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The Health Belief Model and the Gluten-Free Diet: Are Gluten-Free Products Really Beneficial in Athlete Diets?*

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Abstract

People often think gluten-free products are healthier. This idea has been a source of motivation for many consumers, including athletes. With the growing popular perception that gluten-free foods are healthier, whether this diet is actually beneficial has had to be questioned. In the study, on the basis of the Health Belief Model, it was evaluated how the gluten-free diet was preferred among the athletes. With this study, it is aimed to contribute to the formation of awareness in athletes on this issue. Scientific publications published so far have been examined with a systematic literature search. 45 studies between the years 2012-2022 in Web of Science, Scopus and TR Index databases have been examined. "Are Gluten-Free Products Really Beneficial in Athlete Diets?" in all of the reviewed publications. The answer to the research question was sought. The data analyzed with the MAXQDA 2020 qualitative data analysis program were classified and interpreted by the content analysis method. The study was designed according to the ENTREQ control guideline. As a result of the sources examined, it has been determined that a gluten-free diet facilitates digestion, lowers cholesterol levels and reduces cardiovascular risks. However, it has been observed that the body is deficient in meeting the nutrients it needs. Studies conducted in various countries have shown that gluten-free products have poor content, especially in terms of protein and iron content that athletes need. Most of the obtained publications were compilation type. However, it is thought that case studies to be conducted with athletes who eat gluten-free in future studies will allow to discuss the subject from a different aspect.
Keywords: Athlete diet, Health belief model, Gluten-free diet, Gluten, Celiac.

*This study is an extended version of the paper titled "Are gluten-free products really useful in athlete diets?" presented at the 22nd National Tourism Congress.

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INTRODUCTION

Gluten is the structural protein component of wheat, rye and barley grains and forms the basis of various food products consumed worldwide (Bektaş et al., 2022; Kutlu, 2019). People diagnosed with celiac disease show various allergic reactions to this protein and need a gluten-free diet for life (D'angelo & Cusano, 2020). The key to a healthy gluten-free diet is to identify foods that the body shows allergen effects on and remove them from their diet.

In addition to celiac patients, the presence of individuals living with gluten intolerance (non-celiac gluten sensitivity) in the community has reached a sensible and undeniable dimension. Individuals with non-celiac gluten sensitivity report reduced symptoms when they removed gluten from their diet (Rosenbloom, 2014). Products such as rice, corn, quinoa, potatoes, buckwheat, amaranth should be included in the diet instead of carbohydrate sources such as wheat, rye, barley, amaranth , semolina containing gluten (Rosenbloom, 2014; Bektaş et al., 2022).

The belief that gluten-free products are generally healthier is the biggest motivator for many consumers, including athletes (Market Research, 2022). Along with the increasing popular perception that gluten-free foods are healthier, there has been a dramatic increase in the demand and consumption of gluten-free foods (D'angelo & Cusano, 2020). The fact that this condition is also widespread among non-celiac athletes has necessitated the need to question whether a gluten-decontaminated diet is really useful. Using the content analysis method, scientific studies published in the last 10 years in the Web of Science, Scopus and TR index databases were examined. In the results to be obtained from the studies conducted on athletes interested in different sports, the answer to the question of whether gluten is really useful has been sought. With this study, it was aimed to create an awareness among athletes about the gluten-free diet, which is considered one of the healthy diet types.

THEORETICAL BACKGROUND

Athlete's Diets

Athletes resort to various diets to increase their performance, increase their November muscle mass by reducing fat ratios and to have a good fitness. Many athletes are greatly influenced by their social circles, teammates or coaches, especially by social media, about popular diets (Rosenbloom, 2014).

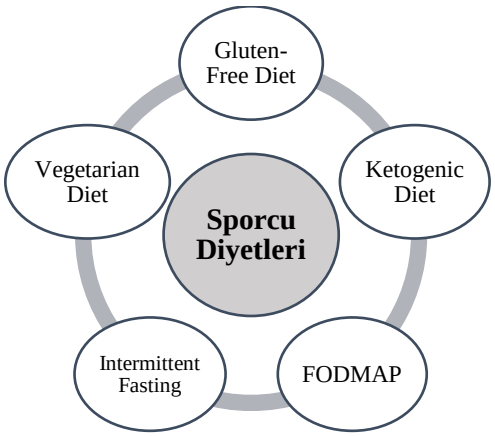


Figure 1. Athlete's Diets

As shown in Figure 1, five basic diets can be given as examples of the diets that athletes apply from time to time. These examples include the “Vegetarian Diet” in which plant-based food consumption is adopted, the “Ketogenic Diet” that requires high fat and low carbohydrate intake, “Intermittent Fasting” where a certain part of the week is fasted, low fermentable oligosaccharides, disaccharides, monosaccharides and polyols (FODMAP). Diet containing gluten and “Gluten-Free Diet” types, in which gluten-containing foods are abandoned, are some of the widely adopted ones among athletes. However, scientific studies have proven that these diets contribute to athlete conditioning (Devrim-Lanpir et al., 2021).

Gluten and Gluten-Free Nutrition

Gluten is a storage protein used as an energy source in some cereals (Ulusoy & Rakıcıoğlu, 2019) and helps to maintain the shape of the product during cooking by providing flexibility and moisture to food products. Although this protein is safe for consumption, it poses a risk for people with celiac disease, gluten sensitivity, gluten ataxia, and wheat allergies (Market Research, 2022). Allergic reactions occur in individuals who cannot tolerate gluten protein and this disease is called celiac disease (Hayıt & Gül, 2017). Gluten; it damages the downy formations that help digestion in the intestines of celiac individuals. This damage is caused by this protein in cereals such as wheat, barley, rye, oats. The only treatment for this disorder, which is considered to be the most common genetic disease of mankind with its current condition, is a strict gluten-free diet that will last a lifetime (Ministry of Health, 2022).

In addition to individuals who cannot tolerate gluten protein, the number of people who adopt a gluten-free diet with the idea that a gluten-free diet is a healthier way of eating is increasing day by day. However, it should be noted that foods containing gluten are useful in cases where they are not sensitive or allergic. Gluten-containing grains, such as barley, wheat and rye, are rich in fiber, vitamins and minerals (D'angelo and Cusano, 2020). Gluten-free nutrition has become a dietary trend, as it has been favored by people with sensitivity, as well as by consumers who want to stay fit (Di Cairano et al., 2020; Şahin et al., 2022).

12-15% of the daily energy should be obtained from proteins, 55-60% from carbohydrates, and 25-30% from fats (Aydoğan, 2018). Considering that gluten protein is also often found in foods in the carbohydrate group, athletes need foods that contain gluten-free carbohydrates. Basic carbohydrate substitutes for a gluten-free diet rice, corn, linen, quinoa, tapyoka, Potatoes, amaranth, nuts and beans (Nelsen, 2002). Food groups and replacement products containing gluten are shown in Table 1.

Table 1. Foodstuffs and substitutes containing gluten (Eberman & Cleary, 2005; Küçük & Yıbar, 2021)

Food Group	Gluten-Containing Foods	Substitution Products
Cereals	Wheat starch, wheat flour, wheat germ, wheat bran, rye flour, oat bran, barley	Rice, rice flour, corn, corn flour, corn starch, potato flour, soy flour, rice varieties, tapioca, amaranth, quinoa, rice bran, flaxseed,millet
Proteins	Canned meat dishes	Varieties of fresh meat and seafood, peanuts and nut butter, beans soy beans, chickpeas, lentils
Fruits	Canned or frozen fruits	Fresh fruits
Vegetables	Canned or frozen vegetables	Fresh vegetables
Dairy Foods	Types of milk and cheese with additives, commercial salad dressings	Eggs, natural milk, butter and cheeses

The fact that gluten-containing food products are wheat-based brings with it a serious problem for those who follow this diet. Reasons such as the fact that wheat is an economical and nutritious food, the widespread use of wheat-based preservatives in the food sector are some

of the disadvantages of a gluten-free diet. In addition to the fact that there is an economically unfavorable situation for those who eat gluten-free, there are also difficulties in the supply of nutritious substitute products.

Gluten in Sports Nutrition

Athletes take care of their nutrition to maintain and increase their performance and generally consume more protein than recommended (Meyer et al., 2020). While the ketogenic diet and paleo diet are more common among the diets applied among athletes (Terzi & Ersoy, 2022), the number of those following a gluten-free diet is increasing day by day. In sports diets, gluten-free products are mostly preferred to alleviate gastrointestinal problems (Graybeal et al., 2022). Gastrointestinal syndrome, a recently coined term among athletes, describes dysfunctions associated with strenuous exercise (Costa et al., 2017).

Gastrointestinal disorders are accepted as the most frequently reported diseases in international sports competitions (Pugh et al., 2018). Gluten intolerance, which is considered one of the gastrointestinal disorders, is one of the most common disorders that athletes can diagnose themselves. The gluten-free diet attracted the attention of athletes when Novak Djokovic, a famous tennis player, attributed his success in his profession to a gluten-free diet. Although there is no scientific evidence that a gluten-free diet provides weight loss, athletes limit their grain sources in the belief that it will improve athletic performance (Lis et al., 2014; Rosenbloom, 2014).

Leone et al., (2020) found that athletes are approximately four times more likely to develop celiac disease themselves than other people. It was determined that the athletes who diagnosed themselves with celiac had high levels of depression and stress in terms of physical, psychological, social and environmental aspects. While it is known that a gluten-free diet facilitates digestion, lowers cholesterol levels and reduces cardiovascular risks, it can be said that the body is deficient in meeting the nutrients it needs.

Gluten-free diet is becoming widespread for many reasons, especially for reasons such as weight control and better gut health. As a result of the widespread use of this diet, gluten-containing grains, especially wheat, are avoided (Cabrera-Chávez, et al., 2017). However, as seen in Table 2, it is observed that the results of international studies on the nutritional values of gluten-free products support each other. The low protein and iron content of gluten-free products; The reasons such as being rich in saturated fat, sugar and salt are proof that this diet will bring more harm than good. It shows that this diet should not be adopted by athletes unless it is necessary, and that nutrients such as protein, iron and carbohydrates should be obtained from natural food sources as required.

Table 2. Examples from international studies on the nutritional values of gluten-free products

Author	Country	Subject of Study
Kulai & Rashid, 2014	Canada	It has been determined that the average protein and iron content of gluten-free products in Canada is lower than gluten-free products.
Wu et al., 2015	Australia	It was found that the average protein content of 3213 packaged gluten-free products in four major supermarkets in Australia was lower.
Fry et al., 2018	England	Gluten-free foods in the UK have been found to be richer in saturated fat, sugar and salt content.
Elli et al., 2015	Italy	A study in Italy found that gluten-free diets had a four-fold increase in blood levels of mercury.
Bulka et al., 2017	USA	It has been determined that the average arsenic and mercury levels in the urine of individuals who eat gluten-free in the USA are high.

Health Belief Model and the Gluten-Free Diet

Health Belief Model (HBM), It is a widely used model in research to study, detect, and form new habits in society (Vahedian-Shahroodi et al., 2021). The model has proven to be one of the most comprehensive conceptual frameworks used in health-based behavior for nearly 50 years. HBM was first introduced in the 1950s by a team of psychologists serving in the public health sector in the United States.

HBM, it argues that the health behaviors of individuals can be influenced by their beliefs, values and attitudes. HBM, which is based on a motivation theory, is based on the fact that accepting any innovation is not a completely rational process, beliefs, perceptions and the social environment can also have effects (Can, 2022). On the basis of HBM, there are elements of health-oriented motivation, and behind the increasingly widespread gluten-free eating actions, there is actually a drive to be healthier the most. The belief that gluten-free products are healthier has also become the biggest source of motivation for many consumers, including athletes (Market Reseach, 2022). The perception created by the social environment, especially social media, for these products leads consumers to the gluten-free diet trend. Athletes who demonstrate the action of HBM and gluten-free nutrition can be interpreted as follows;

1. The more the person feels at risk, the more sensitive he will be to his risky behavior and he will resort to a change in that behavior. For example, if a person finds that gluten protein causes symptoms that interfere with sports activities, they may avoid foods with this protein and adopt a gluten-free diet. As a matter of fact, in the study of Lis et al., (2014) on the prevalence of gluten-free diet in athletes, it was determined that 57% of 942 non-celiac athletes diagnosed gluten intolerance themselves.
2. The reason for the basis of athletes' eating habits is related to the severity of the current situation and the requirements of the sport they are interested in. For example, gluten protein may have a more severe effect on athletes diagnosed with celiac disease compared to a non-celiac athlete. This difference at the point of gluten sensitivity can affect the nutrition routine by creating a person's perception of seriousness. As a matter

of fact, it is stated that athletes have reduced their gluten consumption by about 50% to 100% because they believe that gluten causes poor performance (Lis et al., 2014).

3. Athletes may turn to different types of nutrition with the idea of reducing the severity of their ailments or becoming healthier. The idea that someone with gluten sensitivity will have a healthy digestive system by avoiding wheat-derived foods can be explained by the perception of benefits. Again, Lis and others (2014) found that 8% of the participants had reduced symptoms of abdominal swelling, gas, diarrhea and fatigue along with the gluten-free diet they followed. However, in another study conducted in contrast, 13 non-celiac cyclists were subjected to a gluten-free diet for seven days and observed that this diet did not provide any advantage in the performance of athletes (Lis et al., 2015).
4. Athletes have individually perceived barriers to adapting to a new diet. Due to the fact that gluten-free foods are more costly and tasteless compared to gluten-containing foods, consumers may turn to gluten-containing foods from time to time, knowing the symptoms they will experience. This situation can be explained by the perception of disability in the gluten-free diet tendency.

Perceived sensitivity and seriousness can potentially cause an individual to seek health. A healthy circulatory system and weight loss drive for athletes can also motivate the person to eat gluten-free, along with the perception of benefits. However, economic barriers and product restrictions are some of the obstacles in front of people in gluten-free nutrition. In the light of all these factors, bodily symptoms, environmental stimuli, or media can be seen from the trigger factors to put the person into action. Again, even in local markets, the creation of gluten-free edits and the increase of social media blogs that share gluten-free recipe content are among the reasons that lead people to this diet.

When all these factors are taken into consideration, it is observed that there are many reasons that push the person to gluten-free nutrition. However, the basis of healthy eating habits of individuals is emotional or physical motivation. The main motivation in performing the act of gluten-free nutrition is to lose weight and have a better body mass index. For this reason, the review of studies on gluten-free athletes so far and the determination of the main motivational elements constitute another purpose of the study.

METHOD

Research Model

Systematic Literature Searches (SLTs) make it easier for us to reveal what we know and what we don't, by conducting research on published documents. It shows how the studies made with content analysis can be scientificized. In this study, SLT, one of the qualitative research techniques, was adopted as a method.

In the study, gluten-free nutrition action was explained in athletes within the framework of HBM, which is one of the motivation theory models, and it was discussed whether this diet is beneficial in sportsman's diets as it is thought. Since the study started with a research question and the conclusion of the research could not be determined beforehand, the inductive approach was adopted. We certainly cannot make a hypothesis, assumption or prediction in a qualitative study. Because we do not know where the research process will take us. Studies that can directly contribute to the study were scanned with the following five basic keywords/word

sequences from the determined databases. The aforementioned keyword/word sequences were scanned in two languages, English and Turkish. The keywords/word sequences that can answer the research question are as follows;

1. Gluten (Gluten)
2. Gluten-Free Diet (Gluten-Free Diet)
3. Gluten in Athlete Diets
4. Gluten-Free Diet in Athlete Diets
5. Gluten-Free Diet for Celiac Athletes (Gluten-Free Diet for Celiac Athletes)

Population and Sampling

The sample to be used in SLT studies represents all of the articles required to answer the research question. In this study, 45 articles obtained after determining the keywords related to the subject represent the sample of the study. The sampling process proceeded as follows;

1. Five basic keywords/word sequences were used in the research process. The keywords used were created by examining previous studies on this subject. Scopus, Web of Science and TR Index were preferred because they have journals with high impact factor value and allow a comprehensive search.

2. In the search made on 1 December 2022, a total of 45 studies were obtained between the years 2012-2022.

3. The 45 studies obtained were downloaded in Excel CSV form. During the sorting phase of the articles, the titles and abstracts of each study were examined. The reviewed studies were coded as 1: Directly Related and 2: Indirectly Related. The coding was repeated twice at different times. As a result of the coding, 33 studies were coded as 1, 12 studies: 2.

Ethic Approval

This article is the 22nd edition on the theme of “Sports Tourism”. Presented at the National Tourism Congress “Are Gluten-Free Products Really Useful in Athletes' Diets? it includes an expanded version of the full text entitled ". It refers to the form in which the content of the relevant communiqué has been created by developing and partially changing it. The presented paper contains the main findings of this study, which may be the summary of this study due to certain content restrictions of the congress board. In addition to the statement that deals with the subject as a literature review,; a systematic screening was conducted in this study, and the analysis methods used were described in detail. Again, the association of the gluten-free nutrition trend between HBM and athletes constitutes one of the main differences Decoupling the study from the report.

Data Collection

Systematic literature search, which is one of the qualitative research methods, was conducted in the research. Studies that published between January 2012 and December 2022 in Web of Science, Scopus and TR Index databases were examined. Since 2023 has not been completed yet, studies published in this year were not included in the research. It has been determined that

33 of the 45 studies obtained have the value to contribute directly to the study, and the remaining 12 studies are indirectly related to the research topic.

Data Analysis

The MAXQDA 2020 qualitative data analysis program was used in the study and the studies obtained through document analysis were examined. The documents examined were interpreted with the hierarchical code subcode model of the MAXQDA 2020 qualitative data analysis program. As shown in Figure 2, data obtained through interviews, observations or documents in content analysis are analyzed in four. The study was designed according to the ENTREQ control guideline (Tong vd., 2012).

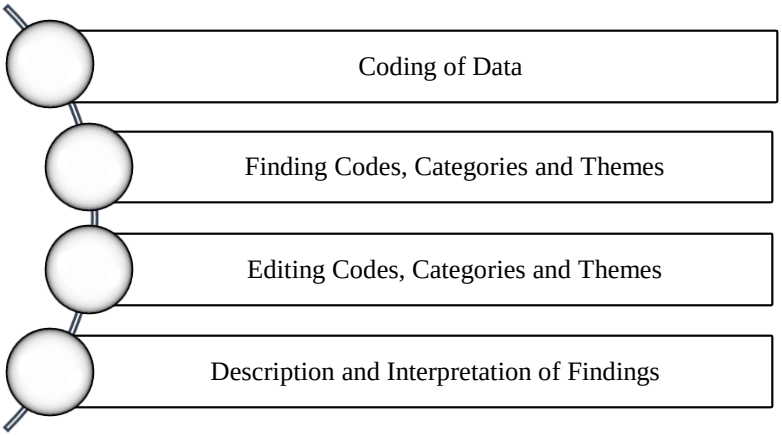


Figure 2. Content analysis stages (Eysenbach & Köhler, 2002).

FINDINGS

In this part of the study, the validity-reliability and the summary of the findings are expressed. Summarizing information such as from which database the examined articles were drawn, what the content information is, study subjects and research types are included. In a qualitative research; The researcher is expected to have a certain degree of consistency in the processes of data collection, analysis, and interpretation, and explain in detail how he achieved this consistency. It is also important for the researcher to critically question the qualitative research process and to have a good command of the process in order to minimize possible mistakes (Baltacı, 2019).

In this study, the results of 33 directly related articles that could answer the research question were evaluated in order to test the validity of the study results. The remaining 12 studies. Since it is not directly related to the research question, it was not interpreted in the findings section. For the reliability of the study, the results obtained as a result of the evaluations of two different coders are shared. After the agreement between the coders was achieved, the results of the study were interpreted. Figure 3. as shown in, a total of 45 studies were achieved with five basic keyword/word sequences and date restrictions. Turkish English and 10% of the studies were obtained from TR Index, 35% from Web of Science, 30% from Scopus and 25% from both Web of Science and Scopus joint indexes.

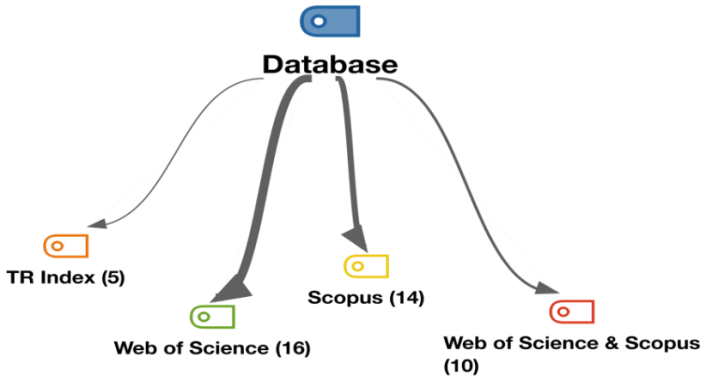


Figure 3. Frequency distributions of examined databases

Of the 45 studies examined, 77% were created using qualitative approaches and 23% were created using quantitative approaches. As shown in Figure 3, as a result of the screening, it was determined that four techniques from qualitative approaches and only questionnaire techniques were used from quantitative approaches. It has been observed that the majority of the studies that are handled with a qualitative approach are compiled as a type of compilation. According to the review studies, minority case studies, experimental studies and systematic literature screening are other qualitative approaches used. The survey technique was the only technique used in the quantitative approach and represents 23% of the studies studied. In accordance with the research purpose, studies that directly explain the relationship between athletes and gluten-free nutrition have been found to be more focused on a qualitative approach. It is thought that more case studies are needed to determine the benefit and harm rate of the gluten-free diet in sports nutrition and to achieve more concrete results.

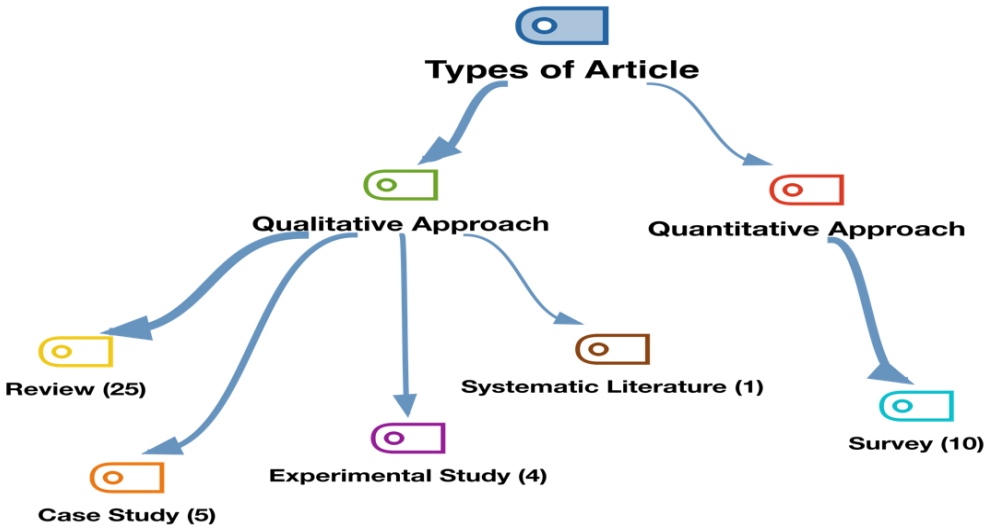


Figure 4. Method distribution of examined studies

The common result of studies conducted on athletes from different sports branches is that there is no proven benefit of gluten-free diet in athletes' diets. Since the number of studies conducted on gluten-free athletes is extremely limited, it does not seem very possible to make precise inferences. However, there have been no findings in case studies conducted so far that a gluten-free diet offers a positive contribution to athlete nutrition. Celiac disease and gluten-free diet were not directly evaluated because the subject was indirectly related to this study. The main results of a total of 33 studies that directly serve the research purpose and the answer to the research question are shown in Figure 6.

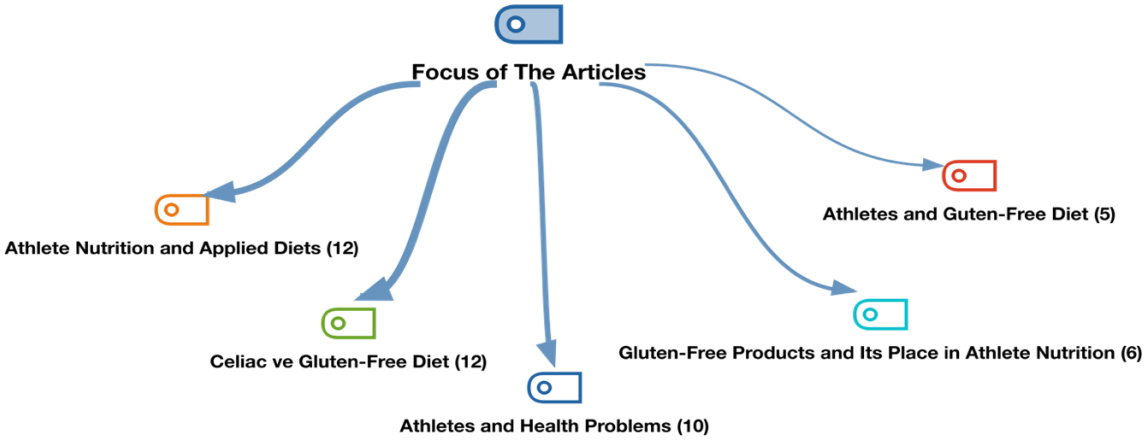
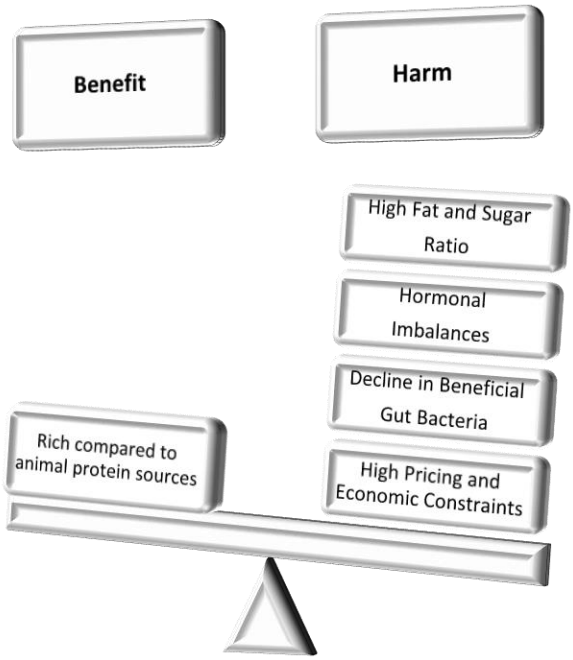


Figure 5. Subject distribution of examined studies



In Figure 6, a lever has been created with the keywords expressing the results of the studies examined on the subject. These keywords are “Is gluten really helpful in athlete diets?” It refers to the main results of the scanned publications to search for the answer to the question. In all studies reviewed, there was no evidence that a gluten-free diet was "healthier" or resulted in an increase or decrease in sports performance. As a result, it was observed that gluten-free diets had no effect on exercise-induced intestinal damage (De Oliveira, 2017; Lis et al., 2014; Lis et al., 2015; Lis et al., 2019; Rosenbloom, 2014).

Figure 6. The benefits and harms of gluten-free foods for athletes

In gluten-free products, high amounts of fat and sugar are used to obtain a texture similar to the viscoelastic properties of wheat (Kreutz et al., 2020; Lis et al., 2016). For this reason, when athletes without gluten sensitivity follow this diet, they are faced with a poor quality diet, as they cannot meet the carbohydrates they need for training and performance. It has been found that gluten-free diets have no effect on intestinal damage caused by exercise, and there is no evidence that this diet provides benefits in preventing athlete's diarrhea (De Oliveira, 2017). Again, in another study, it is stated that the effects of a gluten-free diet on non-celiac athletes did not show positive effects on gastrointestinal health compared to a gluten-containing diet (Spriet, 2019).

Some of the common ailments among athletes are stomach pain/cramps, bloating, intestinal pain/cramps and diarrhea (Erdman et al., 2021). However, since there is no evidence about the benefits of gastrointestinal stress, immune response and athletic performance, a gluten-free diet should not be recommended to athletes who do not have celiac disease (Lis et al., 2019). Also recommended to athletes are bread, pasta, cereals, granola bars, etc. many carbohydrate foods contain gluten (Rothschild et al., 2020). However, athletes traveling for the competition may

have problems accessing gluten-free foods. It may be difficult for athletes to reach their carbohydrate needs by eliminating gluten-containing foods (Lis et al., 2016).

The main concerns of GFD for endurance athletes are low energy availability (Cialdella-Kam et al., 2016). Although GFD limits the consumption of some gluten-containing foods rich in CHO, which can lead to energy deficiency (Sharma et al., 2020). there is not enough data to investigate the effect of GFD on energy deficiency in endurance athletes. We suggest that more work is needed on this issue, especially with a well-planned GFD for endurance athletes. In addition, athletes who consume gluten-containing foods need to take their diet into account to a large extent, because they need to check all October foods for gluten content, which can negatively affect psychology.

DISCUSSION AND CONCLUSION

The best way to identify gluten-related problems is to remove gluten from the diet and check it clinically for health effects (Osorio et al., 2019). The ever-growing stream of gluten-free diets around the world has also manifested itself prominently among athletes. In this study, it is questioned whether the gluten-free diet, which is widespread among athletes, is a really beneficial diet.

Athletes during intense training are advised to avoid animal foods and take in more carbohydrates because their glycogen stores are rapidly depleted. Therefore, plates enriched with vegetable protein sources are extremely effective in improving athlete performance (Reguant-closure et al., 2020). However, an unsustainable costly diet is being adopted especially among athletes due to the gluten-free diet, which spreads rapidly day by day and greatly limits carbohydrate sources. As a result of some scientifically unproven and commercially profitable rumors, some professional athletes base the secret of their success on a gluten-free diet. Many athletes who do not have celiac disease believe that avoiding gluten improves gastrointestinal well-being, reduces inflammation, and provides an advantage for exercise performance (Lis et al., 2016).

It should be remembered that adopting this diet under the name of "healthy diet" for individuals who do not experience gluten intolerance can also create economic pressure. As a matter of fact, even though the sale of gluten-free food products in many retail stores is beginning to become widespread, the price difference between gluten and gluten-free food products is clear. It is seen that 250 grams of gluten-free flour of x brand in online sales channels is sold for 14.50 TL. The price of 1 kg of flour containing gluten belonging to the same brand is seen to be offered for sale at 14.00 TL (Trendyol, 2022). With the growth of the gluten-free market, corn and rice flour, which are cheap but weak in fiber, vitamin and mineral content, have been replaced by nutritious and expensive cereal products such as amaranth, buckwheat and quinoa (Catassi et al., 2015). From this point of view, considering the cost of the gluten-free diet to the consumer, the inability to reach enough food at an affordable price can lead to stress formation and psychological deformation (Cialdella-Kam et al., 2016).

In this review study, which questioned whether the gluten-free diet, which is common among athletes, was really beneficial; related publications were discussed within certain limits. The nutritional deficiencies of gluten-free products or the health problems faced by gluten-free people have been tried to be supported by scientific studies in this field. As a result, as athletes' nutritional knowledge increases, so does their level of meeting their nutritional needs (Spronk

et al., 2014) and healthy eating preferences become more prevalent (Jenner et al., 2018; Trakman et al., 2016). Therefore, it is believed that nutritional literacy among athletes should develop. Nutritional literacy covers a wide range of topics from the conditions in which nutrients are prepared, cooked and stored to the situations in which they pose risks. This awareness should be brought to everyone, including athletes, starting from a young age (Park et al., 2022).

In future studies, it is thought that a qualitative study to be conducted with gluten-free athletes from various sports branches will be useful in terms of addressing the issue in detail and discussing it from a different aspect. In addition to this research proposal, it is thought that it would be useful to examine the effect of gluten-free products on candidates engaged in different sports in October in a comparative manner using an experimental research model. Again, it is believed that carrying out product development studies that increase the nutritional value of gluten-free products for celiac athletes will offer concrete contributions to the field.

Limitations of the Research

For the articles included in the research, Scopus, Web of Science and TR Index indexes, which are assumed to have the most reliable database in the field of food and gastronomy, as in many branches of science, were used. In order to customize the research topic and make a more efficient screening, studies that can be a direct answer to the research question have been examined. These studies were obtained on the five basic keyword/word sequence scale.

Conflict of Interest: There is no personal and financial conflict of interest between the authors of the article within the scope of the study.

Statement of the Contribution Rate of Researchers: Research Design-DG, Data Collection-DG;, Statistical analysis- DG; Preparation of the article, DG; HC.

Information about Ethics Committee Permission: The research was prepared using a method that does not require ethics committee permission.

REFERENCES

Aydoğan, A. U. (2018). Spor yapan çocukta beslenme. *Klinik Tıp Pediatri Dergisi, 10*(5), 19-27.

Baltacı, A. (2019). Nitel araştırma süreci: Nitel bir araştırma nasıl yapılır?. *Ahi Evran Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *5*(2), 368-388. https://doi.org/10.31592/aeusbed.598299

Bektaş, Ş., Öztürk, İ., & Karaoğlu, S. Z. (2022). Glütensiz beslenen hasta ve sağlıklı yetişkinlerin beslenme alışkanlıklarının ve kaygı düzeylerinin değerlendirilmesi. *Bandırma Onyedi Eylül Üniversitesi Sağlık Bilimleri ve Araştırmaları Dergisi, 4*(2), 128-138. https://doi.org/10.46413/boneyusbad.1091857

Bulka, C. M., Davis, M. A., Karagas, M. R., Ahsan, H., & Argos, M. (2017). The unintended consequences of a gluten-free diet. *Epidemiology*, *28*(3), 24-25. https://doi.org/10.1097/EDE.0000000000000640

Cabrera-Chávez, F., Dezar, G. V., Islas-Zamorano, A. P., Espinoza-Alderete, J. G., Vergara-Jiménez, M. J., Magaña-Ordorica, D., & Ontiveros, N. (2017). Prevalence of self-reported gluten sensitivity and adherence to a gluten-free diet in Argentinian adult population. *Nutrients*, *9*(1), 81. https://doi.org/10.3390/nu9010081

Can, A. N. (2022). *The relationship between health beliefs and healthy lifestyle behaviours in obese individuals according to health belief model*. Master Thesis, İnönü University, Institute of Health Sciences, Malatya.

Catassi, C., Elli, L., Bonaz, B., Bouma, G., Carroccio, A., Castillejo, G., & Fasano, A. (2015). Diagnosis of non-celiac gluten sensitivity (NCGS): The Salerno experts' criteria. *Nutrients*, *7*(6), 4966-4977. https://doi.org/10.3390/nu7064966

Cialdella-Kam, L., Kulpins, D., & Manore, M. M. (2016). Vegetarian, gluten-free, and energy restricted diets in female athletes. *Sports*, *4*(4),1-12. https://doi.org/10.3390/sports4040050

Costa, R. J. S., Snipe, R. M. J., Kitic, C. M., & Gibson, P. R. (2017). Systematic review: Exercise-induced gastrointestinal syndrome-implications for health and intestinal disease. *Alimentary Pharmacology & Therapeutics*, *46*(3), 246-265. https://doi.org/10.1111/apt.14330

D'angelo, S., & Cusano, P. (2020). Gluten-free diets in athletes. *Journal of Physical Education and Sport*, *20*(Supplement Issue 4), 2330-2336. https://doi.org/10.7752/jpes.2020.s4314

De Oliveira, E. P. (2017). Runner's diarrhea: what is it, what causes it, and how can it be prevented?. *Current Opinion in Gastroenterology*, *33*(1), 41-46. https://doi.org/10.1097/MOG.0000000000000322

Devrim-Lanpir, A., Hill, L., & Knechtle, B. (2021). Efficacy of popular diets applied by endurance athletes on sports performance: Beneficial or detrimental? A narrative review. *Nutrients*, *13*(2), 1-40. https://doi.org/10.3390/nu13020491

Di Cairano, M., Condelli, N., Caruso, M. C., Marti, A., Cela, N., & Galgano, F. (2020). Functional properties and predicted glycemic index of gluten free cereal, pseudocereal and legume flours, *LWT - Food Science and Technology, 133*(2020), Article 109860. https://doi.org/10.1016/j.lwt.2020.109860

Eberman, L. E., & Cleary, M. A. (2005). Celiac disease in an elite female collegiate volleyball athlete: A case report. *Journal of Athletic Training*, *40*(4), 360-364.

Elli, L., Branchi, F., Tomba, C., Villalta, D., Norsa, L., Ferretti, F., & Bardella, M. T. (2015). Diagnosis of gluten related disorders: Celiac disease, wheat allergy and non-celiac gluten sensitivity. *World Journal of Gastroenterology*, *21*(23), 7110-7119. https://doi.org/10.3748/wjg.v21.i23.7110

Erdman, K. A., Jones, K. W., Madden, R. F., Gammack, N., & Parnell, J.A. (2021). Dietary patterns in runners with gastrointestinal disorders. *Nutrients, 13*(2), 1-15. https://doi.org/ 10.3390/nu13020448

Eysenbach, G., & Köhler, C. (2002). How do consumers search for and appraise health information on the world wide web? Qualitative study using focus groups, usability tests, and in-depth interviews. *BMJ*, *324*(7337), 573-577. https://doi.org/10.1136/bmj.324.7337.573

Fry, L., Madden, A. M., & Fallaize, R. (2018). An investigation into the nutritional composition and cost of gluten-free versus regular food products in the UK. *Journal of Human Nutrition and Dietetics*, *31*(1), 108-120. https://doi.org/10.1111/jhn.12502

Graybeal, A. J., Kreutzer, A., Willis, J. L., Braun-Trocchio, R., Moss, K., & Shah, M. (2022). The impact of dieting culture is different between sexes in endurance athletes: A cross-sectional analysis. *BMC Sports Science, Medicine and Rehabilitation*, *14*(157), 1-9. https://doi.org/10.1186/s13102-022-00549-4

Hayıt, F., & Gül, H. (2017). Çölyak ve çölyak hastaları için üretilen ekmeklerin kalite özellikleri. *Journal of the Institute of Science and Technology, 7*(1), 163-169. https://doi.org/10.21597/jist.2017127429

Jenner, S. L., Trakman, G., Coutts, A., Kempton, T., Ryan, S., Forsyth, A., & Belski, R. (2018). Dietary intake of professional Australian football athletes surrounding body composition. *Journal of the International Society of Sports Nutrition, 15*(1),1-8. https://doi.org/10.1186/s12970-018-0248-5

Kreutz, J. M., Adriaanse, M. P., Van Der Ploeg, E. M., & Vreugdenhil, A. C. (2020). Narrative review: Nutrient deficiencies in adults and children with treated and untreated celiac disease. *Nutrients*, *12*(2), 1-23. https://doi.org/10.3390/nu12020500

Küçük, S. C., & Yıbar, A. (2021). Popüler diyet akımlarının vücut ağırlığı ve sağlık üzerine etkileri. *Akademik Gıda*, *19*(1), 98-107. https://doi.org/10.24323/akademik-gida.927722

Kulai, T., & Rashid, M. (2014). Assessment of nutritional adequacy of packaged gluten-free food products. *Canadian Journal of Dietetic Practice and Research*, *75*(4), 186-190. https://doi.org/10.3148/cjdpr-2014-022

Kutlu, T. (2019). Glütensiz diyet: Gerçekten her zaman yararlı mı?. *Turkish Archives of Pediatrics, 54*(2), 73-75. https://doi.org/10.14744/TurkPediatriArs.2019.82609

Leone, J. E., Wise, K. A., Mullin, E. M., Gray, K. A., Szlosek, P. A., Griffin, M.F., & Jordan, C.A. (2020). Celiac disease symptoms in athletes: prevalence ındicators of perceived quality of life. *Sports Health*, *12*, 246-255. https://doi.org/10.1177/1941738120905137

Lis, D. M. (2019). Exit gluten-free and enter low FODMAPs: a novel dietary strategy to reduce gastrointestinal symptoms in athletes. *Sports Medicine, 49*(Supplement Issue I), 87-97. https://doi.org/10.1007/s40279-018-01034-0

Lis, D. M., Fell, J. W., Ahuja, K. D., Kitic, C. M., & Stellingwerff, T. (2016). Commercial hype versus reality: our current scientific understanding of gluten and athletic performance. *Current Sports Medicine Reports, 15*(4), 262-268. https://doi.org/10.1249/JSR.0000000000000282

Lis, D. M., Stellingwerff, T., Kitic, C. M., Ahuja, K.D., & Fell, J. (2015). No effects of a short-term gluten-free diet onperformance in nonceliac athletes. *Medicine and Science in Sports and Exercise, 47*(12), 2563-2570. https://doi.org/10.1249/MSS.0000000000000699

Lis, D. M., Stellingwerff, T., Shing, C.M., Ahuja, K.D., & Fell, J.W. (2014). Exploring the popularity, experiences, and beliefs surrounding gluten-free diets in nonceliac athletes. *International Journal of Sport Nutrition and Exercise Metabolism, 25*(1), 37-45. https://doi.org/10.1123/ijsnem.2013-0247

Market Research. (2022, September 9). *Gluten-Free Market Research Reports & Industry Analysis.* Accessible address: https://www.marketresearch.com/Food-Beverage-c84/Food-c167/Glüten-Free-c1915/

Meyer, N. L., Reguant-Closa, A., & Nemecek, T. (2020). Sustainable diets for athletes. *Current Nutrition Reports, 9,* 147-162. https://doi.org/10.1007/s13668-020-00318-0

Ministry of Health. (2022, September 9). Celiac Disease and Prevalence. Accessible address: https://hsgm.saglik.gov.tr/tr/metabolizma-ve-colyak/%C3%A7%C3%B6lyak-ve-g%C3%B6r%C3%BClme-s%C4%B1kl%C4%B1%C4%9F%C4%B1.html

Nelsen, Jr D. A. (2002). Gluten-sensitive enteropathy (celiac disease): More common than you think. *American Family Physician, 66*(12), 2259-2266.

Osorio, C. E., Mejías, J. H., & Rustgi, S. (2019). Gluten detection methods and their critical role in assuring safe diets for celiac patients. *Nutrients, 11*(12), 1-17. https://doi.org/10.3390/nu11122920

Park, D., Choi, M. K., Park, Y. K., Park, C. Y., & Shin, M. J. (2022). Higher food literacy scores are associated with healthier diet quality in children and adolescents: The development and validation of a two-dimensional food literacy measurement tool for children and adolescents. *Nutrition Research and Practise, 16*(2), 272-283. https://doi.org/10.4162/nrp.2022.16.2.272

Pugh, J. N., Fearn, R., Morton, J. P., & Close, G. L. (2018). Gastrointestinal symptoms in elite athletes: time to recognise the problem?. *British Journal of Sports Medicine*, *52*(8), 487-488. http://dx.doi.org/10.1136/bjsports-2017-098376

Reguant-Closa, A., Roesch, A., Lansche, J., Nemecek, T., Lohman, T. G., & Meyer, N. L. (2020). The environmental impact of the athlete's plate nutrition education tool. *Nutrients, 12*(8), 1-27. https://doi.org/10.3390/nu12082484

Rosenbloom, C. (2014). Popular diets and athletes: premises, promises, pros, and pitfalls of diets and what athletes should know about diets and sports performance. *Nutrition Today, 49*(5), 244-248. https://doi.org/10.1097/NT.0000000000000043

Rothschild, J. A., Kilding, A. E., & Plews, D. J. (2020). Prevalence and determinants of fasted training in endurance athletes: A survey analysis. *International Journal of Sport Nutrition and Exercise Metabolism*, *30*(5), 345-356. https://doi.org/10.1123/ijsnem.2020-0109

Şahin, M., Odabaş, E., & Çakmak, H. (2022). Kırık leblebiden elde edilen unun glütensiz erişte üretiminde değerlendirilmesi. *Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, *26*(2), 260-267. https://doi.org/10.19113/sdufenbed.1053753

Sharma, N., Bhatia, S., Chunduri, V., Kaur, S., Sharma, S., Kapoor, P., Kumari, A., & Garg, M. (2020). Pathogenesis of celiac disease and other gluten related disorders in wheat and strategies for mitigating them. *Frontiers in Nutrition, 7*(6), 1-26. https://doi.org/10.3389/fnut.2020.00006

Spriet, L. L. (2019). Performance nutrition for athletes. *Sports Medicine*, *49* (Supplement Issue I), 1-2. https://doi.org/10.1007/s40279-018-1027-9

Spronk, I., Kullen, C., Burdon, C., & O'Connor, H. (2014). Relationship between nutrition knowledge and dietary intake. *British Journal of Nutrition, 111*(10), 1713-1726. https://doi.org/10.1017/S0007114514000087

Terzi, M., & Ersoy, G. (2022). Sürdürülebilir beslenme sporcular için sürdürülebilir mi?. *Spor ve Rekreasyon Araştırmaları Dergisi*, *4*(1), 21-31. https://doi.org/10.52272/srad.1073827

Tong, A., Flemming, K., McInnes, E., Oliver, S., & Craig, J. (2012). Enhancing transparency in reporting the synthesis of qualitative research: ENTREQ. BMC medical research methodology, 12(1), 1-8. https://doi.org/10.1186/1471-2288-12-181

Trakman, G. L., Forsyth, A., Devlin, B. L., & Belski, R. (2016). A systematic review of athletes' and coaches' nutrition knowledge and reflections on the quality of current nutrition knowledge measures. *Nutrients, 8*(9), 1-23. https://doi.org/10.3390/nu8090570

Trendyol. (2022, September 12). Flour Prices. Accessible address: https://www.trendyol.com/sr?q=+un&qt=+un&st=+un&os=1&sst=PRICE_BY_ASC&pi=2

Ulusoy, H. G., & Rakıcıoğlu, N. (2019). Health effects of gluten-free diet. *Journal of Nutrition and Diet, 47*(2), 1-6. https://doi.org/10.33076/2019.BDD.1026

Vahedian-Shahroodi, M., Tehrani, H., Robat-Sarpooshi, D., GHolian-Aval, M., Jafari, A., & Alizadeh-Siuki, H. (2021). The impact of health education on nutritional behaviors in female students: An application of health belief model. *International Journal of Health Promotion and Education*, *59*(2), 70-82. https://doi.org/10.1080/14635240.2019.1696219

Wu, J., Neal, B., Trevena, H., Crino, M., Stuart-Smith, W., Faulkner-Hogg, K., Louie, J. C. Y., & Dunford, E. (2015). Are gluten-free foods healthier than non-gluten-free foods? An evaluation of supermarket products in Australia. *British Journal of Nutrition, 114*(3), 448-454. https://doi.org/10.1017/S0007114515002056