T.C
YEDITEPE UNIVERSITY
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SEARCHING THE EFFECTS OF BLOOD GROUPS ON THE NUTRITIONAL HABITS OF INDIVIDUALS ADMITTING TO A PRIVATE CLINIC FOR NUTRITION COUNSELLING, COMPARISON WITH ANTHROPOMETRIC MEASUREMENTS

THESIS OF MASTER

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ONAY

Bu tez Yeditepe Üniversitesi Lisansüstü Eğitim-Öğretim ve Sınav Yönetmeliğinin ilgili maddeleri uyarınca yukarıdaki jüri tarafından uygun görülmüş ve Enstitü Yönetim Kurulu'nun 25./10./2019.. tarih ve 2019/17-03..... sayılı kararı ile onaylanmıştır.

Prof. Dr. Bayram YILMAZ
Sağlık Bilimleri Enstitüsü Müdürü

DECLERATION

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.

Date

Signature

Name Surname

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LIST OF SYMBOLS AND ABBREVIATIONS

WHO :World Health Organization

FAO :Food and Agriculture Organization

UN :United Nations

BMI :Body Mass Index

DM :Diabetes Mellitus

EU :European Union

TSI :Turkish Statistical Institute

LDL :Low Density Lipoprotein

TSA :Turkey Body Weight Research)

TUIK : Turkey Statistical Institute)

ABSTRACT

Coban, P. (2019). Searching The Effects Of Blood Groups On The Nutritional Habits Of Individuals Admitting To A Private Clinic For Nutrition Counselling, Comparison With Anthropometric Measurements, Yeditepe University, Institute of Health Sciences, Departmant of Nutrition and Dietetics, Master Thesis, İstanbul.

In this study, a possible relationship between ABO blood group system and nutrition was searched by observing the anthropometric characteristics of individuals who applied to a private clinic and are feeding appropriate or inappropriate without any knowledge about proper nutrition for blood group suggested in various publications.In addition to demographic information, a questionnaire was used to determine the nutritional habits and food consumption status of 88 volunteers who participated in the study, and anthropometric measurements were also performed. Data were evaluated using SPSS statistical program and Chi-square (x^2) significance analysis was performed. According to the principles set forth in nutrition according to blood type, the beneficial foods of blood type A are plants and red meat is in the category of harmful foods for this blood type. Blood type B is the only group that can consume milk unlike other groups. AB blood type is called hybrid group and blood type AB nutrition is prone to the dominant group. Blood type O is defined as a group that can easily consume red meat.In our study, no statistically significant result was found in BMI of the participants who had high consumption of undesirable nutrients among the blood group A participants. BMI of more than the harmful nutrients of the blood group B is also from this group and those who consumed less of these products compared with BMI no statistically significant result. In terms of the AB blood group, no significant difference was found between BMI and those who did not make the correct nutrition choices. BMI of people who consume nutrients that are considered harmful for that blood group from blood groups was not found statistically significant compared to those consuming them more limited.

Key words: ABO Blood Group System, Nutrition, Popular Diet, Lectin, BMI

ABSTRACT (Turkish)

Çoban, P. (2019). Özel Bir Kliniğe Beslenme Danışmanlığı Almaya Gelen Bireylerin Beslenme Alışkanlıklarına Kan Gruplarının Etkisinin İncelenmesi, Antropometrik Ölçümleri İle Karşılaştırılması. Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü, Beslenme ve Diyetetik Anabilim Dalı, Yüksek Lisans Tezi, İstanbul.

Bu çalışmada, ABOkan grubu sistemi ile beslenme arasındaki olası bir ilişki, özel bir kliniğe beslenme danışmanlığı almaya gelen ve çeşitli yayınlarda ileri sürülen "kan gurubuna uygun beslenme" konusunda herhangi bir bilgiye sahibi olmadan buna uyumlu veya uyumsuz olarak beslenen bireylerin antropometrik özellikleri gözlenerek araştırılmıştır. Araştırmaya gönüllü olarak katılıan 88 kişiye demografik bilgileri yanında, beslenme alışkanlıkları ve kan grubuna göre besin tüketim durumlarını sorgulayan bir anket uygulanmış, aynı zamanda antropometrik ölçümleriyapılmıştır. Veriler SPSS istatistik programı kullanılarak değerlendirilmiştir ve Ki-kare (x^2) anlamlılık analizi yapılmıştır. Kan grubuna göre beslenmede ileri sürülen ilkeler doğrultusunda A grubunun yararlı besinleri bitkiledir ve kırmızı et bu grup için zararlı besinler kategorisindedir. B kan grubu ise diğer gruplardan farklı olarak sütü tüketebilen tek gruptur. AB kan grubu melez grup olarak adlandırılır ve baskınlık duyduğu gruba göre beslenmesi eğilim gösterir. O gurubu kırmızı eti rahatlıkla tüketebilen bir grup olarak tanımlanmaktadır. Araştırmamızda katılımcılardan A kan grubu olanlar içinde istenmeyen besinleri yüksek miktarda tüketen bireylerin,az tüketen bireylere göre BMI'sinde istatiksel olarak anlamlı bir sonuç tespit edilmemiştir. B kan grubunun zararlı besinlerinden fazla tüketlerinBMI'i yine bu guruptan olan ve bu ürünleri daha az tüketenlerin BMI ile karşılaştırıldığında istatiksel olarak anlamlı bir sonuç bulunmamıştır. AB kan grubu açısından bakıldığında öngörülen beslenme tercihlerini doğru yapanlarla yapmayanlar arasında BMI'i açısından anlamlı bir fark elde edilmemiştir. Kan gruparından O kan grubu için zararlı kabul edilen besinleritüketen kişilerin BMI'i bunları daha sınırlı tükentenlere göre istatiksel olarak anlamlı bulunmamıştır.

Anahtar kelimeler: ABO Kan Grubu Sistemi, Beslenme, Popüler Diyet, Lectin, BMI

1. INTRODUCTION AND PURPPOSE

Nutrition is a physiological phenomenon that is carried out in order to provide the energy and essential elements of the body for living. The aim of the nutrition is to provide sufficient and balanced amounts of all nutrients needed according to the age, sex and physiological condition of the individual. Nutrition is one of the basic requirement for maintaining the health of the society and the individuals who make up the society in a healthy way and keeping the human power at the highest level in terms of physical and mental functions (1).

Blood is defined as a tissue that carries nutrients and oxygen to all cells in the body, removes carbon dioxide and waste materials and performs important functions such as immune, defense, acid-base balance maintenance, communication between cells and coagulation. It was first discovered in 1900s that blood differed among individuals. These different blood types were identified as A, B, AB and O Rh blood types were discovered in 1940. Blood type is one of the accepted variations such as hair and eye color. Blood types are thought to have come from the existence of human beings to the present day intact(2).

It is thought that the vital functions of a person can last for 120 years on average. However, it is not yet possible to reach these ages. In order for people to live in a healthy way, each cell in their body needs to consume the right amount of nutrients in proportion to their individual differences. It is suggested that the blood types of individuals should be one of the differences in their nutrition. It is suggested that some people cannot lose weight easily while some lose weight with a certain diet, and some individuals maintain their health in old age, while some others cannot maintain the desired healthy life mentally and physically. Feeding according to blood type is thought to be the solution for this problem. It is thought that it will create healthy generations if people learn the basics of nutrition appropriate to their blood type and continue it and transfer it to their descendants. Studies have not been conducted in sufficient numbers to support these ideas(3,4).

The aim of our study is to observe individuals anthropometricly who admit to a private clinic to receive nutritional counseling and who are fed compatible or incompatible with blood type as claimed, altough they do not have enough knowledge in terms of the subject (4).

2. LITERATURE REVİEW

2.1. Nutrition and Its Importance

Nutrition is defined in the dictionary as taking the nutrients necessary for the body (5). In scientific sources, there are various definitions of nutrition that are similar to each other but which draw attention to different aspects of nutrition. In some of these, nutrition is defined as taking and using nutrients in the most economical way without deteriorating health and losing nutritional value (5), the entire process of taking and using nutrients and also taking and using nutrients by human beings in order to have a long life, a productive and healthy growth and development. Nutrition is described in İbn Sina's famous work "Al-kanun Fi't Tıbb" as follows: "nutrition is that the structures, of nutrients become similar to the body structure, and thus the daily wear and tear in the tissues changes to suit the repair(5).

In another approach, while nutrition was defined by Gürman(2004)as the intake of the nutrients into the body and use of them as required and balanced by human beings in order to survive, develop, make the necessary movements/activities and protect their health(1). It was expressed by Çelik (2015) as a process which includes the steps of taking nutrients into the body, digesting, absorbing and metabolizing them in the body. In a similar way to Gürman (2005) while Soydemir (2017) identifies nutrition as to ensure that the required nutrients are taken into the body in an adequate amount and at the required time for the purpose of health protection, growth, development and life quality (6). Yaşar Arıkan (2001) defines nutrition briefly as the ability of the individual to adequately meet all of the nutrients needed (7).

Therefore, nutrition is defined by the World Health Organization (WHO) as the nutrient intake according to the diet the body needs (8). On the basis of different definitions, it is possible to define nutrition as a process which involves taking the nutrients into the body as required and in a balanced way and using them for the functioning, growth and development of the body and maintenance of a healthy life.

Nutrition is vital as it is an essential process for functioning of the body and sustaining an individual's life (8). Sufficient and balanced nutrition briefly is the economic, continuous and regular intake of energy and nutrients needed in the required size, quality and variety depending on the age, sex and physiological environment of the individual in order to maintain health, to ensure development and growth (5,6,9).

Therefore, it is most of importance to ensure adequate and balanced nutrition by taking care of various issues such as meals consumed during the day, frequency of

meals and the amount of nutrients consumed in a meal in line with the recommendations of experts due to the reasons such as healthy growth and development and health protection (8). Because, when these and similar issues are not taken into consideration, the inadequate and unbalanced nutrition emerges which is defined as the condition that the energy and nutrients required by the body are not included in the metabolism of the desired extent, characteristics and variety. As a result, many functions, especially physical growth and development, and brain and intelligence development are affected adversely (9,10). However, many metabolic disorders such as obesity, cardiovascular diseases, hypertension, hypercholesterolemia and diabetes may start to appear in the organism (11). Therefore, it is observed that human health as a whole is negatively affected as a result of inadequate and unbalanced nutrition (11,12).

2.2. Nutrients and Healthy Nutrition

Nutrient is defined in dictionaries as substances that enter into the structure of living tissues and give energy to organisms or that are needed for the feeding of any organism (13). In academic studies, it is defined as complex compounds consisting of nutritional elements (1) or chemical structures which exist in foods, absorbed in the body and important for health (4). The six essential nutrient groups are carbohydrates, protein, fat, vitamins, minerals and water and they are found in the foods. Since these nutrients (13) cannot be produced in the body, they are structures that must be taken from outside.

2.2.1. Carbohydrates

In the dictionary, carbohydrates are defined as the general name of ornic compounds composed of hydrogen and oxygen atoms (1) and they are the most important and primary energy source of the body. Carbohydrates are named in various ways according to what way and how much oxygen, carbon and hydrogen combine and the way the organism utilizes them. Therefore, carbohydrates are classified as sugars, polysaccharides and oligosaccharides according to their degree of polymerization by the Food and Agriculture Organization (FAO) and World Health Organization (WHO). (7)

Carbohydrates affect the blood glucose level due to their structure and following digestion they pass into the blood as glucose and form blood glucose levels (14,15). They provide most of the energy the body requires. Brain tissue uses only carbohydrates for energy. Furthermore, 1 g carbohydrate provides 4 kcal energy. Therefore, following

a carbohydrate-rich nutrition program can provide individuals with the opportunity to continue their lives without fatigue for longer. They play a role in the passage of sodium from the intestines into the blood and are effective in the retention of water through the electrolytes. Carbohydrates prevent the use of protein to produce energy as the body primarily uses carbohydrates for fuel. Thus, proteins can be used for different functions.By increasing bowel movements, carbohydrates play a role in the digestion of substances such as non-starch polysaccharides, oligosaccharides, resistant starch and lignin and they can provide to remove feces from the body (9). Therefore, important nutrition sources rich in carbohydrates such as fresh vegetables and fruits, pulses such as beans, lentils and peas, whole grain breads, honey and molasses (12) should be included in the nutrition program in a balanced way (13). Yet 55-60% of the energy taken from a healthy diet should consist of carbohydrates.

2.2.2. Proteins

Proteins are defined as natural substances with a complex structure, which form the main substance of living cells, which usually arise from the combination of amino acids with carbon, sulfur and oxygen elements (16) and they are known as the building blocks of cells. Thus proteins form the cell structure in the body (4).

Proteins that are found in different tissues such as skin, muscles, bones and organs are the structure that makes up (17) the structure of enzymes, cells and various hormones. The most important tasks of proteins are building resistance against diseases by strengthening the immune system as well as repairing worn body cells, preserving, renewing and strengthening bone and muscle tissues (18). In addition, proteins are involved in the structure of oxygen carrying hemoglobin in red blood cells, in the structure of enzymes, in the osmotic balance of intracellular and extracellular fluids and in providing energy (19).

Furthermore, 1 g of protein provides 4 kcal of energy and proteins are important for the production of antibodies, strengthening the immune system, and maintaining the liquid and acid-base balance (3). Therefore, 10–15% of daily energy needs to be provided from proteins. In case of protein deficiency, important health problems occur in the body. (20).

The quality of proteins is defined as the degree to which the body utilizes protein and varies according to the condition of digestion and absorption, the type and amount

of amino acids in the composition of the protein and the conversion to body proteins (16, 20).

Foods vary in terms of protein quality and quantity (20). For example, 100% of breast milk and eggs are used when taken into the body. They are therefore called exemplary proteins. 91-100% of other foods of animal origin such as milk and meat are digested. Furthermore, food of animal origin such as milk and meat are called good quality proteins (21).

Furthermore, cheese and skim-milk cheese, mutton, sea food, egg, beef, chicken, liver, kidney, cow's milk are shown in good quality proteins. In addition, sesame, peanut, walnut, potato, rice, corn, nuts and wheat products can be shown as examples to protein-rich vegetable sources (17). However, they contain low quality protein in foods and are very difficult to digest.

On the other hand, legumes such as dried beans, lentils and chickpeas are rich in protein (18). Fresh fruits and green vegetables such as cabbage, leek, spinach, green beans and lettuce are not considered to be protein-rich (16).

2.2.3. Fats

Fats are defined in the dictionary as vegetable or animal fats with glycerol and palmitic, stearic, oleic acids present and varying in consistency according to the ratio of these substances (16). Lipid is a heterogeneous group of molecules consisting mainly of carbon and hydrogen atoms, insoluble in water and soluble in organic solvents such as ether, chloroform and acetone (21).

Fats are a high-energy nutrient (16) and are an important source of energy for the organism (22). Fats, such as carbohydrates, provide energy to the body and the amount of this energy is more than twice the energy of carbohydrates. Because 1 g fat is able to provide approximately 9 calories of energy (1). Similar rates are 4 kcal/g in proteins and 4 kcal/g in carbohydrates. (16).

Some of the functions of fats in the body are as follows: (23,24):

a) They provide adaptation of body temperature to ambient temperature change.

b) Fat in the body helps protect vital organs by providing physical cushioning.for example, the kidneys are physical cushioned with a thick layer of fat and are particularly protected against cold.

c) Fats provide the absorption of fat-soluble vitamins such as vitamins A, D, E and K.

d) Since they stay in the stomach for a long time, they give a feeling of satiety in terms of relieving hunger.

e) They form the structure of the cell. In particular, they meet the requirements with essential fatty acids for infant and fetus development and eye, brain and skin health.

Fats are divided into two groups according to their chemical structure (59). Accordingly, if there are no double bonds in the chemical structure they are called saturated fatty acids. If there are double bonds they are called unsaturated fatty acids (23). Furthermore, fatty acids are classified according to whether double bond between carbons exist and the number of carbon in the molecule. The chain length of fatty acids is very important in nutrition. Those with less than 6 "c" in the molecule are referred to as short chain, those with 6-10 "c" are called medium chain and those with more than 12 "c" are called long chain fatty acids (19).

Saturated fats are solid at room and body temperature, and the carbon atoms in saturated fats are bonded together by a single bond (19). The best examples of saturated fats are animal fat, tail oil, margarine, butter and milk fat (25). However, the majority of the fat in sea food is unsaturated (23). Furthermore, saturated fat content of mayonnaise, salami, sausage,soudjouk (fermented sausage), chocolate varieties, chips, avocado, olives, biscuits and crackers, wafers, all cream foods is high (25).

Unsaturated fats are found as liquid at room and body temperature (25) and have double bonds between carbon atoms in their structure (23). Unsaturated fatty acids are more common in vegetable fats. As unsaturated fatty acids canot be synthesized in the human body, they must be taken into the body with supplementary food. They are classified as Omega-6, Omega-3 and Omega-9 (w-9) fatty acids (23).

Olive oil, hazelnut and hazelnut oil are monounsaturated oils and they are divided into two categories:

1) Omega 6 series such as soy, cotton, sunflower, corn oil (25).

2) Omega 3 series such as mackerel, salmon, tuna fish, sardine, anchovies, salvia oil, kiwi, flaxseed oil, perilla and purslane (23).

However, when fats are consumed more than the body requires, they are stored in the body and transformed into body fat (26). Therefore, over-consumption of fats causes problems such as over-weight and obesity and diseases such as diabetes, hypertension and cancer (24).

Therefore, the following should be taken into account in the total energy intake:

- The intake of trans fatty acids should be reduced.
- In patients with LDL-cholesterol greater than ≥100 mg / dL, saturated fat should be <7%.
- Dietary cholesterol intake limit of <300 mg / dL should be observed.
- The proportion of saturated fats should be <10%.
- 2-3 servings of sea food should be consumed per week.
- Total polyunsaturated fatty acids intake should be ~ 10% of energy (27).

2.2.4. Vitamins and minerals

Vitamins are organic compounds which help to produce the biochemical processes required to produce energy from fats, carbohydrates and proteins and which turn these processes into a regular form by including the structure of some enzymes in the body (28). Vitamins can not be produced in the body and they are required for the metabolic events in the body to occur and sustain in a normal and healty form (9).

Therefore, vitamins are involved in growth, maintenance of a healthy life, development and regular work of the body (23). Since most vitamins cannot be synthesized by the body, they must be taken with nutrients (29). Because to be able to sustain a balanced and healthy life depends on the regular functioning of the organs and executing their duties. Therefore, vitamins play an important role in the regular functioning of metabolism. (23).

In addition, vitamins cooperate with other nutrients. Therefore, they work together with other nutrients in cell, nervous, skeletal and digestive systems, and skin and mucous membrane health (23).

Vitamins are grouped under two groups considering their properties. These groups are fat and water soluble vitamins.

- Vitamins A, D, E, K are fat-soluble vitamins.
- C and B group vitamins are water-soluble vitamins (29).

2.2.5. Water

Water is one of the most basic necessities which is found in all nutrients and which makes up 70% of the human body and also important just like oxygen for human to continue their vital activities. An adult needs to drink an average of eight to twelve

glasses of water each day. Although individuals can survive for weeks without eating, they can live up to five to six days without consuming water (4).

Various health problems occur with the loss of liquid in the body. Some of the problems are as follows:

- Changes in blood flow to the muscle tissue slow down the removal of metabolic waste.
- Results such as decrease in total plasma volume and heart minute volume occur.
- The distribution of nutrients in the body declines.
- An increase in body internal temperature (rectal temperature) occurs.
- Cellular metabolism in the body undergoes changes.
- Heart rate increases.

Therefore, adequate water intake comes up as an important issue (30).

2.4. Anthropometric Measurements in Determining Nutritional Status

Anthropometric measurements are of great importance in determining the nutritional status of individuals. Therefore, many anthropometric methods that are economical, reliable, repetitive and sensitive to changes have been developed and they are still in use (31).

Anthropometric methods are simple, reliable, non-destructive, inexpensive, doable by anyone, easy to apply, accurate and precise when standard techniques are used, objective, fast and sensitive. Some commonly used anthropometric methods are Body Mass Index (BMI), skinfold thickness, body weight, body height, Bioelectrical Impedance (BIA) measurement, diameter and circumference measurements, fat-free body mass determinations and body fat percentage (31,32).

2.4.1. Body weight and height

The determination of body weight and height is a method that allows an assessment according to reference values or by other words standards. The reference values include normal ranges according to age and gender and body weight percentiles based on height. Therefore, evaluations regarding being lean, overweight, short or long and nutritional status can be made. However, calculating the body mass index using body weight and height allows for easier and more practical interpretation (33).

2.4.2. Body Mass Index (BMI)

Body Mass Index (BMI) is used to determine nutritional characteristics, classification of obesity, detection of diseases such as obesity and planning treatment methods. It is the measure of the body in kg weight divided by the square of length (BMI = body weight (kg)/height (m^2) (34). Although BMI cannot directly measure the proportion of fat in the body, it is widely preferred for its ease of use (35).

As a result of the measurement, the BMI being less than 18.5 indicates that the individual is underweight and that a value between 18.5-24.9 is normal weight. Furthermore, in Table 2.1 the body mass index value is categorized as preobesity for the values of 25-29.9 kg/m^2, first degree obesity for 30-34.9 kg/m^2 , second degree obesity for 35-39.9 kg/m^2 and third degree or extreme obesity for values above 40 kg/m^2 (36).

Table 2. 1. Classification by BMI

BMI	Classification
<16,0	Severe underweight
16-18,5	Underweight
18,5-24,9	Normal weight
25-29,9	Lightweight (preobese)
30-34,9	Overweight - first degree obese
35-39,9	Overweight - second degree obese
≥40	Severe overweight (second degree obese)

2.4.3. Waist / Hip ratio

Waist/hip ratio is a measurement method used in risk assessment for healthy nutrition and chronic diseases by revealing where the body fat accumulates. The waist measurement is made by finding the distance between the lowest rib and the anterior upper face of the pelvis and measuring the circumference through the midpoint. Hip measurement is carried out by circumferential measurement at the highest point. The waist/hip ratio is determined by dividing the waist circumference (cm) by the hip circumference (cm) (34).

In men, waist circumference exceeding 93 cm is considered to be risky for health and exceeding 101 cm is considered as high risk. In women, these measures are>

79 cm (risky) and > 87 cm (high risk). Furthermore, it is recommended that the waist / hip ratio is not more than 1.0 in men and 0.8 in women (36).

2.4. Blood Group Systems

Blood has several physiological characteristics. It was first discovered by the famous researcher Landsteiner that these characteristics vary from person to person. The most common type of grouping is the ABO blood group system. The ABO blood group system contains three antigens which are A, B and O (Rh). These antigenic structures belonging to ABO system are found on platelet and erythrocyte surface as membrane antigens, in the endothelial and epithelial cells (skin, cervical, mammary gland, etc.) And also in plasma and saliva etc. In dissolved form. Another characteristic of these antigens is the presence of strong reactive antibodies in the sera of individuals receiving erythrocytes containing antigens that are not on the surface of their group erythrocytes. These characteristics make ABO blood group antigens important for tissue transplantation and transfusion (37).

Blood group antigens are the form of gene and gene groups that can be converted into products. DNA and RNA become products through many processes in the endoplasmic reticulum or ribosome. The structure of ABO blood group antigens is formed by carbohydrates. These groups are linked to oligosaccharide antigens by lipids or polypeptides. The resulting glycosphingolipids or glycoproteins may be found in dissolved form in membranes and body fluids (38).

Table 2. 2. Antigen-Antibody Relationships in ABO Blood Groups System.

Blood type	Erythrocyte antigen	Serum antibody
O	—	Anti - A and Anti – B
A	A	Anti – B
B	B	Anti – A
AB	A and B	—

2.4.1. Rh antigens

One of the important systems in terms of medical genetics is Rh blood groups. The genetics of the system, which was considered the most important finding after the ABO groups that was discovered at the beginning of the 20th century, has been briefly

explained rather than its application details. Rh antigen was discovered in 1940 by Landsteiner and Wiener with research on Macacus Rhesus Monkey and therefore it is called Rh. As erythrocytes agglutination carry the antigen, they were identified as Rh positive. If erythrocytes are not agglutination and they are antigen-free they were identified as Rh negative (37,38).

2.5. Nutrition According to Blood Type

2.5.1. Relationship between blood type and lectin

Lectins are non-immune proteins that can bind specific monosaccharides and oligosaccharides, in particular viruses, plants and animals. The most prominent feature of lectins is that they bind to specific receptors on the surface of human and animal erythrocytes, causing agglutination. Binding of lectins with specific carbohydrates and agglutination activities are basically similar to binding of antibodies with antigen. The binding and agglutination activities of lectins with sugars are simpler than with antibodies(39).

The synthesis of lectins in cells is controlled by genes rather than by stimulation by an antigen. In addition, it forms cross-links between polysaccharide and glycoprotein molecules in solutions and causes their precipitation. While many lectins only interact with their own monosaccharide residues (L-fructose, D-galactose, D-mannose), some other lectins tend to react with their own complex sugars (β-D-galactosido (1-3) n-acetyl-D-galactosamine). Lectins are involved in many biological events such as regulation of intracellular trafficking of glycoproteins; attachment of infectious agents to host cells; routing of leukocytes to inflammatory sites; metasstasis and cell interactions in the immune system. A full understanding of how lectins bind to carbohydrates at the molecular level can allow the design and production of drugs to combat many diseases such as infection, inflammation and cancer (40).

Lectin is found in the cells of all living things, but in different amounts in the structure of the nutrients. There are several potential hazards associated with lectin. Lectin increases intestinal permeability and can cause autoimmune diseases, can behave like insulin and lectin can cause leptin sensitivity (37,40).

Lectins can interact with blood group antigens. Lectins in food that do not comply with blood group antigens may precipitate. These precipitation can occur in larger amounts by targeting certain organs (such as kidney, liver, stomach and brain). While the lectins in the foods may be compatible with some blood types, the same

lectins may precipitate and not match with the other blood types. Because of this, some foods may be beneficial for some blood types, while others may not(40).

2.5 2. Blood group diet

It is accepted that the nutrients taken have a direct effect on our health. Our diet is considered to be in a cycle selected thousands of years ago. Within a wide range of nutrition a uniform nutrition for everyone does not have positive effects on human health. In the medical world, when people are treated according to their blood groups, differences are taken into consideration. For example, there are many varieties of an apple. Due to the differences arising from this diversity, their growing climates and the care given to them vary. Considering the diversity in the blood group, it is expected that there will be differences both in the treatment and in forming the diet. According to blood groups, people are gathered under four groups and each of these groups are also divided into two as Rh + and Rh- factors. Furthermore, considering that each blood group is actually found as a complex in the form of AA-AO, BB-B0, AB and OO pairs, twelve different groups can be mentioned together with Rh factor. These differences in blood group are still the main criteria for blood-letting and blood- transfusion. However, four main groups are taken into consideration when evaluating nutrition. Taking into account of the differences between blood groups, foods differ in terms of their benefits and harms. It is thought that these differences affect the anthropometric properties of the individuals positively or negatively according to the amount of the food group consumed. The nutrients in these groups are divided into three (42,43).

- Very useful foods (as effective as drugs)
- Neither useful or nor harmful (a neutral food)
- Nutrients to be avoided (poison effect)

In the blood group diet, the individual should consume even a portion of the nutrients that are beneficial to him every day. Instead of consuming foods that should stay away, he/she should control his/her amount and portion. Foods or beverages that are not recommended because they are harmful to blood groups consist of foods that cannot be digested by the body or are hardly digested. The detailed distinction between blood groups is as follows (42).

2.5.2.1. Blood type “O” plan

Individuals with O blood groups develop with intense physical activity and proteins of animal origin. Digestive systems show features that are prone to adaptation in ancient times. The high protein-containing predator-gatherer feeding system and the necessity of intense physical activity have been incorporated into the system of the Ogroup since the early ages and caused ketosis. Ketosis is a result of a diet that contains high protein and fat, but low carbohydrates. The body uses proteins and fats by metabolizing them for ketones. Ketones are used instead of glucose to regulate glucose levels. Ketosis is thought to be associated with low caloric intake and intense physical activity resulting in a favorable body structure for prey(42,43).

Significant features

- “0” blood type: predator
- Useful food: meat
- The digestive system is resistant.
- It cannot adapt to nutrient and environmental changes.
- It needs an effective and active metabolism to be fit and energetic.

Red meat

Most useful: Basic food group for the blood type O is meat. They can consume all kinds of meat, even if they are fatty.It is considered that meat is not harmful for blood type O. Red meat (cattle, goat, sheep, etc.) İs considered to be useful. In order to increase the benefit of meat consumption, it is desirable not to eat cereal and carbohydrate along with the meat (42,43).

Harmful red meat types: Salami, sausage and soujouk (fermented sausage) are considered harmful for the blood type O although blood type O are carnivores.

Sea food

Most useful: Each type of sea food is considered to be healing beyond food for blood type O. But sea food such as octopus, squid, mussels, catfish and salmon caviar are not included in this group.

Oils

Most useful:Olive oil, which is beneficial for all blood groups, is a kind of nutrient that has healing qualities for the blood type O. Furthermore, olive oil, flax and walnut oil are also included in the useful oils for blood type O.

Harmful oils: All other oils, including corn and sunflower oil, are not considered useful for O groups. Therefore, it is recommended that blood type O should stay away from these types of oils.

Dried nuts

Most useful: Walnut and roasted pumpkin seeds are considered the most beneficial for blood type O.

Harmful nuts: The most harmful is peanuts. It is also thought that all nuts that are unroasted and stale make digestion difficult for the blood type O and impair the quality of blood.

Vegetables and fruits

Most useful: Vegetables such as artichoke, cabbage, broccoli, zucchini, lettuce, spinach, arugula and parsley are useful. Furthermore, chicory, chard, radish, red beet, onion, garlic, ginger, saffron, red paprika, linden, green tea and carob are among the foods that are beneficial for the digestive system of the blood type O.

Harmful vegetables and fruits: Cauliflower is a vegetable that should be consumed for many blood groups. But it is not good for blood type O. It is also thought that orange is not beneficial for blood type O.

Milk and dairy products

Dairy products are troublesome for blood type O. They should consume cheese and similar hard-to-digest dairy products carefully.

Wheat products

It is difficult for the blood type 0 individuals to digest wheat products (42,43).

Neither useful or nor harmful *foods (edible foods):* Chicken and turkey are foods that can be consumed by blood type O. Chicken and turkey meat are among the edible foods that are not considered healing as red meat. Dairy products can be consumed in portion control such as kefir, yogurt, white cheese, old kashar and tulum cheese. Furthermore, eggs, sesame seeds, chestnuts, nuts, almonds and pine nuts and legumes are among the foods that can be consumed by blood type O (42,43).

2.5.2.2. Blood type "A" plan

Those with blood type A should eat vegetarian. Blood type A individuals are considered to be non-combatant farmers whose ancestors live in permanent settlement. It is very important to consume natural foods as much as possible for the blood type A

individuals who has very sensitive structure. It was observed that individuals with blood group are open to heart disease, cancer and diabetes. Blood type A individuals who feed according to blood type O plan can easily loss weight. In terms of metabolism, blood type A is the opposite of blood type O. Blood type A individuals are more tired and weak when they consume meat products; but they are known to be more energetic when they eat vegetables. Those with blood type O use meat as fuel, while blood type A are thought to store meat as fat (42,43).

Significant features;

- Blood typeA : they are farmers.
- Usefool food: vegetables.
- They have sensitive digestive systems.
- They adapt well to feeding behaviours and settled environment.
- They should have an agricultural diet in order to be fit and productive.

Meat

Most useful: White meat and sea food are useful for blood type A individuals.

Harmful meat: All meats except chicken and turkey are in the category of harmful for blood type A.

Oils

Most useful: Genuine olive oil is very useful for the blood type A individuals compared to other foods. Furthermoe almond oil, walnut oil, flax seed, sunflower oil and fish oil are among the useful foods.

Dried nuts

Most useful: Peanut has ahealing property for blood type. Pumpkin, almonds and walnuts follow the peanut.

Harmful nuts: It is thought that all nuts that are unroasted and stale make digestion difficult for the blood type A and impair the quality of blood.

Legume

Most useful: Legumes such as black eyed peas, kidney beans, broad beans, other kinds of beans and all kinds of lentils are extremely useful for blood type A individuals. Legumes are a source of protein. Blood type A can take in the proteins by means of legumes which they can not take in by means of meat.

Harmful legumes: Rice, barley and chickpeas are among the harmful foods.

Vegetables

Most useful: Vegetable is the most healing food group for the blood type A. In particular, nutrients such as pumpkin, gumbo, white cabbage, broccoli, artichoke, jerusalem artichoke, carrot, spinach, black cabbage, curly, parsley and leek are useful for the blood type A.

Dairy products:

Most useful: There is no dairy product with healing property for blood group A.

Harmful dairy products: Foods such as cream cheese, permasan cheese, goat cheese and ice cream are harmful for the blood type A (42,43).

Neither useful or nor harmful *foods (edible foods):* Chicken and turkey are foods that can be consumed for blood type A. These are not among the foods with healing property like vegetables, but are among the edible foods. Dairy products can be consumed in portion control such as kefir, yogurt, white cheese, old kashar and tulum cheese. Furthermore, eggs, sesame seeds, chestnuts, nuts, almonds and pine nuts and legumes are among the foods that can be consumed by blood type A (42,43).

2.5.2.3. Blood type "B" plan

Blood type O and A are opposite poles in many respects. Blood type B has a distinctive and unique structure. It is literally original and sometimes like a chameleon with its variable structure. Blood type B and O are similar in many ways; but there are characteristics of blood type B which are completely different from the others. Blood type B is a strong and alert blood group. Blood type B was found to be able to withstand diseases such as heart disease and cancer which are very common in modern life. Unlike these diseases, blood type B is more prone to unusual diseases such as skin tuberculosis and chronic fatigue syndrome. Blood type B is balanced and nutritious. It contains a wide variety of foods. Corn, buckwheat, lentils, peanuts and sesame seeds are the major factors in weight gain for those with blood type B. Those with blood type B slow down metabolism with gluten taken with wheat germ containing gluten and whole wheat products. It is recommended to remove wheat completely in the blood group B nutrition (42,43).

Significant faetures

- Blood type B: they are nomadic.
- Balanced nutrition is essential.
- The digestive system is resistant.
- Blood type B has the most flexible diet.

Blood type B needs to balance his physical and mental activities in order to be fit and healthy.

Meat

Most useful: For the blood type B, mutton, goat meat and rabbit meat are among the useful foods. The digestive system renews itself with these nutrients and helps it to repair.

Harmful meats: Chicken meat is thought to cause serious problems for blood type B even if the chicken is grown in a completely natural environment. In addition, goose, partridge, duck and beef are not considered beneficial for blood type B.

Dairy products

Most useful: Dairy products with healing properties for blood type B include white cheese, goat cheese, kefir, string cheese and skim-milk cheese.

Harmful dairy products: Icecream is among harmful food for blood type B(42,43).

2.5.2.4. Blood type "AB" plan

It is a biologically complex blood group and does not fit any classification. Due to multiple antigens, they sometimes react like blood type A and sometimes blood type B. Sometimes it has the characteristics of both groups. This multiple qualification can have positive or negative impacts depending on the circumstances. To determine and understand the blood type AB diet, it is necessary to examine and understand blood types A and Bwell. Lectin, which has a binding effect in all blood groups, is better tolerated by those in blood type AB. Blood type AB decreases lectin reactions with its double effects. Those with blood type A and B cannot tolerate tomato lectin, while blood type AB can consume tomato without any problems (42).

Significant features

- Blood type AB is mysterious compared to other groups.
- It is a modern combination of blood types A and B.
- They have sensitive digestive systems.
- They adapt well to changes in the environment and nutritional conditions.
- Thay have an extremely tolerant immune system.

Meat

Most useful: Turkey meat is beneficial for blood type AB individuals. In addition, sheep, lamb and goat meat are not as useful as turkey meat but they are among the edible foods.

Harmful meats:It is thought that beef, venison, partridge, buffalo meat and goose meat cause serious problems for the blood type AB.

Sea food

Most useful: Bonito, salmon, sardines and mackerel are among the sea foods that are useful for blood type AB individuals. In addition, squid, caviar and sea bass are among the edible foods altough they are not beneficial.

Harmful sea food: For blood type AB, seafood such as octopus, trout, anchovies and flounder are thought to cause serious problems.

Dairy products

Most useful: Dairy products with healing properties for blood type AB include white cheese, goat cheese, kefir, old kashar cheese, goat milk and and strained yoghurt.

Harmful dairy products : Mixed whole milk, cream, butter and ice cream are harmful foods for blood type AB.

Oils

Most useful: The most beneficial oil for the blood type AB is olive oil as in other blood types.

Harmful oils: Avocado and sunflower oil, coconut oil, corn oil and peanut are among the harmful oil and nutrition groups.

Legumes

Most useful: Red beans and green lentils are extremely useful for blood group AB individuals. Fresh beans, yellow and red lentils are also consumable for blood group AB.

Harmful legumes : Dried beans, broad beans, cowpea and chickpeas are foods that are not considered beneficial for blood type AB.

Neither useful or nor harmful *foods (edible foods):*

Peanuts, walnuts and almonds are among consumable foods for blood group AB individuals. Vegetables such as cucumber, cauliflower, white cabbage, eggplant, leek, purslane, lettuce and carrot are among the consumable foods. Fruits and citrus products such as figs, grapes, cherries, sour cherries, plums and lemons are consumable foods(42,43).

3.MATERIALS AND METHODS

3.1. The Research Environment

The research was conducted in a private nutrition counseling center.

3.2. Sampling of Research

It was aimed to reach the individuals who admitted to receive nutritional counseling in the clinic between July 2018 - September 2018. The study was conducted with 88 voluntary participants who asked for nutrition consultations.

The individuals who admitted to a private nutrition counseling center between July 2018 and September 2018 constituted the population of the research.

3.3. Data Collection

3.3.1. Data collection tools

The survey, which is the data collection tool of the study, contains 30 questions. The survey consists of three parts. In the first part, general information such as gender, age, occupation, marital status, education status, blood groups, occupational status, sports status, chronic disease status, smoking and alcohol using status are involved. In the second part, the dietary habits such as the frequency of meals consumed, the number of snacks and main meals and the appetite status, and finally in the third part, anthropometric features such as weight, height and waist-hip ratio were tried to be learned (Appendix-1).

The food preferences of the study group were determined by the frequency of food consumption. Calculations were made by taking the height (tape measure), weight (Tanita body analysis scale; sensitive upto 100 g), waist and hip circumference (tape measure), BMI and waist/hip ratio of the individuals in our study.

The food preferences of the study group were determined by the frequency of food consumption. Food consumption frequency according to the blood group according to the nutritionally beneficial and harmful nutrients suggested by taking into account for each blood group separate food consumption frequency table was created. The changes and weights of the foods determined in the frequency of food consumption were taken as follows.

Meat (fish, chicken, mutton, beef): 30 g

Cheese: 30 gr

Milk: 1 cup: 200 ml

Vegetables: 4 tablespoons: 100 g

Legumes: 5 tablespoons: 100 g

Wheat: 2 tablespoons: 25 g

Olive: 5 pieces

1 teaspoon: 5 g

Oil (sunflower oil-olive oil): ½ tablespoon 5g

1 teaspoons: 3 g

1 tablespoons:10 g

Nuts and peanuts: 1 serving 8 pieces: 8 grams

Walnut: 1 serving: 3 pieces: 15 grams

Ice Cream: 1 to ball of ice cream10 g

All these data were taken in the amounts stated above and calculated on a monthly basis.

1 month 30 days and 4 weeks.

(Appendix-1).

3.3.2. Data collection process

The surveys were conducted between July 2018 and September 2018.

3.4. Data Evaluation

SPSS statistics 22 program was used to evaluate the data of the study and a variety of descriptive and educible statistical methods were used. Accordingly, the suitability of the data for normal distribution was evaluated with the Shapiro-Wilks test. Oneway Anova test and Post Hoctukey HSD test were used in the discriminant analysis compatible with the normal distribution.

The normality test was done with Shapiro-Wilk test. Non-parametric statistical methods were used for values with skewed (nonnormally distributed, shapiro-wilk $p>0.05$) distribution. Descriptive statistics were presented using mean and standard deviation for normally distributed variables and median (and minimum-maximum) for the non-normally distributed variables.

Non-parametric statistical methods were used for values with skewed distribution. For comparison of two non-normally distributed independent groups Mann Whitney U test was used. For comparison of more than two non-normally distributed

independent groups Kuskal Wallis test was used.Statistical analysis was performed using the MEDCALC statistical software version 12.7.7

4. RESULTS

Table 4.1. Gender Distribution Table

Gender	**N**	%
Female	53	60,2
Male	35	39,8
Total	88	%100

The group of 88 people who participated in the study consisted of individuals who admitted to a private clinic between July and September 2018 to receive nutritional counseling. It was determined statistically that 39.8% of the individuals were male and 60.2% were female(Table 4.1).

Table 4.2 Table of Education Distribution

Education		**n**	**%**
Valid	**Secondary school graduate**	4	4,5
	High school graduate	31	35,2
	Graduated from a Universty	43	48,9
	Master's / PhD	10	11,4
	Total	88	100,0

When the educational status of the research sample was examined, it was determined that the distribution was 4.5% of secondary school graduates, 30% of high school graduates, 43% of university graduates and 11.4% of graduate / doctorate (Table 4.2).

Table 4.3. Blood "Rh" Factor Distribution

	n	**%**
A Rh+	24	27,3
A Rh-	8	9,1
B Rh+	13	16,2
B Rh-	5	4,2
AB Rh+	11	12,5
AB Rh-	5	5,7
O Rh+	14	16,1
O Rh-	8	9,1

The general blood groups of the participants were found as follows. According to the research, out of 88 participants 24 were A Rh (+) positive, 14 were O Rh (+) positive, 13 were B Rh (+) positive, 11 were AB Rh (+) positive, 8 were O Rh (-) negative, 8were A Rh (-) negative, 4 were B Rh (-) negative and 5 were AB Rh (-) negative (Tablo 4.3).

Table 4.4. Blood Groups Distribution

	n	**%**
A blood group	32	36,3
B blood group	18	20,4
AB blood group	16	18,1
O blood group	22	25,2
Total	88	100

Among the general blood groups, 36.3% were found to be A blood group, 20.4% were B blood group, 18.1% were AB blood group and 25.2% were O blood group(Table 4.4).

Table4.5. Height, Weight, Waist / Hip Ratio and Bki Average, Min.-Max Values and BMI Distribution

Dimensions	Min.-Max	Mean ± ss
Length (cm)	152-186	170,5±8,52
Weight (kg)	45-118	75,69±15.88
BMI	15,3-38,8	26,54±5,15
Waist circumference (cm)	58-120	86,03±18,9
Hip circumference (cm)	60-126	96,78±15,28
Waist / hip ratio	0,70-1,15	0,93±0,12

When the data in table 4.5 is examined, the heights of the individuals who admitted to receive nutritional counseling vary between 152 and 186 cm and the average is 170.5 ± 8.52. The weight varies between 45 and 118 kg and the average is 75.69 ± 15.88. BMI values range from 15.3 to 38.8, with an average of 26.54 ± 5.15. Waist circumference range from 58 to 120 cm and the average is 86.03 ± 18.9. The hip circumference varies between 60 and 126 cm and the average is 96.78 ± 15.28. Waist / hip ratios vary between 0.70 and 1.15, and the average is 0.93 ± 0.12 (Table 4.5).

When the distribution of anthropometric properties in blood groups is examined in Table 4.6. there is a statistically significant difference between blood groups and weight and waist / run circumference. It was determined that. According to post-hoc paired comparisons, there was a significant difference between weight and waist / hip circumference and Avs B and B vs AB (Mann-Whitney U p <0.01) (Table4.6)

Table 4.6. Distribution of Anropometric Properties According to Blood Group

	A		B		AB		0		Materiality	
	Mean	S.D	Mean	S:D	Mean	S:D	Mean	S:D	X^2	Sig.
Height (cm)	172	10	168	8	172	7	170	7	2,168	0,538
Weight (kg)	80,38	13,01	67,00	11,78	82,13	12,06	70,96	20,14	13,897	**0,003***
BMI (kg/m²)	26,61	4,73	24,96	5,65	27,72	2,74	24,39	6,23	5,178	0,159
Waist circumference	89,44	15,43	81,88	15,25	91,75	16,76	83,79	22,97	3,794	0,285
hip circumference	95,19	15,98	86,25	11,38	93,50	12,68	89,75	17,51	6,601	0,086
Waist / hip Ratio	,94	,06	,92	,06	,97	,07	,92	,12	9,050	**0,029***

**Kruskal Wallis test*

Post-Hoc Pairwise Comparisons (p^2)	**A vs. B**	**A vs. AB**	**A vs. O**	**B vs. AB**	**B vs.O**	**ABvs.O**
Weight	**0,001**	0,539	0,018	**0,006**	0,557	0,062
Waist / hip circumference	0,216	0,086	0,030	0,035	0,304	0,041

Mann-WhitneyU

Table 4.7 . Comparıson Parameters Accordıng To BMI (Blood Group- A Grup)

BMI	Underweight	Normal weight	Overweight	p[1]
	Mean ±SD (Min-Max)	Mean ±SD (Min-Max)	Mean ±SD (Min-Max)	
Olive Oil Quantity	150±0 (150-150)	120±46,48 (60-150)	77,73±109,13 (10-300)	**0,044***
White Meat Quantity	720±0 (720-720)	880±761,47 (120-1800)	455±562,41 (30-1800)	0,114
Cereals Quantity	800±0 (800-800)	1166,67±314,11 (800-1500)	1029,09±511,83 (400-2000)	0,496
Vegetable Quantity	3000±0 (3000-3000)	5333,33±1032,8 (4000-6000)	3350±1370,81 (1200-6000)	**0,017***
Milk Quantity	0±0 (0-0)	266,67±51,64 (200-300)	205,88±155 200 (0-400)	0,129
Red Meat Quantity	180±0 (180-180)	1360±780,15 (240-2400)	1272±668,02 (240-1920)	0,062

**Kruskal Wallis test*

Post-Hoc Pairwise Comparisons (p[2])	Underweight vs. Normal weight	Underweight vs. Overweight	Normal weight vs. Overweight	p[2]
Olive Oil Quantity	0,643	0,181	0,033	
Vegetable Quantity	0,071	0,886	**0,005**	

Mann-WhitneyU

There is statistically significant difference between BMI groups and olive oil quantiy and vegetable quantity (Kruskal Wallis p<0,05). According to Post-hoc Pairwise comparisons, There is significant difference between Normal weight vs. Overweight in terms of vegetable quantity (Mann-Whitney U p<0,05 Bonferroni correction) (Table4.7).

Table4.8. Comparıson Parameters Accordıng To BMI (Blood Group- B Grup)

BMI	Underweight	Normal weight	Overweight	P
	Mean ±SD (Min-Max)	Mean ±SD (Min-Max)	Mean ±SD (Min-Max)	
Mutton Quantity	-	240±0 (240-240)	360±185,9 (120-480)	0,476
Chicken Meat Quantity	-	240±0 (240-240)	870±319,11 (360-1080)	**<0,001**
Ice Cream Quantity	-	1710±1058,35 (720-2700)	1770±419,39 (1440-2400)	1,000
White Chesee Quantity	-	45±37,42 (10-80)	180±21,38 (160-200)	**<0,001**
Legumes Quantity	-	1150±374,17 (800-1500)	1275±296,41 (1000-1600)	0,234
Dried Nuts Quantity	-	128±46,45 (24-160)	424±328,29 (40-720)	0,108
Olive Quantity	-	258±44,9 (216-300)	192,5±73,12 (108-300)	**0,038**

Mann-Whitney U test

There is statistically significant difference between BMI groups in terms of Chicken Meat Frequency, Chicken Meat, white cheese and olive quantity (Kruskal Wallis $p<0,05$). According to there is significant difference between Normal weight vs. Overweight in terms of Chicken Meat Frequency, Chicken Meat, white cheese and olive quantity (Table 4.8).

Table4.9 Comparıson Parameters Accordıng To BMI (Blood Group- AB Grup)

BMI	Underweight	Normal weight	Overweight	p[1]
	Mean ±SD .(Min-Max)	Mean ±SD .(Min-Max)	Mean ±SD (Min-Max)	
Mutton Quantity	-	-	110±34,64 (90-180)	-
Beef Quantity	-	-	615±709,08 (180-1800)	-
Cheese Quantity	-	-	945±578,62 (240-1800)	-
Milk Quantity	-	-	5000±1400,95 (2400-6400)	-
Dried Nuts Quantity	-	-	505±436,07 (120-1600)	-
Legume Quantity	-	-	1192,5±460,02 (600-1800)	-

There is not statistically significant difference between BMI groups in terms of Mutton quantitiy , Beef quantitiy, Cheese quantitiy, Milk quantitiy, Dried Nuts quantitiy, Legume quantitiy (Table 4.9).

Table 4.10 Comparıson Parameters Accordıng To BMI (Blood Group- O Group)

BMI	Underweight	Normal weight	Overweight	p
	Mean ±SD (Min-Max)	Mean ±SD (Min-Max)	Mean ±SD (Min-Max)	
Red Meat Quantity	-	308,57±85,52 (240-400)	1126,15±500,89 (720-2400)	**<0,001**
Fish Quantity	-	200±0 (200-200)	193,33±179,03 (30-400)	0,864
Olive Oil Quantity	-	300±0 (300-300)	275,85±244,28 (72-750)	0,183
Sunflower Seed Oil Quantity	-	180±149,67 (20-300)	176±135,83 2 (36-360)	1,000
Walnut Quantity	150±0 (150-150)	180±149,67 (20-300)	696±971,74 (120-2400)	0,187
Healnut Quantity	-	62,14±26,59 (45-120)	204,23±94,42 (75-360)	**<0,001**
Milk Quantity	23250±13500 (3000-30000)	7885,71±641,43 (7200-8400)	4933,33±1058,3 (4000-6400)	0,385[1]
Wheat Berry Quantity	-	2357,14±801,78 (1500-3000)	2065,38±887,74 (600-3000)	0,483

Kruskal Wallis test,

There is statistically significant difference between BMI groups in terms of Healnut Quantity (Kruskal Wallis p<0,05) (Table 4.10).

Table 4.11. Comparıson Parameters Accordıng to BMI(Blood Group A & Healthy-Unhealthy

BMI	Underweight	Normal weight	Overweight	P
	Mean ±SD Med.(Min-Max)	Mean ±SD Med.(Min-Max)	Mean ±SD Med.(Min-Max)	
Healthy Quantity	1875±276,22 1867,5 (1570-2187,5)	1135,88±395,79 1021,25 (705-1704)	1875±276,22 1867,5 (1570-2187,5)	**0,008***
Unhealthy Quantity	813,33±401,03 815 (270-1350)	728,67±364,76 820 (120-1160)	813,33±401,03 815 (270-1350)	0,067

**Kruskal Wallis test,*

Post-Hoc Pairwise Comparisons (p^2)	Underweight vs. Normal weight	Underweight vs. Overweight	Normal weight vs. Overweight
Healthy Quantity	0,071	0,424	**0,002**

Mann-Whitney U test

There is statistically significant difference between BMI groups in terms of Healthy Frequency, Unhealthy Frequency (Kruskal Wallis p<0,05). According to Post-Hoc Pairwise comparisons, there is significant difference between Normal weight vs. Overweight in terms of Healthy Frequency Quantity (Mann-Whitney U p<0,08 Bonferroni correction). Average of Healthy and Unhealthy Frequency is higher in normal weight group than the others (Table 4.11).

Table 4.12. Comparıson Parameters Accordıng to BMI(Blood Group B & Healthy-Unhealthy

BMI	Underweight	Normal weight	Overweight	P
	Mean ±SD (Min-Max)	Mean ±SD (Min-Max)	Mean ±SD (Min-Max)	
Healthy Quantity	-	480±0 (480-480)	960±0 (960-960)	**0,010**
Unhealthy Quantity	-	364,2±83,41 (272-442)	552,13±74,13 (460-620,8)	0,001

Mann-Whitney U test

There is statistically significant difference between BMI groups in terms of Healthy Frequency (Kruskal Wallis p<0,05) (Table4.12).

Table 4.13. Comparıson Parameters Accordıng to BMI(Blood Group AB & Healthy-Unhealthy

BMI	Underweight	Normal weight	Overweight	P
	Mean ±SD (Min-Max)	Mean ±SD (Min-Max)	Mean ±SD (Min-Max)	
Healthy Quantity	-	-	627,78±265,24 (370-930)	-
Unhealthy Quantity	-	-	2269,17±425,19 2426,67 (1220-(2533,33)	-

There is not statistically significant difference between BMI groups in terms of Healthy Frequency, Unhealthy Frequency (Kruskal Wallis p>0,05) (Table 4.13

Table 4.14. Comparıson Parameters Accordıng to BMI(Blood Group O & Healthy-Unhealthy

BMI	Underweight	Normal weight	Overweight	p
	Mean ±SD (Min-Max)	Mean ±SD (Min-Max)	Mean ±SD (Min-Max)	
Healthy Quantity	-	230±0 (230-230)	683±329,96 (502,5-1265)	**0,036**
Unhealthy Quantity	-	2621,25±402,26 (2191,25-2955)	1736,92±220,31 (1590,25-2232,5)	**0,001**

Mann-Whitney U test

There is statistically significant difference between BMI groups in terms of Healthy Frequency, Unhealthy Frequency (Kruskal Wallis p<0,05) (Table 4.14)

5. DISCUSSION

The results of the questionnaire applied to a group of 88 people who applied to a private clinic between July and September 2018 to receive nutritional counseling were discussed. This is a study examining nutrition according to the blood group that has been on the agenda in recent years. The discussion section of the research was examined in accordance with the flow in the findings section.

The heights of individuals who admitted to a private nutrition counseling center range between 152 cm and 186 cm and the average was 170.5±8.52. Their weights range between 45 and 118 kg and the average was 75,69±15.88. The body mass index (BMI) values of the participants ranged between 15.3 and 38.8 and the average was 26.54 ± 5.15. When the evaluation is made based on the BMI classification which was calculated according to theTSA (Turkey Body Weight Research) 2010 (50) that was performed by TSI (Turkish Statistical Institute). While the BMI value of 47.4% of the participants was less than 25, 53.6% of them was 25 and above. According to the World Health Organization (WHO) (52) definitions of obese and underweight, the majority of the participants (51.5%) were classified as overweight. The BMI values of the male participants are higher than the BMI values of the female participants. According to the TSA 2010 (50) data, 37.3% of men in Turkey are overweight and while 13.2% are obese, while 28.4% of women are overweight and 21% are obese. When the values are examined, it is seen that individuals prone to obesity occur. Obesity is an important public health problem on a global scale. According to the study conducted by NHANES (National Nutrition and Health Survey), the prevalence of obesity (BMI> 30) in 2003-2004 was 31.1% for males, 33.2% for females, 33.3% for males and 35.3% for females in 2005-2006.

In this study, among the participants, it was found that the proportion of men with high BMI (27.1) was higher than that of women with high BMI (25.0)(52).

The distribution of the individuals in terms of blood types is as follows. A blood 36,3 % (Rh + 27,3%; A Rh- 9,1%); B blood 20,4%(Rh+ 16,2,6%; B Rh- 4,2); AB blood 18,1% (Rh+ 12,5%; AB Rh- 5,7%) and 0 blood 25,2% (Rh+ 16,2%; 0 Rh – 9,1%) (Table 4.3). A similar distribution was observed between the blood types of the individuals who participated in this study and the blood types in the study conducted with 82.292 people between 1995-2000 in Eskişehir Kızılay Blood Center (52).

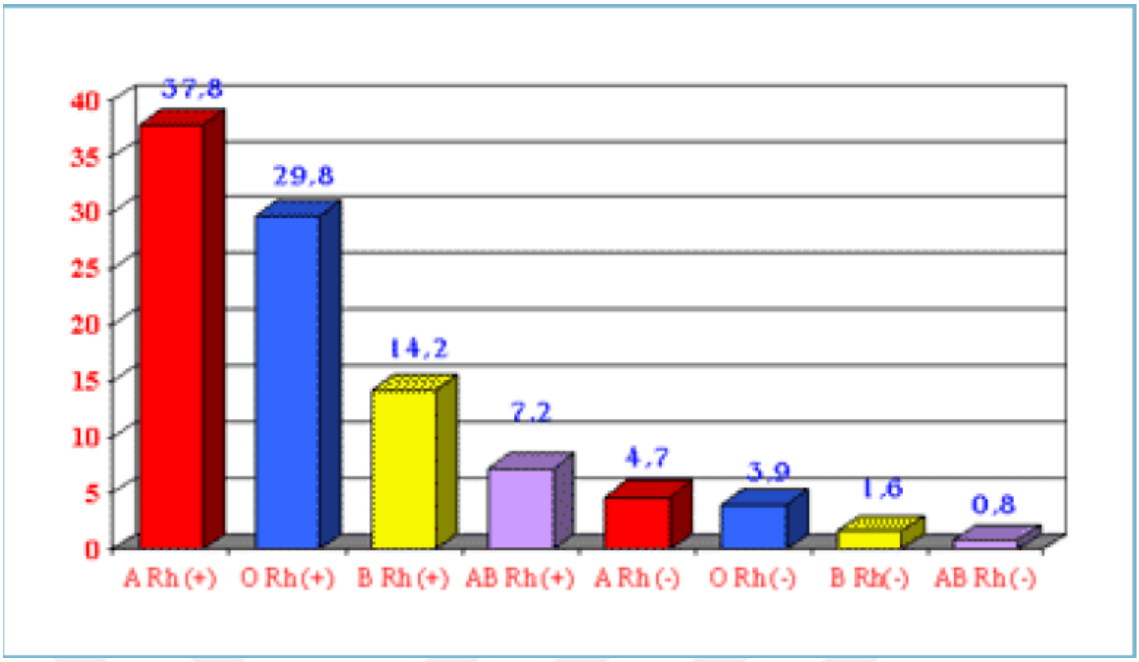

Figure5.1. Eskişehir Kızılay Station Blood Group Distribution Figure

In the blood group studies carried out in Eskişehir Kızılay Blood Center between 1995-2000, a distribution was found as shown in the chart below.The study involved 82,292 people. Although the data of 88 people were used in the study, a similar distribution was obtained (Figure 1.1).

BMI distributions of the participants with blood group A, B and O in the study consisted of each of the weak, normal and overweight individuals. Among the participants who participated in this study, there were no underwight and normal-weighted individuals among those with AB blood type. All AB blood group participants participating in the study were overweight. Because the AB blood group is the least common blood group in the community, the number of individuals (AB; 18.1%) in the study population has the lowest percentage among the other blood groups. (A; 36%, B; 20.4% and O; 25.2% (Table 4.4).

In the book written by Dr. Peter J.D'Adamo (The Blood Type Diet), about nutrition, it is stated that mono-type nutrition will not give the same reactions and results for everyone. It is argued that the difference can be maintained by blood type and individuals' nutrition can be classified. Based on blood type principles, it is argued that each existing group has beneficial, neutral and harmful nutrients. It is argued that when the individuals consume beneficial nutrients and leave the harmful foods out of their diet, the individuals usually keep their normal weight and if the diet is preferred by

choosing these foods, weight loss may be easier. The beneficial nutrients of the blood type A are classified as olive oil, white meat, cereals and vegetables. In the study sample, when the BMI of individuals with blood group A were compared, it was seen that BMI values of those who consumed vegetables and olive oil were more significant and statistically higher than those who consumed less. (p=0,005) (p<0,005). In terms of consuming harmful foods, no difference regarding consumption was found between normal weight and overweight individuals. Kokort studies conducted in 2018(53) and 2 of which were included in this study showed that increased vegetable consumption caused weight loss of 0.09-0.1 kg for four years. (p<0.001). In other studies, it was stated that increased vegetable intake may lead to lower risk of weight gain and risk of overweight or obesity. In my study with overweight individuals, BMI values of individuals with higher vegetable consumption were statistically significant than those with less vegetable consumption. However, although vegetables are beneficial nutrients for blood group A, high BMI values of those who consume more vegetables than those who consume less vegetables suggest that the blood group does not affect the anthropometric properties of the blood group but portion amount does.

In the book written by Dr. Peter J.D'Adamo (The Blood Type Diet), about nutrition, beneficial and harmful nutrients for blood type B have been identified as follows.Useful foods are mutton and feta cheese, while harmful foods are chicken, ice cream, legumes, olives and nuts. When the consumption of these nutrients by blood type B individuals was compared with BMI, BMI of normal weight and overweight individuals consuming frequent and high quantities of chicken meat and olive oil, which are classified as harmful were found to be high statistically significant (p <0.05) than those consuming less amounts. BKI values of the participants were found to be high when they consume protein rich food. Dietary protein saturation is effective for body weight management as it increases energy consumption and changes body composition in favor of lean body mass. (54). Contrary to this information, however, in my study, BMI was found to be high in anthropometric measurements of individuals who consume protein rich food.

According to the same sources mentioned above, regarding the the nutrition explained for blood type AB, useful foods are mutton, feta cheese, roasted dry, while harmful foods are claimed to be beef, milk and legumes. In the research sample, the consumption of these foods by blood type AB individuals is compared with BMI (weak, normal and overweight). In the study, there was no significant result for BMI of overweight individuals in terms of sheep, beef, cheese, milk, dried nuts and legume

consumption with regards to weak, normal and overweight individuals. This is due to the fact that there are no individuals with normal and weak BMI among the participants with the EU blood group. I think that working in a larger group to get better data in the EU blood group will strengthen the outcome and will lead to more meaningful data.

According to the same sources mentioned above for blood type 0, according to the suggested nutrition program useful foods are red meat, fish, olive oil and walnuts. No difference was found between normal and overweight individuals in terms of consumption of beneficial nutrients. The harmful foods are defined as sunflower oil, peanut, milk and wheat. In the research sample, when the consumption of these foods by blood type O individuals is compared with BMI, among the BMI groups, BMI of individuals who consume only peanut and red meat were statistically higher than those consuming less. Hazelnut contains compounds that have a positive effect on glucose homeostasis, weight control and vascular health. (55). Although it is argued that hazelnut adversely affects anthropometric measurements in individuals with blood group 0, it is an important food used in weight control.

There was no difference between the groups in the blood type A when they are only grouped according to the BMI of the beneficial food consumers. In the same way, no difference was found when they are only grouped according to the BMI of the harmful food consumers.This may be due to the fact that from harmful foods only the most distinct meat group associated with overweight is not sufficient to reflect total disintegration.

There was no difference between the groups in the blood type B when they are only grouped according to the BMI of the beneficial food consumers. In the same way, no difference was found when they are only grouped according to the BMI of the harmful food consumers.

When the grouping of beneficial and harmful foods in blood type AB and bmı (weak, normal, overweight) were compared, statistically significant result wasnot observed among the useful foods ($p>0,05$).

When the grouping of beneficial and harmful foods in blood type 0 and bmı (weak, normal, overweight) were compared, no statistically significant result was observed among the useful foods. When the foods are examined separately, the significance is not seen in groups.

There are not enough studies on this subject. Anthropometric properties are associated with nutrition, but nutrition does not vary according to blood type and does not affect anthropometric properties.

6. CONCLUSION

As a result, it is possible to list the data obtained by the study as follows:

- According to blood type, no statistically significant difference was found between nutrition and anthropometric measurements.
- The sample of the study was conducted with a small group. To draw conclusions with study results, it was found that the sample size was insufficient.
- Approaches that nutrition can change the anthropometric characteristics of individuals according to blood groups are not possible with a small number of participants.

7.RECOMMENDATIONS

Nutrition is one of the individualized and unique situations in human life such as fingerprints. It is argued that mono-type nutrition will not give the same reactions and results for everyone, and nutrition of individuals can be classified by providing this difference by blood type. In order to understand nutrition according to the blood type which is thought to increase the level of nutrition and quality of life, the subject should be strengthened by conducting more studies. By accessing to larger sample groups, the subject can be examined more extensively by working with more nutrient variables.It is possible to shed light on the subject with more comprehensible and proven information as the number of popular diets are increasing rapidly by new ones every day and there is information pollution about the subjects.

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9. APPENDİXES

9.1. Appendıx 1. Questionnaire used in the research

YEDİTEPE UNIVERSITY

FACULTY OF HEALTH SCIENCES

NUTRITION AND DIETETICS DEPARTMENT

Dear participant,

The aim of this study is to search searching the effects of blood groups on the nutritional habits of ındividuals admitting to a private clinic for nutrition counselling, comparison with anthropometric measurementsyour identity and answers will be kept confidential by researchers. Please do not leave blank answers. Thank you for your participation.

Survey

Survey no :

Date :

I. GENERAL INFORMATION

1. Gender :

a) Male b) Female

2. Age :

3. Marital status :

a) Married b) single c) widow/widower

4. Your job :

5. What is your educational status?

A. Primary school graduate c. High school graduate

B. Secondary school graduate d. University graduate

E. Master / doctor

6. Your blood type:

A) A rh+ c) B rh+ e)AB rh+ g) 0 rh+

B) A rh- d) B rh- f) AB rh- h) 0 rh-

7. Do you smoke?

A. Yes b. No

8. ıf yes, how often and how many cigarettes do you smoke?

9. cigarettes per day cigarettes per week …….. Cigarettes per month

10. do you have the habit of regularly drinking alcoholic beverages?

a. Yes b. No

11. ıf yes, how often and how much alcohol do you consume?

Per day/week/month …….. Cup / goblet / bottle / box ……..(beer / wine / raki / vodka etc.)

12. 12. Do you have any or any of the following situations?

a) hypothyroidism e) chronic liver disease

b) anemia f) chronic renal failure

c) diabetes g) heart failure

d) hyperthyroidism

13. What is the highest body weight you have during your lifetime?

.....kg

14. What is the lowest body weight you have during your lifetime?

.....kg

15. Do you follow a specific diet?

16. If your answer is yes, what is the reason?

A) to lose weight b) due to health reasons c) vegetarian

D) to gain weight

17. are you taking any medication?

a) Yes b) no

18. If your answer is yes, for what disease do you use the medicine?

Name of the disease

19. Have you used any additional vitamin-minerals in the last year?

a) Yes c) no

If your answer is no, move on to the other question.

20. If yes, ıf the answer is yes, specify the purpose, frequency and duration of use of vitamins and minerals..

Vit&min : ……..

a) Amount : ……..

b) Duration : ……...

21. Do you exercise regularly?

(at least 3 days a week, at least 30 min a day brisk walking, jogging, football and so on.)

a) Yes b) no

II.NUTRITION HABITS

1. How many meals do you eat a day?

…….. Main meal, …… snacks

2. How do you define your eating speed?

a) Fast b) moderate c) slow

3. Are your meal times regular?

a) yes b) no

4. Indicate your appetite status (in general). ……

a) ı have no appetite b) moderate c) ı'm very appetite.

IV. ANTHROPOMETRIC MEASUREMENTS

1. Height:…….cm.

2. Body weight:……..kg.

3. Bmı:……..kg/m²

4. Waist circumference:……cm.

5. Hip circumference:……cm.

6. Waist-hip ratio: …….

V. FOOD CONSUMPTION FREQUENCY ACCORDING TO BLOOD TYPES

Food Consumptıon Frequency Chart For Blood Type A

Food	Amount	Everyday	6 days a week	5 days a week	4 days a week	3 days a week	2 days a week	Once a week	Once in 15 days	Once a month	Never	How many years?
Olive oil												
White meat												
Cereals												
Vegetable												
Milk												
Red meat												

Food Consumptıon Frequency Chart For Blood Type AB

Food	Amount	Everyday	6 days a week	5 days a week	4 days a week	3 days a week	2 days a week	Once a week	Once in 15 days	Once a month	Never	How many years?
Mutton												
Beef												
Cheese												
Milk												
Dried nuts												
Legumes												

Food Consumptıon Frequency Chart For Blood Type 0

Food	Amount	Everyday	6 days a week	5 days a week	4 days a week	3 days a week	2 days a week	Once a week	Once in 15 days	Once a month	Never	How many years?
Red meat												
Fish												
Olive oil												
Sunflower oil												
Walnut												
Peanut												
Milk												
Wheat												

Food Consumptıon Frequency Chart For Blood Type B

FOOD	Amount	Everyday	6 days a week	5 days a week	4 days a week	3 days a week	2 days a week	once a week	once in 15 days	Once a month	Never	How many years?
Mutton												
Chicken meat												
White cheese												
Icecream												
Legumes												
Dried Nuts												
Olive												

9.2. Appendix 2. Ethics Committee Approval Form

T.C. YEDİTEPE ÜNİVERSİTESİ

Sayı : 37068608-6100-15-1512 **21/06/2018**
Konu: Klinik Araştırmalar
Etik kurul Başvurusu hk.

İlgili Makama (Pınar Çoban)

Yeditepe Üniversitesi Hastanesi, Biyokimya Anabilim Dalı Prof. Dr. Serdar Öztezcan'ın sorumlu olduğu **"Özel Bir Kliniğe Beslenme Danışmanlığı Almaya Gelen Bireylerin Beslenme Alışkanlıklarına Kan Gruplarının Etkisinin İncelenmesi Antropometrik Ölçümler ile Karşılaştırılması"** isimli araştırma projesine ait Klinik Araştırmalar Etik Kurulu (KAEK) Başvuru Dosyası (**1488** kayıt Numaralı KAEK Başvuru Dosyası), Yeditepe Üniversitesi Klinik Araştırmalar Etik Kurulu tarafından **20.06.2018** tarihli toplantıda incelenmiştir.

Kurul tarafından yapılan inceleme sonucu, yukarıdaki isimi belirtilen çalışmanın yapılmasının etik ve bilimsel açıdan uygun olduğuna karar verilmiştir (**KAEK Karar No: 871**).

Prof. Dr. Turgay ÇELİK
Yeditepe Üniversitesi
Klinik Araştırmalar Etik Kurulu Başkanı

Yeditepe Üniversitesi 28 Ağustos Yerleşimi, İnönü Mahallesi Kayışdağı Caddesi 34755 Ataşehir / İstanbul
T. 0216 578 00 00 www.yeditepe.edu.tr F. 0216 578 02 99

9.3. Appendix 3. Curriculum Vitae

Personal ınformation

Name	Pınar	**Last name**	Çoban
Place of birth	Tokat	**Date of birth**	01.10.1992
Nationality	T.C	**Tc. No**	55327530808
E-mail	pinarcbn1@gmail.com	**Tel**	0537 512 09 13

Education status

Degree	Branch	Name of graduate ınstitution	Graduation year
Doctorate			
Master's degree	Nutrition and Dietetic	**Yeditepe University**	2019
Bachelor's level	Nutrition and Dietetic	**Yeditepe University**	2016
High school		Generel Ali Rıza Ersin Lisesi	2010

Foreign languages	Foreign language examination grade
English	

ıf there is more than one exam (kpds, üds, toefl; ıelts etc.), all results should be written.

Work experience (sort from recent to oldest)

Position	Institution	Duration (year - year)
Nutritionist	Medicalpark Pendik Hospital	2018 October -Currently
Nutritionist	Private Nutrition Clinic	2017 December-2018 October
Nutritionist	Anadolu Sağlık Merkezi-	2016 December -2017

	Johns Hopkins Hospital	November

Computer skills

Programme	**Ability to use**
Microsoft office	Very good

*** rate as very good, good, moderate, weak**

Scientific studies

articles published in scı, sscı, ahcı indexes

Articles published in other journals

Papers presented at ınternational scientific meetings and published in proceedings

Publications in the proceedings of refereed conferences / symposiums

Diğer (görev aldığı projeler/sertifikaları/ödülleri)
