from reference number 26,29)

Hardness Area	Practicing Time	Hardness Degree	First Energy Sources	Proportional of Energy Metabolism Division	
				Anaerobic	Aerobic
1	< 6 -8s	Maximum	ATP- PC	100-65	0-5
2	6-40 s	High	ATP-PC fast glycolysis	95-80	5-20
3	40 s- 2 min	Mid-High	Fast or Slow Glycolysis	80-50	20-50
4	2-3 min	Middle	Slow glycolysis and oxidative	50-40	50-60
5	3-30 min	Mid-low	Oxidative	40-5	60-95
6	>30 min	Low	Oxidative	5-2	95-98

Nowadays, 400 m swimming is accepted at the middle stage because of energy demands. However, when looking at them, every 100 m swimming scores in 400 m, every 100 meter demonstrates anaerobic characteristics. Although it is still middle-distance, analyses demonstrate that the first 100 meter of 400 m races requires 45% of the total races' output energy, which means anaerobic capacity plays a significant role in 400-meter swimming (36).

2.2.5. Periodization of swimming training

Swimming is a type of sport which is competed at twenty events. These races can be performed in the Olympic swimming pools on the short course (25 m) or the long course (50 m) at Olympic swimming pools (37).

Every athlete trains before competitions to increase the capacity of their performance. Progression of training is based on physical improvements, physiological improvements, and biomotoric and biological specialities (38). Improving these parameters takes time. For this reason, the training schedule is planned to make the exercises periodic within a year. Depending on the number of competitions, the program can be divided into two or three periods in a year (Table 2.5.). The program is planned according to the main races, and one race period is called a macrocycle. The macrocycle is divided into stages such as adaptation (1-2 weeks), general preparation (4-12 weeks), special preparation (4-8 weeks), competition period (1-2 weeks), and narrowing race-transition (Table 2.5.). This phase takes between 11-18 weeks in a macrocycle.

Exercise types and intensities vary according to the stages in the macrocycle. Exercise is known to affect body systems. When considering a cardiovascular response, the intensity, duration, and frequency of exercises are key factors.

The age, gender, activity level, health level, exercise intensity, exercise frequency, and the athlete's fitness level are important factors when designing the athlete's exercises. An exercise program starts with a warm-up, continues with the main set, and ends with a cool-down time.

Table 2.5. Periodization of Training Modeling in One Year (This table is adapted from Matyetev) (modified from reference number 9, 39)

Training periods	Preparation		Competition				Transition
Phases	General	Special	Pre-Competition				
Macro cycle							
Micro cycle							

Table 2.6. Training Plan in One Year (modified from reference number 9, 35)

Season Parts	# of Weeks in a cycle	# of Week in Macrocycle		
		Preparation	Race	Transition
1 Part	52	≥32	10-15	5
2 Parts	26	13	5-10	3
3 Parts	17-18	≥8	3-5	2-3

2.3. Sports Nutrition

Sports nutrition is very important for athletes. A person or professional athlete who does regular sports should pay attention to their nutritional needs for the following reasons:

- An athlete's energy requirement
- To supply recovery in and after training
- To keep or improve the performance

Sports nutrition contains many parameters: energy, carbohydrate, proteins, vitamins, minerals containing body mass, regulation-ordering the menu, ergogenic help, and vitamins.

Proper energy taking is the main elements of an athlete's diet. An appropriate diet list leads to protect body homeostasis, power, endurance, and muscle mass.

Besides, it regulates metabolism and improves performance. Also, it determines macro-nutrient (carbohydrates, proteins, fats) and micro-nutrients (vitamins, minerals) nutrients (40-42). It also helps to regulate body composition.

Regulation and determination of person energy requirements are based on age, gender, body composition, daily eating-statement, any medical treatment and illnesses (40-42). Thus, according to these parameters, individual energy requirements demonstrate diversity.

2.3.1. Food sources

Food sources are the other important points for diets. They can be divided into two groups as Macronutrients and Micronutrients.

2.3.1.1. Macronutrients

Carbohydrates, proteins, and fats are macronutrients. Carbohydrates are the primary source of energy for athletes. One gram of carbohydrate accommodates four calories of energy. As mentioned earlier, the main energy sources of metabolism is glucose, the main unit of carbohydrates. Glucose is used to generate energy during exercise. In addition, glucose is stored in muscle in the form of glycogen.

Carbohydrates are the main resources for brain and central nervous system work (CNS) (40-42). Basic carbohydrate sources are as follows:

- Whole grains (oat, wheat, bulgur, rice… etc.)
- Fruits (apple, strawberry, blueberry, raspberry, orange, grape, banana…etc.)
- Vegetables (broccoli, carrot, pumpkin, green leaf, leek…etc.)
- Root-plant (potato, yam)
- Milk
- Yoghurt

Proteins are the other important unit of macronutrients. Proteins play important roles in the body such as regulating enzymes and hormones, supporting cell and body structures, and increasing muscles. Amino acids are the basic units of proteins. Some amino acids -called essential amino acids- are taken into the body from the outside (43).

Proteins in sports nutrition affect anabolic reactions, aerobic and anaerobic performance (the use of anaerobic performance proteins is essential), recovery, and competition.

Some of the protein sources are (43):

- Animal origin food (red meat, chicken, fish, egg… etc.)
- Milk productions (milk, yogurt, cheese…etc.)
- Legumes and oilseeds (beans, lentils, lupines , peanuts , soybeans)

Fats are important for maintaining homeostasis, body and organs. It also helps to regulate the body temperature. Also, some vitamins are soluble in oils (A, D, E and K).

Some essential amino acids, also known as essential oils, are not produced in the body and are therefore taken from outside. When looking at the structure of fatty acids, some oils have double bonds called unsaturated fats, while some oils do not have double bonds called saturated fats (44).

According to their categories:

- Animal-based fats (saturated fats) (butter… etc.)
- Plant based oil (unsaturated fats) (olive oil, avocado, corn oil, sunflower seed oil…etc.)

2.3.1.2. Micronutrients

Micronutrients contain vitamins and minerals. They are essential for the growth and development of young athletes. Vitamin and mineral deficiency adversely affects health and causes poor performance.

Vitamin D, calcium, zinc and iron are some important micronutrients for athletes. Some of the functions of the vitamins and minerals are:

a) B Vitamins (45)

- It works as a co-factor in metabolism
- To support the energy requirement
- Whole grains, legumes, seeds and nuts, meats, eggs, fruits and vegetables are good vitamin sources.

b) Vitamin D (46)

Calcium absorption in bones is important. It is suggested that young athletes can take Vitamin D at least 600 IU/day (39**).** Vitamin D can be absorbed under the skin through sunlight. Vitamin D absorption varies according to geographical location. Supplements can occur when other forms of vitamin D taking are exposed to the sun. In addition, the effectiveness of vitamin D negatively affects performance (46).

c) Iron

- Iron plays role of transportation of oxygen uptake to tissues
- It affects the growth and increment of blood volume and lean muscle mass (40-42)
- It must be taken for adolescents at
  - 11 mg/day for males (41, 47)
  - 15 mg/day for females (41, 47)
- Meat, eggs and grains are the good iron sources.

d) Calcium

- Calcium is essential for metabolism which includes enzyme activity, muscle contraction.
- Calcium effects the bone hardness and health (42)
- During training, metabolism requires iron (42,47)
- Milk products, spinach, broccoli, nuts are some types of calcium products.

e) Zinc (48)

- Zinc plays role on muscle growth, fatique and immune system
- Zinc provides stabilization of plasma and subcellular membranes
- Catalytic for enzyme is significant
- Deficiency of zinc results in the prevention of muscle growth
- Excess of zinc result in muscle damage (after exercising muscle leakage releases zinc into the extracellular fluid that may harm the muscle)

f) Magnesium (49)

- Magnesium is a significant co-factor
- Magnesium binds ATP
- It plays role on energy metabolism, protein synthesis, cell growth and glycolysis
- It regulates cardiorespiratory functions during exercise
- Legumes, seeds, nuts, milk, meats, and vegetables are good vitamin sources.

Free radicals (ROS) are unstable and reactive. Free radicals bind proteins, lipids, cells, and DNA that can be harmful to health. In addition, many exercises negatively affect performance by increasing ROS production (causing oxidative stress and muscle fatigue). Antioxidants help reveal free radicals. Vitamins A, C and E are good antioxidants and are important for the immune system (50).

g) Vitamin A (51)

Vitamin A can be found in nature in two different forms. Although all the vitamin A benefits are still not fully known, it is known to reduce ROS and protect bones against fracture.

h) Vitamin C (52)

It is essential to have an optimum level of vitamin C in the tissues. Vitamin C plays a role in iron absorption. It preserves the hemoglobin structure and prevents the formation of methemoglobin. In addition, the antioxidant vitamin C helps the digestion of iron.

i) Vitamin E (53,54)

Vitamin E is found in plasma, and, like vitamin A, it reduces ROS and protects tissue damage. It also plays a role in lipid peroxidation and, along with vitamin C, it helps healing.

2.3.1.3. Hydration

Hydration depends on one's needs. Daily fluid consumption varies according to the education types and environments (55). The daily fluid need can be calculated by multiplying the weight of athletes by 30-35 ml.

Fluids regulate blood viscosity, blood pressure, acid-base balance, thermoregulation, healing, neuro-signaling, digestion, and it maintains kidney health. It should be taken 3.7 L / day in men and 2.7 L / day in women (47).

2.3.2. Nutrition of athletes

Balanced nutrition of athletes throughout the day will ensure their performance to be better.

There are some parameters that can be handled for utilization times for athletes. For example, carbohydrate usage during exercise is good for supporting performance.

- **Carbohydrates**

Consumption of a sufficient amount of carbohydrates must be taken at three times of exercise: before, during, and after the training by preventing low blood glucose and by providing less feeling starving (56).

During exercise, the consumption of carbohydrate affects performance positively. Also utilization of carbohydrates during exercise regulates blood glucose like the consuming carbohydrates before training. The other essential effects of the utilization of carbohydrates during exercise are that they reduce the pain senses (56).

After exercises, utilization of carbohydrates is significant to refill glycogen storage and to make a recovery. It also prepares the body for the next training. Simple carbohydrates should be preferred after training (56).

The daily carbohydrate intake of adolescent athletes should be 6-10 gr./kg./day in their diets (42). In addition, athletes should intake 1-1.2 gr./kg /h carbohydrate within 0-4 hours after the end of training (42).

- **Proteins**

Proteins lead to feel of satiety during a day. But, consuming proteins in daily diets is also important for regulation of body activity. However, utilization of protein is not necessary on training. But after training, it is significant for recovery. Then it knows that utilization of protein sources with carbohydrates should be consumed within the first 30 min of after training (such as chocolate milk) (57).

The daily protein intake of adolescent athletes should be 1,2-1,6 gr./kg/day in their diets (42). Also, athletes should intake up to 2. gr./kg/day after the intensity training. (42).

- **Fats**

Fats are as important as carbohydrates and proteins. However, it should not be preferred before and during the training. Athletes should be mainly unsaturated fats on daily diets (58).

During a tough workout, the glycogen store is emptied and the athletes feel exhausted. Carbohydrate use should be high in this type of training and protein-rich foods should be consumed to prevent possible injuries after training (58).

In general, nutrition is essential for healthy living and athletic performance. Athletes should consume all kinds of nutrients in their daily diets. The regulations of macronutrients and micronutrients, adequate fluid consumption, snacks and recovery time foods (30 minutes after training) are important factors for achieving and gaining good performance (58).

The daily protein intake of adolescent athletes should be the range between 25-35% of daily energy demand in their diets (42).

2.3.2.1. Dehydration

Dehydration is the factor for decreasing performance that affects athletes' strength, endurance, coordination negatively. Also, dehydration cause mental retardancy during training (47, 59).

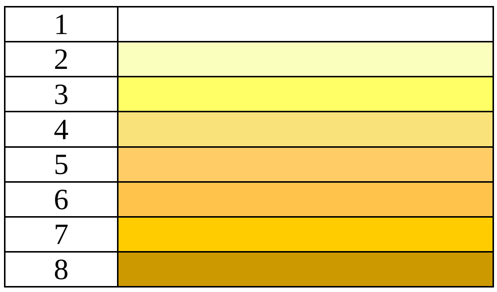


Figure 2.5. Dehydration Urine Color Chart (modified from reference number 60)

Table 2.7. Liquid Consumption at Training (47,55,59,60)

Time	Liquid Consumption Time/ Period	Liquid Amount
Before Training	Before 4 Hours	5-7ml/kg
	Before 2 Hours	3-5 ml/kg
During Training	During training/ 15 min periods	0,4-1,8 liter
After Training	After Training	After training, 1,5 liter of liquid for every 1 kg of body mass loses

2.3.3. Nutrition of adolescents

Balanced nutrition is necessary for adolescent athletes to perform optimally, to grow, to develop and to be healthy. For this reason, athletes must take their energy requirements into their daily diets.

Consumption of carbohydrates, protein and fat in daily diet is vital to keep performance at optimum level. In particular, the glycogen tank must be full to improve anaerobic performance. For this reason, carbohydrates, which are the first energy source of the muscles, should be included in the daily diet list. The daily nutritional amounts of adolescents are shown in Table 2.8. .

Daily consumption of protein (sufficient amount) is required to develop muscle tissue, protein synthesis, anabolic stimulation for recovery. Athletes should prefer quality protein sources (meat, chicken, fish, legumes, milk). According to some sources, additional foods are required for adolescents to get enough nutrients (61).

Fat consumption is also important for fat-soluble vitamins such as A, D, E, and K. As with carbohydrates and proteins. Insufficient fat consumption negatively affects the development and performance of the athlete.

Table 2.8. Adolescents Daily Nutrition Amounts (modified from reference numbers 42, 62)

Proteins	%10-30 of daily energy demand 1,2-1,6 gr./kg/day **After training for recovery ,in 0-1 hours;** 0,3gr./kg/ hour
Carbohydrates	%45-65 of daily energy demand 6-10 gr./kg./day **After training for recovery ,in 0-4 hours;** 1-1,2 gr./kg/hour **If the activity takes 70-150 mins., during activity;** 30-60gr./hour
Fats	25-35% of daily energy demand < 10% saturated fats of daily energy demand

3. MATERIALS & METHODS

Ethical permission was obtained on 27.06.2019 with the title of “Adolesan Yüzücüler İçin Geliştirilen Beslenme ve Kara Antrenmanı Programlarının Fiziksel Performans Parametreleri Üzerine Etkilerinin Değerlendirilmesi” (see Appendix 4.).

This descriptive study aims to examine the anthropometric characteristics of adolescent swimmers (100-400 m range swimmers), the basic characteristics of their nutritional habits, and the performance parameters such as their anaerobic power capacity. The measurements were analyzed (with student t-test and chi-square test), and the results were categorized in national/international scales.

In the present study, the Swimming Branch of Fenerbahçe Sports Club was studied, and eight swimming and three dry-land training sessions were conducted weekly with swimmers of 2003-2004 Group A Teams.

Two methods were used: swimming and dry land. Maximum heart rate test and T2000 test were selected for water tests, and jumping and cardiopulmonary tests were selected for dry land tests.

Body parameters were learned by analyzing athletes' daily diet consumption with GAIA 359 Body Composition Analyzer, 24-Hour Food Consumption Record Form and the Physical Activity Level Determination Form (24 hours). In addition, the other information was obtained by using the Data Collection Form.

Volunteer swimmers who born between 2003 and 2006 years, who did not use a drug that would affect doing exercise and did not have injuries that prevented them from playing sports during the study period were included voluntarily in this study. Athletes who took drugs that affect metabolism (included supplements) or had a disability that would prevent them from doing sports were not included in the study.

3.1. Cardiopulmonary Stress Test (CPET-CPX)

The cardiopulmonary stress test has measured the maximum oxygen consumption (VO_{2peak}), aerobic capacity and cardiorespiratory endurance. This test has been used for cardiovascular system capacity (CVS) at sedentary patients and has measured the athletes' performance capacity and anaerobic threshold (63-65).

The cardiopulmonary test measured by the "Breath by Breath" technique includes metabolic parameters and cardiorespiratory function parameters (66).

Indirect calorimeter measurements, tidal volume and P0 measurements are performed by this method, (63,67). Also, measurement integration is based on a cardiac output (68). Especially obstructive pulmonary diseases and sports performance and other parameters have been measured with the inbreathe technique.

Parameters of CPET system measurement (69):

- VO2= Oxygen Consumption
- O2= Carbon Dioxide Output
- BF= Breath Frequency
- VE= Ventilation per minute
- RER= Oxygen Carbon dioxide Consumption Ratio (RER)
- EQO2= Breathing equivalent for O2
- EQCO2= Breathing equivalent for CO2
- HR= Heart Rate
- VO2/kg= Oxygen Consumption per body weight (O2/kg)
- O2-pulse= According to Heart Rate Oxygen Production
- MET= Metabolic unit (1MET= 3,5 ml/min/kg)
- HRR=Heart Rate Rezerve (=Pred HRmax-HRact)
- HR/Vkg= Heart Rate Increment
- dO2/dH=Heart Rate/ Oxygen Increment Graph
- Lactate= Lactic acid

- O2-Deb= Oxygen debt
- O2-Det=Oxygen deficiency
- EKG

parameters.

Figure 3.1. Treadmill (modified from reference number 69)

3.1.1. Incremental test system

An incremental test system is generally used for clinic and sports medicine for cardiopulmonary function measurements with the “breath by breath” technique via a submaximal way. It measures the maximum oxygen capacity (VO_{2max}), the oxygen peak value measurements and the determination of inhalation-exhalation rates (70). For these reasons, “Bruce Protocol” was used at “Master Screen SPX” programs on treadmill ergometer (71). In this test protocol, the athlete runs against a specific increasing force on the treadmill, and the device calculates the parameters that vary depending on the exhaled breath and the heartbeat value by the breath by breath technique (72).

The incremental test (Bruce Protocol) was terminated when the RER value exceeded 1.15 (73).

The Bruce Protocol is an indirect measurement of maximum oxygen consumption and aerobic power by means of the breath-by-breath technique. The athlete is asked to run for three minutes while an increasing force is applied to him from slow to fast (70-72). Every three minutes increment (3-4 METs) is called the step (74).

With this program, the following types of parameters are observed:

- Heart rate (HR)
- Maximum oxygen consumption (VO_{2max})
- Maximum oxygen value (VO_2peak)
- Oxygen Carbondioxide Consumption Ratio (RER)
- Anaerobic Threshold =AT (AT=1)

The final adoption of the Bruce Protocol is used for the tests. Power is increased at each stage in the test and recovery is achieved for 5 minutes at the end of the test (72, 75).

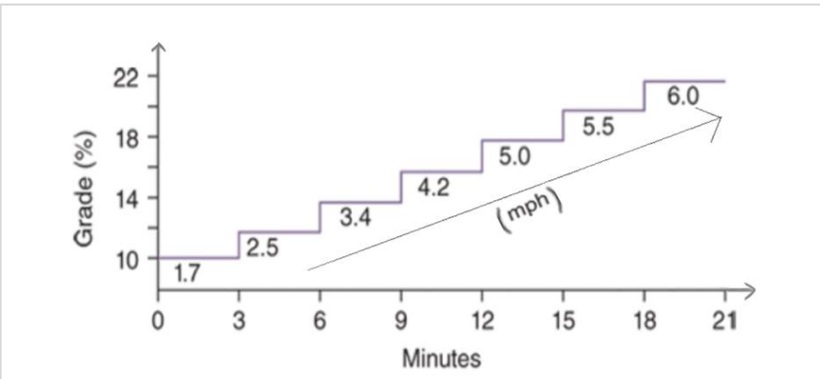


Figure 3.2. Bruce Test Protocol (modified from reference number 75)

During the test (Bruce protocol) if any adverse health conditions were encountered (e.g. disability status or abnormal change in blood pressure) the test would be terminated.

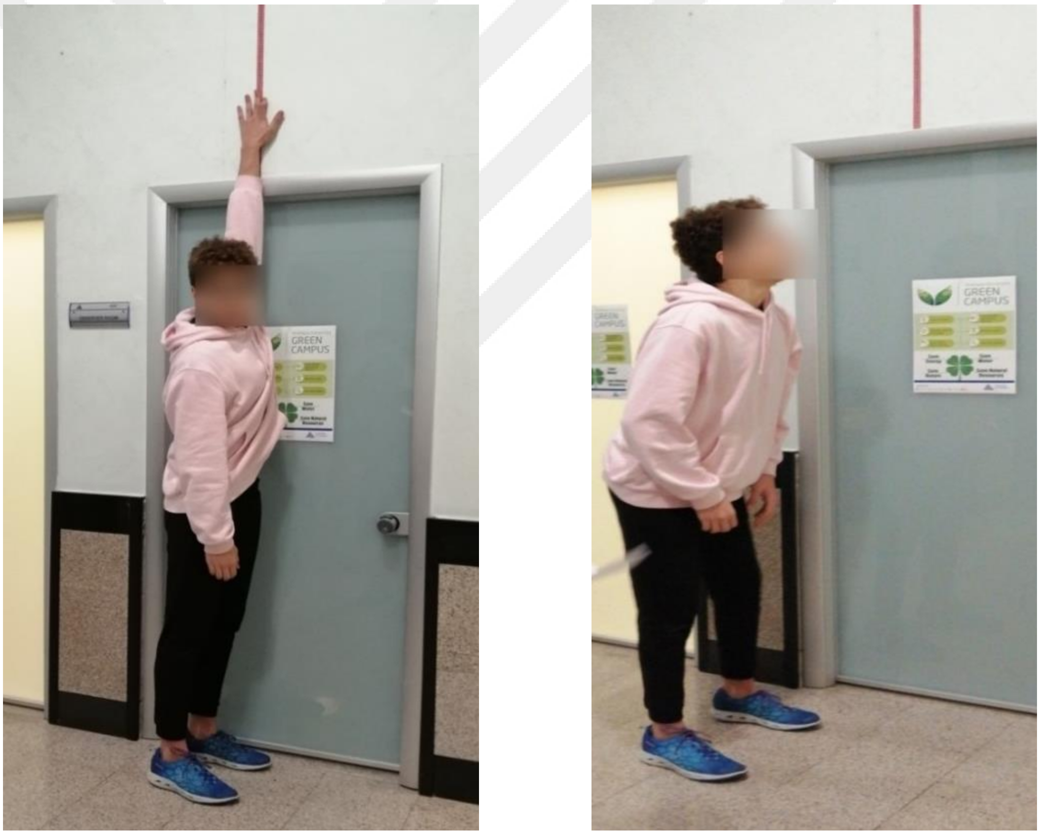
Figure 3.3. Treadmill Machine Bruce Protocol

3.1.2. Jumping test

The jump test is a method to measure anaerobic capacity. “Countermovement Jump” technique is preferred for athletes. In this study, the distance between the point where the athletes can reach the standing heels while touching the ground and the point where they can jump and touch is measured in centimetres (76-80). The jump of athletes is the jump to the highest point (Vertical jumping, stretching) after the posture (76-80). The anaerobic power is calculated by the “Lewis Formula”. For gaining good results, “jumping off the highest point is repeated three times and “the best value” is taken by formulation (76-80).

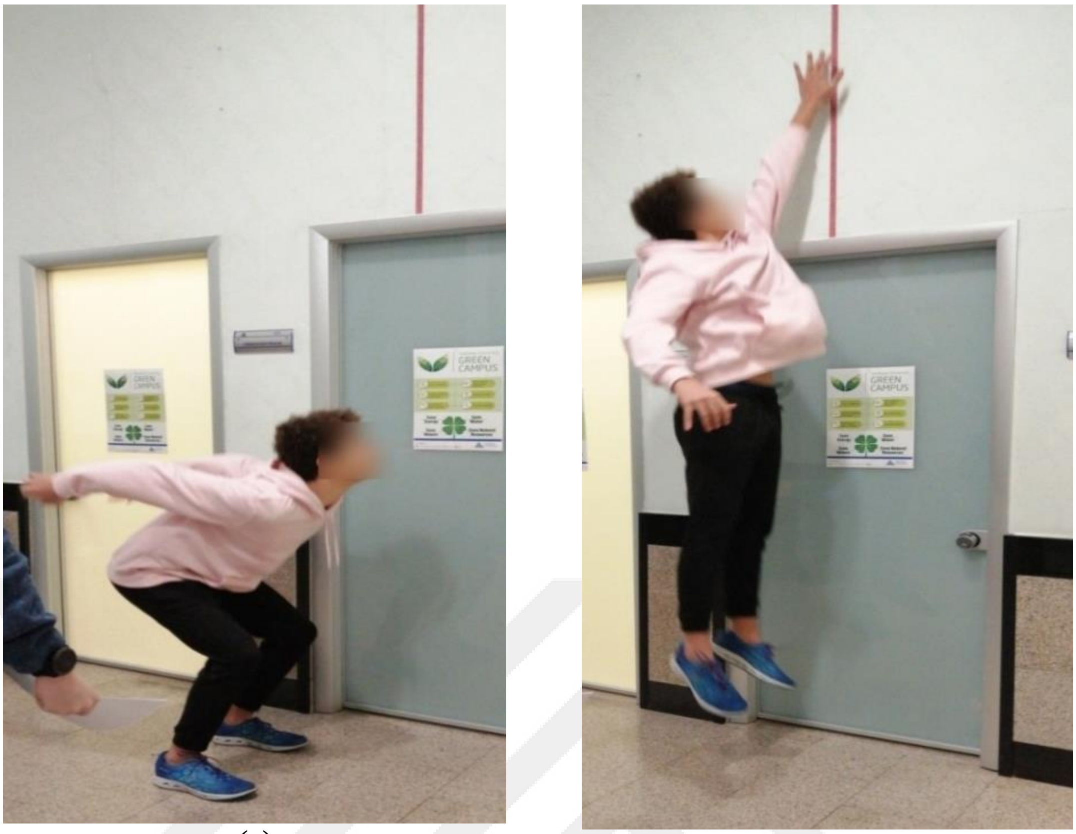
Lewis Formula (76):

Anaerobic Power (Watts) = √ 4.9 x Body Weight (kg) x √Vertical Jump Score (m) x 9.81 (7)



(a) (b)

Figure 3.4. Vertical Jump (a) Test 1, (b) Test 2



(c) (d)

Figure 3.4. Vertical Jump (c) Test 3, (d) Test 4

3.1.3. Classification of VO_{2peak} and anaerobic power

3.1.3.1. Classification of VO_{2peak}

Athletes VO_{2peak} degrees were taken from endurance tests at the treadmill. Then athletes VO_{2peak} degrees were classified into six categories according to their age and performance.

Table 3.1. 13-19 Age VO_{2peak} Classification (modified from reference numbers 81,82)

Gender	Very Poor	Poor	Fair	Good	Excellent	Superior
Female	< 25.0	25.0 -30.9	31,0 – 34.9	35.0 – 38.9	39.0 – 41.9	> 41.9
Male	< 35.0	35.0 - 38.3	38.4 – 45.1	45.2 – 50.9	55.1 – 55.9	> 55.9

3.1.3.2. Classification of anaerobic power

Athletes' anaerobic power degrees were taken from vertical jump test results. Then athletes jumping distances (cm) were classified into five categories according to their age and performance.

Table 3.2. Classification of Anaerobic Power (modified from reference number 83, 84)

Gender	Very Poor	Below Average	Average	Above Average	Excellent
16-19 Age (83)					
Female (cm)	< 26	26 - 35	36 - 46	47 - 58	> 58
Male (cm)	< 30	30 - 39	40 - 49	50 - 65	> 65
15-16 Age (84)					
Female (cm)	< 35	35 – 40	41 - 50	51 - 60	> 60
Male (cm)	< 40	40 - 49	50 - 55	56 – 65	> 65

3.1.4. T-2000 test

The test contains the protocol that leads to the determination of the maximum oxygen capacity (VO_{2max}) in athletes. Additionally, the T-2000 test can be used for the determination of specialization and characterization of muscle types. On the other hand, this test can be used for both long-distance and short-distance swimmers (85).

T-2000 test records for swimmer 2000 meter swimming time. Then, the average 100-meter value is recorded. After that, some formulation is applied (86-88).

For 100 meter:

T2000 [21]= 2000 meter (time)/ 20 (10,1)

= 100 meter (max value) +2 (10, 2)

= 100 meter low value (10, 3)

The values represented the 100 meters swimming performance and the value represented 75% of VO_{2max} (86-88).

3.1.5. Maximum heart rate test

Table 3.3. Heart Rate Test Protocol

Beginning (Reference)

Starting Heart Rate:
Warm Up (X meters)

Test
Heart Rate:

<u>Test 1: Maximum 100 Meter</u>

Part 1: Freestyle	1.50 m (sec)	Pace (min)	2.50 m (sec)	Pace (min)	Total (min)	HR (10 sec)	HR (min)
100 m Maximum							
400 m easy	**X**	**X**	**X**	**X**	10	**X**	**X**

10 minute break (when HR came under 27, second part starts)

<u>Part 2: Maximum Heart Rate Test</u>

Heart Rate:

	1.50 m (sec)	**2. 50 m (sec)**	**100 m**	**HR (10 sn)**	**Rest (sec)**
50 m ascend		**X**	**X**		5
50 m ascend		**X**	**X**		5
100 m (best +6)					10
100 m (best +4)					10
50 m maximum		**X**	**X**		5
50 m maximum		**X**	**X**		5
50 m maximum		**X**	**X**		5
50 m maximum		**X**	**X**		5

End
100 meter easy
Heart Rate:

The maximum heart rate test allows to learn the athlete heart rate at maximum performance and to better review their body development. The maximum heart rate test protocol has been clearly arranged to determine the 100-meter swimming performance changing. Also, the test has been used in training before this study has started. Wingate test types of protocols were not chosen because it was requested to see the second 50-meter performance in one hundred meters swimming (89). The test did not require measurements of lactate like the other types of tests (90, 91).

Maximum heart rate test preparing for Stage 2 Turkey Swimming Federation Swimming Coaches Prep Course "Special Training Theory" has benefited from the lecture notes (88).

The main aim was to determine the heart rate on the carotid artery for ten seconds after swimming (88). This test was designed to support the ergometer CPET-Bruce Test and to observe the cardiopulmonary system's alteration from the revision of the other water tests. In addition, when the maximum heart rate test was designed, 50m step test was regulated for athletes (92). The first two 50 meters and two 100 meters swimming distances in the second part of the test are similar to the 50 meter step test (92). However, it tests the "Bruce protocol" in water with test distances and workload (73,88).Turkish Swimming Federation and maximum heart rate information in the tests which were arranged later according to the literature can be seen in four 50-meter maximum performance. (88)

3.2. Nutrition Regulation

Athletes body composition was determined by bioelectrical impedance analysis technique (GAIA 359 PLUS) (93, 94). In addition, athletes height was measured by stadiometer (93,94).

In order to determine the nutritional status, a 24-hour food consumption form was filled out including one double training day, one single training day and one non-training day.

Figure 3.5. Body Composition Analyzer (modified from reference number 94)

3.2.1. The Calculation of Athletes Daily Nutrition Requirements

Athletes’ energy requirements can be calculated by the sum of their basal-metabolism rate, physical activity value and food thermodynamic energy. For the growth and development, tissues need two kcal per day in an adolescent's body, which is found by multiplying basal metabolism and physical activity constant. (42, 95)

Basal metabolism rate can be calculated with the Schofield equation (Table 3.4.) (42, 96, 97).

Physical activity level (PAL) can be calculated by daily physical activity differences. The measurement of PAL was based on sum of activity stages, which was calculated by the activity constant multiplied by activity stage (1.0 x resting,1.5 x very slightly active, 2.5 x slightly active, 5.0 x middle active , 7.0 x hard activity) being divided 24 hours (98,99) (Table 3.5.).

Table 3.4. Schofield Equation Between 10-17 Age (modified from reference numbers 96, 97)

Age Group	Men	Women
10-18 ages	17,7*weight+659 (kcal)	13,3- 4*weight+693(kcal)

Table 3.5. 24 Hours -Physical Activity Level (PAL) Determination Form (Activity Constant*Hour)(modified from reference number 98,99)

TYPE OF ACTIVITY	Activity Constant	HOUR	MINUTES
Resting	**1.0**		
Very Slightly Active (at school, playing sth. watching tv ,etc)	**1,5**		
Slightly Active (walking slowly, cleaning home, room etc)	**2,5**		
Middle Activity (walking fast, cycling etc)	**5,0**		
Hard Activity (Trainings)	**7**		
TOTAL		**24 HOUR**	**1440 MINUTE**

Table 3.6. 24 Hours -Physical Activity Level (PAL) Determination Form Scale (REE*Hour) (modified from reference number 99)

Activity Level	Very Active	Active	Middle Active	Slightly Active	Bedridden
Range	2 ≥	1.8 -1 .9	1.6 – 1.7	1.4 - 1.5	1.2 – 1.3

PAL value was multiplied by basal metabolism rate, and then nutrition thermodynamic energy was added to determine the total daily energy requirement.

Nutrition thermodynamic energy was the energy for the digestion of food, and it takes ten percent of the basal metabolism rate (42, 96).

3.2.2. Reference Values

Food consumption and energy consumption values of adolescent athletes should be categorized according to their anthropometric and physiological futures. Therefore, daily carbohydrate consumption, daily protein consumption, daily fat consumption, and daily energy consumption were categorized according to the age. Table 3.7., Table 3.8., Table 3.9., and Table 3.10. show the basic nutritional reference values of athletes born in 2003 or 2004 (42).

Table 3.7. Daily Carbohydrate Consumption Ranges for Adolescents (modified from reference number 42)

		2004 - Female	2004 - Male	2003 - Female	2003 - Male
Daily Carbohydrate Consumption Reference Ranges	**Insufficient**	44% of daily energy and below			
	Ideal	45-65% of daily energy			
	Excess	66% of daily energy and above			

Table 3.8. Daily Protein Consumption Ranges for Adolescents (modified from reference number 42)

		2004 - Female	2004 - Male	2003 - Female	2003 - Male
Daily Protein Consumption Reference Ranges	**Insufficient**	9% of daily energy and below			
	Ideal	10-30% of daily energy			
	Excess	31% of daily energy and above			

Table 3.9. Daily Fat Consumption Ranges for Adolescents (modified from reference number 42)

		2004 - Female	2004 - Male	2003 -Female	2003 – Male
Daily Fat Consumption Reference Ranges	**Insufficient**	24% of daily energy and below			
	Ideal	25-35% of daily energy			
	Excess	36% of daily energy and above			

Table 3.10. Daily Energy Consumption Ranges for Adolescents (modified from reference number 99)

		2004 -Female	2004 - Male	2003 -Female	2003 – Male
Daily Energy Consumption Reference Ranges	**Insufficient**	2770 kcal and below	3438 kcal and below	2792 kcal and below	3559 kcal and below
	Ideal	2771-3089 kcal	3439-3994 kcal	2793-3120 kcal	3560-4135 kcal
	Excess	3090 kcal and above	3995 kcal and above	3121 kcal and above	4136 kcal and above

3.2.3. Data Collection Forms

- Data Forms 24 Hours Food Consumption Record: In order to determine amount of food consumed by athletes, 24-hour food consumption records were taken on three different days. Table 2.7., Table 2.8., Table 3.7., Table 3.8., Table 3.9., Table 3.10 and Table 3.5. were used in determining and classifying the nutritional consumption of athletes.
- Data Gathering form: The status of the athletes was evaluated with this form.
- Physical Activity Level Detection Form for 24 Hours: With this form, it was planned to evaluate the daily physical activities of the athletes and to calculate their daily energy needed through the ’Schofield Equation” using the information in this activity form.
- Anthropometric measurements of female and male athletes were calculated with World Health Organization reference parameters (96). Body mass index reference values were categorized with the "TUBER scale" (99,100) by comparing them with “Türk çocuklarında vücut ağırlığı, boy uzunluğu, baş çevresi ".

Table 3.11. Percentile Values of Body Mass Index Values (kg/m^2) (modified from reference number 100)

Percentile Values	16 Age Female	16 Age Male	17 Age Female	17 Age Male
5	18.1	18.0	18.5	18.7
15	19.1	19.3	19.5	19.9
25	19.8	20.1	20.1	20.7
50	21.1	21.9	21.5	22.5
75	23.0	24.1	23.1	24.7
85	24.0	25.4	24.2	26.1
95	26.1	28.2	26.2	28.8

Table 3.12. Categorization of Percentile Values of Body Mass Index Values (modified from reference number 99)

Classification	16 Age Female	16 Age Male	17 Age Female	17 Age Male
Underweight	<16.4	<16.7	<16.6	<17.1
Risk of Underweight	16.4-18.0	16.7-18.1	16.6-18.2	17.1-18.6
Normal	18.1-24.1	18.2-23.6	18.5-24.8	18.7-24.3

3.2.4. Measurements & Tests

At the beginning of the study, a three-day food consumption record was used to determine the nutritional habits of the athletes, and data collection forms were taken to find out the general condition of the athletes (42, 94-99). At the same time, T2000 and maximum heart rate tests were performed in Fenerbahçe Sports Club Swimming Branch. (The two water test times were between 72 hours minimum).

3.3. Swimming Progression Details

The "Swim Progress Details" shows the changing swimmer performance in races. For example, the swimmer can freely swim 100 meters in 59 seconds. 59 seconds was considered 100% of the performance. If the swimmer could swim faster than the swimming degree, such as 58.75 seconds, the progress shows more than 100%. This study takes the average of three best performances of the last three races (between

December 2019 and February 2020) performed at the Turkish Swimming Federation, in which best degrees were taken in different races (101). Also, these races were chosen mainly 100-meter races (butterfly, backstroke, breaststroke, freestyle and individual medley), but if the athlete swam 200-meter or 400-meter distances, the best 100 meter swimming time and race progression were taken for study from the Turkish Swimming Federation Progression Details Reports at Races (101). However, if the athletes did not have any 100-meter swimming degrees, they swam 100-meter freestyle at race tempos for the study at the same racing competition times.

4. RESULTS

4.1. Statistical Results

This study was a descriptive study and was carried out with seven (36.8%) female athletes and 12 (63.2%) male athletes. The mean age was 16.63 ± 0.49 years, and there were no differences between the groups.

Table 4.1. The Mean Values of Anthropometric Descriptions

	Total (n=19) Mean ±SD	Female (n=7) Mean ±SD	Male (n=12) Mean ±SD	*p
Gender (%)	100	36.84	63.16	.52
Age (year)	16.68 ± 0.48	16.57 ± 0.53	16.67 ± 0.49	-
Weight (kg)	67.82 ± 10.73	57.79 ± 6.73	73.67 ± 7.89	.00
Height (cm)	176.16 ± 9.02	166,79 ± 6.04	181.25 ± 4.98	.00
Hips (cm)	93.70 ± 3.88	91.74 ± 3.11	94.86 ± 3.92	.09
Body Mass Index	21.73 ± 2.06	20.71 ± 2.16	22.32 ± 1.83	.10
Percent Body Fat (%)	16.59 ± 4.40	20.01 ± 3.69	14.59 ± 3.52	.01
Soft Lean Mass (kg)	52.78 ± 8.80	43.143 ± 4.62	58.41 ± 4.62	.00
Basal Metabolic Rate (cal)	1605.84 ± 204.60	1374.43 ± 107.47	1740.83 ± 9 0.78	.00
Total Energy Expenditure (cal)	3001.63 ± 790.06	2370.00 ± 446.73	3370.08 ± 714.55	.00
*Female and Male groups were compared with Student t-test and Chi-square Test				

The measurements of anthropometric specialities and body composition analysis (weight (kg), height (cm), hips (cm), BMI (%), basal metabolic rate (cal) and total energy expenditure (cal)) are shown in Table 4.1.. The mean weight was 73.67 ± 7.89 kg, the height mean was 176.16 ± 9.02 cm, and the hip circumference mean was 93.70 ± 3.88 cm.

The mean values of athletes' anthropometric specialities were in the normal range. A statistically significant difference was found between female and male groups. The females had lower mean anthropometric specialities than male athletes ($p< 0.05$). Male athletes were 15. 88 ± 1.16 kg heavier than female athletes (Females = 57.8 ± 6.73 and Males = 73.7 ± 7.89 kg, $p<0.05$). Similar to the weight, male athletes were 14.46 ± 1.06 cm taller than female athletes (Females= 166.79 ± 6.04 cm and Males = 181.63 ±

4.98, p<0.05). Besides, mean hip circumference of males were larger than female hips (3.12 ± 0. 81 cm; p>0.05).

The mean value of athletes' body mass index (BMI) was 21.73 ± 2.06%. The BMI of male athletes were 1.61 ± 0.33% more than The BMI of female athletes (The BMI of Females: 57.8 ± 20.71 ± 2.16% and The BMI of Males : 22.32 ± 1.83%, p<0.05).

The average value of body fat percentage (PBF) of athletes was 16.59 ± 4.40%. Females had higher percent body fat than males (Females = 20.01 ± 3.69 and Males = 14.59 ± 3.52, p<0.05).

The mean of soft lean mass (SLM) was 52.78 ± 8.80 kg (min 35.8-max 65.0 of SLM), and the mean of basal metabolic rate (BMR) was 1605.84 ± 204.60 cal (min= 1241.00 cal and max=1873.00 cal of BMR). Males had significantly higher SLM and BMR than Females (p<0.05). The average value of females' SLM was 43.14 ± 4. 62 kg and the average value of males' SLM was 58.41 ± 4.62 kg. In addition, the average value of athletes Basal Metabolic Rate (BMR) was 1605.84 ± 204.60 cal (Females = 1374.43 ± 107.47 cal and males = 1740.83 ± 90.78 cal, p<0.05)

Total energy expenditure (TEE) minimum and maximum mean was 3001.63 ± 790.06 cal. There was significant differences between TEE values of female and male groups. TEE values were lower in females than in males athletes (p<0.05).

Five male athletes were taller than other male athletes. Five female and six male athletes had normal height. Two athlete were very tall in both genders (Table 4.2.).

Seventeen athletes had normal body weight values. Besides, one athlete was overweight in males and one athlete was thin at male group, too. In addition, all females had normal values according to their ages (Table 4.2.).

Table 4.2. Percentile Classification of Athletes Physical Parameters

Physical Parameters	Classification	Female	Male	Total
Height	Normal	5	6	11
	Tall	1	5	6
	Very Tall	1	1	2
Weight	Thin	0	1	1
	Normal	7	10	17
	Overweight	0	1	1
BMI	Underweight	1	0	1
	Risk of Underweight	1	0	1
	Normal	5	12	17

Table 4.3. The Classification Results of Body Fat Percentage

	Female	Male	Total
Ideal	7	2	9
Over	0	10	10

Table 4.4. Daily Nutrient Consumption and Recommended Daily Allowances (RDA)

	RDA Range	Athletes Daily Nutrient Consumption Mean ±SD		*Classification of Female Daily Nutrient Consumption (n=7)		Classification of Male Daily Nutrient Consumption (n=12)	
		F	M	Class	The Percentile of Class (%)	Class	The Percentile of Class (%)
Energy (kcal)	2950-4929	1994.71 ± 572.30	3027.33 ± 789.68	Insufficient	85.71	Insufficient	83.33
***Carb (%)**	45-65	31.43 ± 11.70	41.50 ± 6.07	Insufficient	85.71	Insufficient	58.33
Protein (%)	10-30	20.43 ± 4.58	17.38 ± 2.75	Ideal	100.00	Ideal	100.00
Fat (%)	25-35	47.43 ± 7.07	41.08 ± 5.45	Excess	100.00	Excess	83.33
Liquid (L)	1.6-3	1.69 ± 0.90	2.03 ± 0.82	Insufficient	71.43	Insufficient	58.33

*Carb=Carbohydrate

All female athletes' BFP values were ideal. However, only two male athletes had ideal BFP, but the other male athletes had excess fat percentage (Table 4.3.).

When looking at the Table 4.4., energy consumption was mainly categorized as insufficient (78.95%, n=15). On the other hand, 85.71% of females had inadequate carbohydrate consumption and of energy in their daily diets. Like female athletes, male athletes had inadequate carbohydrate consumption and of energy intake (Energy= 83.33% and, Carbohydrate= 58.33%).

Athletes daily protein consumption was shown in Table 4.4.. All athletes had ideal amount of protein consumption in their daily diets.

The mean daily fat consumption was shown in Table 4.4., and the mean fat consumption all athletes was excess in their daily diets (n=17 (89.47%)), and female athletes tended to consume more fat than males in their daily diets. All female athletes consumed daily fat at excess amount, but male athletes consumed daily fat at 83.33% of excess ratio.

The daily liquid consumption of athletes was insufficient (Female =71.43% and Male = 58.33%)

Table 4.5. Physical Activity Coefficient

	Female (n=7) Mean ±SD	**Male (n=12) Mean ±SD**	**Total (n=19) Mean ± SD**
Energy Consumption (kcal)	1994.71 ± 572.30	3027.33 ± 789.68	2646.90 ± 867.27
Physical Activity Coefficient	2.29 ± 0.12	2.19 ± 0.30	2.23 ± 0.25
Physical Activity Degree			
Very Active	7 (100.00%)	9 (75.00%)	16 (84.21%)
Active	0	2 (16.67%)	2 (10.53%)
Less Active	0	1(8.33%)	1 (5.26%)

Physical Activity Coefficient was shown in Table 4.5. and the mean physical activity coefficient was 2.23 ± 0.25. Also, all female athletes were very active, but nine male athletes were very active, two male athletes were active and one athlete was less active. Totally sixteen athletes were very active, two athletes were active and one athlete was less active as shown in Table 4.5..

Table 4.6. Swimming Performance Tests

	Female (n=7) Mean ±SD	**Male (n=12) Mean ±SD**	**Total Mean ±SD**
Swimming Tests			
T2000 max 100 meter(sec)	80.86 ± 3.67	73.84 ± 1.98	76.42 ± 4.36
MaxHR Test 100 meter (sec)	64.75 ± 2.36	58.66 ± 2.69	60.90 ± 3.92
Max100 meter test HR (bpm)	189.43 ± 4.72	191.00 ± 6.18	190.42 ± 5.60
***Race max 100 meter (sec)**	62.90 ± 2.90	54.76 ± 2.63	57.76 ± 4.83
HR=Heart Rate , MaxHR= Maximum Heart Rate,			

T2000 swimming test represented the 100-meter swimming training performance. When looking at the mean training performance parameters 100-meter swimming was 76.4 ± 4.36 sec and according to the table male athletes swam 7.02 ± 1.69 sec faster than females at T-2000 test in which females swam in 80.86 ± 3.67 sec and males swam in 73.84 ± 1.98 sec.

The comparison of The Maximum Heart Rate Test Maximum 100 meter and The Race Maximum 100 meter were displayed at Table 4.6. . According to the results, mean swimming times had 3 seconds of differences, which the Max HR test swimming time was 57.76 ± 4.83 sec and the test time was 60.90 ± 3.92 sec. During the swimming test and race Heart Rate mean was 190.42 ± 5.60bpm.

Males swam 6.09 ± 0.33 sec faster than females according to mean swimming time. (64.75 ± 2.36 sec in females and 58.66 ± 2.69 sec in males). During performance, mean maximum heart rate of males were 1.57 ± 1.46 bpm higher than females (mean HR for females = 189.43 ± 4.72 bpm and for males = 191.00 ± 6.18 bpm). (Table 4.6.)

The incremental system anaerobic threshold was observed at 17.21 ± 3.14 min of test. Male athletes had more test duration than female athletes (15.86 ± 1.77 min in females and 18.20 ± 3.85 min in males). Similar to test duration, mean load maximum (W) values were higher in male compared to females (females = 268.86 ± 43.00 W and males = 384.33 ± 79.02 W). Also, there was a significant difference between female and male athletes ($p<0.05$). (Table 4.7.)

Table 4.7. The Results of Cardiopulmonary Endurance Test (CPET)

Parameters CPET	Female (n=7) Mean ± SD	Male (n=12) Mean ±SD	Total Mean ±SD. Deviation	*p
Test Duration (min)	15.86 ± 1.77	18.20 ± 3.85	17.21 ± 3.14	.16
Load max (W)	268.86 ± 43.00	384.33 ± 79.02	341.79 ± 87.79	.00
Maximum Heart Rate (bpm)	160.29 ± 19.78	160.58 ± 8.24	166.16 ± 13.90	.16
VE (L/min)	106 ± 14.17	158.67 ± 26.66	139.26 ± 34.39	.00
BF (1/min)	50.57 ± 5.16	48.67 ± 6.39	49.37 ± 5.89	.51
VO_2 (mL/min)	2922.29 ± 393.56	4578.67 ± 638.78	3968.21 ± 987.35	.00
VCO_2 (mL/min)	3107.71 ± 279.56	4665.08 ± 655.95	4091.32 ± 940.59	.00
RER	1.31 ± 0.04	1.24 ± 0.08	1.27 ± 0.07	.68
VO_{2peak} (mL/min/kg)	51.99 ± 6.37	62.21 ± 6.72	58.44 ± 8.17	.01
*Female and Male groups were compared with Student t-test				
BF= Breath Frequency, HR=Heart Rate, RER= Oxygen Carbon dioxide Consumption Ratio, VCO_2= Volume of Exhaled Carbon Dioxide , VE= Ventilation per minute, VO_2= Volume of Oxygen Consumption, VO_{2peak}=Maximum Oxygen Uptake				

Mean maximum heart rate values were similar in both female and male athletes (female =160.29 ± 19.78 bpm and male = 160.58 ± 8.24 bpm). In addition, mean ventilation per minute values were higher in males than in females (female vs. male = 106.00 ± 14.17 L/min vs. 158.67 ± 26.67 L/min; whole population = 139.26 ± 34.39 L/min).

As shown in Table 4.7. there was a significant statistical differences between oxygen consumption of female and male athletes, and the mean volume of exhaled carbon dioxide results and ventilation per minute (VE(L/min)).

The volume of oxygen consumption and the mean volume of exhaled carbon dioxide results were demonstrated in Table 4.7.. According to results, male athletes consumed and consumed more oxygen than females, (females vs. males = 2922.29 ± 393.56 mL/min vs. 4578.67 ± 638.78 mL/min; whole population = 3968.21 ± 987.35 mL/min), and exhaled more carbon dioxide than females (females vs. males = 3107.71 ± 279.56 mL/min vs. 4665.08 ± 655.95 mL/min; whole population = 4091.32 ± 940.59 mL/min).

Mean respiratory exchange ratio (RER) was 1.27 ± 0.07 (females =1.31 ± 0.04 and males = 1.24 ± 0.08). At the same time, mean peak oxygen intake was seen 58.44 ± 8.17 mL/(kg. min), while it was 51.99 ± 6.37 mL/(kg. min) for females and was 62.21 ± 6.72 mL/(kg. min) for males ($p<0.05$).

Table 4.8. Classification of VO_{2peak}

VO_{2peak} Class	Female	Male	Total
Superior	7 (100.00%)	10 (83.33%)	17 (89.47%)
Good	0	1(8.33%)	1(5.26%)
Excellent	0	1(8.33%)	1 (5.26%)

Seventeen athletes had superior VO_{2peak}. Besides, ten male athletes had superior VO_{2peak}, one male swimmer had good VO_{2peak} and one male athletes had excellent VO_{2peak}. (Table 4.8.)

Table 4.9. Pre-exercise Heart Rate (Pre-ex HR) and Post Exercise Heart Rate (Post-ex HR) & Blood Pressure (n=19)

	Pre Exercise			Post Exercise			*p
	Female	**Male**	**Total**	**Female**	**Male**	**Total**	
Heart Rate (bpm)	69.86 ± 11.09	63.83 ± 11.65	66.05 ± 11.52	114.86 ± 6.04	108.92 ± 14.82	111.11 ± 12.45	.000
Systolic Blood Pressure (mmHg)	121.00 ± 11.83	133.33 ± 10.86	128.79 ± 12.49	131 ± 9.95	141.50 ± 11.31	137.63 ± 11.65	.001
Diastolic Blood Pressure (mmHg)	75.43 ± 8.04	85.50 ± 10.02	81.79 ± 10.38	76.14 ± 12.88	81.25 ± 10.11	79.37 ± 11.14	.404
*Values were analysed with Paired Sample Test							

Heart rate and blood pressure results were shown that in Table 4.9.. Mean heart rate mean was 68.22%, and pre-exercise HR values were lower than post-exercise HR. Like HR, mean pre-exercise systolic blood pressure was lower compared to mean post-exercise systolic blood pressure. Unlike systolic blood pressure, mean diastolic blood pressure decreased after exercise.

There was a significant statistical differences between pre-exercise and post exercise results of heart rate and blood pressure values. Mean pre-exercise heart rate values were 69.86 ± 11.09 bpm in females and 63.83 ± 11.65 bpm in males, while post-exercise heart rate values were 114.86 ± 6.04 bpm in females and 108.92 ± 14.82 bpm in males ($p<0.05$). Mean pre-exercise systolic blood pressure values were 121.00 ± 11.83 mmHg in females and 133.33 ± 10.86 mmHg in males ($p<0.05$) while post-exercise systolic blood pressure (mmHg) values were 131 ± 9.95 mmHg in females and 141.50 ± 11.31mmHg in males ($p<0.05$). In addition, pre-exercise diastolic blood pressure values were 75.43 ± 8.04 mmHg in females and 85.50 ± 10.02 mmHg in males while post-exercise diastolic blood pressure values were 76.14 ± 12.88 mmHg in females and 81.25 ± 10.11 mmHg in males.

Table 4.10. Vertical Jump Test

Anaerobic Power Test	Female (n=7) Mean ±SD	Male (n=12) Mean ±SD	Total Mean ±SD
Jump (cm)	43.50 ± 16.88	46.36 ± 5.85	45.31 ± 10.86
Lewis Formula (W)	526.94 ± 267.94	709.91 ± 149.27	642.50 ± 213.94

The average results of jump were between 43.50 ± 16.88 cm and maximum 46.36 ± 5.85 cm. In addition, the average results of power (Lewis Formula) were 642.50 ± 213.94 W (according to gender; females = 526.94 ± 267.94 W and males =709.91 ± 149.27 W).

Table 4.11. Classification of The Jump Assessment

Class	**Female (n=7) Mean ±SD**	**Male (n=12) Mean ±SD**	**Total Mean ±SD**
Average	5 (71.43%)	7 (58.34 %)	12 (63.16%)
Below Average/ Poor	1 (8.33%)	1 (8.33%)	2 (10.53%)
Above Average/Excellent	1 (8.33%)	4 (33.33%)	5 (26.32%)
Jump Assessments were compared with Student t-test $p<0.05$ Jump assessment and VO_{2peak} were compared with Chi-square test $p<0.05$			

The Jump Assessment (Table 4.11.) results mainly were categorized as "Average" at 63.16% (n=12). Also two (10.53%) athletes were categorized as below average and five (26.32%) athletes were categorized above average. In addition, four (33.33%) athletes performed above average in jump assessment in male group, however only one (8.33%) athlete demonstrated excellent performance in jump assessment at female group.

Table 4.12. The Average Results of Progressions of The Swimmers Three Short-Distance Races (All Branches Best 100 Meters)

Gender	**Average Progression Min (%)**	**Average Progression Max (%)**	**% Total Average Progression ±SD**
Female	95.00± 3.00	103.33±0.00	100.86 ± 5.15
Male	101.00 ±4.36	109.67± 0.58	104.08 ± 2.43
Total	**95.00±3.00**	**109.67±0.58**	**102.89 ± 3.87**

The average results of progression demonstrated was minimum 95.00 ± 3.00 % and maximum 109.67 ± 0.58%. In addition, male athletes demonstrated more progression with minimum 101.00 ± 4.36%, maximum 109.67 ± 0.58%, and 104.08 ± 2.43% of average values.

4.2. Results of Data Collection Forms

4.2.1. General Information Forms

Table 4.13. General Questions Part of Questionnaire Form

General	Answers ± SD	
Sports starting age (years old)	6.47 ± 1.65	
Have been doing sport (year)	9.47 ± 1.78	
Hours of sleeping (hour)	7.50 ± 0.96	
Staying at school? (hours)	7.82 ± 0.61	
Utilization of phone, computer, TV etc. (hours a day)	2.49 ± 1.10	
Social activities (days/ hours)	1.66 ± 0.82	
	YES (n)	**NO (n)**
General		
Taken a break to do sport	3	16
Feeling tired when get up	15	4

As shown in the Table 4.13., the age of start doing sports was 6.47 ± 1.65 years and athletes had been doing sports for 9.47 years ± 1.78. Three (15.79%) athletes took a break to sport.

Mean duration of sleep of the athletes was 7.50 ± 0.96 hours in a day. They also spent 7.82 ± 0.61 hours at school a day. Besides, athletes were using phone, computer, TV, etc. for 2.49 ± 1.10 hours / day. In addition, they had social activity 1.66 ± 0.82 days a week.

4.2.2. General Health Injuries

Four (21.05%) of athletes had illnesses, four (21.05%) athletes had surgery and two (10.53 %) of athletes used medical drugs that cannot affect to do sport (Table 4.14).

Table 4.14. General Health/Injuries Part of Questionnaire Form

	YES (n)	NO (n)
General Health/ Injuries		
Having illnesses	4	15
Having surgery	4	15
Medical drugs usage	2	17
Having injuries	10	9
To get injured in last three months	3	16
To get injured last month	2	17

Ten (52.63%) athletes had a history of injuries and three (15.79 %) athletes got injured in last three months, and two (10.53%) athletes had injuries but that had not a problem for doing training.

4.2.3. Sports Health/Injuries

Four (21.05%) athletes had injuries that were shoulder injuries (n=2), feet injuries (n=1) and scoliosis (n=1). Generally, pain occurred after trainings which were after moderate-hard trainings (n=6, (31.58%)), hard trainings (n=17, (89.47 %)), and dry-land trainings (n=13, (68.42%). To prevent the injuries, 12 (63.16%) athletes used preventions (like relaxant gel, ice compression (RICE technique (Rest, Ice, Compression, and Elevation)) after training.

Table 4.15. Sports Health/Injuries Part of Questionnaire Form

	YES (n)	NO (n)
Sports Health/ Injuries		
Having injuries or any medical situations	4	13
Having problems to do your training healthy	-	19
Having pain after middle-hard training	6	13
Having pain after hard training	17	2
Having pain after dry- land training	13	6
Utilization of prevention (like “voltaren” gel, ice compression) after training at home	12	7

4.2.4. Athletes Diets

4.2.4.1. Athletes General Diets

Table 4.16. Athletes Diets Part of Questionnaire Form

	YES (n)	NO (n)
About diets		
Having allergy	4	15
Having nutrient allergy	1	18
Having food intolerance	-	19
Having food limitation in daily diet	2	17
Having nutrient model in the diet (ketogenic-alkali etc)	-	19
Utilization of supplements	-	19
The food that it can be never eaten	9	10

According to the results, there was no obstacle for athletes' daily diets not to be considered unhealthy.

Two (10.53%) athletes had food limitation, four (21.05%) athletes had food allergy, one (5.26%) had nutrient allergy and there was not any food intolerance was seen. Nine (47.37%) athletes preferred some food to never eat.

4.2.4.2. The Diets before Competitions

Table 4.17. Athletes Diets At Race Period Part of Questionnaire Form

	YES (n)	NO (n)
Before races		
The utilization of some special nutrients before race	16	3
The special food which if preferred to eat among races	19	-
Changing diet in three days before competitions	13	6

Sixteen (84.21%) of athletes consumed special nutrients before races which were generally carbohydrate type of foods and all athletes preferred to eat special foods. Thirteen (68.42%) athletes changed their diets in three days before competitions.

5. DISCUSSION AND CONCLUSION

In this thesis, analysis of anthropometric characteristics, nutritional habits, physical activity levels, performance parameters of young competitive swimmers from both genders were examined.

In this study, BMI, nutritional consumption and performance parameters of the athletes were compared. Research has also shown that BMI affects performance and that the daily food consumption parameters are other factors that directly affect the performance (40). Females' BMI was 20.71 ± 2.16, and males' BMI was 22.32 ± 1.83. According to The World Health Organization, in this age group, female BMI value should be in range of 18.1-24.6 and male BMI value should be in the range of 18.2-24.3 (41-42). In this study, the BMI's of the athletes were placed in healthy value ranges. However, when the BMI value of the population in this study was compared with other studies, female BMI was lower than that of other female swimmers and male-BMI value was higher than that of other male swimmers (102. The mean BMI value of the whole study population was similar in this age group, but lower or higher than the BMI results of the other studies (103).

The athletes' anthropometric characteristics showed that weight, height, BMI and soft lean mass values were higher in male swimmers compared to female swimmers (Table 4.1) in agreement with literature (43, 103, 104). As expected, female swimmers had higher body fat percentage (BFP) than male swimmers. However, while female swimmers BFP values were found ideal, the majority of male swimmers (83.33%) showed excess BFP values (Table 4.3). This finding is important since it's known that the higher than normal BFP could affect the swimming performance inversely (42,103,104). Based on this, when the nutritional status of swimmers was examined, it was found that both female and male swimmers' daily fat consumption was higher than the recommended range. In addition, they were not consuming enough carbohydrates daily. The energy consumption values of 15 (78.95%) athletes were insufficient, three (15.79%) athletes were ideal, and one (5.26%) athlete was excess (Table 4.4). Females' energy consumption were 2370.00 ± 446.73 cal, and males' were 3370.00 ± 714.55 cal. However, some other studies on this age group have shown that the daily energy need for females with the ideal weight and heavy activity level for their ages was 2771-2793 kcal and 3439-3560 kcal for boys (97, 98). Accordingly, it was determined that both genders in the study group had insufficient daily energy intake. These athletes were adolescence; adequate energy consumption during this period is crucial for growth and development. Increasing the energy intake in their diets would have been beneficial for both their development process and their long-term performance.

As above-mentioned, consumption of macronutrient (carbohydrate-protein-fat) statistical analysis demonstrated that 13 (68.42%) swimmers' carbohydrate consumption were not enough; six (31.58 %) swimmers' carbohydrate consumption was ideal. Carbohydrates are the primary energy source and carbohydrate stores are limited in the body. The availability of carbohydrate as a substrate for energy is a critical factor for high intensity anaerobic performance and prolonged aerobic exercise. Therefore, adequate carbohydrate consumption is important for energy stores and athletic performance. Inadequate carbohydrate consumption causes the depletion of glycogen stores in the muscles and the resulting poor performance (105). As a result, carbohydrate intake was insufficient in this study group; on the contrary, fat consumption in the diet was excess (89.47%, n = 17). Although dietary fat intake was necessary for energy supply, regular functioning of certain hormones, and intake of fat-soluble vitamins, the daily fat consumption of the athletes in this study was more than their needs. Some studies have claimed that high fat intake may result from less carbohydrate consumption (106). If the carbohydrate consumption of these athletes was increased and their fat consumption was reduced, their performances could improve positively. After analyzing the daily protein intake of all participants, protein consumption was in the ideal percentage range. The eating habits of athletes were compared with swimmers of other studies, and the results showed that carbohydrate consumption and energy intake were lower than other studies (102,106). Although the protein consumption of athletes (Table 4.4) was in the ideal / normal range in this study, the protein consumption results of athletes were higher than in other studies (102, 105). Like nutrient consumption, athletes' daily liquid consumption was insufficient, and liquid consumption analyses results were not related to VO2peak. Some researchers suggested dehydration could negatively affect water balance at the intercellular degree that affected the exercise performance (107).

When the relationship between anthropometric parameters and performance results were examined, there were significant differences in weight and height that impacted performance. Soft lean mass, total energy expenditure, percent body fat and total energy expenditure analysis showed statistically significant association with performance in the literature (108). There was no difference between genders in terms of the effect of anthropometrics on performance, in contrast to some studies which suggested different gender-specific anthropometric features could affect VO2peak and swimming performance (109-111).

For the evaluation of aerobic capacity of the study group, incremental exercise testing (CPET-Bruce Protocol) was performed with treadmill. Peak oxygen uptake (VO2peak) was used in assessing aerobic capacity. According to results, one (5.26%) athlete was good and 18 (94.74%) were superior for VO2peak and test time. VO2peak value of male swimmers were 62.21 ± 6.72 mL/min/kg, VO2peak value of female swimmers were 51.99 ±6.37 mL/min/kg. The average of the whole study group VO2peak value was 58.44 ± 8.17 mL/min/kg (Table 4.7). These findings were found in parallel with the number of studies in the literature (104, 112, 113). The mean value of the maximum heart rate reached during the test was 166.16 ± 13.90. Mean maximum heart rate values were similar in both female and male athletes (female =160.29 ± 19.78 bpm and male = 160.58 ± 8.24 bpm). Maximum heart rate values were also obtained by using sport-specific in-water tests: Max HR Test and T2000 test (114). These tests are commonly used in water and allow the coaches and sport scientists to examine heart rate values at a particular swimming speeds. T2000 test and MaxHR Test were significant for demonstration of performance level and the result were compatible with the VO2peak obtained from CPET.

The blood pressure value in exercise testing is an important evaluation parameter. Normal systolic and diastolic pressure values should not be above 220 and 100 mm Hg, respectively before the test. According to the recommended guidelines for exercise stress testing, elevations in either systolic and/or diastolic blood pressure to 250 and 130 mm Hg, respectively, are indications to terminate the test (115). Therefore, it is very important to monitor this data before and after the test. Table 4.9 shows the blood pressure values of the study group before and after the cardiopulmonary exercise test. Mean pre-ex systolic blood was lower compared to mean post-ex systole blood pressure by 8.84%. Unlike systolic blood pressure, mean diastolic blood pressure decreased by 2.96% after exercise. The mean pre-exercise test blood pressure of the study group was 128.789 ± 12.49 bpm systolic and 81.79 ± 10.38 bpm diastolic, which were both in the normal range and consistent with the literature (107,116).

The short-distance freestyle swimming performance is highly related with the anaerobic power. In this study, for the assessment of anaerobic power of the swimmers, the vertical jump test was performed. According to results of the test; one (5.26%) swimmer was "excellent", four (21.05%) were "above average", twelve (63.16%) were “average”. Only two (5.26%) athletes had “poor” jump ratings (Table 4.11). As a result, although this study group represents the short-distance swimmers which requires a high anaerobic power production, the majority of the study group (63.16%) were found to be classified as “average”. Therefore, their exercise training programs should be modified personally according to their needs, and anaerobic exercise modalities such as plyometric exercise could be added their exercise routines (117).

After the statistical analysis (Chi-square test, p=0,012) it was determined that jump assessment could be associated with VO2peak in this study group. This finding might be important in terms of the relationship between the anaerobic and the aerobic capacity, and their collaborated effect on the swimming performance.

This study has been carried out on swimmers in the junior swimming team of a professional sports club whose health has already been controlled by "sports doctor/experts". Those who had any disease that prevented them from doing sports could not pass the controls and could not get a swimming license. Only 5.26% (n = 1) of the athletes had occasional asthma. 5.26% (n = 1) reported that they used regular medication for the thyroid. With controls, these conditions do not constitute an obstacle for swimming, and some studies show that swimming training is suitable for swimmers with asthma compared to the other sports branches as it exhibits a horizontal posture that causes less bronchoconstriction (bronchospasm) compared to the other sports (118-119). Three (15.79%) athletes have scoliosis according to their previous medical examination and evaluations. It is known that swimming exercise could affect scoliosis treatment both positively or negatively (107, 120). While correct exercise can correct or reduce scoliosis (121), the wrong exercise can increase the likelihood of scoliosis and hyper kyphosis. Research has also indicated that swimming training alone is not sufficient to treat scoliosis. In addition, conservative treatment with physical therapy might be more beneficial in addition to swimming (120,121).

Finally, our results showed that these adolescent swimmers had normal anthropometric measures except BFP values in males. While all female swimmers had ideal BFP values, majority of the male swimmers had excess fat percentage. Although it did not seem to affect their performance-related parameters, excessively high or low levels of body fat could disadvantageous for their long-term performance. In the anaerobic power measurements, it was found that even though this study group represents the short-distance swimmers which require a high anaerobic power production, the majority of the study group (63.16%) were classified as “average”. For this reason, if their exercise training programs are modified personally according to their needs, and anaerobic exercise modalities such as plyometric exercise are added to their exercise routines, their performance can be more improved. Moreover, when their nutritional habits were evaluated it was determined that their daily total energy, carbohydrate and liquid consumption were mainly classified as insufficient in the whole study group, showing that their eating habits were not appropriate. Not only regulation of nutritional habits but also nutritional training can improve their performance. Athletes can learn the nutritional habits that are necessary to maintain a healthy lifestyle by working with professionals. This study works with 19 adolescent swimmers, all of whom have elite athlete specialities. The improvement of their performance requires extra cares for performance tests and eating habits.

Conclusion:

In this descriptive study with analytical components, we evaluated the anthropometric features, nutritional habits, cardiopulmonary capacities, anaerobic powers as well as race performance progressions in the nineteen adolescent competitive short- distance swimmers. Our study group consisted of adolescent athletes who require certain nutritional guide to maintain normal growth and physiological maturation and to achieve athletic performance. In this regard, by analyzing the nutritional, anthropometrical, and physiological characteristics of young athletes, very critical data was acquired which could be used to regulate their training programs, dietary patterns, performance, and most importantly their health. Based on this, it seems important and needed to assess the health and performance status of such athletes to provide scientific information to the literature. Accordingly, we suggest that these analytical data could be useful for the plan future studies to fill the gaps in complex physiological mechanisms of swimming training and athletic performance.

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7. APPENDICES

7.1. Sporcunun Değerlendirmesi Amacıyla Yapılan Veri Toplama Formu

Sporcunun Değerlendirmesi Amacıyla Yapılan Veri Toplama Formu

Katılımcı Ad-Soyadı/Name-Surname:

Katılımcı Doğum Yılı /Birth Date:

Cinsiyet/Gender:

☐ Kadin ☐ Erkek

1. Kaç yaşında spora başladınız? /How old were you when you started to do sport?

   …………………………………………………………………………………………………

2. Günde kaç saat uyuyorsunuz? /How many hours do you sleep a day?

   …………………………………………………………………………………………………

3. Kaç yıldır spor yapıyorsunuz? /How many years have you done sports?

   …………………………………………………………………………………………………

4. Spora ara verdiğiniz bir zaman oldu mu? Evet ise süre belirtiniz. / Have you ever taken a break to do sport? If your answer is "Yes-Evet" explain.

   ☐ Evet ☐ Hayir

   ………………………………………………………………….

5. Bu zamana kadar geçirmiş olduğunuz sakatlık/ sakatlıklar var mı? Evet ise belirtiniz. Do you have any any injuries?

   ☐ Evet ☐ Hayir

   ……………………………………………………………………….

6. Son üç ay içerisinde geçirmiş olduğunuz sakatlık/ sakatlıklar var mı? Evet ise belirtiniz. Did you get injure in last three mounths?

   ☐ Evet ☐ Hayir

   …………………………………………………………………………

7. Son bir ay içerisinde geçirmiş olduğunuz sakatlık/ sakatlıklar var mı? Evet ise belirtiniz. Did yo get injured last month.

☐ Evet ☐ Hayir

……………………………………………………………………………

8. Hala sakatlığınız/sakatlıklarınız devam etmekte midir? Evet ise, doktor sakatlığınızın/sakatlıklarınızın size ne zamana kadar devam edeceğini söyledi, belirtiniz. Have you still have any injuries or any medical situations?

   ☐ Evet ☐ Hayir

   ……………………………………………………………………………

9. Sakatlığınız/sakatlıklarınız antrenman yapmak için bir engel teşkil etmekte midir? Can you do your training clearly?

   ☐ Evet ☐ Hayir

   ……………………………………………………………………………

10. Orta şiddette olan bir yüzme antrenmanından sonra ağrınız olur mu? Evet ise ağrıyan bölgenizi/bölgeleriniz belirtiniz. Do you have any pain after middle-hard training.

    ☐ Evet ☐ Hayir

    ……………………………………………………………………………

11. Zor bir yüzme antrenmanından sonra ağrınız olur mu? Evet ise ağrıya bölgenizi/bölgeleriniz belirtiniz. Do you have any pain after hard training.

    ☐ Evet ☐ Hayir

    ……………………………………………………………………………

12. Kara antrenmanından sonra ağrınız olur mu? Evet ise ağrıya bölgenizi/bölgeleriniz belirtiniz. Do you have any pain after land training.

    ☐ Evet ☐ Hayir

    ……………………………………………………………………………

13. Antrenmandan sonra evinizde sakatlanmayı önleyici veya iyileştirmeye yönelik uygulamalarda(voltaren sürmek, buz tutmak/kompresi) bulunur musunuz? Evet ise belirtiniz.

    Do you use any preventions (like voltaren gel, ice compression) after training at home?.

    ☐ Evet ☐ Hayir

    ……………………………………………………………………….

14. Günde ortalama kaç saat uyursunuz, belirtiniz. How many hours do you sleep a day?

……………………………………………………………………………………

15. Günün kaç saatini okulda geçirirsiniz, belirtiniz. How many hours do you stay at school?

……………………………………………………………………………………

16. Ekran(televizyon, bilgisayar, telefon, video vb.) karşısında günde kaç saat oturursunuz, belirtiniz. How many hours do you watch tv and use compute, telephone etc?

……………………………………………………………………………………

17. Sosyal aktiviteleri haftada kaç gün, kaç saat yaparsınız, belirtiniz.How many days/ hours do you have social activities

……………………………………………………………………………………

18. Sabahları yorgun uyanır mısınız? Do you feel tired when you get up?

☐ Evet ☐ Hayir

………………………………………………………………………

19. Tanısı konulmuş herhangi bir hastalık/sağlık probleminiz var mı? Evet ise belirtiniz. Do you have any ilnesses? (If yes, explain)

☐ Evet ☐ Hayir

………………………………………………………………………

20. Kullanmakta olduğunuz ilaç/ilaçlar var mı? Evet ise belirtiniz. Do you use any medical drugs? (If yes, explain)

☐ Evet ☐ Hayir

…………………………………………………………………………

21. Geçirmiş olduğunuz bir ameliyat/ameliyatlar var mı? Evet ise belirtiniz. Did you do any surgery?

☐ Evet ☐ Hayir

…………………………………………………………………………

22. Herhangi bir şeye karşı alerjiniz var mı? Evet ise belirtiniz. Do you have any allergy?

☐ Evet ☐ Hayir

……………………………………………………………………………

23. Besin alerjiniz var mı? Evet ise belirtiniz. Do you have any food intolerance?

☐ Evet ☐ Hayir

……………………………………………………………………………

24. Besin intoleransınız var mı? Evet ise belirtiniz. Do you have any food intolerance?

☐ Evet ☐ Hayir

……………………………………………………………………………

25. Günlük diyetinizde besin kısıtlaması gerektiren bir hastalığınız var mı? Evet ise belirtiniz. Do you have any food limitation in your daily diet?

☐ Evet ☐ Hayir

……………………………………………………………………………

26. Günlük beslenmenizde uyguladığınız bir beslenme modeli(vejeteryan-vegan-ketojenik-alkali-paleo vb..) var mı? Evet ise belirtiniz. Do you use any nutrient model in your diets (ketogenic-alkali etc)

☐ Evet ☐ Hayir

……………………………………………………………………………

27. Tercihen hiç tüketmediğiniz bir besin var mı? Evet ise belirtiniz. Which food you never eat?

☐ Evet ☐ Hayir

……………………………………………………………………………

28. Besin destekleri kullanıyor musunuz? Evet ise belirtiniz. Do you use supplements?

☐ Evet ☐ Hayir

……………………………………………………………………………

29. Yarışa girmeden önce yemeyi/içmeyi özellikle tercih ettiğiniz bir gıda var mı? Evet ise belirtiniz. Do you have any special nutrient which you especially prefer to consume before race?

☐ Evet ☐ Hayir

……………………………………………………………………………

30. Yarış aralarında ne yemeyi/içmeyi tercih edersiniz? Which food you prefer to eat between races?

…………………………………………………………………………………………

31. Yarıştan önceki son üç gün yeme düzeninizde bir değişiklik olur mu? Evet ise belirtiniz. Do you change your diet at three days before competitions.

☐ Evet ☐ Hayir

……………………………………………………………………………

7.2 Physical Activity Detection Form

EK-3

FİZİKSEL AKTİVİTE DÜZEYİ SAPTAMA FORMU
PHYSICAL ACTIVITY DEGREE DETECTION FORM

Değerli Katılımcımız/ Dear Participant,

Bir gün boyunca (24 saat) tabloda belirtilen aktivite türlerinden hangisini yaparken ne kadar zaman geçirdiğinizi saat veya dakika cinsinden belirtiniz.

Please write your daily activity (24 hours).

AKTİVİTE TÜRÜ/ TYPE OF ACTIVITY	SAAT/HOUR	DAKİKA/ MINUTES
Dinlenme/Resting (uyku, uzanma) (sleeping, napping)		
Çok Hafif Aktivite **Very Slightly Active** (okulda geçirilen zaman, oturma, oturarak çalışma, araba kullanma, dikiş, masa başı oyun oynama, tv seyretme vb.) (at school, studying lectures, sitting, driving, playing sth. watching tv ,etc)		
Hafif Aktivite **Slightly Active** (yavaş yürüme, ev temizliği, oda toplama vb.) (walking slowly, cleaning home, room etc)		
Orta Aktivite **Middle Activity** (hızlı yürüme, yük taşıma, bisiklete binme vb.) (walking fast, cycling etc)		
Ağır Aktivite **Hard Activity** (basketbol, tırmanış, futbol, yüzme antrenmanları, yokuş yukarı yük taşıma vb.) (Trainings)		
TOPLAM/TOTAL	**24 SAAT/HOUR**	**1440 DAKİKA/MINUTE**

7.3. 24 Hours Nutrient Consumption Record Form

24 SAATLİK BESİN TÜKETİM KAYDI FORMU

24 HOURS NUTRIENT CONSUMPTION RECORD FORM

Besin tüketim kayıt formu gün boyunca hangi besinleri, ne miktarda tükettiğinizi saptamak amacı ile uygulanmaktadır. 2 gün hafta içi, 1 gün hafta sonu olacak şekilde besin tüketim kaydınızı tutmanız beklenmektedir. Bu formda porsiyon belirtmek için size yardımcı olacak bilgiler aşağıda belirtilmiştir.

This form provides to determine the amount of your daily food consumption. 2 weekdays and 1 weekend must be recorded. Requirement of food measurement information is given :

- Süt, yoğurt, kefir, cacık vb. besinlerin porsiyonları; kase, bardak cinsinden belirtilebilir.
  Milk, yoghurt types of nutrients can be written as one glass- bowl of
- Peynir porsiyonları; parmak veya kibrit kutusu cinsinden belirtilebilir.
  The portion of cheese can be represented as match box
- Yumurta ve kuru yemiş porsiyonları adet cinsinden belirtilebilir.
  Eggs and nuts can be written as number
- Et/tavuk/balık/hindi vb. besinlerin porsiyonları; el ayası büyüklüğü, el büyüklüğü, köfte büyüklüğü ve gram cinsinden belirtilebilir.
  Meat/chicken/turkey etc. Types of nutrients can be measured as hand portion or meatball or grams
- Ekmek/pide/bazlama/lavaş porsiyonları; tost ekmeği büyüklüğü dikkate alınarak adet cinsinden belirtilebilir.
  The portions of bread/pide/bazlama/lavaş can be written as amount of toast bread (ex: half pide = 2,5 toast bread of pide)
- Makarna/pilav/buğday/yulaf vb. besinlerin porsiyonları; pişmiş şekilleri dikkate alınarak çorba kaşığı, kepçe veya tabak cinsinden belirtilebilir.
  Rice,pasta,wheat,oat,etc types of (baked) nutrients portions can be handled as tablespoon, scoop (do not measure at raw form)
- Tencere yemekleri (sebze/kurubaklagil yemekleri); çorba kaşığı, kepçe veya tabak cinsinden belirtilebilir.
  "Cookware" types of foods (vegetables, legumes) can be measured by table spoon, scoop or plate
- Meyveler; tane, adet veya avuç içi cinsinden belirtilebilir.
  Fruits can be written as number or palms.
- Paketli ürünler; marka, gram ve adet cinsinden belirtilebilir.
  Packed products can be written as their marks, grams and number of pieces.

Kahvaltı yapıyor musunuz? Cevabınız evet ise, hangi besinleri ne miktarda (tabak, tane, bardak, kaşık, gram, avuç hesabı vb.) tükettiğinizi aşağıdaki boşluğa belirtiniz. Do you have breakfast? If you say yes, the amount of consumption of nutrients should be written.

☐ Evet /Yes ☐ Hayır /No

1. Gün /Day	2. Gün /Day	3. Gün Day

Kahvaltı ve öğlen yemeği arasında ara öğün tüketiyor musunuz? Cevabınız evet ise, hangi besinleri ne miktarda (tabak, tane, bardak, kaşık, gram, avuç hesabı vb.) tükettiğinizi aşağıdaki boşluğa belirtiniz.

Do you eat snack between breakfast and lunch. If you say yes, the amount of consumption of nutrients should be written.

☐ Evet /Yes ☐ Hayır /Yes

1. Gün /Day	2. Gün /Day	3. Gün /Day

Öğlen yemeği yiyor musunuz? Cevabınız evet ise, hangi besinleri ne miktarda (tabak, tane, bardak, kaşık, gram, avuç hesabı vb.) tükettiğinizi aşağıdaki boşluğa belirtiniz. Do you eat lunch? If you say yes, the amount of consumption of nutrients should be written.

☐ Evet /Yes ☐ Hayır /No

1. Gün /Day	2. Gün /Day	3. Gün /Day

Öğlen ve akşam yemeği arasında ara öğün tüketiyor musunuz? Cevabınız evet ise, hangi besinleri ne miktarda (tabak, tane, bardak, kaşık, gram, avuç hesabı vb.) tükettiğinizi aşağıdaki boşluğa belirtiniz.

Do you eat snack between lunch and dinner. If you say yes, the amount of consumption of nutrients should be written.

☐ Evet /Yes ☐ Hayır /No

1. Gün /Day	2. Gün /Day	3. Gün/ Day

Akşam yemeği yiyor musunuz? Cevabınız evet ise, hangi besinleri ne miktarda (tabak, tane, bardak, kaşık, gram, avuç hesabı vb.) tükettiğinizi aşağıdaki boşluğa belirtiniz. Do you eat dinner? If you say yes, the amount of consumption of nutrients should be written.

☐ Evet /Yes ☐ Hayır /No

1. Gün / Day	2. Gün /Day	3. Gün /Day

Akşam yemeğinden arasında ara öğün tüketiyor musunuz? Cevabınız evet ise, hangi besinleri ne miktarda (tabak, tane, bardak, kaşık, gram, avuç hesabı vb.) tükettiğinizi aşağıdaki boşluğa belirtiniz.

Do you eat snack between dinner and night. If you say yes, the amount of consumption of nutrients should be written.

☐ Evet /Yes ☐ Hayır/ No

1. Gün /Day	2. Gün /Day	3. Gün /Day

1 gün boyunca tükettiğiniz su miktarını nedir? Litre veya bardak cinsinden belirtiniz………………….

Please write your daily water consumption? You can write as liter or glass…………………………

7.4. Ethical Approval

T.C. YEDİTEPE ÜNİVERSİTESİ

Sayı : 37068608-6100-15- 1710 27/06/2019
Konu: Klinik Araştırmalar
Etik kurul Başvurusu hk.

İlgili Makama (Mehtap Kaçar)

Yeditepe Üniversitesi Tıp Fakültesi Fizyoloji Anabilim Dalı Doç. Dr. Mehtap Kaçar'ın sorumlu araştırmacı olduğu **"Adolesan yüzücüler için geliştirilen beslenme ve kara antrenman programlarının fiziksel performans paremetreleri üzerine etkilerinin değerlendirilmesi"** isimli araştırma projesine ait Klinik Araştırmalar Etik Kurulu (KAEK) Başvuru Dosyası **(1692)** kayıt Numaralı KAEK Başvuru Dosyası), Yeditepe Üniversitesi Klinik Araştırmalar Etik Kurulu tarafından **26.06.2019** tarihli toplantıda incelenmiştir.

Kurul tarafından yapılan inceleme sonucu, yukarıdaki isimi belirtilen çalışmanın yapılmasının etik ve bilimsel açıdan uygun olduğuna karar verilmiştir (**KAEK Karar No: 1058**).

Prof. Dr. Turgay ÇELİK
Yeditepe Üniversitesi
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