https://dergipark.org.tr/tr/pub/food
OPEN ACCESS JOURNAL

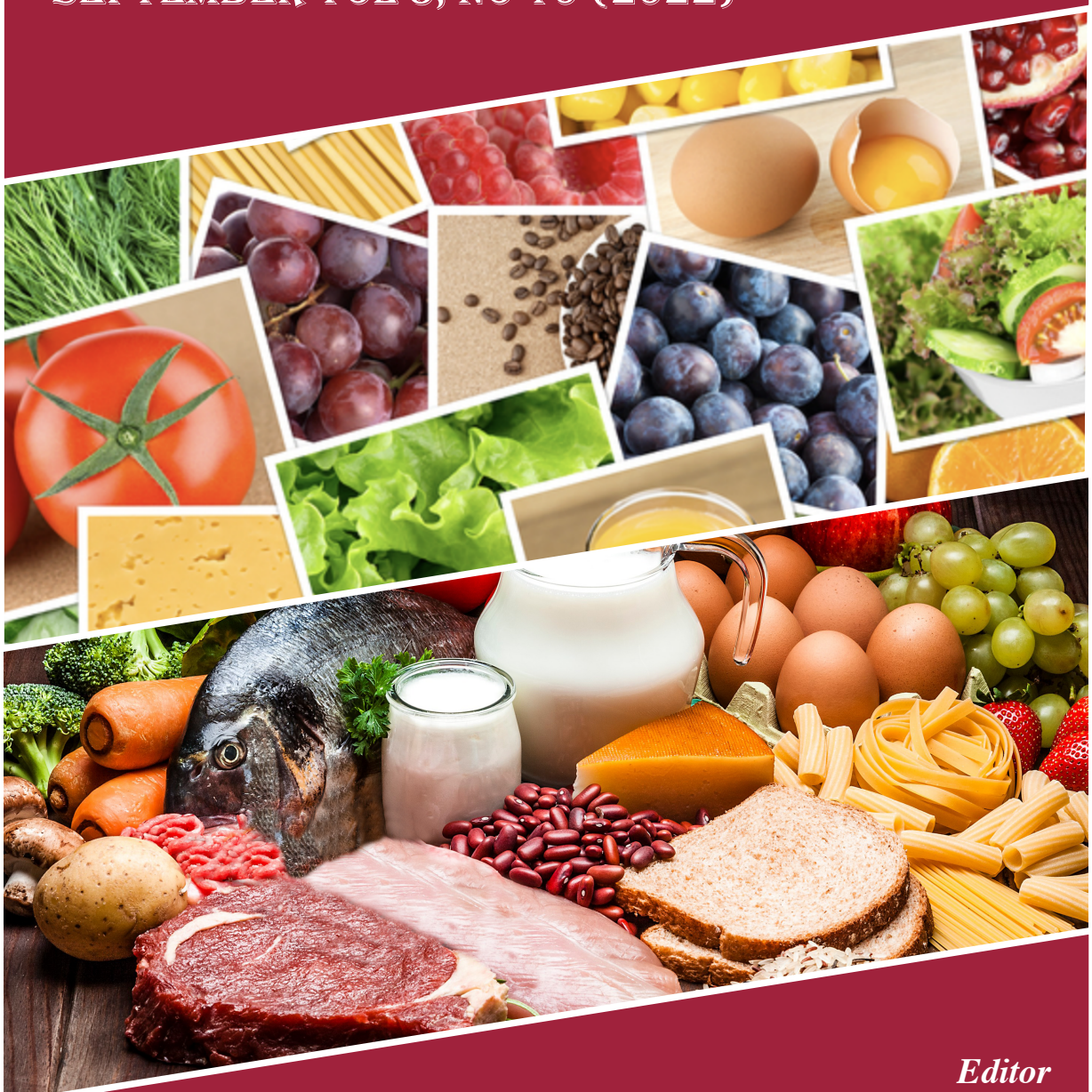
ISSN 2667-5803

DergiPark AKADEMİK
ASOS indeks

FHTI

JOURNAL OF FOOD HEALTH AND TECHNOLOGY INNOVATIONS

SEPTEMBER VOL 5, NO 10 (2022)



Editor
Prof. Dr. Özlem TOKUŞOĞLU

Journal of Food Health and Technology Innovations
September Vol 5, No 10 (2022)

TÜBİTAK ULAKBİM

https://dergipark.org.tr/tr/pub/food
OPEN ACCESS JOURNAL

ISSN 2667-5803

FHTI Journal of Food Health and Technology Innovations
September Vol 5, No 10 (2022)

DergiPark AKADEMİK

Review Article

Promising Tools for Food Safety and Quality: Artificial Intelligence and Smartphones

Ebru AKDOĞAN[1]*, Deniz BAŞ[2]*

Abstract

The use of artificial intelligence (AI) in the food industry can drastically improve food safety and quality control. The first step in using AI in the food industry would be collecting data from relevant systems, which is typically achieved with the use of various sensors. The data obtained from such sensors can be large and diverse and needs to be processed to extract relevant information. The final goal of using AI based systems for food applications is to create a system that can make independent, localized decisions and take appropriate actions. However, AI based systems can be costly and require expertise for their implementation. Using a smartphone can provide a cost-effective and easy to use solution for the widespread adoption of AI based methods in the food industry since they can be used as controllers, data processors, monitors, and even sensors. The data processing and AI algorithms can be performed trough mobile phone APPS. This review explores the latest research on the field of food safety and quality control using smartphones in combination with AI.

Keywords: Smartphones, artificial intelligence, machine learning, artificial neural networks, food safety, food quality

TÜBİTAK ULAKBİM

1 Department of Chemistry, Ankara Hacı Bayram Veli University, Ankara, 06900, Turkiye
2 Department of Food Engineering, Faculty of Engineering, Çankırı Karatekin University, Çankırı, 18100, Turkiye
http://orcid.org/0000-0003-1494-681X

*Corresponding Author: ebru.akdogan@hbv.edu.tr

Introduction

Since the term artificial intelligence (AI) was first introduced in 1956 by John McCarthy, driven by the focus and perspective of researchers, its definition evolved significantly. In a wide perspective AI is defined as "the ability of machines or computer systems to perform tasks that typically require human intelligence". Game playing such as chess, natural language processing to understand and generate human language, expert systems to mimic the decision-making abilities of human experts and robotics to perform tasks such as manufacturing, assembly, and transportation are among the early applications that made use of AI. Today, AI applications extended to many sectors including transportation, home/service robots, healthcare, education, public safety and security, employment, entertainment (1). In the food industry, the use of AI can greatly improve food safety and quality control. The first step for employing AI in these applications would be the collection of data from the relevant systems. In the food sector this data is usually generated via a wide variety of sensors. This data is large and diverse, characteristically heterogenic, unstructured, noisy, and contain high redundancy. Raw data need to be curated and stored then processed to extract relevant information. The goal is to eventually construct a system capable of autonomously making independent, localized decisions and take appropriate actions (2).

The literature reviewed for this article was collected from Google Scholar in the period 2018-2023. The following sets of keywords were used; Set-1: "food safety" and "artificial intelligence" and "smartphone"; Set-2: "food quality" and "artificial intelligence" and "smartphone". The search yielded a total of 2,250 and 1,310 papers, respectively. This review is limited to papers that include the use of both smartphone and AI.

Types of AI

When data is fed into artificial intelligence (AI), it can use either pre-set knowledge-based rules or identify underlying patterns and rules through machine learning. The former is known as rule-based or expert systems and the latter as machine learning (ML). In the rule-based systems, knowledge-based rules can be defined by physical principles or expert knowledge that is based on experience. Here, sensors or devices continuously monitor the system or process and collected data is analysed using pre-defined rules. Such systems are most beneficial in scenarios where real-time control is needed. However, the food materials' complexity and heterogeneity limits the use of rule-based systems in the food industry (2). In ML the AI learns from data rather than being explicitly programmed using pre-defined rules. Large amounts of unstructured data are input into ML algorithms, which after analysing it can identify patterns and relationships within the data. ML algorithms can be used to perform tasks such as generating an alert, taking action or predictive modelling (3). The three types of ML are; supervised, unsupervised, and semi-supervised ML. In supervised ML, the training data is labeled with the desired output, whereas in unsupervised ML it is not labelled. In semi-supervised ML combination of both type of data is used. ML models can be more precise and accurate than traditional statistical models, particularly when working with datasets that are large and have many variables (4). ML algorithms have tremendous potential in food safety applications. For instance, it was found that ML techniques like AdaBoost can be more successful at predicting the populations of indicator microoroganism E. coli image processing weather data compared to count-based regression models like Poisson and negative binomial(5). Artificial Neural Networks (ANNs) are a type of artificial intelligence (AI) that is based on the structure and function of biological neural networks that are commonly used in machine learning algorithms. They have the ability to learn from data, adapt to new inputs, and make decisions based on the information they have processed. They have gained significant attention in the food science field due to their ability to produce successful results in sensory analysis, pattern recognition, classification, prediction of microbial activity, and optimization of food processes (6).

Applications of AI in for food safety and quality control

AI has been applied in the food industry to classify and sort products based on size and shape, as well as to detect defects and the presence of microorganisms. Robotics, image processing technologies, and sensing

technologies, have been used in combination with AI to achieve these goals. The use of AI in the food industry for tasks such as sorting, classifying, and predicting various parameters, quality control and food safety are constantly increasing. Extensively used techniques include expert systems, artificial neural networks, fuzzy logic, adaptive neuro-fuzzy inference systems, and ML. AI can also be near infrared (NIR) spectroscopy, combined with electronic nose, electronic tongue, and computer vision system (CVS), greatly enhancing the capabilities of these technologies. The question remains which AI technique in combination with sensor will yield the best results for a specific task. In a recent review, Mavani et al. provided a detailed guideline on how to choose the most appropriate AI method (7). The guideline is summarised here and readers can refer to the review article for more details. First step in choosing the most suitable AI would be to define the objective of using AI for a given application such as classification, quality control, prediction, detection and so on. Then the sensor that will be used to collect the data needs to be chosen. The most appropriate algorithm based on the data and objective should be decided after which the available data and the algorithm of choice would be integrated. Finally, the performance of the model should be tested and validated based on R^2 and MSE values. If the model is not successfully validated a new algorithm should be chosen and the following steps should be repeated (7).

Combination of smartphones with AI for food safety and quality control

Smartphones are becoming popular tools for on-site sensing applications because they can function as controllers, data processors, monitors, and even sensors with have built-in function modules that can be used independently or in combination with other accessories in various sensing systems (8). The camera of most smartphones can capture images with high resolution and can actually perform as an optical sensor from which raw data is collected. The wired and wireless connectivity of smartphones also provides a point for the integration of external sensors that can be used in combination with the smartphone without compromising the portability of the system (Figure 1). For instance, Hamamatsu Photonics developed an ultra-compact, lightweight, and low-cost micro-spectrophotometer that is small enough to fit on the tip of a finger. It is able to measure in the visible wavelength range and can be used for colour sensing and point-of-care testing with smartphones. Smartphones have been used in optical biosensing systems that utilize techniques such as colorimetry (9), fluorescence (10), and surface plasmon resonance (11) where they act as an image capturer and processer. The processing power of the smartphone provides a platform for programming and/or deploying applications (APPs) empowered with AI for analysing the image. With the use of miniaturised external potentiostats, a smartphone can be used as an electrochemical sensor (12). Biosensors are another type of sensor that can be integrated to smartphones and provide data for food safety and quality control applications. A biosensor is a device that combines a biological component with a physicochemical detector to detect specific components based on the principle that certain biomolecules have the ability to selectively recognize other components. Enzymes, hormones, tissues, cells, or organelles are typically used as sensing elements. They can be used to quickly detect various aspects of food safety, such as microbial burden, additives, and contaminants offering several advantages such as affordability, ease of use, rapid response, high sensitivity, specific detection, and the ability to multiplexing. Hence the combination of biosensors and smartphones can be very useful in portable field detection (6).

The most straightforward technique for combining smartphones with AI is the adaptation of computer vision system (CVS), which analyse various parameters such as the size, colour, shape, and texture from a digital image. A smartphone camera has been proven to be an effective and low-cost tool for the implementation of CVS. In fact, “Smartphone-based Image Processing" has found use in imaging-based quality control applications (13). Such image processing for food quality and safety assessment is becoming more popular due to its advantages over traditional techniques such as; being non-destructive, eco-friendly and user-friendly, safe to use, energy-efficient, fast, low-cost, not requiring highly-skilled personnel, reducing human error and having high precision (14). Besides these, as being naturally portable, a smartphone-based system

allow on-site analysis without additional investment costs for information technologies.

Image processing applications typically involve three steps; image capturing, pre-processing, and feature extraction. In the image capturing step a camera module is used to take pictures of the test samples. The most commonly used strategy is to capture RGB (Red, Green, Blue) colour images. RGB images can also be converted to the CIELAB (device-independent colour space; L*, a*, b*, C*ab, and Hab) or HSV (Hue, Saturation, Value) colour space. IR and hyperspectral images can also be used. The pre-processing step consists of removing noise from the input image and separating the region of interest (ROI) from the background. In the feature extraction step, features that are based on colour, texture, morphology and/or the geometry are extracted using image processing techniques. Furthermore, ML can be employed for the quality-based classification of food items. Alternative to feature extraction-based approaches, Convolutional Neural Networks (CNNs) can also be used but such models generally require a large number of images (tens of thousands) as input data (14). A machine vision-based smartphone app was developed to accurately predict the tenderness of beef samples. The app used an image processing algorithm to extract texture features from the images of beef. These features were then correlated with instrumental data obtained through texture analysis using an ANN model (15). Models based on ANNs and colour measurement to predict the fermentation index of fine cocoa beans have been developed and tested using RGB values obtained from a smartphone camera as an inexpensive and easy method for predicting the fermentation index in cocoa beans (16). Nasiri et al. developed a deep Convolutional Neural Network (CNN) for classifying healthy and defective date fruit, and predicting how ripe healthy dates were. The training and testing of the model was performed on a dataset of images of four different classes of date fruit that was collected using a smartphone camera. Their model achieved a classification accuracy of 96.98% outperforming traditional classification methods that were based on feature engineering (14).

A sensor system that accurately identify organic and conventional apples has been developed by Song et al. using a diffraction grating sheet and a smartphone. The system was tested on 150 apples and analysed using computer vision techniques and ML algorithms. The employed algorithms were able to accurately classify the samples, even with low-quality images, with accuracies ranging from 93% to 100%. The proposed system was the low-cost and non-invasive (17). In another study, Song et al. developed a sensor where a sequence of light of different colours is generated using a smartphone and the record a video of the reflected light from a food sample to perform authentication. The video was transformed into sensor data using computer vision techniques which was then analysed using pattern recognition techniques. The accuracy of the sensor system tested on olive oil and milk was reported to be 96.2% and 100%, respectively (18).

Turco et al. used Multi Imaging Analysis (MIA) of digital images obtained from a smartphone camera and NIR spectra of geopropolis. They aimed to create Partial Least Square (PLS) regression models to foresee of the total flavonoid content and antioxidant capacity of geopropolis' ethanolic extracts. When models were compared it was observed that Color-based PLS models had better precision while the predictive capacity of the two models was similar. Both the digital photos and NIR spectra combined with PLS models were shown to have a potential for predicting the TFC and AC of geopropolis with acceptable accuracy, offering a fast and low cost method for controlling the quality of geopropolis extracts (19).

Traditional methods for assessing the quality of beverages such as high-performance liquid chromatography, gas chromatography, UV-visible and NIR spectrometers, colorimeters and viscometers etc. can be time-consuming, costly, involve expensive equipment and require trained personnel. Sensory evaluation practices require a fixed panel of trained experts which is costly and time-consuming (20). Some industries rely on a single person to assess the sensory quality which is not objective or reliable. Hence ML coupled smartphone empowered CV methods can also be used for this purpose. For example,

Li et al. proposed a novel method for evaluating the quality of Keemun black tea. For this purpose, smartphone imaging, micro-NIR spectrometry, and ML techniques were used. The method involved obtaining colour, texture, and spectral data from the tea samples. An ML was used to classify the quality grades of the tea. The proposed method was reported to be more accurate than evaluating the colour, texture, or spectral data separately (21). De Lima et al. used digital images obtained from a smartphone camera for the classification of red wines based on colour histograms and supervised pattern recognition techniques. They were able to correctly differentiate the wines produced in the São Francisco Valley region from the wines from other regions. Furthermore, their method correctly classified wines based on winemaker and grape variety, with a high degree of accuracy (22).

Gunda et al. developed a mobile application platform for water quality monitoring, and specifically for bacterial contamination. The platform incorporated a low-cost rapid test kit (Mobile Water Kit) to detect indicator bacteria (Escherichia coli) in water samples within an hour. The detection was based on the appearance of pinkish red colour on the surface of the sensing area with its intensity representing the level of bacteria in the water samples. The mobile APP used an image of the sensing area to classify it into E. coli present or absent using deep learning techniques with Google Tensorflow. Approximately 99% accuracy has been achieved in classification (23).

The use of AI incorporated smartphone technologies can be used to detect food adulteration. For example, Costa et al. described a fast, low-cost, and portable colorimetric method for detecting milk adulterants using a smartphone camera and lab-made apps based on the histograms of the RGB images and partial least squares regression. The method was based on reactions that result in colour change such as detect hydrogen peroxide, starch, and sodium hypochlorite (24). Tripathy et al. realized the development of a paper-based pH sensor for detecting milk adulteration using smartphone cameras and ML algorithms to classify the sensing platform's colour transitions into different pH ranges. A high accuracy of the classification using support vector machines was achieved (average accuracy of 99.71%) the freshness of milk and the quality of pasteurization could also be determined (25). Iymen et al. developed a method using AI and transverse sound vibrations to verify the authenticity of food products identifying whether they are organic as claimed by the manufacturer. The method involved neural networks with mel-frequency cepstral coefficient (MFCC) feature extraction techniques. They used a selection of butter and cheese samples with the aim of not only differentiating butter from cheese, but also differentiating between dairy products with and without non-dairy additives. They demonstrated a concept that could be used to create a smartphone app that allows consumers to check the quality of their food (26). A smartphone APP has been developed by Gong et al. for real-time monitoring of food freshness using a colorimetric indicator made of cellulose paper with synthesized gelatin methacryloyl (GleMA) that changes colour based on the freshness of meat. A convolutional neural network (CNN) model trained on labeled images of the indicator has been integrated to the APP resulting in a prediction accuracy of 96.2%. The APP has been proposed to be used by consumers to quickly determine the freshness of meat within 30 seconds (27). More sophisticated yet low-cost apparatus can be combined with smartphones and AI. For instance, Coronel-Reyes et al. developed a method for predicting the storage time of eggs at room temperature using a low-cost smartphone-connected near-infrared reflectance spectrometer and an ML algorithm. According to the researchers their technique has potential in both industrial and consumer use (28). Such systems have the potential to be easily used by the end-users if they can be produced at a low cost (29). Food Sniffer is such an example. It is a handheld device that connects to a smartphone through an app with the ability to assess the freshness of raw meat, poultry, and fish. The device measures the gas levels of the raw meat to determine the freshness and safety of the meat for consumption (30).

Conclusion

AI is defined as the ability of machines or computer systems to perform tasks that typically require human intelligence. The use of AI in the food industry can dramatically

improve food safety and quality control. Despite the huge promise it holds, the adoption and use of technologies generating data to support AI in the food and agriculture industry is currently limited to developed countries. Farmers and small producers in less developed parts of the world lack the resources to utilize or implement such tools. Smartphone based systems can contribute to overcome such limitations due to their ease-of-use and cost-effectiveness along with other actions such as education, financial and governmental support for implementation. The first step in using AI in conjugation with smartphones in the food industry is collecting data from relevant systems, which is typically done through the use of sensors. These sensors can either be the camera of a smartphone or an external sensor that can be connected to the smartphone. The data collected can be large and diverse and needs to be processed to extract relevant information which can ideally be performed trough mobile phone APPS. The goal is to create a potable, low-cost and easy to use system that can make independent, localized decisions and take appropriate actions for food safety and quality assessment.

References

1. Stone P, Brooks R, Brynjolfsson E, Calo R, Etzioni O, Hager G, et al. Artificial intelligence and life in 2030: the one hundred year study on artificial intelligence. arXiv preprint arXiv:221106318. 2022.
2. Misra N, Dixit Y, Al-Mallahi A, Bhullar MS, Upadhyay R, Martynenko A. IoT, big data and artificial intelligence in agriculture and food industry. IEEE Internet of Things Journal. 2020.
3. Rajan K, Saffiotti A. Towards a science of integrated AI and Robotics. Elsevier; 2017. p. 1-9.
4. Karanth S, Benefo EO, Patra D, Pradhan AK. Importance of artificial intelligence in evaluating climate change and food safety risk. Journal of Agriculture and Food Research. 2022:100485.
5. Buyrukoğlu G, Buyrukoğlu S, Topalcengiz Z. Comparing regression models with count data to artificial neural network and ensemble models for prediction of generic Escherichia coli population in agricultural ponds based on weather station measurements. Microbial Risk Analysis. 2021;19:100171.
6. Zhang J, Huang H, Song G, Huang K, Luo Y, Liu Q, et al. Intelligent biosensing strategies for rapid detection in food safety: A review. Biosensors and Bioelectronics. 2022:114003.
7. Mavani NR, Ali JM, Othman S, Hussain M, Hashim H, Rahman NA. Application of artificial intelligence in food industry—A guideline. Food Engineering Reviews. 2022;14(1):134-75.
8. Lu Y, Shi Z, Liu Q. Smartphone-based biosensors for portable food evaluation. Current Opinion in Food Science. 2019;28:74-81.
9. Zeinhom MMA, Wang Y, Sheng L, Du D, Li L, Zhu M-J, et al. Smart phone based immunosensor coupled with nanoflower signal amplification for rapid detection of Salmonella Enteritidis in milk, cheese and water. Sensors and Actuators B: Chemical. 2018;261:75-82.
10. Shan Y, Wang B, Huang H, Jian D, Wu X, Xue L, et al. On-site quantitative Hg2+ measurements based on selective and sensitive fluorescence biosensor and miniaturized smartphone fluorescence microscope. Biosensors and Bioelectronics. 2019;132:238-47.
11. Zhang J, Khan I, Zhang Q, Liu X, Dostalek J, Liedberg B, et al. Lipopolysaccharides detection on a grating-coupled surface plasmon resonance smartphone biosensor. Biosensors and Bioelectronics. 2018;99:312-7.
12. Lin H-Y, Huang C-H, Park J, Pathania D, Castro CM, Fasano A, et al. Integrated magneto-chemical sensor for on-site food allergen detection. ACS nano. 2017;11(10):10062-9.
13. Ye Y, Guo H, Sun X. Recent progress on cell-based biosensors for analysis of food safety and quality control. Biosensors and Bioelectronics. 2019;126:389-404.
14. Meenu M, Kurade C, Neelapu BC, Kalra S, Ramaswamy HS, Yu Y. A concise review on food quality assessment using digital image processing. Trends in Food Science & Technology. 2021;118:106-24.
15. Hosseinpour S, Ilkhchi AH, Aghbashlo M. An intelligent machine vision-based smartphone app for beef quality evaluation. Journal of food engineering. 2019;248:9-22.
16. León-Roque N, Abderrahim M, Nuñez-Alejos L, Arribas SM, Condezo-Hoyos L. Prediction of fermentation index of cocoa beans (Theobroma cacao L.) based on color measurement and artificial neural networks. Talanta. 2016;161:31-9.
17. Song W, Jiang N, Wang H, Guo G. Evaluation of machine learning methods for organic apple authentication based on diffraction grating and image processing. Journal of Food Composition and Analysis. 2020;88:103437.
18. Song W, Jiang N, Wang H, Vincent J. Use of smartphone videos and pattern recognition for food authentication. Sensors and Actuators B: Chemical. 2020;304:127247.
19. Turco JF, do Nascimento CL, de Lima VA, Torres YR. Could antioxidant capacity and flavonoid content of ethanolic extracts of geopropolis from Brazilian native bees be estimated from digital photos and NIR Spectra? Microchemical Journal. 2020;157:105031.
20. Gonzalez Viejo C, Torrico DD, Dunshea FR, Fuentes S. Emerging technologies based on artificial intelligence to assess the quality and consumer preference of beverages. Beverages. 2019;5(4):62.

21. Li L, Wang Y, Jin S, Li M, Chen Q, Ning J, et al. Evaluation of black tea by using smartphone imaging coupled with micro-near-infrared spectrometer. Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy. 2021;246:118991.
22. de Lima CM, Fernandes DDS, Pereira GE, de Araújo Gomes A, de Araújo MCU, Diniz PHGD. Digital image-based tracing of geographic origin, winemaker, and grape type for red wine authentication. Food chemistry. 2020;312:126060.
23. Gunda NS, Gautam S, Mitra S, editors. Artificial intelligence for water quality monitoring. ECS Meeting Abstracts; 2018: IOP Publishing.
24. Costa RA, Morais CL, Rosa TR, Filgueiras PR, Mendonca MS, Pereira IE, et al. Quantification of milk adulterants (starch, H2O2, and NaClO) using colorimetric assays coupled to smartphone image analysis. Microchemical Journal. 2020;156:104968.
25. Tripathy S, Reddy MS, Vanjari SRK, Jana S, Singh SG. A step towards miniaturized milk adulteration detection system: Smartphone-based accurate pH sensing using electrospun halochromic nanofibers. Food Analytical Methods. 2019;12(2):612-24.
26. Iymen G, Tanriver G, Hayirlioglu YZ, Ergen O. Artificial intelligence-based identification of butter variations as a model study for detecting food adulteration. Innovative Food Science & Emerging Technologies. 2020;66:102527.
27. Gong W, Yao H-B, Chen T, Xu Y, Fang Y, Zhang H-Y, et al. Smartphone platform based on gelatin methacryloyl (GelMA) combined with deep learning models for real-time monitoring of food freshness. Talanta. 2023;253:124057.
28. Coronel-Reyes J, Ramirez-Morales I, Fernandez-Blanco E, Rivero D, Pazos A. Determination of egg storage time at room temperature using a low-cost NIR spectrometer and machine learning techniques. Computers and Electronics in Agriculture. 2018;145:1-10.
29. Goyal K, Kumar P, Verma K. Food adulteration detection using artificial intelligence: a systematic review. Archives of Computational Methods in Engineering. 2022;29(1):397-426.
30. FoodSniffer [Available from: http://www.myfoodsniffer.com/.

Figures:

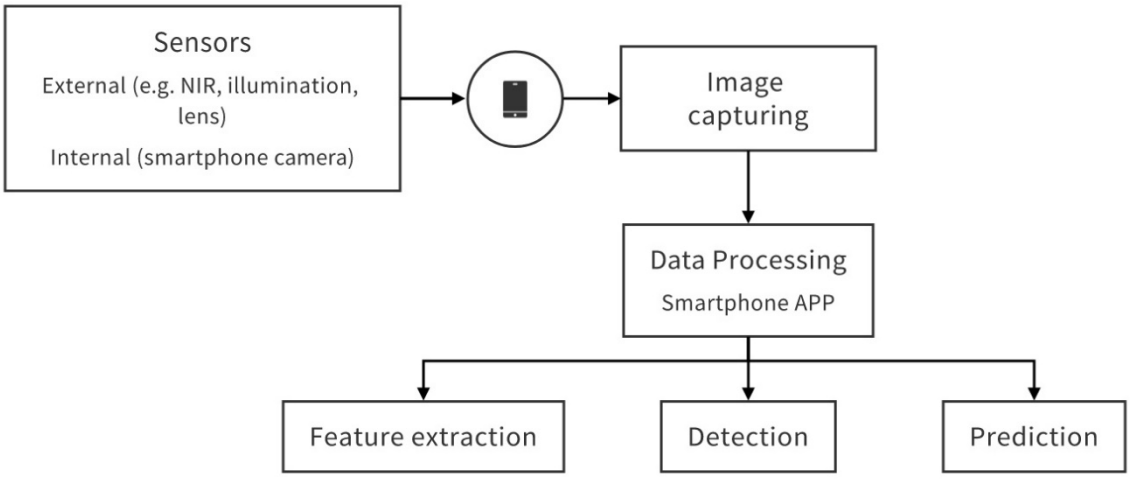


Figure 1. Schematic illustration of the use of smartphones in conjugation with AI basde mobile APPs.

https://dergipark.org.tr/tr/pub/food
OPEN ACCESS JOURNAL

ISSN 2667-5803

FHTI Journal of Food Health and Technology Innovations
September Vol 5, No 10 (2022)

DergiPark AKADEMİK

Review Article

Bioactive potential of medlar (Mespilus germanica L.) leaves in terms of ABTS and DPPH antioxidant capacity assays

Elif YILDIZ[1]*, Aycan YİĞİT ÇINAR[2], Ozan GÜRBÜZ[3]

Abstract

In strengthening the immune system, demand for natural products is increased rather than preferring food supplements and medicines. Instead of well-known, there are many hidden, valuable, naturally grown in own flora contents only appreciated by local people and utilized as traditional treatments. Medlar leaves are used for antioxidant, diuretic and diabetic properties as one this contents. For pointing the lights on it, antioxidant capacity of extractable, hydrolysable and bioaccessible extractions were evaluated in terms of $TEAC_{ABTS}$ and $TEAC_{DPPH}$ as a scope of this study. Samples were obtained from Yenicaga, Bolu from West Blacksea side of Turkey. Bioaccessible phenolics were determined as 37.41-43.84 μmol Trolox/g for $TEAC_{ABTS}$ and 130.26-145.79 μmol Trolox/g for $TEAC_{DPPH}$. %Bioaccessibility was % 31.43-39.78 over the extractable and hydrolysable fraction. This study was aimed be a clue for the bioactive potential of the medlar leaf and it should be revealed as bioactive contents with their provided effects for leaves on health in detail with further studies.

Keywords: medlar leaves, antioxidant capacity, ABTS, DPPH, %bioaccessibility

TÜBİTAK ULAKBİM

1Bursa Uludag University, Keles Vocational School, Food Processing Department, 16740, Keles, Bursa, Turkiye
Bursa Technical University, Faculty of Engineering and Natural Science, Department of Food Engineering, 16310, Bursa, Turkiye
3Bursa Uludag University, Faculty of Agriculture, Department of Food Engineering, 16059, Nilufer, Bursa, Turkiye

*Corresponding author: elifyildiz@uludag.edu.tr

Introduction

Bioactive potential of consumed foods is gained importance for determining their beneficials, improving diet quality for healthier life and preferring more effective foods for better nutrition. For this aim, the basis of the recent researches presents the evaluation of food and food components and determining their potential on health benefits. The cost valued raw materials with high bioactive potential are widespread cultivated and individuals could reach them easily. On the other hand, there are many fruit, vegetable and herbs that are naturally grown in own flora but not getting the deserved awareness and attention. These hidden contents are generally appreciated by local people and utilized as traditional treatments. Medlar is one these valuable sources and not recognized-well.

Medlar (*Mespilus germanica L.*), as a member of Rosacea family, is included in group of pome fruits. Although its homeland is South-West and South-East Europe, it is known that it was brought to Rome at BC 200 and to Greece at BC 700 (Phipps et al., 2003). In Turkey, it grows wild especially in the Marmara Black Sea and Aegean Regions (Yılmaz and Gercekcioglu, 2013). The flowering time of the tree is from May to June and fruits are harvested on September and October (Phipps et al., 2003). The fruits are known as good source of sugars, organic acids, vitamins, minerals (Haciseferogulları et al., 2005) and generally utilized as pickle, vinegar, jam and marmalade by the local people of presented areas. Bioactive potential of fruits is dedicated to phenolic compounds as *p*-coumaric, caffeic, ellagic, ferulic acids and pyrogallol (Voaides et al., 2021). Gulcin et al., (2021) evaluated the antioxidant properties of lyophilized fruits detailed. Voaides et al., (2021) handled medlar with comprehensive review study. They revealed its disregarded potential detailed not only in terms of fruits and leaves but also bud flowers and bark. Antioxidant and antimicrobial effects of medlar are emphasized by authors.

The plum-like fruit has thick, hard, oblong-shaped and hairy leaves with pointed-tips. The up-side of leaves is in dark green color while down-side is lighter green (Maral and Bostan, 2020). Instead of fruits, although not very well known, medlar leaves are picked and dried in autumn also brewed as tea or included in herb mixes because of their health benefits by local people. Voaides et al., (2021) indicated their diuretic, diabetic, hematopoietic effects on health. Alongside this usage, dried leaves are mixed with honey and fruits of resinous trees.

Antioxidants are gain importance with identification of the free radicals and their effect on human metabolism. They are significantly responsible from aging, chronic diseases, various health problems and disruption of metabolic balance. Therefore, consumption of antioxidant-containing foods became very crucial for human nutrition and wellness. In addition to revealing the chemical contents in detail, the bioactive potential determination is important point for understanding effects of these compounds. Antioxidant capacity (AC) assays are commonly used for interpretation of this relation. They are collected under two main headings as hydrogen atom transfer (HAT) and electron transfer (ET) methods (Prior et al., 2005). The most common ones are DPPH (2,2diphenyl-1-picrylhydrazyl), ABTS (2,20-azinobis-(3-ethyl benzothiazoline-6-sulfonic acid) diammonium salt), CUPRAC (Cupric Reducing Antioxidant Capacity), FRAP (Ferric Reducing Antioxidant Power) and Total Phenolic Component analysis (Folin-Ciocalteu Method). these methods are used because of easily applicable and reproducible and provided comparison with the existing literature. Alongside the chosen methodology extraction procedure is more crucial for determining the potential. *In vitro* bioaccessible extraction is provides more realistic estimation by digestion enzymes with pH, temperature and duration

arrangement comparing to solutions that did not exist purely in metabolism.

In this content, this study is included bioactive potential determination of medlar leaves by ABTS and DPPH AC assays for attract notice and provide utilization.

2. Material and Methods

2.1. Material

Medlar leaves belong to *Mespilus germanica L.* species were obtained from Bolu province, Yenicaga district, Dere Village **(ML1)** and Oren Village **(ML2)** on October 2020. Samples obtained from Dere Village were codded as ML1, while Oren Village as ML2 in content of the study. After picking from tree, leaves were brought to laboratory inside of the plastic bag and kept in -18 °C till extraction for analysis.

2.2. Methods

2.2.1. Determination of antioxidant capacity

Medlar leaves were evaluated in terms of ABTS and DPPH antioxidant capacity (AC) assays as for three different bioactive extractions: extractable, hydrolysable and bioaccessible. Extractable phenolic fraction could ne considered as free-, while hydrolysable fraction as bounded-phenolic fractions. Bioaccessible fraction also considered as released potential of phenolics by digestion enzymes: pepsin and pancreatin (with bile salts) in terms of mimic *in vitro* digestion model.

Extraction

Free and bound phenolic fractions were obtained by the methodology of Vitali et al., (2009). 2.0 g of medlar leaves extracted for 2 h at 20°C by shaking water-bath (250 rpm) with 20 mL methanol/water /HCl (80:10:1 v/v). Then the mixture was centrifuged (Sigma centrifuge 3 K 30, Germany) at 3500 rpm for 10 min at 4°C. Supernatant was taken as free phenolic fraction (extractable phenolics), residue was extracted for 20 h at 85°C by shaking water-bath (250 rpm) with 20 mL H_2SO_4 / methanol (1:10 v/v). Then the mixture was centrifuged (Sigma centrifuge 3 K 30, Germany) at 3500 rpm for 10 min at 4°C. Supernatant was taken as bound phenolic fraction (hydrolysable phenolics). The obtained extracts were kept in in -18 °C till analyses.

Bioaccessible fractions were obtained by the methodology of Bouayed et al. (2012). 2.0 g of medlar leaves extracted for 2 h at 37°C by shaking water-bath (250 rpm) with pepsin enzyme (40 mg/mL; pH:2) as gastric conditions. The pancreatic enzyme (2 mg/mL) together with porcine bile (12 mg/mL) were added to mixture for intestinal conditions (pH:7.2) and extraction continued for 2 h at 37°C by shaking water-bath (250 rpm). Supernatant was taken as bioaccessible phenolic fraction. The obtained extracts were kept in in -18 °C till analysis.

ABTS antioxidant capacity assay

Determination of bioactive potential in terms of AC according to ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6 sulfonic acid) assay produced by the methodology of Apak et al., (2008).

7mM ABTS solution (with distillated water) and 2.45 mM $K_2S_2O_8$ solution (with distillated water) were mixed and standed in dark for 12-16 h. The obtained stock ABTS solution was diluted by ethanol solution %1:10 (v /v). The obtained extracts were mixed with ABTS solution and kept in dark for 6 min. Spectrophotometric (Shimadzu UV 1208, Japan) values were determined at 734 nm over concentrated ethanol. Trolox equivalent calibration curve was obtained as $y = 3009.2x - 5.0458$ with $R^2 = 0.9983$. Triplicate results were given as mean±SD in terms of Trolox equivalent antioxidant capacity (TEAC) as μmol Trolox/g sample.

DPPH antioxidant capacity assay

Determination of bioactive potential in terms of AC according to DPPH (2.2diphenyl-1-picrylhydrazyl) assay produced by the methodology of Brand-Williams et al., (1995). The obtained extracts were mixed with 6 $\times 10^{-5}$ M DPPH solution (with methanol) and kept in dark for 30 min. Spectrophotometric (Shimadzu UV 1208, Japan) values were determined at 515 nm over concentrated methanol. Trolox equivalent calibration curve was obtained as y = 2527.1x + 0.4248 with R^2 = 0.9999. Triplicate results were given as mean±SD in terms of Trolox equivalent antioxidant capacity (TEAC) as μmol Trolox/g sample.

% Bioaccessibility

From the obtained results of extractable, hydrolysable and bioaccessible extractions, %bioaccessibility was calculated according to Anson et al., (2009, Eq:1). This value was considered as potential of bioaccessibility over free and bounded phenolics.

$$B\% = \frac{B}{E+H} \times 100 \qquad \text{Eq(1)}$$

**B%: %bioaccessibility; E: Result belong to extractable phenolics for related assay; H: Result belong to hydrolysable phenolics for related assay, B: Result belong to bioaccessible phenolics for related assay*

2.2.2. Statistical Evaluation

Obtained results from AC assays were evaluated by JMP IN 7.0.0 (Statistical Discovery from SAS 2005. Institute Inc.). The mean values obtained with standard deviations and the statistical difference between the two samples in terms of extraction were determined by LSD (Least Significant Difference) test.

3. Results and Discussion

AC results of two medlar leaf samples as extractable, hydrolysable, bioaccessible phenolic fractions are given in Table 1. Samples were obtained from two close villages as Dere Village and Oren Village in Yenicaga district of Bolu (Turkey). Instead of samples-based differences, hydrolysable fraction was showed higher potential than extractable and bioaccessible fractions. Higher temperature (85 °C) with longer extraction duration (20 h) thought to be reason of releasing more of phenolics. For evaluating of bioactive potential, evaluation and prediction the process in metabolism will be more realistic with *in vitro* bioaccessible extractions of digestive enzymes. Bioaccessible phenolics were determined as 37.41-43.84 μmol Trolox/g for $TEAC_{ABTS}$ and 130.26-145.79 μmol Trolox/g for $TEAC_{DPPH}$. %Bioaccessibility was % 31.43-39.78 over the extractable and hydrolysable fraction. As geographical and growing conditions are difference caused parameters on bioactivity, structure and releasability of compounds are effective on obtained results. In terms of AC assays, higher results were obtained with DPPH, and similar potential pattern was given by ABTS as well. In this sense, for potential determination ABTS could be preferred as to shorter waiting time (6 min) of the relevant reagent relaxions in the methodology in order to analyze more samples in the same time.

Conclusion

Recently, individuals are intended to change habits in natural and traditional. West Blacksea, as obtained area of samples, because forestry landscape and traditional knowledge from elders, people are utilized from many naturally grown species. Most of the information are originated from colloquial knowledge. %Bioaccessibility was % 31.43-39.78 over the extractable and hydrolysable fraction in terms of obtained $TEAC_{ABTS}$ and $TEAC_{DPPH}$ results. Studies on this subject will be provided increase the awareness and consume of medlar leaves and other contents.

References

Anson, N. M., Selinheimo, E., Havenaar, R., Aura, A. M., Mattila, I., Lehtinen, P., ... & Haenen, G. R. (2009). Bioprocessing of wheat bran improves in vitro bioaccessibility and colonic metabolism of phenolic compounds. Journal of Agricultural and Food Chemistry, *57*(14), 6148-6155.

Apak R, Guclu K, Ozyurek M, Celik SE, 2008. Mechanism of Antioxidant Capacity Assays and the CUPRAC (Cupric Ion Reducing Antioxidant Capacity) Assay. Microchimica Acta, 160(4): 413–419.

Bouayed, J, Deußer, H, Hoffmann, L, Bohn T, 2012. Bioaccessible and Dialysable Polyphenols in Selected Apple Varieties Following In Vitro Digestion vs. Their Native Patterns. Food Chemistry, 131(4): 1466– 1472.

Brand-Williams W., Cuvelier M.E., Berset C.L.W.T. (1995). Use of a Free Radical Method to Evaluate Antioxidant Activity. LWT - Food Science and Technology, 28(1): 25–30.

Gülçin, İ., Topal, F., Sarikaya, S. B. Ö., Bursal, E., Bilsel, G., & Gören, A. C. (2011). Polyphenol Contents and Antioxidant Properties of Medlar (Mespilus germanica L. *Records of Natural Products*, *5*(3), 158.

Haciseferogulları, H., Ozcan, M., Sonmete, M. H., & Ozbek, O. (2005). Some physical and chemical parameters of wild medlar (Mespilus germanica L.) fruit grown in Turkey. *Journal of Food Engineering*, *69*(1), 1-7.

Maral, E., & Bostan, S. Z. (2020). Physical and Chemical Characterization of Promising Medlar Genotypes from Çarşamba District (Samsun province, Turkey). KSU Journal of Natural Sciences, 23(4), 816-823, 2020

Phipps, J. B., O'Kennon, R.J., Lance, R.W. (2003). Hawthorns and medlars. *Royal Horticultural Society, Cambridge, UK*.

Prior, R. L., Wu, X., & Schaich, K. (2005). Standardized methods for the determination of antioxidant capacity and phenolics in foods and dietary supplements. *Journal of agricultural and food chemistry*, *53*(10), 4290-4302.

Vitali D, Dragojević IV, Šebečić B, 2009. Effects of Incorporation of Integral Raw Materials and Dietary Fibre on the Selected Nutritional and Functional Properties of Biscuits. Food Chemistry, 114(4): 1462–1469.

Voaides, C., Radu, N., Birza, E., & Babeanu, N. (2021). Medlar—A Comprehensive and Integrative Review. *Plants*, *10*(11), 2344.

Yilmaz, A., & Gercekcioglu, R. (2013). Medlar (Mespilus germanica L.) Population and distribution in Tokat ecology. *International Journal of Agricultural and Natural Sciences*, *6*(2), 01-04.

Tables

Table 1. Antioxidant capacity results of medlar leaves in terms of different phenolic fractions

Phenolic Fraction	ABTS Assay		DPPH Assay	
	ML1*	ML2	ML1	ML2
Extractable Phenolics as Free (μmol Trolox/g)	47.97 ± 0.12^{b**}	54.83 ±0.57^{a}	241.24 ± 0.52^{b}	246.07 ± 0.44^{a}
Hydrolysable Phenolics as Bounded (μmol Trolox/g)	71.05 ± 0.20^{a}	64.67 ± 0.69^{b}	138.03 ± 1.37^{a}	120.48 ± 0.41^{b}
Total Phenolics Extractable + Hydrolysable	119.02 ± 0.23^{a}	119.50 ± 0.59^{a}	379.27 ± 1.37^{a}	366.55 ± 0.82^{b}
Bioaccessible Phenolic fraction (μmol Trolox/g)	37.41 ± 0.12^{b}	43.84 ± 0.27^{a}	130.26 ± 0.90^{b}	145.79 ± 0.41^{a}
%Bioaccessibility	31.43 ± 0.04^{b}	36.69 ± 0.07^{a}	34.34 ± 0.23^{b}	39.78 ± 0.19^{a}

ML1: Medlar leaf sample that obtained from Dere Village, Yenicaga, Bolu; **ML1: Medlar Leaf sample that obtained from Oren Village, Yenicaga, Bolu*

*** Different letters (a-b) represent statistical significancy ($p<0.05$) in terms of sample for same phenolic extraction*

https://dergipark.org.tr/tr/pub/food
OPEN ACCESS JOURNAL

ISSN 2667-5803

FHTI Journal of Food Health and Technology Innovations
September Vol 5, No 10 (2022)

DergiPark AKADEMİK

Review Article

Turkey's Geographical Indications Dairy Products

Seval Sevgi KIRDAR[a,b,]

Abstract

Geographical indications (GIs) are place designations that are used to identify items that originate in those locations and to safeguard the reputation and caliber of a distinctive product with local origins. The phrase is most frequently used in reference to alcoholic beverages, food, and agriculture. Turkey is one of the countries in the world with a very high GI potential. According to the data of the Turkish Patent and Trademark Office (TÜRKPATENT), there are about 2500 products that can receive CI registration. European Union Registration Status of geographically indication products in Turkish agricultural products are 8 products and has made an application to the EU Commission totally for 31 products. Dairy products [(55 pieces: 34 cheese, 2 butter, 4 cream, 9 yoghurt, 2 ice cream, 2 ayran, and 2 others (Bolu Keçi, Gerede Keçi)] constitute 5.3% of the share in food products. While it constitutes 2.7% of the total registered products, it has a rate of 61.8% among dairy products. The number of dairy products for which GI applications have been made is 19. This value constitutes 4.58% of the total of 720 products at the application stage. A total of 34 cheeses, of which 14 (3 from abroad) originate here and 20 have a geographical indication, have been registered. In this review, information will be given about the geographical indication registered dairy products in Turkey.to prefer Hardaliye. Although there were many research about the functional properties, health benefits, consumers

Keywords: Geographical indications, Protected Geographical Indication, Protected Designation of Origin, Traditional Specialty Guaranteed, Dairy products.

TÜBİTAK ULAKBİM

a Burdur Mehmet Akif Ersoy University Burdur Food, Agriculture and Livestock Vocational Higher Education School Food Processing Department , Burdur, TURKEY
bBurdur Mehmet Akif Ersoy University Health Sciences Institute, Burdur, TURKEY
* Corresponding Author: Seval Sevgi KIRDAR
The University of Burdur Mehmet Akif Ersoy,
Burdur Food, Agriculture and Livestock Vocational Higher Education School Food Department of Food Processing, Milk and Dairy Products Programme,
15030 İstiklal Campus, Burdur/Turkey Phone: + 90 2482132274
Email: skirdar@mehmetakif.edu.tr

1 - Introduction

Geographical indications can be used to locate products whose reputation, quality, or other attributes are linked to their country of origin. Numerous nations across the world have implemented various legislative frameworks pertaining to geographical indications(WIPO, 2022).In Europe, the origin-based protection of food products has a long history. Since the 1920s, Parmigiano-Reggiano cheese made in the Po River Valley in Italy and Roquefort cheese produced in France have been protected (1). France and Italy have created a sophisticated legal protection system for geographical indications during the past century, including AOP (Appellation d'Origine Contrôlée) in France and DOP (Denominazione di Origine Controllata) in Italy. The majority of the EU's system is built on these systems (8).

Countries at the international level of GI have entered into a variety of agreements over many years to secure the protection of origin in their internal affairs and international trade relations. The process that began with the Paris accord of 1883 proceeded with the Madrid and Lisbon agreements of 1891 and 1999, respectively. The Trade-Related Intellectual Property Rights Agreement of 1994 is the most general and comprehensive of these accords (TRIPS) (3). In 1995, Turkey became one of the nations that joined the convention (Yildiz, 2008). In Turkey, the Turkish Patent and Trademark Office receives requests for geographical registration and administers the processes for registering items (2).

Protected Geographical Indication (PGI), Protected Designation of Origin (PDO), and Traditional Specialty Guaranteed are the three mechanisms that have been identified by Regulation 1151/2012 as being available to protect the quality and origin of food products within the European Union (TSG). Both the PGI and PDO programs are concerned directly with the country of origin of food goods (6).

The European Commission grants a Protected Designation of Origin (PDO) to regional products originating in a given region, provided that the quality or other characteristics of the product are essentially attributable to the particular geographical environment of the place of origin. The geographical environment encompasses natural and human factors, such as climate, soil conditions, topography, local know-how, etc. Products bearing this label must be produced, processed and prepared in a certain geographical area using a recognised and controlled method, for example cheeses made in a certain area from the milk of a local animal breed reared in that geographical area(Examples: Gorgonzola (cheese). Protected geographical indication (PGI), The product may be manufactured in any other location provided that at least one of the product characteristics to which a geographical indication is linked to the defined boundary should be originated from the said region. Traditional Speciality Guaranteed (TSG), The products that cannot be registered as designation of origin or geographical indication can be registered as traditional speciality guaranteed products speciality guaranteed if it can be proven that the product is on the traditional market for at least 30 years. In order to register these products as traditional speciality guaranteed products, these products should have been made by either traditional production, processing, traditional composition or traditional materials (TÜRKPATENT, 2022).

In addition to global population expansion, the reshaping of human needs, habits, and preferences, as well as socioeconomic developments, have altered the consumption structure. New technologies, which are utilized extensively in the production of agriculture, food, and other basic necessities, have boosted the demand for and significance of traditional and regional goods. (5).

The main purpose of the protection of geographical indications and traditional product names is to protect the quality process of the products and to ensure the sustainability of the production process of the product, as well as to keep the cultural values alive. At the same time, it contributes to regional economic development and prevents migration.It also enables countries to exist in

the international market with their unique products.

Included in the group of GI are the products obtained when at least one of the steps such as growing, production, and processing of the products belonging to that region, which is located in a region with defined borders, occurs inside the borders of that region (4). The items that fall under the designation "origin group" are those that have undergone all stages of production, cultivation, and processing within a defined geographical location (Turkish Patent and Trademark Office, 2022). In addition, the idea of "Speciality Guaranteed Products" is prohibited from both the designation of origin and protected GI. This idea does not encompass geographical limits. Institution for Turkish Patents and Trademarks It is defined as "names demonstrated to have been customarily used for at least 30 years to describe products referenced in the relevant field." This idea pertains to the use of traditional raw materials and production and processing methods (Turkish Patent and Trademark Office, 2022).

Turkey is one of the countries in the world with a very high GI potential. According to the data of the Turkish Patent and Trademark Office (TÜRKPATENT), there are about 2500 products that can receive CI registration (Cakmakcı and Salik 2021). As of November 2022, 1250 products have been taken under protection with a GI registration certificate, and 705 products for which an application has been made are in the evaluation phase.

European Union Registration Status of geographically indication products in Turkish agricultural products are 8 products (Table 1) and has made an application to the EU Commission totally for 31 products.

2. Geographical Indications Protections Of Dairy Products In Turkey

When the Turkish Statistical Institute (TUIK) data is analyzed, 756,646 tons of cheese were produced in Turkey in 2020. While 729,539 tons (96.4%) of this is cow cheese, 27,108 tons (3.6%) is made up of other cheeses (made from sheep, goat, buffalo, and/or mixed milk). Assuming an average of 13% cheese yield (including soft and hard cheeses), it can be calculated that approximately 24% of the total amount of milk (22,960,379 tons) produced in our country is processed into cheese. According to 2020 data, approximately 16.6% of the cheeses produced are soft type (125.556 tons), 30.1% are medium soft type (228.026 tons), 21% are hard type (158.819 tons), 30.7% are medium hard type (232.419 tons), 1.3% are extra-hard type (9.573 tons), and 0.3% are cheese made from curd (1,252 tons) (9). Turkey's total cheese production, the majority of which (96%) is made from cow's milk, decreased by 6.5% in 2019 compared to the previous year, to 707 thousand tons, the total supply increased by 6.6% to 714 thousand tons, and cheese exports reached 50 thousand tons, as calculated as follows:Turkey ranks 4th in the world in cheese production (TEPGE, 2020).

According to TÜRKPATENT's data, in the distribution of registered GIs by product groups, food products (chocolate, confectionery, and derivatives; processed and unprocessed meat products; meals and soups; oils; alcoholic and non-alcoholic beverages; dairy products, processed and unprocessed fruits and vegetables; honey; bakery and pastry products; and condiments for food) accounted for 83.5% of the total with 1044 registrations, while handicrafts and others accounted for 16.5% with 206 registrations. Dairy products [(55 pieces: 34 cheese, 2 butter, 4 cream, 9 yoghurt, 2 ice cream, 2 ayran, and 2 others (Bolu Keçi, Gerede Keçi)] constitute 5.3% of the share in food products. While it constitutes 2.7% of the total registered products, it has a rate of 61.8% among dairy products. The number of dairy products for which GI applications have been made is 19. This value constitutes 4.58% of the total of 720 products at the application stage (TÜRKPATENT, 2022).

Geographical indication registration activities in Turkey are generally carried out by local governments, commodity exchanges, chambers of commerce, chambers of industry and producer organizations.

A total of 34 cheeses, of which 14 (3 from abroad) originate here and 20 have a geographical indication, have been registered by TÜRKPATENT throughout our country. Dairy products with CI in Turkey: Some of the information specified in the registration documents is given in Table 2. The application process for 42 products continues. (Table.3).

In countries with a large number of dairy products entitled to protection by the EU, especially in France, the relationship between producers and manufacturers has a great impact on the success of geographically indicated dairy products. Thanks to an ideal production chain in these countries, it is possible to supply quality raw milk. This is accomplished through effective relationship management between manufacturers. In addition, the organization of the producers creates a sustainable supply chain, and it is seen that the producer associations are entitled to geographical indication protection in the process of taking them under protection In addition, with an effective monitoring system, the reliability of geographically indicated products for consumers increases (Tekelioğlu, 2022).Since June 21, 1996, when the first registrations were made by the EU, it has been seen that the most protected dairy products belong to France, so much so that 23.36% (57 units) of the total dairy products under protection are French products. 54 of these dairy products are cheese. Italy comes in second with 54 dairy product protection rights. Following Italy are, in order, Spain (28), Greece (21), England (17), Portugal (15), and Germany (10). Some cheese varieties that are protected by the EU and are an important source of income for the area where they are produced are Comté cheese (France), Feta cheese (Greece), Parmigiano Reggiano cheese (Italy), and Queijo Serpa cheese (Portugal). But Erzincan Tulum cheese, which was the first cheese variety to be registered by the Turkish Patent Institute on September 12, 2000, and Ezine cheese, which is associated with Turkey and was registered on April 10, 2007, have not yet been registered with the EU (7).

Conclusion

Turkey has a significant GIs that can be analyzed in the context of gastronomic products. Turkey's rich cultural legacy, suitable climate zone, and favorable geographical location have enabled it to have a vast potential for agricultural products This abundant GIs of food and agricultural products has a significant impact on culinary tourism. By supporting local agricultural activities, GI provides value to local products and aids to the promotion of regions receiving GIs. Therefore, it safeguards local values and gastronomic traditions. Additionally, GIs products are an important factor for safety, quality, and origin that enables manufacturers to promote their products with ease and consumers to purchase with confidence.

Despite the fact that there are more than 150 certified cheese varieties in Turkey, there are other cheese variants with unique qualities that are in danger of extinction. While the majority of these cheeses are produced and consumed in sufficient amounts to meet the need in the region where they are produced, some of them are well-known throughout the country and bring extra value as commercial products. It is necessary to classify the cheeses of our country according to their various characteristics, to develop and standardize their production technologies, to register them, to obtain the GI registration of more cheeses, to create a regularly updated database of their properties and compositions, and to introduce them to the world through gastronomic tourism by establishing cheese routes.The internationally valid geographical indications provide a great advantage for the product from which the mark is obtained. It causes both the worldwide recognition of the product and the gaining of a different prestige for the country. So, when the subject is looked at in terms of Turkey, it becomes clear how important it is to increase the number of products with international geographical indications.

References

1. Barham, E., Sylvander, B. 2011. Labels of origin for food: Local development, global recognition. Wallingford: CABI Publishing.

2. Cukur, F., Cukur, T. 2017. Coğrafi işaretli ürünlerin kırsal kalkınma açısından değerlendirilmesi: Muğla il örneği. Tarım Ekonomi Dergisi, 23(1), 188-194.

3. Echols, M. A. 2003. Geographical indications for foods, TRIPS and the DOHA Development Agenda. Journal of African Law, 47(2), 199-220.

4. Erol, Y. 2014. T rk e de coğraf şaretleme s stem n n mevcut ap s . Yayınlanmamış yüksek lisans tezi, Gaziosmanpaşa Üniversitesi, Tokat.

5. Hazarhun, E., Tepeci, M. 2018. Coğrafi işarete sahip olan yöresel ürün ve yemeklerin Manisa'nın gastronomi turizminin gelişimine katkısı. Güncel Turizm Araştırmaları Dergisi, 2(Ek1), 371-389.

6. İlhan, Ö. (2021). Characteristics of EU Registered Geographical Indications of Food and Agricultural Products and Investigation of Their Relationship with the Geographical Area. Aydın Gastronomy, 5(2), 117-129.

7.Kırdar, S.S., 2022. Traditional Foods and Geografical İndications. Lecture notes.p60.(Unpublished)

8.Tekelioğlu, Y., 2021. Coğrafi İşaretlerin a,b,c'si. YÜciDERGİ, 2:14-32.

9. TEPGE, 2020. Durum ve Tahmin Süt ve Süt Ürünleri 2020. TEPGE Yayın No:321, ISBN:978-605-7599-48-3.49s.

Turkish Patent and Trademark Office (2022). "What is Geographical Indications". https://ci.turk patent.gov. tr /sayfa/coğrafi-işaret-nedir (Date of access: 07.02.2022)

Yıldız, B.2008. Ticaretle bağlantılı fikrî mülkiyet hakları sözleşmesi'nde (TRIPs' de) coğrafi işaretlere ilişkin düzenlemeler. Ankara Barosu Fikri Mülkiyet ve Rekabet Hukuku Dergisi, 8(3), 45-107.

WIPO (2022). Geographical Indications- What is a geographical indication? https://www.wipo. int/geo_indications/en/ (Date of access: 07.12.2022).

www.ci.turkpatent.gov.tr (Date of access: 01.02.2022).

http://ec.europa.eu/agriculture/quality/door/list.html?locale=de, erişim 4.12.2022

Table.1. . European Union Registration Status of geographically indication products in Turkish agricultural products.

Products Groups (name)	Product category	Date of Application	Date of Registration
Antep Baklavası / GaziantepBaklavası (PGI)	Class 2.3. Bread, pastry, cakes, confectionery, biscuits and other baker's wares	10/07/2009	21.12.2013
Aydin İnciri (PDO)	Class 1.6. Fruit, vegetables and cereals fresh or processed	11.06.2013	17.02.2016
Malatya Kayısısı (PDO)	Class 1.6. Fruit, vegetables and cereals fresh or processed	13.05.2014	07.07.2017
Aydın Kestanesi (PDO)	Class 1.6. Fruit, vegetables and cereals fresh or processed	08.09.2015	24.09.2020
Milas Zeytinyağı(PDO)	Class 1.5. Oils and fats (butter, margarine, oil, etc.)	13.11.2017	23.12.2020
Taşköprü Sarımsağı(PDO)	Class 1.6. Fruit, vegetables and cereals fresh or processed	09.01.2017	16.04.2021
Bayramiç beyaz (PDO)ı	Class 1.6. Fruit, vegetables and cereals fresh or processed	01.02.2018	16.04.2021
Giresun Tombul Fındığı(PDO)	Class 1.6. Fruit, vegetables and cereals fresh or processed	26.04.2018	20.06.2022

Tablo 2. Dairy products with CI in Turkey

CHEESES				
Cheeses Name	Registration Date	CI Type	Geographical Boundary	Applicant
Erzincan Tulum Cheese	12.09.2000	PDO	Erzincan	Erzincan Chamber of Commerce and Industry
Ezine Cheese	10.04.2007	PDO	Ezine, Bayramiç and Ayvacık Districts and Şerbetli, Etili, Ahlatlıburun, Küçüklü, Alibeyköy, Söğütalan, Karacaören, Kurşunlu and Kirazlı Villages	Association for the Protection, Development and Promotion of Ezine Cheese and Dairy Farmers
Edirne Beyaz Cheese	23.10.2007	PGI	Türkiye	Edirne Chamber of Commerce and Industry
Erzurum Civil Cheese	01.03.2020	PGI	Erzurum	Erzurum Commodity Exchange
Erzurum Küflü Civil Cheese	01.03.2010	PGI	Erzurum	Erzurum Commodity Exchange
Diyarbakır Örgü Cheese	15.02.2010	PGI	Diyarbakır	Diyarbakır Governor's Office
Kars Kaşarı	14.02.2014	PDO	Kars Ve Ardahan	Kafkas University Rectorate
Malkara Eski Kaşar Cheese	06.12.2017	PDO	Tekirdag Province Malkara District	Malkara Chamber of Commerce and Industry
Yozgat Çanak Cheese	18.12.2017	PGI	Yozgat	Yozgat Belediye Municipality
Karaman Divle Obruğu Tulum Cheese	08.12.2017	PDO	Karaman Province Ayrancı District	Karaman Chamber of Commerce and Industry
Van Otlu Cheese	31.12.2018	PDO	Van - Hakkari	Van Chamber of Commerce and Industry
Antep Sıkma Cheese	04.06.2018	PDO	Gaziantep	Gaziantep Commodity Exchange
Antakya Sürkü (Çökeleği)	26.02.2018	PGI	Hatay	Antakya Chamber of Commerce and Industry
Antakya Küflü Sürkü	12.06.2018	PGI	Hatay	Antakya Chamber of Commerce and Industry
Manyas Kelle Cheese	16.12.2020	PGI	Balıkesir Province Manyas, Bandırma and Gonen Districts	Manyas District Governorate
Bolu Keşi	22.09.2020	PGI	Bolu Province Göynük, Mengen and Mudurnu Districts, Sakarya Province Taraklı District and Bilecik Province Gölpazarı District	Bolu Chamber of Commerce and Industry
Kırklareli Beyaz Cheese	23.12.2020	PDO	Kırklareli	Kırklareli Chamber of Commerce and Industry and Commodity Exchange
Çankırı Küpecik Cheese	01.10.2021	PGI	Çankırı	Çankırı Municipality
Antakya Carra Cheese	18.02.2021	PDO	Hatay Province Antakya, Arsuz, Belen, Yayladağ, Altınözü and Reyhanlı Districts	Antakya Chamber of Commerce and Industry
Gümüşhane Deleme Cheese	17.03.2021	PGI	Gümüşhane	Gümüşhane Chamber of Commerce and Industry
Pınarbaşı Uzunyayla Çerkes Cheese	14.04.2021	PDO	Uzunyayla Plateau	Kayseri Pınarbaşı Municipality
Sakarya Abhaz (Abaza) Cheese	03.05.2021	PGI	Sakarya	Sakarya Chamber of Commerce and Industry
Vakfıkebir Külek Cheese	25.05.2021	PGI	Trabzon	Vakfıkebir Municipality
Maraş Parmak/Sıkma Cheese	17.04.2021	PGI	Kahramanmaraş	Kahramanmaraş Municipality
Urfa Cheese	27.07.2021	PGI	Şanlıurfa	Şanlıurfa Commodity Exchange
Kargı Tulum Cheese	26.10.2021	PDO	Corum Province Kargi District	Kargı Municipality
Antakya Künefelik Cheese	22.12.2021	PGI	Hatay	Antakya Chamber of Commerce and Industry
İvrindi Kelle Cheese	09.02.2022	PGI	Balikesir Province Ivrindi District	İvrindi Municipality
İzmir Tulum Cheese	24.01.2022	PGI	Aydın, Balıkesir, İzmir and Manisa	İzmir Commodity Exchange
Yüksekova Çirek Cheese	18.04.2022	PGI	Hakkari Province Yüksekova District	Yüksekova Chamber of Commerce and Industry
Çayeli Koloti Cheese	24.08.2022	PDO	Rize	Çayeli District Directorate of Agriculture and Forestry
Hellim Cheese	04.11.2009	PDO	Cyprus Island	Cyprus Turkish Chamber of Industry
Parmesan Cheese	20.11.2017	PDO	Italy's Provinces of Parma, Reggioemilia, Modena and Mantua, and the banks of the Po and Reno Rivers	Consorzio Del Formaggio Parmigiano-Reggiano
Grana Padano Cheese	28.03.2018	PDO	Some Areas on the Banks of the Po and Reno Rivers in Italy	Consorzioper La Tutela Del Formaggio Grana Padano
ICE CREAMS				
Görele İce cream	21.06.2019	PGI	Giresun province, Görele district	Görele Municipality
Maraş İce cream	18.04.2018	PGI	Kahramanmaraş	Kahramanmaraş Chamber of Commerce and Industry
BUTTER				
Erzurum butter	23.10.2022	PGI	Erzurum	Erzurum Commodity Exchange
Tonya butter	18.08.2018	PDO	Trabzon province Tonya district	Tonya Municipality

Kaynak: www.ci.gov.tr

Tablo.3. Dairy products under application in Turkey

CHEESES		
Product name	CI Type	Geographical Boundary
Abaza peyniri	PGI	Sakarya
Atlantı Dededağ Tulum	PGI	Konya
Ayrancı berendi Kar Obruğu peyniri	PDO	Karaman
Ayvalık kelle peyniri/Ayvalık Sepet peyniri	PGI	Balıkesir
Ayvalık Kirli hanım peyniri	PGI	Balıkesir
Ağrı Tulum peyniri	PDO	Ağrı
Bayramiç peyniri	PDO	Çanakkale
Bergama Tulum peyniri	PGI	İzmir
Ermenek peyniri	PDO	Karaman
Eskipazar Şırdanlı peynir	PGI	Karabük
Gorgonzola	PDO	Yurt dışı
Gömeç kirli hanım peyniri	PGI	Balıkesir
Hanak tel peyniri	PDO	Ardahan
Kars Gravyer peyniri	PGI	Kars
Kazımkarabekir Bastırık peyniri	PGI	Karaman
Kepsüt Bükdere Küflü katık peyniri	PGI	Balıkesir
Kırklareli Ereğli kaşar peyniri	PDO	Kırklareli
Mengen peyniri	PGI	Bolu
Muş kaşarı	PGI	Muş
Sındırgıeğridere Yünlü Tulum peyniri	PGI	Balıkesir
Talas Otlu Çömlek peyniri	PGI	Kayseri
Çardak Deri peyniri	PGI	Çardak
İspir Krun peyniri	PDO	Erzurum
DAİRY PRODUCTS OTHER THAN CHEESES AND BUTTER		
Altınyayla Tomas Kaymağı	PGI	Sıvas
Ayrancı Yanıksı Yoğurdu	PGI	Karaman
Balıkesir Manda Kaymağı	PGI	Balıkesir
Başyayla Karın Kaymağı	PGI	Karaman
Başyayla Kuru Keşi	PGI	Karaman
Beytüşşebap Teremast Yoğurdu	PGI	Şırnak
Kandıra Manda Yoğurdu	PDO	Kocaeli
Karapınar Koyun Yoğurdu	PGI	Konya
Malatya Deri Çökeleği / Malatya Kuru Çökelek	PGI	Malatya
Mancusun Manda Kaymağı	PDO	Kayseri
Sandıklı Kese Yoğurdu	PGI	Afyonkarahisar
Savaştepe Mihaliç Kelle Peyniri	PGI	Balıkesir
Talas Zincidere Kuru Kaymağı	PGI	Kayseri
Yoğurt	TSG	
Özvatan Çömlek Peyniri	PGI	Kayseri
İstanbul Manda Yoğurdu	PDO	İstanbul
BUTTER		
Ayrancı Koyun Tereyağı	PDO	Karaman
Balya Tereyağı	PGI	Balıkesir
ICE CREAM		
Elazığ Vişne Dondurması	PGI	Elazığ ili

Kaynak: www.ci.gov.tr

https://dergipark.org.tr/tr/pub/food
OPEN ACCESS JOURNAL

ISSN 2667-5803

FHTI Journal of Food Health and Technology Innovations
September Vol 5, No 10 (2022)

DergiPark AKADEMİK

Review Article

Determination of Consumer Knowledge Level, Preferences and Attitudes Towards Lentils Which is An Important Vegetable Protein Source and Evaluation in Case of Gastronomic Value

Elif Selime Ulgen[1], Ilkay Gök[1], Eda Kulak[1]

Abstract

This study was performed with 330 consumers by using an online survey to examine knowledge, attitudes, and behaviors and to determine the effect of sociodemographic factor of consumers on lentil consumption. The importance of lentil in the history, its role in religious terms, nutritional content, health benefits, and the use of lentils in the food industry as an alternative product were summarized from literature research.

Chi-square test, t-test and one-way analysis of variance test (ANOVA) in the evaluation of data; Scheffe test was used to determine the direction of the differences. The results of factors such as knowledge level, consumption preferences, consumption habits, consumption frequency, consumption reasons were obtained and evaluated.

39.2% of the participants consumed lentil once in 2 weeks, 33.4% once or twice a week; 77.5% consume lentil as a soup. We see that lentil is consumed mostly as lentil soup, a traditional form, at the first order. The awareness of consumers must be increased to improve consumption of lentil with different alternative forms, such as a source of high vegetable protein, dietary fiber and must be informed for consumption options together with traditional recipes.

Keywords: Lentil, Gastronomy, Vegetable Protein, Healthy Food, Consumer Attitude

TÜBİTAK ULAKBİM

1.Istanbul Okan University, Faculty of Applied Sciences, Department of Gastronomy, Tuzla, Istanbul

*Corresponding Author: ilkygok@gmail.com; ilkay.gok@okan.edu.tr

Introduction

Since start of humanity, there have been animal foods and plant foods as two basic food sources in human life [1]. With the transition of people to a settled life, it has been seen that animal domestication and plant production using seeds have become widespread. It is known that these seeds are mainly lentils, chickpeas, peas and broad beans [2]. Pulses are considered to be among the best nutritional sources due to their nutritional value [3] [4].

Latin name is *Lens Culinaris*, are the seeds of a legume that has been used for centuries and has a great importance in human nutrition [5]. Archaeological remains reveal that lentils were consumed 9500-13000 years ago and are one of the first domesticated crops [6]. The earliest archaeological finds of lentils are found in the Mesolithic and Paleolithic layers of the Franchthi Cave in Greece; It was obtained in the Mesolithic layer near Göbekli Tepe in Şanlıurfa, which is the current settlement name in Mureybit. There is evidence that Egyptians, Romans and Hebrews consumed lentils [7]. In general, lentils were found with the excavations made in many of the regions in the Middle and Near East. Among the civilizations, the Egyptians, Greeks and Romans accepted lentils as a valuable product and used it both in human nutrition and animal nutrition [8]. When book of Seyahatname of Evliya Çelebi is examined, it is seen that the lentil dish is a very popular dish in the palace kitchens [9].

Lentils, which have such an ancient history, are also encountered in religious sources such as the Qur'an, the Torah and the Bible. In the Qur'an, lentils are mentioned in the 61st verse of Surat al-Baqara**.** Rich people want to consume vegetables such as lentils, onions, garlic, cucumbers that poor people consume, and the Prophet Moses tells those who make this request that they should go to the city and uses the phrase "Exchange the superior with the inferior"; he says that the people in the lower strata are punished with misery and helplessness [10]. According to the Catholic faith, "Remembrance Day of the Dead " is held on the 2nd or 3rd of November in Europe. On this commemoration day, a meal consisting of lentils, peas and beans is prepared, and poor people are distributed along with other food available at home [11]. According to the Orthodox faith, it has become a tradition to drink lentil soup, which represents the sadness and tears of Mary, on the day of the crucifixion of Jesus on Easter, and this tradition is called "the tears of the Virgin Mary". However, vinegar is added to the soup to symbolize the sufferings of Jesus [12]. According to the sources in the Torah and the symbolic stories that emerged, it seen that lentils are the food of pain and mourning. When Adam and Eve lost their children, when Cain killed Abel, when Abraham's brother Haran died, it is known that lentil food is consumed. From this information, it is clearly understood that lentils represent death and are consumed as a mourning food [13].

Looking at the lentil plant, it is seen that the consumption of green and red lentil species is much more common. The colors found in lentils are due to zeaxanthin carotenoids and lutein. The approximate values of lentil components are as follows; 51.1% carbohydrates (48.8% starch, 1.8% soluble sugar), 13.8% dietary fiber, 0.9% soluble fiber, 0.9% insoluble fiber, 23% protein, 1% fat [14] [15]. In addition to being rich in protein and carbohydrates, lentils are also rich in vitamin B and minerals of Fe, Mn, Na, Ca, Cu, Zn, P [16].

Lentils, which are in the group of foods that do not contain cholesterol, are poor in terms of saturated fatty acids. It is stated that it is good for brain and nervous health, strengthens the immune system, protects against immune system-related diseases, increases breast milk in nursing mothers, and increases intestinal digestion. Since it is also a source of energy, it is recommended to be consumed by people

who work hard in their daily life or athletes who do heavy sports. Thanks to its fibrous structure, it contributes to preventing the rise of blood sugar. For this reason, it is a food that diabetic patients can easily consume. It lowers hypertension because it has potassium content. Lentils, which are rich in protein, are good for anemia thanks to their high folic acid content [17].

Nutrition facts for green and red lentils are given in Table 1 and 2. The striking situation in both tables is that lentils are very rich in protein and fiber.

Table 1 125 ml Cooked Whole Green Lentils Nutrition Facts [41]

Table 2 125 ml Cooked Split Red Lentil Nutrition Facts [42]

Legumes, which have an important place for human and animal consumption, enrich the soil they are in by binding the free nitrogen in the atmosphere to the soil [18]. Nitrogen in plants; It plays an important role in root respiration, chlorophyll production, flowering, fruit formation and maturation. Being a heat, cold and drought resistant plant makes lentil production easier. Since it is a food obtained from the seeds of the lentil plant, it is a product suitable for consumption all year. It is a plant food source for human, and a fattening source for animals. Thus, the efficiency in production increases and waste materials are reduced. Maximum efficiency is obtained from the product [19]. Important lentil producing countries are respectively; Canada, India, Australia, Turkey, USA. Canada meets the lentil production with a rate of 33% worldwide [20]. When it is considered on Turkey, it is seen that there are fluctuations in production.

Enriching foods is seen as a way to reduce nutrient deficiencies. Especially the food industry; It also aims to diversify products in order to reduce the increasing world population, reduce availability and cost [21]. These situations increase the need for vegetable protein. In addition to being rich in protein and fiber, lentils are a cheap and healthy plant food source for consumers due to their nutritional values [22]. In addition to being a rich source of protein, lentils can also be preferred because it is a product that can be easily produced, stocked and distributed. Having such a rich nutritional content, lentils are seen as an important protein source of the future. While the studies to increase the use of lentils have increased, alternative products have started to be produced with lentil.

Thanks to the development of lentil processing technologies in recent years, it can be obtained by separating its protein and starch. Different formulations have been created with the protein and starch obtained, and they have started to be used in baby foods, snacks and bakery products. Also, lentils; It is also used as a protein gelling agent, emulsifier and stabilizer, and with these properties, it creates an alternative to animal foods [23].

Since lentils, which are a type of legume, do not contain gluten, they are suitable for consumption by consumers with gluten intolerance. Thanks to the new studies, the use of lentils as a delicious and healthy food in alternative products has started to increase, apart from the usual way of consumption. Pastas and chips obtained from lentils, which are accepted as health-supporting products and which people prefer to consume as a source of vegetable protein and fiber in their daily diets, have taken their places on the shelves.

The consumption preferences of individuals are changing day by day and these changes cause the development of different nutrition trends. For example, with the spread of vegan-vegetarian nutrition, consumers need more vegetable protein. For this reason, studies on vegetable proteins have increased and different recipes have been started to be created using

protein-rich plants. In addition, people's meat consumption tends to decrease with political, philosophical, environmentalist and animal-loving approaches. The search for alternative food to animal proteins has accelerated in recent years. Sales of products containing vegetable protein have increased due to sustainability and environmental concerns [24] [25].

Benayad et al. (2021) showed that the antioxidant, protein and fiber ratio of the couscous, which they prepared by mixing lentil flour with semolina, increased and the carbohydrate and fat ratio decreased. In the study of Benayad et al., an increase in the nutritional values of couscous obtained with the addition of lentil flour was observed. The microbiological quality of couscous added to lentil flour increased and the shelf life of couscous was extended. In addition, enriched couscous was highly appreciated by those who tasted it [26]. In addition to the production of couscous, it is aimed to enrich the nutritional content of the products obtained by using lentil flour in pastas, breads and similar pastries.

Benmeziane et al. (2021), it was explained that decreasing of sineresis value of yogurt which is produced from milk enriched with lentil flour and this yogurt was liked by the consumer. Therefore, lentil flour is a functional product that can be used in yoghurt production to increase its probiotic and prebiotic properties [27].

In this study, it was aimed to determine the consumption size and consumer knowledge level of lentils, which added in food formulations in order to increase their nutritional value. It is aimed to be a source for studies by determining the consumer knowledge level of lentils. Studies to expand the usage areas of lentils in the food industry should continue and these studies should be supported and consumer awareness should be increased.

Materials and Methods

Research Method and Sample

This study was carried out in 2021 to determine the lentil consumption attitudes and knowledge levels of consumers. Survey analysis technique was used as a research method. While selecting the research sample, non-probabilistic, purposeful sampling type was chosen. The criterion sampling method was applied based on the selection of people with certain qualifications [28] [29]. In line with this information, the research population was determined as the lentil market in Turkey, and the sample was determined as lentil consumers living in Turkey.

According to the determined sample, the sufficient number of participants for the survey was calculated by Tabachnick and Fidell (2006) considering that there should be 8 + 50 participants per statement. The formula (15*8) + 50 was used for the 15 statements in the survey [30]. In this way, the number of participants was calculated as 170. The survey reached 330 participants.

Data Collection Tool of the Research

In order to determine the survey questions to be used in the research, a literature review was made, researches on similar subjects and measurement tools were examined. The survey form was prepared on the internet and presented to the consumers. Care was taken to ensure that the survey from was understandable and 32 questions were asked. The prepared survey form consists of three parts. In the first part, while descriptive information (age, gender, marital status) was directed to the consumers participating in the research; In the second part, questions were asked in order to measure the lentil consumption attitudes and behaviors of the consumers, and in the third part to measure the knowledge level of the consumers about lentils. In the first 17 questions, questions

including the demographic characteristics of the participants and their knowledge about lentils were asked. The other 15 questions were prepared on a 5-point Likert type scale (1=Strongly Disagree, 2=Disagree, 3=Undecided, 4=Agree, 5=Strongly Agree).

Evaluation of Research Data

Chi-square test, t-test and one-way analysis of variance test (ANOVA) in the evaluation of data; The Scheffe test was used to determine the direction of the difference. IBM-SPSS Statistics 22 program was used for statistical analysis of the survey data. During the analysis of the results, frequency and percentage frequency tables of the responses were created, the results were evaluated and interpreted. In order to measure the reliability of the prepared survey form, Cronbach's Alpha analysis was applied and a value of 0.703 was obtained as a result of the analysis. To test the differences and relationships, $p<0.05$ was accepted as significant at the 95.0% confidence interval. Chi-square analysis method is a common analysis method used to measure the relationship between two variables [31]. Equality of ratios is tested using the chi-square analysis method [32] [33]. The t-test, on the other hand, is used to investigate whether there is a significant difference between the two sample groups in terms of means [34] [33]. ANOVA analysis (analysis of variance) is a method used to compare two or more groups, or to examine changes over time by considering a single group [32] [33].

Descriptive Analysis of Nominal Data Directed to Consumers

Turkey has hosted many different cultures throughout history. Along with this cultural diversity, the variety of food is also quite high. For example, it is seen that mucedder, which is very common in Kilis, actually comes from Arabian lands and is a part of Arab food culture. [35]. In the study, the participants were asked how many number of lentil varieties they know, how many number of lentil dishes they know, and their awareness of beluga lentils. The The level of knowledge of the survey participants about lentils is given in Table 5 in line with their marital status. The marital status of the participants; show a significant difference in the number of lentil varieties they know. The significance (p) value is

Findings and Discussion

Consumer Identifiable Information

In line with the data obtained in the study, the findings of the analyzes regarding the demographic characteristics are given in Table 3. A total of 330 people participated in the survey. The majority of the participants are between the ages of 18-24. Participant percentages; 18-24 age 49.2%, 25-29 age 19.1%, 30-35 age 14%, 36 age and over 17.6%. 59.9% of the survey participants were female and 40.1% were male. The number of female participants is 19.8% more than the number of male participants. When we look at the answers to the marital status of the participants; When the marital status of the participants is examined; It is seen that 75.1% of them are single and 24.9% of them are married.

Table 3 Descriptive characteristics of survey participants (n=330)

answers obtained are given in Table 4, taking into account the gender of the participants. There were no significant differences between the genders of the survey participants in line with the answers obtained. The p value of all three questions was greater than 0.05.

Table 4 Data on the level of knowledge of the survey participants about lentils according to their gender

0.022 and is less than 0.05. The number of lentil dishes that the participants knew showed a significant difference in line with their marital status. Significance (p) value is 0.024 and is less than 0.05. In the case of beluga lentil awareness, there was no significant difference between marital status.

Table 5. Data on the level of knowledge of the survey participants about lentils according to their marital status

The relationship between the level of knowledge of the survey participants about lentils and their age groups is given in Table 6. The number of lentil varieties known by the participants and the awareness of beluga lentils do not differ significantly according to age groups. However, the number of lentil dishes that the participants knew differed significantly between age groups. The significance value is 0.002.

Table 6. Data on the level of knowledge of the survey participants about lentils according to age groups

Considering the consumption frequency of lentils, the number of those who consume once or twice a week is 33.4%, the number of those who consume once in 2 weeks is 39.2%, and the number of those who consume more than twice a week is 5.2%. While 21.3% consume it once a month, the number of those who do not consume is 0.6%. When a general evaluation is made, it is seen that lentil consumption is quite common and sufficient.

When the survey participants were asked about the most consumed lentil varieties, it was seen that red lentils were the most consumed lentils with 62.2%. Green lentils take the second place with 31.9%. The lowest percentage belongs to beluga lentils with 0.3%. Although the worldwide awareness and consumption of Beluga lentils is high, it is not preferred much in Turkey. The consumer is not very familiar with the product.

Within the scope of the survey, consumers were asked which lentil consumption preference is the most, and the answer of 77.5% of the participants was lentil soup. When the study of 'Soups in Turkish Cuisine Culture' by Mine Arlı and Hüseyin Gümüş is examined, it is seen that there are 17 soups containing lentils [36]. The fact that lentils are used so much even under the title of soup indicates the value of lentils in Turkish cuisine culture. Lentil soup is followed by lentil dish with 13.1%. The total percentage of these two dishes is 90.6%, this result shows that only 9.4% of the participants do not consume soup and meal. Other data are as follows; meatball 4%, salad 2.7%, “Afyon bükmesi” 0.9%, “Tokat Batı” 0.3%, “Müceddere” 1.2%, “Bayburt galacoş” 0.3%. None of the participants preferred “Malhıtalı Aş”.

When the participants were asked about their lentil consumption reasons, 5 answers were determined; cheap, delicious, satisfying, healthy, easy to prepare. Although lentils provided all these answers, it was asked to determine the priority of consumers. 41.6% of the participants stated that they consumed it because it was delicious. 38.6% of them consume it because it is healthy. The fact that it is satisfying, cheap and easy to prepare, has a low percentage of being the first factor in consumers' preference for lentils.

The survey participants were asked about their lentil consumption frequency, their preferred lentil varieties, their lentil consumption preferences and their priorities in lentil consumption. Lentil consumption habits were evaluated according to the gender of the participants. The responses received are listed in Table 7. With the

gender of the participants; There is no significant difference between their preferred lentil varieties, their lentil consumption preferences and their priorities in lentil consumption. There was a significant difference between the lentil consumption frequency and gender of the The lentil consumption habits of the survey participants according to their marital status are given in Table 8, and the lentil consumption habits by age groups are given in Table 9. There was a significant difference between the marital status of the participants and their priorities in lentil consumption. The significant difference observed is 0.009. There was no significant difference between the age groups of the participants. The significance value (p) obtained is 0.032 and is less than 0.05.

Table 7. Data on lentil consumption habits of the survey participants according to their gender

participants and their lentil consumption habits.

Table 8. Data on lentil consumption habits of the survey participants according to their marital status

Table 9. Data on lentil consumption habits of the survey participants according to age groups

In Table 10, Table 11 and Table 12, data on the level of knowledge of the participants about the production regions of red and green lentils and the world leader in lentil production are given. According to the data obtained, there was no significant difference between the genders of the participants. When the marital status and answers of the participants were examined, a significant difference was found only in the answers given to the question of production region of red lentil. The significance value obtained was found to be 0.026.

When the green-red lentil production regions of the participants and the country that is the world leader in lentil production were asked, there were significant differences between the age groups of the participants in each question in line with the answers received. Significant difference values are indicated in Table 12. In line with the answers given by the participants, there was a significant difference between age groups in the question of the world leader in lentil production. The significant difference (p) value is 0.002.

Table 10. Data on the level of knowledge of the survey participants about the production regions of red-green lentils and the world leader in lentil production according to their gender

Table 11. Data on the level of knowledge of the survey participants about the production regions of red-green lentils and the world leader in lentil production according to their marital status

Table 12. Data on the level of knowledge of the survey participants about the production regions of red-green lentils and the world leader in lentil production according to to age groups

Participants were asked the question in which region of Turkey green and red lentils are produced intensively. When it comes to green lentils, 50.5% of the participants answered the Central Anatolia Region. The answers of the remaining participants were almost equally distributed in the other 6 regions. 49.5% of the participants know the region where green lentils are produced intensively [37]. In the same direction, the question of the production region of red lentils was asked to the participants in order to measure information. In this question, the participants were generally divided into two groups. 40.7% of the participants gave the

answer of Central Anatolia, 40.4% of them gave the answer of Southeastern Anatolia. In this case, the participants who know that red lentil production is intense in Southeast Anatolia covers 40.4%. Considering the demographic characteristics in the answers given for the red lentil production region, there was a significant difference between marital status. Significance (p) value was obtained as 0.026. Although Turkey seems to be the leader of lentil production, Canada has actually taken the lead [20]. With the seeds it brought from Turkey in 1973, it has become the world leader in lentil exports for almost half a century. In the results of this consumer attitude survey, the answers given by the participants are as follows; 22.2% Canada, 30.7% India, 8.5% USA, 32.2% Turkey, 6.4% Australia.

Conclusion and Recommendations

As a result of this study carried out on 330 consumers in order to determine the knowledge, attitudes and behaviors of consumers about lentils; There were differences in some of the answers given by the participants and similarities in some of them. The majority of the participants were aware that lentils are a functional product and reflected this situation in their consumption. When the participants were asked about the reasons for lentil consumption, 38.6% of the participants emphasized that they consume lentils because it is healthy. The reason for preference that comes before the health option is stated by 41.6% of the participants because it is delicious. Married and single participants; There were significant differences in the number of lentil varieties they knew, their answers to the region where red lentils were grown, and their priorities in lentil consumption ($p>0.05$). Considering the age groups of the participants; There were significant differences in the answers given to the number of lentil dishes they know, the region where red lentils are produced in Turkey, the region where green lentils are produced in Turkey, and the country that is the world leader in lentil production ($p>0.05$). When the participants were evaluated by gender, there was a significant difference in the frequency of lentil consumption ($p>0.05$).

Although the consumers stated that lentil is a functional product, the frequency of consumption was found to be infrequent as a result of the study. Despite the low consumption frequency and the fact that there are dozens of lentil-based dishes in Turkey, more than half of the participants stated that they know 1-3 varieties of lentil dishes. Necip Buğra Engin 's study titled 'Examination of Consumer Attitudes towards Tarhana Consumption ' conducted with 302 participants in 2019, 84.4% of the participants stated that Tarhana is a functional product [38]. At the same time, 84.8% of the participants in Engin's study like the taste of lentils. Consumers' approaches to lentils and Tarhana are similar in terms of being functional.

89.9% of the participants of Engin's study prefer to consume Tarhana as soup. 77.5% of the lentil consumer attitude survey participants stated that they consume lentils as soup ($p>0.05$). In terms of consumption, both products are preferred by consumers in the form of soup.

The participants were asked about the frequency of consumption of lentils, which is an important vegetable protein source. The consumption frequency of lentils, which is an easily accessible, convenient, healthy and functional food, differs between male and female participants. In the graduate study of 'Development of a Food Consumption Frequency Questionnaire for Vegan and Vegetarian Individuals Living in Turkey' by Tuğçe Nur Balcı, who is student at Hacettepe University, the participants were asked about the frequency of consumption of green and red lentils. 285 vegan and vegetarian individuals participated in the

study. 53.6% of the participants 2-4 times a month, 33.3% of the participants 2-3 times a week, 1.2% of the participants 4-6 times a week, 2.4% of the participants once a day, 1,2% of the participants consume green lentils 2-3 times a day or more. 50% of the participants 2-4 times a month, 29.8% of the participants 2-3 times a week, 4.6% of the participants 4-6 times a week, 1.2% of the participants once a day, 1.2% of the participants consumes red lentils 2-3 times or more a day [39]. When the two studies are compared, the results obtained differ, because Balcı's study was conducted among vegan or vegetarian individuals. Lentils have an important place in vegan and vegetarian diets due to being a functional product. When the lentil consumer attitude survey and Balcı's study are compared, it is seen that vegan and vegetarian individuals include lentils more frequently in their daily diets.

Consumers stated that the world leader in lentil production is Turkey, not Canada. When the lentil production in Turkey is evaluated on a ton basis, it is decreasing day by day, and imported lentils are on the shelves in Turkey. Promoting the production and consumption of lentils; Studies should be made to make this healthy, functional, satisfying, cheap and delicious product easily accessible to consumers. The sustainability of lentil dishes, which have a very rich place in Turkish food culture, should be ensured and recorded and transferred.

Due to the rapidly increasing world population, the food industry is also developing rapidly. This emerging industry aims to meet needs and create alternative foods. While developing alternative foods, care is taken to ensure that foods meet the nutritional needs of people, are easily accessible, cost-effective, satisfying and certainly functional. Consumers are becoming more conscious about healthy nutrition and the demand for healthy food is increasing accordingly [40].

Lentil is a food that can be developed with its rich nutritional content, easy storage, cheapness and accessibility. The fact that it is a vegetable source that offers an alternative to animal foods in terms of its high protein content makes lentils even more valuable. While the consumption of animal foods has decreased in recent years, the consumption of vegetable proteins has increased [24] [25]. Lentil, which is such a functional food, can be considered as an important vegetable protein source of the future.

Today, product development studies are carried out using lentils. The purpose of using lentils while creating food products; enriching the foods, developing alternative products based on lentils besides the classical recipes, supporting the consumption of the consumers. At the beginning of the developed products are pasta, couscous, bread and chips produced based on lentil flour. With the increase in product development and research and development studies, diversification is expected in these products.

In line with the studies to be carried out, healthy foods and snacks to be obtained from lentils can prevent consumers from consuming unhealthy snacks, and thus reduce the obesity rates, which have become a major risk today. Use of lentils and lentil-based products; Use of lentils and lentil-based products; will increase with further work. For this reason, studies on lentils, which may be an important vegetable protein source of the future, should be expanded and supported. In the same direction, people should be encouraged to consume lentils and their awareness should be raised.

Compliance with the Ethical Standard

Conflict of interest: The authors declared that there are no actual, potential, or perceived conflicts of interest for this article.

References

[1] E. Kaya, *Yüksek Lisans Tezi: Ülkemizde Yetiştirilen Bazı Mercimek Çeşitlerinin Bileşimlerinin Belirlenmesi,* Adana, Türkiye: Çukurova Üniversitesi Fen Bilimleri Enstitüsü. Gıda Mühendisliği Anabilim Dalı, 2010.

[2] E. Pekşen ve C. Artık, *Antibesinsel Maddeler Ve Yemeklik Tane Baklagillerin Besleyici Değerleri,* Samsun, Türkiye: Ondokuzmayıs Üniversitesi Ziraat Fakültesi Tarla Bitkileri Bölümü, 2004.

[3] Y. F. Cheng ve R. Bhat, «Functional, physicochemical and sensory properties of novel cookies produced by utilizing underutilized jering (Pithecellobium jiringa Jack.) legume flour,» *Food Bioscience,* no. 14, https://doi.org/10.1016/j. fbio.2016.03.002, p. 54–61, 2016.

[4] Y. Maphosa ve V. A. Jideani, «The role of legumes in human nutrition,» %1 içinde *In C. H. María (Ed.), Book of functional food-improve health through adequate food*, Spain: Cadix, https://doi.org/10.5772/intechopen.69127, 978-953-51-4718-3, 2017, p. (pp. 104–121).

[5] S. Şehirali, Yemeklik Tane Baklagiller, Ankara, Türkiye: Ankara Üniversitesi Ziraat Fakültesi Matbaası, sf; 435, 1988.

[6] M. Singh, H. D. Upadhyaya ve I. S. Bisht, «Tahıl Bakliyat İyileştirmenin Genetik ve Genomik Kaynakları,» *ScienceDirect,* pp. Sf 1-10, 2013.

[7] P. Filippone, *The History and Origin of Lentils.,* One of Man's First Food Sources,3, 2019.

[8] S. Özdemir, Yemeklik Baklagiller, Hasad Yayıncılık, 165, 2006.

[9] M. Yerasimos, Evliya Çelebi Seyahatnamesin'de Yemek Kültürü, YKY, 106, 2019.

[10] A. Bayındır, Kur'an Işığında Doğru Bildiğimiz Yanlışlar, İstanbul: Süleymaniye Vakfı Yayınları, 3. Baskı, 278-279, 2010.

[11] F. J. Simoons, *Plants of Life, Plants of Death, Madison,* University of Wisconsin Press, 252, 1998.

[12] P. Fieldhouse, Food & Nutrition, London: Croom Helm, 117, 1986.

[13] L. Gizberg, *Legends of the Jews,* 2003.

[14] M. Zeece, *Gıda Sistemleri ve Gelecekteki Yönlendirmeler, Gıda Kimyasına Giriş,* 2020.

[15] A. Romano, V. Gallo, P. Ferranti ve P. Masi, «Lentil flour: nutritional and technological properties, in vitro digestibility and perspectives for use in the food industry,» *ScienceDirect,* 2021.

[16] U. D. P. &. L. Council, «General Properties of Dry Peas, Lentils & Chickpeas,» %1 içinde *Processing Information & Technical Manual*, 2010, pp. 13-16.

[17] N. Yeşilçubuk, «Baklagillerin Gıda Sanayi Açısından Önemi Ve Kullanım,» %1 içinde *İstanbul Teknik Üniversitesi Gıda Mühendisliği Bölümü, Bakliyat ile Sağlıklı Beslenme Sağlıklı Hayat Sempozyumu*, İstanbul, Türkiye, 2016.

[18] B. Mollison, Permakültüre Giriş, Sinek Sekiz Yayınları, 274, 2011.

[19] B. M. Avcı, *Baklagillerin Önemini Bilmeliyiz,* Türkiye, 2016.

[20] T. M. O. G. Müdürlüğü, «Dünya Hububat Ve Bakliyat Raporu,» 2020. [Çevrimiçi]. Available: www.tmo.gov.tr.

[21] H. Khazaei, M. Subedi, M. Nickerson, C. Martinez-Villaluenga, J. Frias ve A. Vandenberg, Seed Protein of Lentils: Current Status, Progress, and Food Applications, Food, 2019.

[22] A. Romano, V. Gallo, P. Ferranti ve P. Masi, «Lentil flour: nutritional and technological properties, in vitro digestibility and perspectives for use in the food industry,» *ScienceDirect,* 2021.

[23] M. Joshil, Y. Timilsenal ve B. Adhikari, «Global production, processing and utilization of lentil: A review,» *ScienceDirect -Journal of Integrative Agriculture,* cilt 16, no. 12, p. 2898–2913, 2017.

[24] H. Aiking, «Future protein supply,» *Trends in Food Science and Technology,* no. 22, p. 112–120, 2011.

[25] D. C. –. F. a. Agriculture, «Earth Policy Institute,» 2012. [Çevrimiçi]. Available: http://www.earth-policy.org/data_center/C24. [Erişildi: 21 June 2017].

[26] A. Benayad, M. Taghouti, A. Benali, N. Benbrahim ve Y. Aboussaleh, «Development and nutritional, technological, microbiological, cooking and sensory characterization of durum wheat couscous partially enriched with lentil semolina,» *Food Bioscience,* 2021.

[27] F. Benmeziane, R. K. Raigar, N. E.-H. Ayat, D. Aoufi, L. Djermoune-Arkoub ve A. Chala, «Lentil (Lens culinaris) flour addition to yogurt: Impact on physicochemical, microbiological and sensory attributes during refrigeration storage and microstructure changes,» *LWT - Food Science and Technology,* cilt 140, 2021.

[28] Ş. Aslan, Sosyal Bilimlerde Araştırma Yöntemleri Nicel, Nitel ve Karma Tasarımlar İçin Bir Rehber, Eğitim Yayınevi, 2019.

[29] Y. Koç, «Sosyal Bilimlerde Örnekleme Kuramı.,» *The Journal of Academic Social Science,* pp. 480-495., 2017.

[30] B. Tabachnick ve L. Fidell, «Using Multivariate Statistics, 5th ed.,» %1 içinde *Using Multivariate Statistics*, Boston, Allyn & Bacon, 2006.

[31] M. Nakip, Pazarlama Araştırmaları Teknikler ve (SPSS Destekli) Uygulamalar, Ankara: Seçkin Yayınevi, 2. Basım, 2006.

[32] T. Baş, «Anket,» Seçkin yayıncılık Sanayi ve Ticaret A.Ş, Ankara, 2010.

[33] A. Sandallıoğlu, *Adana İlinde Organik Tarım Ürünleri Tüketimi ve Tüketici Eğilimleri,* Adana: Çukurova Üniversitesi. Fen Bilimleri Enstitüsü, Tarım Ekonomisi Anabilim Dalı. Doktora Tezi, 2014.

[34] Ş. Kalaycı, A. Albayrak, A. Eroğlu, E. Küçüksille, A. B., M. Karaltı, H. Keskin, E. Çiçek, A. Kayış, E. Öztürk, Ö. Antalyalı, N. Uçar, H. Demirgil, D. İşler ve O. Sungur, SPSS Uygulamalı Çok Değişkenli İstatistik Teknikleri, Ankara: Asil Yayın Dağıtım Ltd. Şti Yayınları, 1. Baskı, 2005.

[35] Z. N. Gülaç, « Ürün Raporu Mercimek 2017,» T.C. Tarım Ve Orman Bakanlığı Tarımsal Ekonomi Ve Politika Geliştirme Enstitüsü - Tarımsal Ekonomi Ve Politika Geliştirme Enstitüsü Tepge, Ankara, Türkiye, 2018.

[36] M. Arlı ve H. Gümüş, Türk Mutfak Kültüründe Çorbalar, 2017.

[37] «Türkiye İstatistik Kurumu (TUİK),» [Çevrimiçi]. Available: www.tuik.gov.tr. [Erişildi: 2017].

[38] N. Engin, *Tarhana Tüketimine İlişkin Tüketici Tutumlarının İncelenmesi,* İstanbul, Türkiye: İstanbul Okan Üniversitesi, Sosyal Bilimler Enstitüsü, Gastronomi Bölümü, 2019.

[39] T. Balcı, *Türkiye'de Yaşayan Vegan ve Vejetaryen Bireylere Özgü Besin Tüketim Sıklığı Anketi Geliştirilmesi,* Ankara, Türkiye: T.C. Hacettepe Üniversitesi Sağlık, Bilimleri Enstitüsü, Beslenme Bilimleri Programı, 2018.

[40] M. Vatansever, B. H. Tığa, S. Kumcuoğlu ve Ş. Tavman, «Farkli Oranlarda Mercimek Unu ve Patates Nişastasi İçeren Karişimlarin Ekstrüde Çabuk Erişte Üretiminde Kullaniminin İncelenmesi,» *The Journal of Food,* cilt 45, no. 5, pp. 837-849, 2020.

[41] «Nutritional Information for Lentils,» 2021. [Çevrimiçi]. Available: https://www.lentils.org/.

[42] «Nutritional Information for Lentils,» 2021, [Çevrimiçi]. Available: https://www.lentils.org/.

TABLES

Table 1 125 ml Cooked Whole Green Lentils Nutrition Facts [41]

	% Daily Value*
Total Fat 0.5 g	1%
Saturated fat 0 g	0%
Trans fat 0 g	0%
Cholesterol 0 mg	6%
Sodium 5 mg	0%
Total Carbohydrates 23 g	8%
Dietary Fiber 9 g	32%
Total Sugar 0 g	0%
Added Sugar 0 g	0%
Protein 12 g	
Vitamin D 0 mcg	0%
Calcium 25 mg	2%
Iron 2 mg	10%
Potassium 252 mg	6%
Folate 39 mcg DFE	10%
* Percent Daily Value indicates how much a nutrient in a serving of food contributes to the daily diet, using 2,000 calories per day for general nutritional advice.	

Table 2 125 ml Cooked Split Red Lentil Nutrition Facts [42]

	% Daily Value*
Total Fat 0.5 g	1%
Saturated fat 0 g	0%
Trans fat 0 g	0%
Cholesterol 0 mg	6%
Sodium 5 mg	0%
Total Carbohydrates 25 g	9%
Dietary Fiber 4 g	14%
Total Sugar 0 g	0%
Protein 12 g	
Vitamin D 0 mcg	0%
Calcium 12 mg	0%
Iron 3 mg	15%
Potassium 273mg	6%
Folate 55 mcg DFE	15%
* Percent Daily Value indicates how much a nutrient in a serving of food contributes to the daily diet, using 2,000 calories per day for general nutritional advice.	

Table 3 Descriptive characteristics of survey participants (n=330)

		Frequency	Percent (%)
Gender Distribution of Participants	Female	198	59.9
	Male	132	40.1
	Total	330	100
Age Distribution of Participants	18-24	163	49.2
	25-29	63	19.1
	30-35	46	14.0
	36 and over	58	17.6
	Total	330	100
Marital Status of Participants	Married	82	24.9
	Single	248	75.1
	Total	330	100

Table 4 Data on the level of knowledge of the survey participants about lentils according to their gender

		Female		Male		Total		p value χ2 value
		n	%	n	%	n	%	
Number of Known Lentil Varieties	0	1	0.3	5	1.5	6	1.8	p: 0.282 χ2 : 4.290
	1	2	0.6	4	1,2	6	1.8	
	2	82	24.6	64	20.4	146	45	
	3	81	24.3	42	13.1	123	37.4	
	4	22	6.4	10	3	32	9.4	
	More than 4	12	3.2	5	1.4	17	4.6	
	Total	200	60.6	130	39.4	330	100.0	
Known Number of Lentil Dishes	0	2	0.6	0	0	2	0.6	p: 0.434 χ2: 1,000
	1-3	101	30.5	70	21.2	171	51.7	
	4-6	73	22.3	54	16.6	127	38.9	
	7-9	16	4.6	3	0.9	19	5.5	
	More than 9	8	2,4	3	0.9	11	3.3	
	Total	200	60.6	130	39.4	330	100.0	
Beluga Lentil Awareness	I did not hear	158	48.7	101	31.5	260	80.2	p: 0.657 χ2: 0.165
	I heard, I don't consume	11	6.2	12	6.9	23	13.1	
	I've heard, I'm consuming	31	4.4	16	2.3	47	6.7	
	Total	200	60.6	130	39.4	330	100.0	

Table 5. Data on the level of knowledge of the survey participants about lentils according to their marital status

		Married		Single		Total		p value χ2 value
		n	%	n	%	n	%	
Number of Known Lentil Varieties	0	0	0	6	1.8	6	1.8	p: 0.022 χ2 : 2.277
	1	0	0	6	1.8	6	1.8	
	2	27	8.3	119	36.7	146	45	
	3	41	12.4	82	25	123	37.4	
	4	10	2.9	22	6.5	32	9.4	
	More than 4	3	0.7	13	3.9	18	4.6	
	Total	81	24.5	248	75.5	330	100.0	
Known Number of Lentil Dishes	0	2	0.6	0	0	2	0.6	p: 0.024 χ2: 0.438
	1-3	33	9.9	138	41.8	171	51.7	
	4-6	36	11	91	27.9	127	38.9	
	7-9	7	2	12	3,5	19	5.5	
	More than 9	3	0.9	8	2,4	11	3.3	
	Total	81	24.5	249	75.5	330	100.0	
Beluga Lentil Awareness	I did not hear	65	20	195	60.2	260	80.2	p: 0.549 χ2: 0.852
	I heard, I don't consume	7	3.9	16	9.2	23	13.1	
	I've heard, I'm consuming	9	1,2	38	5.5	47	6.7	
	Total	81	24.5	249	75.5	330	100.0	

Table 6. Data on the level of knowledge of the survey participants about lentils according to age groups

		18-24 Ages		***25-29 Ages***		***30-55 Ages***		***Age 36 and Above***		***Total***		***p value χ2 value***
		n	%	n	%	n	%	n	%	n	%	
Number of Known Lentil Varieties	0	4	1,2	1	0.3	1	0.3	0	0	6	1.8	p: 0.131 χ2: 5.111
	1	3	0.9	2	0.6	0	0	1	0.3	6	1.8	
	2	85	26.1	26	8.01	21	6.4	14	4.31	146	45	
	3	50	15.2	28	8.5	18	5.4	27	8.2	123	37.4	
	4	11	3.2	8	2.35	4	1.1	9	2.64	32	9.4	
	More than 4	7	1.89	4	1.08	1	0.27	5	1.35	17	4.6	
	Total	160	48.48	69	20.9	45	13.5	56	16.8	330	100.0	
Known Number of Lentil Dishes	0	0	0	0	0	2	0.6	0	0	2	0.6	p: 0.002 χ2: 2,800
	1-3	94	28.4	28	8.4	25	7.55	24	7.25	171	51.7	
	4-6	57	17.4	34	10.4	12	3.6	24	7.3	127	38.9	
	7-9	4	1.15	6	1.68	5	1.4	4	1.12	19	5.5	
	More than 9	5	1.5	1	0.3	4	1,2	4	1,2	11	3.3	
	Total	160	48.4	69	20.7	45	13.5	56	16.8	330	100.0	
Beluga Lentil Awareness	I did not hear	129	39.7	50	15	39	11.7	42	12.6	260	80.2	p: 0.153 χ2: 1.005
	I heard, I don't consume	6	3,4	9	5.04	3	1.68	5	2.8	23	13.1	
	I've heard, I'm consuming	25	3,5	10	1.4	3	0.42	9	1.28	47	6.7	
	Total	160	45.4	69	20.7	45	13.5	56	16.8	330	100.0	

Table 7. Data on lentil consumption habits of the survey participants according to their gender

		Female		Male		Total		p value χ2 value
		n	%	n	%	n	%	
Lentil Consumption Frequency	Never	0	0	2	0.6	2	0.6	p: 0.032 χ2 : 2,412
	Daily	1	0.3	0	0	1	0.3	
	Once or twice a week	73	22.1	37	11.1	110	33.4	
	More than twice a week	14	3.22	8	2,4	22	5.2	
	Once in 2 Weeks	84	14.8	43	12.9	127	39.2	
	Once a Month	28	0.94	40	1.35	68	2.3	
	Total	200	60.6	130	39.39	330	100.0	
More Preferred Lentil Varieties	Green Lentil	62	18.83	43	13.06	105	31.9	p: 0.733 χ2: 0.899
	Red Lentil	129	39	80	24.19	209	63.2	
	Yellow Lentil	8	2.45	7	2.14	15	4.6	
	Beluga Lentil	1	0.3	0	0	1	0.3	
	Total	200	60.6	130	39.39	330	100.0	
Lentil Consumption Preference of Participants	Soup	153	46.5	102	31	255	77.5	p: 0.957 χ2: 0.099
	Meatball	6	1.84	7	2.15	13	4	
	Green Lentil Dish	30	8.93	14	4,168	44	13.1	
	Salad	6	2.02	2	0.675	8	2.7	
	Malhıtalı Aş	0	0	0	0	0	0	
	Afton Bükme	1	0.3	2	0.3	3	0.9	
	Tokat Batı	1	0.3	0	0	1	0.3	
	Bayburt Galacoş	0	0	1	0.3	1	0.3	
	Müceddere	3	0.72	2	0.48	5	1,2	
	Total	200	60.6	130	39.39	330	100.0	
Priority of Participants in Lentil Consumption	Being Cheap	6	1.83	11	3.36	17	5.2	p: 0.345 χ2: 1.947
	Being Delicious	83	25.20	54	16.39	137	41.6	
	Being Hearty	17	4.99	14	4.10	31	9.1	
	Being Satiate	80	24.3	47	14.2	127	38.6	
	Easy Preparation	14	4.27	4	1.22	18	5.5	
	Total	200	60.6	130	39.39	330	100.0	

Table 8. Data on lentil consumption habits of the survey participants according to their marital status

		Married		Single		Total		p value χ2 value
		n	%	n	%	n	%	
Lentil Consumption Frequency	Never	0	0	2	0.6	2	0.6	p: 0.319 χ2 : 0.850
	Daily	1	0.3	0	0	1	0.3	
	Once or twice a week	30	9.1	80	24.29	110	33.4	
	More than twice a week	4	0.94	18	4.25	22	5.2	
	Once in 2 Weeks	33	10.1	94	29.1	127	39.2	
	Once a Month	13	0.43	55	1.86	68	2.3	
	Total	81	24.54	249	75.45	330	100.0	
More Preferred Lentil Varieties	Green Lentil	19	5.78	86	26.12	105	31.9	p: 0.225 χ2: 1.683
	Red Lentil	59	17.85	150	45.35	209	63.2	
	Yellow Lentil	3	0.92	12	23.68	15	4.6	
	Beluga Lentil	0	0	1	0.3	1	0.3	
	Total	81	24.54	249	75.45	330	100.0	
Lentil Consumption Preference of Participants	Soup	63	19.2	192	58.3	255	77.5	p: 0.232 χ2: 0.048
	Meatball	2	0.615	11	3.38	13	4	
	Green Lentil Dish	12	3,58	32	9.52	44	13.1	
	Salad	1	0.33	7	2.36	8	2.7	
	Malhıtalı Aş	0	0	0	0	0	0	
	Afton Bükme	2	0.6	1	0.3	3	0.9	
	Tokat Batı	1	0.3	0	0	1	0.3	
	Bayburt Galacoş	0	0	1	0.3	1	0.3	
	Müceddere	0	0	5	1,2	5	1,2	
	Total	81	24.54	249	75.45	330	100.0	
Priority of Participants in Lentil Consumption	Being Cheap	2	0.61	15	4,588	17	5.2	p: 0.009 χ2: 9.211
	Being Delicious	27	8.2	110	33.4	137	41.6	
	Being Hearty	3	0.89	28	8.21	31	9.1	
	Being Satiate	43	13.1	84	25.5	127	38.6	
	Easy Preparation	6	1.83	12	3.66	18	5.5	
	Total	81	24.54	249	75.45	330	100.0	

Table 9. Data on lentil consumption habits of the survey participants according to age groups

		18-24 Ages		*25-29 Ages*		*30-55 Ages*		*Age 36 and Above*		*Total*		*p value χ2 value*
		n	%	n	%	n	%	n	%	n	%	
Lentil Consumption Frequency	Never	1	0.3	1	0.3	0	0	0	0	2	0.6	p: 0.196 χ2: 2,467
	Daily	0	0	1	0.3	0	0	0	0	1	0.3	
	Once or twice a week	57	17.3	18	5.46	10	3.03	25	7.59	110	33.4	
	More than twice a week	12	2.83	6	1.41	1	0.23	3	0.7	22	5.2	
	Once in 2 Weeks	53	16.35	30	9.25	22	6.79	22	6.79	127	39.2	
	Once a Month	37	1.25	13	0.43	12	0.40	6	0.2	68	2.3	
	Total	160	48.48	69	20.9	45	13.63	56	16.96	330	100.0	
More Preferred Lentil Varieties	Green Lentil	53	16.1	25	7.59	10	3.03	17	5.16	105	31.9	p: 0.259 χ2: 0.720
	Red Lentil	100	30.23	39	11.7	33	9.97	37	63.2	209	63.2	
	Yellow Lentil	7	2.14	5	1.53	1	0.3	2	0.61	15	4.6	
	Beluga Lentil	0	0	0	0	1	10.3	0	0	1	0.3	
	Total	160	48.48	69	20.9	45	13.63	56	16.96	330	100.0	
Lentil Consumption Preference of Participants	Soup	126	38.29	53	16.1	37	1.24	39	11.8	255	77.5	p: 0.313 χ2: 0.591
	Meatball	8	2.46	3	0.92	0	0	2	0.615	13	4	
	Green Lentil Dish	17	5.06	9	2.67	7	2.08	11	3.27	44	13.1	
	Salad	2	0.67	3	1.01	1	0.33	0	0.6	8	2.7	
	Malhıtalı Aş	0	0	0	0	0	0	2	0	0	0	
	Afton Bükme	1	0.3	0	0	0	0	0	0.6	3	0.9	
	Tokat Batı	0	0	1	0.3	0	0	2	0	1	0.3	
	Bayburt Galacoş	1	0.3	0	0	0	0	0	0	1	0.3	
	Müceddere	5	1,2	0	0	0	0	0	0	5	1,2	
	Total	160	46.46	69	20.9	45	13.63	56	16.96	330	100.0	
Priority of Participants in Lentil Consumption	Being Cheap	8	2.44	1	0.3	4	1.22	4	1.22	17	5.2	p: 0.208 χ2: 0.515
	Being Delicious	69	20.95	33	10.02	16	4.85	19	5.76	137	41.6	
	Being Hearty	19	5.57	6	1.76	5	1.46	1	0.29	31	9.1	
	Being Satiate	53	15.55	26	7.63	19	5.77	29	8.81	127	38.6	
	Easy Preparation	11	3.36	3	0.91	1	0.3	3	0.91	18	5.5	
	Total	160	46.46	69	20.9	45	13.63	56	16.96	330	100.0	

Table 10. Data on the level of knowledge of the survey participants about the production regions of red-green lentils and the world leader in lentil production according to their gender

		Female		***Male***		***Total***		***p value χ2 value***
		n	%	n	%	n	%	
Red Lentil	Marmara Region	8	2.6	8	2.6	16	5.2	p: 0.052 χ2 : 1.351
	Black Sea Region	0	0	5	1.5	5	1.5	
	Aegean Region	5	1.38	8	2.21	13	3.6	
	Central Anatolia Region	82	25.1	51	15.6	133	40.7	
	Eastern Anatolia Region	16	5.42	2	0.67	18	6.1	
	Southeast Anatolia Region	86	25.36	51	15.9	137	40.4	
	Mediterranean Region	3	0.9	5	1.5	8	2,4	
	Total	200	60.6	130	39.39	330	100.0	
Green Lentil	Marmara Region	10	3.44	13	4.46	23	7.9	p: 0.221 χ2: 2.826
	Black Sea Region	8	2.19	11	3.01	19	5.2	
	Aegean Region	9	2.74	10	3.05	19	5.8	
	Central Anatolia Region	107	32.35	60	18.14	167	50.5	
	Eastern Anatolia Region	24	7.66	18	5.74	42	13.4	
	Southeast Anatolia Region	36	10.26	11	3.13	47	13.4	
	Mediterranean Region	6	1.85	7	2.15	13	4	
	Total	200	60.6	130	39.39	330	100.0	
World Leader	Canada	48	14.4	26	7.8	74	22.2	p: 0.382 χ2: 0.507
	India	60	18.05	42	12.64	102	30.7	
	USA	11	3.46	16	5.03	27	8.5	
	Turkey	69	1.82	37	11.2	106	32.2	
	Australia	12	3.65	9	2.74	21	6.4	
	Total	200	60.6	130	39.39	330	100.0	

Table 11. Data on the level of knowledge of the survey participants about the production regions of red-green lentils and the world leader in lentil production according to their marital status

		Married		***Single***		***Total***		***p value*** ***χ2 value***
		n	%	n	%	n	%	
Red Lentil	Marmara Region	5	1.63	11	3,57	16	5.2	p: 0.026 χ2 **:** 1.883
	Black Sea Region	0	0	5	1.5	5	1.5	
	Aegean Region	3	0.84	10	2.76	13	3.6	
	Central Anatolia Region	24	7.35	109	33.35	133	40.7	
	Eastern Anatolia Region	9	3.05	9	3.05	18	6.1	
	Southeast Anatolia Region	36	10.62	101	29.78	137	40.4	
	Mediterranean Region	4	1,2	4	1,2	8	2,4	
	Total	81	24.54	249	75.45	330	100.0	
Green Lentil	Marmara Region	5	1.71	18	6.18	23	7.9	p: 0.175 χ2: 3.038
	Black Sea Region	1	0.28	18	4.92	19	5.2	
	Aegean Region	2	0.63	17	5.27	19	5.9	
	Central Anatolia Region	45	13.6	122	36.89	167	50.5	
	Eastern Anatolia Region	9	2.88	33	10.52	42	13.4	
	Southeast Anatolia Region	16	4.6	31	8.8	47	13.4	
	Mediterranean Region	3	0.92	10	3.07	13	4	
	Total	81	24.54	249	75.45	330	100.0	
World Leader	Canada	24	7.2	50	15	74	22.2	p: 0.101 χ2: 5.166
	India	25	7.53	77	23.17	102	30.7	
	USA	8	2.51	19	5.98	27	8.5	
	Turkey	23	6.99	83	25.21	106	32.2	
	Australia	1	0.30	20	6.09	21	6.4	
	Total	81	24.54	249	75.45	330	100.0	

Table 12. Data on the level of knowledge of the survey participants about the production regions of red-green lentils and the world leader in lentil production according to to age groups

		18-24 Ages		*25-29 Ages*		*30-55 Ages*		*Age 36 and Above*		*Total*		*p value χ2 value*
		n	%	n	%	n	%	n	%	n	%	
Red Lentil	Marmara Region	8	2.6	2	0.65	4	1.3	2	0.65	16	5.2	p: 0.027 χ2: 2,413
	Black Sea Region	3	0.9	1	10.3	0	0	1	0.3	5	1.5	
	Aegean Region	8	2.21	3	0.83	0	0	2	0.55	13	3.6	
	Central Anatolia Region	73	22.33	35	10.71	10	3.06	15	4.59	133	40.7	
	Eastern Anatolia Region	6	2.03	2	0.67	6	2.03	4	1.35	18	6.1	
	Southeast Anatolia Region	58	17.1	26	7.66	22	6.48	31	9.1	137	40.4	
	Mediterranean Region	4	1.25	0	0	3	0.9	1	0.3	8	2,5	
	Total	160	48.48	69	20.9	45	13.6	56	16.96	330	100.0	
Green Lentil	Marmara Region	10	3.43	7	2,4	2	0.68	4	1.37	23	7.9	p: 0.040 χ2: 1.858
	Black Sea Region	13	3,55	3	0.82	3	0.82	0	0	19	5.2	
	Aegean Region	14	4.2	5	1.52	0	0	0	0	19	5.8	
	Central Anatolia Region	76	22.98	37	11.18	25	7.55	29	8.76	167	50.5	
	Eastern Anatolia Region	20	6.38	8	2.55	7	2.23	7	2.23	42	13.4	
	Southeast Anatolia Region	18	5.13	7	1.99	6	1.71	16	4.56	47	13.4	
	Mediterranean Region	9	2.7	2	0.61	2	0.61	0	0	13	4	
	Total	160	48.48	69	20.9	45	13.6	56	16.96	330	100.0	
World Leader	Canada	21	6.3	19	5.7	11	3.3	23	6.9	74	22.2	p: 0.002 χ2: 7.963
	India	49	14.74	19	5.71	19	5.71	15	4.51	102	30.7	
	USA	14	4.4	5	1.57	4	1.25	4	1.25	27	8.5	
	Turkey	59	90.46	23	6.98	10	3.03	14	4.25	106	32.2	
	Australia	17	5.1	3	0.91	1	0.30	0	0	21	6.4	
	Total	160	48.48	69	20.9	45	13.6	56	16.96	330	100.0	

https://dergipark.org.tr/tr/pub/food
OPEN ACCESS JOURNAL

ISSN 2667-5803

FHTI Journal of Food Health and Technology Innovations
September Vol 5, No 10 (2022)

DergiPark AKADEMİK

Review Article

Consumer Awareness, Attitudes and Preferences of Functional Bevarage Hardaliye

Furkan Burak Ünal[1], İlkay Gök[2]*, Eda Külak[2]

Abstract

Traditional foods are important for the future functional food industry, and they might inspire the development of new products. Hardaliye is a functional beverage obtained from the lactic acid fermentation of dark colored aromatic grapes. The aim of this research is to investigate the perceptions, attitudes, and behaviors of Hardaliye between 300 participants who lived in Istanbul. The names of the developed surveys have been stated as the "Awareness of the Hardaliye", "the Obstacles to the Consumption of the Hardaliye", and "the Reasons for the Preference of the Hardaliye". According to the research results, the awareness level of Hardaliye is low. The age group with the highest recognition of the Hardaliye is 50 and above. The awareness of Hardaliye is higher among participants who consume any functional beverage. In addition, the participants who know that the raw material of Hardaliye is grape, has a high recognition of Hardaliye. It has been revealed that those who have not heard of Hardaliye before, those who do not consume any functional drinks, and those who do not know the raw material of Hardaliye have more obstacles for Hardaliye consumption. It was determined that the participants who heard Hardaliye before, knew the raw material of Hardaliye and consumed any functional drink had higher levels of reasons to prefer Hardaliye. Although there were many research about the functional properties, health benefits, consumers don't familiar about the this traditional functional beverage.

Keywords: Recognition, Hardaliye, Kırklareli, Reasons for preference, Local beverage

TÜBİTAK ULAKBİM

1.Namık Kemal University, Vocational Education School
2. İstanbul Okan University, Faculty of Applied Sciences

*Corresponding Author: ilkygok@gmail.com; ilkay.gok@okan.edu.tr

Introduction

The most important factors affecting consumer preferences are related with the geographical, historical, and economic structure or culture of a country. Culture is the most important determining factor in food and beverage selection. There are significant differences between countries and cultures in the food and beverage preferences of consumers [1].

Hardaliye is generally produced around Kırklareli in the Thrace Region [2]. It is non-alcoholic grape-based fermented beverage and consumed since ancient times [3]. Mainly red grape juice and pomace was mixed with whole/ground or heat-treated mustard seeds (0,3-0,4%), sour cherry leaves and benzoic acid (0,1%) and fermented at room temperature nearly 10 days. Hardaliye which is the product of lactic acid fermentation of dark colored aromatic grapes production techniques differ by the people of the region. The main production steps of Hardaliye are listed as crushing the washed grapes, fermentation of crushed grapes, cherry leaves and mustard seeds, and filtering the mixture [4].
Hardaliye is characterized as a mild throat-burning beverage with a bitter taste. In 2017, Kırklareli Hardaliye was registered with the sign of origin.There are differences in the stages of traditional and industrial Hardaliye production. In the traditional method, mustard grains are lightly crushed together with the grapes. Next, mustard seeds, a layer of black grape puree and a layer of cherry leaves are filled into barrels. In the final stage, the mixture in these filled barrels is fermented for 10-15 days. In the industrial method, the grapes are first washed and mashed in barrels. In the next step, crushed mustard seeds and 0.1% benzoic acid are added into the barrel and the mixture in the barrels is left to ferment for 10 days at room temperature (18–24°C). In this method, the fermentation time varies depending on the ambient temperature. The mixture, whose fermentation is completed at the last stage, is filtered, bottled and cooled [1].

Chemical and microbiological properties are studied detailly in literature and results showed that Hardaliye have many health benefits such as beneficial for anemia, cardiac diseases and cancer and categorized as functional beverage [1, 4, 15-17] especially colon cancer [1]. Hardaliye contains more potassium, magnesium, zinc and selenium minerals and antioxidants, more phenolics, quercetin, gallic acid, and trans-resveratrol than grape juice. An anti-cancer effect of hardaliye is related with repressing FoxM1 expression [1].
The aim of this study is to determine the awareness and consumption level of Hardaliye. For this purpose, first of all, all the details about Hardaliye were included, and asked to 300 consuörs and then the results obtained within the framework of the analysis of the data collected by the survey method were interpreted.

Materials and Methods

The population of the research consists of individuals over the age of 18 living in Istanbul. The sample of the research consists of 300 participants residing in Istanbul, selected by simple random method from the population. Data were collected from the participants through an online survey.
This research aimed to determine effect of socio demographic properties like age, education level, profession, monthly income on consumer buying behavior, nutrition knowledge level on consumption of Hardaliye.

Since the Hardaliye consumption preferences didn’t study before, hypothesis was obtained because of the literature reviews.

The hypotheses of the research are given below:

H1: Awareness of Hardaliye differ according to consumer age
H2: Awareness of Hardaliye differ according to consumer gender
H3: Awareness of Hardaliye differ according to previous knowledge level of Hardaliye
H4: Awareness of Hardaliye as a functional beverage differ from other bevarages
H5: Awareness of Hardaliye differ based on knowledge about the main ingredient
H6: Obstacles for consumption of Hardaliye differ according to their age
H7: Obstacles for consumption of Hardaliye differ according to their gender
H8: Obstacles for consumption of Hardaliye differ according to previous knowledge level of Hardaliye
H9: Obstacles for consumption of Hardaliye as a functional beverage differ from other bevarages
H10: Obstacles for consumption of Hardaliye differ based on knowledge about the main ingredient
H11: Consumers preferences of Hardaliye changes according to their age
H12: Consumers preferences of Hardaliye changed depending on gender
H13 Consumers preferences of Hardaliye changes according to their previous information level about it
H14: Consumers preferences of Hardaliye changes because of its functional properties
H15: Consumers preferences of Hardaliye changes according to their knowledge about the main ingredient

The data was collected through 300 questionnaires nad processed using statistical software IBM SPSS 25.0 program and analyzed by descriptive statistics such as frequency, percentage, mean and standard deviation, and inference statistics to test the hypotheses. In the analyzes, the socio-demographic information of the participants was examined with descriptive statistics. In the research, firstly, internal consistency analysis was conducted for Hardaliye Awareness Survey, Hardaliye Consumption Obstacles Survey and Hardaliye Reasons for Preference Survey. If there was any inconvenience between the data, the consistency of the answers given by the participants to the scale statements were discussed. Then, the personal information of the participants and their answers to the survey statements were evaluated. In addition, the assumption of normal distribution of the scales was evaluated by looking at the skewness and kurtosis coefficients, and parametric test methods were preferred. While the "independent sample t test" was used in the comparisons of the variables satisfying the assumption of normal distribution in 2 groups, "one-way analysis of variance (One-way ANOVA)" was used in the comparisons of groups of three or more. Statistical significance was evaluated at the $p<0.05$ level in all the results obtained.

Results and Discussion

Explanatory Factor Analysis

Yaşlıoğlu [5], it is stated that “the smallest sample number for factor analysis should be 50”. The sample group of 300 people was considered to be sufficient for the research.

“Exploratory factor analysis may not be suitable for all data structures. The suitability of the data for factor analysis can be examined with the Kaiser-Meyer-Olkin (KMO) coefficient and the Barlett Sphericity test, and it shows that a value below 0.5 is unacceptable. In addition, the significance value of the Barlett Sphericity test should be less than 0.05” [6]. However, the scale expressions must satisfy the univariate normality assumption, and the univariate normality assumption was evaluated by looking at the skewness and kurtosis coefficients. “The skewness and kurtosis values of the scale expressions are

between +1.50 and -1.50 indicates that the variables comply with the univariate normality assumption" [7]. In the study conducted by George and Mallery [8], it was stated that the limit values of the skewness and kurtosis coefficients were wider and were accepted between +2.00 and -2.00. As a result, it was determined that all of the scale expressions were within the specified ranges, there were no extreme values, and they provided the assumption of univariate normality.

According to the principal components analysis applied to the data obtained as a result of the answers given to the questions in the "Hardaliye Awareness Survey", it was understood that the sample size was sufficient (KMO = 0.750) and the Barlett Sphericity test was also significant (X^2 =635.256; p < 0.001) [6]. In line with these results, the results of the "EFA" applied to the Hardaliye Awareness Survey are given in Table 1.

Table 1 EFA Results for Hardaliye Awareness Survey

In the EFA analysis applied to the data of the questions in the Hardaliye Awareness Survey, factors with an eigenvalue above 1.00, items with a common variance load above 0.50 and items with factor loads above 0.45 were included in the analysis. In addition, the difference between the load values of an item under two factors is expected to be greater than 0.10 [5]. 30 items consisted of one dimension and explained 63,128% of the total variance (Table 1).

In the EFA analysis applied to the data of the questions in the Hardaliye Consumption Obstacles Survey, factors with an eigenvalue above 1.00, items with a common variance load above 0.50 and items with factor loads above 0.45 were included in the analysis. In addition, the difference between the load values of an item under two factors is expected to be greater than 0.10 [5]. 12 items consisted of one dimension and explained 54,726% of the total variance (Table 2).

Table 2 EFA Results for Hardaliye Consumption Obstacles Survey

In the EFA analysis applied to the data of the questions in Hardaliye, Reasons for Preference Survey, factors with an eigenvalue above 1.00, items with a common variance load above 0.50, and items with factor loads above 0.45 and items with factor loads above 0.45 were included in the analysis. has been done. In addition, the difference between the load values of an item under two factors is expected to be greater than 0.10 [5].15 items consisted of one dimension and explained 90.06% of the total variance (Table 3).

Table 3EFA Results for Hardaliye Reasons for Preference Survey

Internal Consistency Analysis

"When look at the Cronbach's Alpha values of the Awareness of Hardaliye, the Obstacles of Hardaliye Consumption and the Reasons for Preference of Hardaliye; these values were determined respectively as 0.970, 0.896 and 0.992. These values are; reveals that the surveys are highly reliable and it has been concluded that it is suitable for use in the analysis (Table 4).

Table 4 Reliability Analysis Findings of the Surveys

Personal Information of Participants

According to the frequency analysis results in Table 5, when the distribution of the participants based on their age is examined; it is seen that 40.0% of the participants included in the research are between the ages of 18-25, 11.7% are between the ages

of 26-33, 14.7% are between the ages of 34-41, 12.0% are between the ages of 42-49, 11.3% are between the ages of 50-57 years old and 10.3% of them are 58 years old and over. The gender distribution of the participants included in the research is presented in Table 6.

Table 5 Age Distribution of Participants

Table 6 Gender Distribution of Participants

According to the frequency analysis results in Table 6, when the distribution of the participants based on their gender is examined; it is seen that 61.7% of the participants included in the research are female and 38.3% are male. The distribution of the hometown of the participants included in the research is presented in Table 7.

Table 7 Distribution of Participants' Hometowns

According to the frequency analysis results in Table 7, when the distribution of the participants based on their hometowns is examined; although the participants in the research live in Istanbul, only 2.0% of them are from Istanbul. The distribution of hearing status of Hardaliye before the participants included in the research is presented in Table 8.

Table 8 The participants' "Have You Heard of Hardaliye Before?" Distribution of Answers to the Question

According to the frequency analysis results in Table 8, it is seen that 64.3% of the participants had not heard of Hardaliye before. The distribution of any functional beverage consumed by the participants included in the research is presented in Table 9.

Table 9 "Do you consume any functional beverage?" Distribution of Answers to the Question

According to the frequency analysis results in Table 9, it is seen that 68.0% of the participants do not have a functional beverage that they consume. The distribution of the participants' knowledge of the main ingredient of Hardaliye is presented in Table 10.

Table 10 The participants were asked "What is the Main Ingredient of Hardaliye?" Distribution of Answers to the Question

According to the frequency analysis results in Table 10, 64.3% of the participants stated that they did not know the main ingredient of Hardaliye.

Findings on Survey Responses

When the analysis results obtained in Table 11 were evaluated;
- It was seen that the expression "16. Hardaliye is a beverage from the Thrace region." had the highest mean with an average value of 3.26±1.45. According to this result; it can be evaluated that the participants were consumed at the level where they were undecided about which region Hardaliye belongs.
- In the expression "8. Hardaliye is often consumed in my family." had the lowest mean with an average value of 1.66 ±0.74. According to this result; it can be concluded that the participants consumed Hardaliye at a very low level.

Table 11 Descriptive Analysis Results of Survey on Hardaliye Awareness

When the analysis results obtained in Table 12 were evaluated;
- It was seen from the expression "4. Far from sales points." showed the highest mean with an average value of 4.28±0.60. According to this result; it was seen that there was a very high level of obstacle, as the point of sale as far from the consumer.

- The expression "8. It has no superiority over other drinks." Had the lowest mean with an average value of 3.31±0.87. According to this result; it could be seen that the participants were not sure about the superiority of Hardaliye compared to other consumed bevarges and it didn't signifiactly effcet the obstacles to consume Hardaliye .

Table 12 Descriptive Analysis Results of the Survey on Obstacles to Hardaliye Consumption

According to the results obtained in Table 13, it was seen that the participants were generally undecided to drink hardaliye and this result may be explained by lack of participants knowledge about it. They didn't drink or heard Hardaliye before.

Table 13 Descriptive Analysis Results of Hardaliye Reasons for Preference Survey

Findings Regarding Surveys

According to the results in Table 14 it was found that the awareness of Hardaliye was very low, the perceptions of obstacles of Hardaliye consumption were high, and participants were undecided in their opinions to consume Hardaliye.

Table 14 Descriptive Analysis Results of Surveys

Difference Tests and Hypothesis Evaluation

The results of ANOVA shoved that hyphothesis H1 "Awareness of Hardaliye differ according to consumer age") was accepted (Table 15, $F=4.617$, $p<0.001$. However, between groups there was a statistically significant difference with the Bonferroni post-hoc test. When the analysis results were examined, it was concluded that the awareness level of Hardaliye of the participants aged 42-49 was lower than the level of awareness of Hardaliye of the participants aged 18-25, aged 50-57 and aged 58 and over, and this situation was statistically significant ($p<0.05$).

Table 15 Differentiation of the Average Scores Obtained from the Awareness of Hardaliye According to the Age of the Participants

The results of the independent sample t-test were shown in Table 16. As a result of the analysis, it was determined that the awareness level of Hardaliye of female participants was higher than male participants, but this situation was not statistically significant ($p>0.05$). In this context, and the H2 hypothesis "Awareness of Hardaliye differ according to consumer gender" hypothesis was rejected.

Table 16 Differentiation of the Average Scores Obtained from the Awareness of Hardaliye According to the Gender of the Participants

The hypothesis H3 "Awareness of Hardaliye differ according to previous knowledge level of Hardaliye" hypothesis was accepted depending on the results of the independent sample t-test shown in Table 17. The awareness level of the participants who had heard of Hardaliye before was significantly higher than the participants who had not heard of Hardaliye ($p<0.05$)

Table 17 Differentiation of the Average Scores Obtained from the Awareness of Hardaliye According to the Participants' Hearing of Hardaliye

It was determined that the awareness level of Hardaliye of the participants who consumed any functional beverage was higher than the participants who did not consume it, and this situation was statistically significant ($p<0.05$). In this context, when the hypothesis was evaluated, H4 "Awareness of Hardaliye as

a functional beverage differ from other bevarages" hypothesis was accepted shown in Table (18).

Table 18 Differentiation of the Average Scores Obtained from the Awareness of Hardaliye According to the Status of Any Functional Beverage Consumed by the Participants

The results of the independent sample t test showed that the awareness level of the participants who knew the main ingredient of Hardaliye was higher than the participants who did not know, and this situation was statistically significant ($p<0.05$) (Table 19). In this context, H5 "Awareness of Hardaliye differ based on knowledge about the main ingredient" was accepted.

Table 19 Differentiation of the Average Scores Obtained from the Awareness of Hardaliye According to the Participants' Knowledge of the Main Ingredient of Hardaliye

The results of ANOVA presented in Table 20 showed that the age groups of the participants, the perceptions of the obstacles to Hardaliye consumption differ statistically ($F=3.611$, $p=0.003$) and H6 "Obstacles for consumption of Hardaliye differ according to their age" was accepted. However, between groups statistically significant difference were examined with the Bonferroni post-hoc test and it was concluded that the level of obstacles to Hardaliye consumption of the participants aged 26-33 was higher than the levels of obstacles to consumption of Hardaliye of the participants aged between 18-25 and 50-57 years old, and this situation was statistically significant ($p<0.05$).

Table 20 Differentiation of the Average Scores Obtained from the Obstacles of Hardaliye Consumption According to the Age of the Participants

The results of the independent sample t-test shown in Table 21 indicated that the level of obstacles to Hardaliye consumption of male participants was higher than female participants, but this situation was not statistically significant ($p>0.05$). In this context, when the hypothesis was evaluated; H7 "Obstacles for consumption of Hardaliye differ according to their gender" hypothesis was rejected.

Table 21 Differentiation of the Average Scores Obtained from the Obstacles of Hardaliye Consumption According to the Gender of the Participants

The level of obstacles to consumption of Hardaliye was higher in the participants who had not heard of Hardaliye before, and this situation was statistically significant ($p<0.05$). The results of the independent sample t-test were shown in Table 22. In this context, when the hypothesis was evaluated, H8 "Obstacles for consumption of Hardaliye differ according to previous knowledge level of Hardaliye" hypothesis was accepted.

Table 22 Differentiation of the Average Scores Obtained from the Obstacles of Hardaliye Consumption According to the Participants' Hearing of Hardaliye

The results of the independent sample t-test are shown in Table 23. As a result of the analysis; It was determined that the level of obstacles to Hardaliye consumption was higher in the participants who did not consume any functional beverage, and this situation was statistically significant ($p<0.05$). In this context, when the hypothesis is evaluated; "H9: Obstacles for consumption of Hardaliye as a functional beverage differ from other beverages" hypothesis was accepted.

Table 23 Differentiation of the Average Scores Obtained from the Obstacles of Hardaliye Consumption According to the

Status of Any Functional Beverage Consumed by the Participants

It was determined that the participants who did not know the main ingredient of Hardaliye had a higher level of barriers to consumption of Hardaliye than those who knew, and this situation was statistically significant ($p<0.05$). The results of the independent sample t-test were shown in Table 24. In this context, hypothesis H10 "Obstacles for consumption of Hardaliye differ based on knowledge about the main ingredient" was accepted.

Table 24 Differentiation of the Average Scores Obtained from the Obstacles of Hardaliye Consumption According to the Participants' Knowledge of the Main Ingredient of Hardaliye

Between the age groups of the participants, the perceptions of Hardaliye were found as statistically ($F=20.133$, $p<0.001$) different. According to this result, H11 "Consumers preferences of Hardaliye changes according to their age." hypothesis was accepted. The results of ANOVA were shown in Table 25. However, between groups there was a statistically significant difference with the Bonferroni post-hoc test. When the analysis results were examined; It was concluded that preference of Hardaliye of the participants aged between 42-49 were lower than other age groups, and this situation was statistically significant ($p<0.05$).

Table 25 Differentiation of the Average Scores Obtained from the Reasons for Preference Hardaliye According to the Age of the Participants

The results of the independent sample t-test analysis showed that male participants preferred Hardaliye higher than female participants, but this situation was not statistically significant ($p>0.05$) and hyphothesis H12 "Consumers preferences of Hardaliye changed depending on gender" hypothesis was rejected.

Table 26 Differentiation of the Average Scores Obtained from the Reasons for Preferece Hardaliye According to the Gender of the Participants

The results of the independent sample t-test were shown in Table 27. As a result of the analysis, it was determined that the participants who had heard Hardaliye before showed a higher level of reasons for preference Hardaliye than the participants who had not heard of it, and this situation was statistically significant ($p<0.05$). In this context, when the hypothesis was evaluated; hypothesis H13 "Consumers preferences of Hardaliye changes according to their previous information level about it" was accepted.

Table 27 Differentiation of the Average Scores Obtained from the Reasons of Preference Hardaliye According to the Participants' Hearing of Hardaliye

The results of the independent sample t-test (Table 28) showed that preference of Hardaliye were higher in the participants who consumed any functional beverage than the participants who did not consume, and this situation was statistically significant ($p<0.05$). In this viewpoint, when the hypothesis H14 was evaluated, "Consumers preferences of Hardaliye changes because of its functional properties" was accepted.

Table 28 Differentiation of the Average Scores Obtained from the Reasons for Preference Hardaliye According to the Status of Any Functional Beverage Consumed by the Participants

The participants who knew the main ingredient of Hardaliye had a higher level of reasons for consumption of Hardaliye than the participants who did not know, and this situation was statistically significant

($p<0.05$). The results of the independent sample t-test were shown in Table 29. In this context, when the H15 hypothesis was evaluated, "Consumers preferences of Hardaliye changes according to their knowledge about the main ingredient" was accepted. The general evaluation of the hypotheses analyzed according to the socio-demographic characteristics of the participants included in the research was presented in Table 30.

Table 29 Differentiation of the Average Scores Obtained from the Reasons for Preference Hardaliye According to the Participants' Knowledge of the Main İngredient of Hardaliye

Table 30 Analysis of Hypothesis According to the Socio-Demographic Characteristics of the Participants

Conclusion

It was seen that 3 of the 15 hypotheses were rejected and the other hypotheses were accepted (Table 30). No significant differences were obtained between male or female about the awareness of Hardaliye, the obstacles to Hardaliye consumption and the reasons for preference of Hardaliye.

When the differences between the participants' age, gender, previous information about Hardaliye like functional beverage, being heard the main ingredient of Hardaliye before and the mean scores obtained from the research variables were examined, it was concluded that gender was not effective on these factors.

In another way, the perceptions of the awareness of Hardaliye differ significantly according to age, having heard before, consuming any functional beverage, and knowing the main ingredient of Hardaliye. Obstacles to Hardaliye consumption showed differences according to age, hearing about Hardaliye before, consuming any functional beverage, and knowing the main ingredient of Hardaliye. Similarly, it is understood that gender didn't significantly affected.

According to the results of the study, it was obtained that the level of awareness of Hardaliye is quite low, consumers don't familiar about this traditional functional beverage. In addition, the consumption of functional beverages among the participants is also quite low. The results of the research showed that the awareness level of Hardaliye is higher among the participants aged 50 and over. Participants who have heard Hardaliye before showed a high level of awareness and high preference for Hardaliye, while the level of obstacles to Hardaliye consumption is lower. The awareness level of Hardaliye is significantly higher in participants who consume a functional food and beverage.

In the literature, it is seen that Hardaliye has not been investigated within the scope of consumer awareness, reasons for consumption, preference and obstacles to consumption. Researchers were mostly carried out on the quality of Hardaliye, its sensory properties, production technology, the effect of the substances used on fermentation, pasteurization, chemical and microbiological quality, health benefits on human. But there were no information about the consumer preferences and this research lightens the consumer awareness level.

In the study of Turkoz Bakirci et al. [9], the effect of local product festivals on gastronomic tourism within the scope of Urla example were studied. As a result of the research, it was determined that food festivals significantly increased awareness of local foods. In the study of Alabacak [10], discussed the awareness of traditional foods in Turkish culinary culture within the framework of Ankara example. In the study, it was determined that the rate of hearing

about traditional food is very low. In the study of Çakır and Çakır [11], the awareness of Hayrabolu Cheese Dessert was investigated. In the study, the awareness of the dessert was determined to also quite low. Even in Tekirdağ cuisine which dessert mostly prepared in this area, awareness is unfortunately at a quite level. Unfortunately, findings of this study was in parallel with the studies in the literature

However, there are some positive results. Cömert and Dinç [12], investigated the awareness of medicinal plants by young people. The results of the research showed that the majority of the young people had knowledge about medicinal plants. Alabacak [10], investigated the awareness of traditional Turkish foods in the province of Ankara and found that the level of awareness of traditional Turkish was increasing. In the study of Sandıkcı [13], conducted research on the awareness of ceremonial meals in Afyon. According to the results of the research, the level of awareness of ceremonial dishes decreases as generations change. Accordingly, while the participants from the X generation have more information about ceremonial meals, the level of knowledge of the Y generation participants is lower. In this study is similar to Sandıkcı's (2019) [13] research in this finding. In this study, the level of awareness increases with age.

Within the scope of the analyzes made and the results obtained in this study, it is recommended to organize product festivals, information's about health benefits of hardaliye in social media, TV programs etc to increase the awareness of Hardaliye and to reduce the level of obstacles to Hardaliye consumption.

Another suggestion to increase the awareness and consumption of Hardaliye is to send products to accommodation service providers with various marketing activities by the producer brands. In this way, awareness of domestic tourists will be increased and it will be possible to introduce Hardaliye to foreign tourists. In later studies, the awareness and consumption of Hardaliye can be studied to fill the gap in the literature.

There are many kinds of traditional functional foods and beverages that contain extraordinary bioactive compounds like Hardaliye. Although Hardaliye has important health benefits, familiar taste, and functional properties, awareness of Turkish consumer was limited as seen in the study. This kind of functional traditional beverages need to be increased familiarities, consumer knowledge and may provide increase in marketing size. Because the development of designed functional foods and beverages without a noticeable reduction in their flavor and sensory acceptability has become the modern-day challenge for researchers. Recently, the interest in developing functional foods has been thriving, driven largely by the market potential for foods that can improve the health and wellbeing of the consumer. Increasing consumer awareness in combination with advances in various scientific domains provide companies with unique opportunities to develop an almost infinite array of new functional food concepts. The development and marketing of these products is rather complex, expensive, and risky, as special requirements should be fulfilled.

References

[1] I. Gok, Functional Functional Potential of Several Turkish Fermented Traditional Foods: Biotic Properties, Bioactive Compounds, and Health Benefits, Food Reviews International, 2021.

[2] M. S. Bayındır and S. Öngel, "Gastronomide Kültürel Miras Bakış Açısıyla Kırklareli Hardaliyesi'nin Geleneksel Üretiminin Değerlendirilmesi," Journal of Tourism and Gastronomy Studies, vol. 7, no. 3, pp. 1867-1886, 2019.

[3] F. C. Prado, J. L. Parada, A. Pandey and C. R. Soccol, "Trends in nondairy probiotic beverages," Food Research International, vol. 41, no. 2, pp. 111-123, 2008.

[4] Y. Gucer, H. Aydogdu and T. Durgun, "A traditional Thracian beverage: 'hardaliye'," Trakia Journal of Sciences, vol. 7, no. 2, pp. 208-210, 2009.

[5] M. M. Yaşlıoğlu, "Sosyal Bilimlerde Faktör Analizi ve Geçerlilik: Keşfedici ve Doğrulayıcı Faktör Analizlerinin Kullanılması," Istanbul University Journal of the School of Business, vol. 46, pp. 74-85, 2017.

[6] A. Çakır, Faktör Analizi, İstanbul Ticaret Üniversitesi Sosyal Bilimler Enstitüsü, 2014.

[7] B. Tabachnick and L. Fidell, Using Multivariate Statistics, Boston: Pearson, 2013.

[8] D. George and M. Mallery, SPSS for Windows Step by Step: A Simple Guide and Reference, Boston: Pearson, 2010.

[9] G. Türköz Bakırcı, T. Bucak and K. N. Turhan, "Bölge Gastronomi Turizmi Üzerine Yöresel Ürün Festivallerinin Etkisi: Urla Örneği," Journal of Tourism and Gastronomy Studies, vol. 5, no. 2, pp. 230-240, 2017.

[10] C. H. Alabacak, Türk Mutfak Kültüründeki Geleneksel Yemeklerin Bilinirliği: Ankara İli Örneği, Gazi Üniversitesi Sosyal Bilimler Enstitüsü, 2018.

[11] A. Çakır and G. Çakır, "Tekirdağ Mutfağı'nın Geleneksel Tatlılarından Hayrabolu Peynir Tatlısı'nın Trakya'da Bilinirliği ve Kemalpaşa Peynir Tatlısı İle Karşılaştırılması," Namık Kemal Üniversitesi, Hayrabolu Değerleri Sempozyumu, pp. 121-126, 2010.

[12] M. Cömet and H. Dinç, "Şifalı Bitkilerin Gençler Tarafından Bilinirliği," Journal of Tourism and Gastronomy Studies, vol. 2, no. 3, pp. 23-27, 2014.

[13] N. Sandıkcı, Tören yemeklerinin bilinirliği üzerine kuşaklar arasındaki farklılıkların belirlenmesine yönelik bir araştırma: Afyonkarahisar ili örneği, Afyon Kocatepe Üniversitesi Sosyal Bilimler Enstitüsü, 2019.

[14] TÜRKPATENT, "Resmi Coğrafi İşaret ve Geleneksel Ürün Adı Bülteni," 15 Mart 2017. [Online]. Available: https://www.turkpatent.gov.tr/TURKPATENT/resources/temp/64E02AA2-8BA4-4353-A26B-A5A1767B1821.pdf;jsessionid=427AFCEB46088DE2DF88EC01F278EA6D.

[15] F. Coşkun, "A Traditional Turkish Fermented Non-Alcoholic Grape-Based Beverage,"Hardaliye"," Beverages, vol. 3, no. 1, pp. 1-3, 2017.

[16] M. Bayram, Y. Esin, C. Kaya, M. İlhan, G. Akın and R. Etdöğer, "Geleneksel Yöntemle Müşküle Üzümünden Üretilen Hardaliyenin Bazı Özelliklerinin Belirlenmesi," Academic Food Journal/Akademik GIDA, vol. 13, no. 2, 2015.

[17] M. Arıcı and F. Coşkun, "Hardaliye: fermented grape juice as a traditional Turkish beverage," Food Microbiology, no. 18, pp. 417-421, 2001.

TABLES

Table 1 EFA Results for Hardaliye Awareness Survey

Awareness Survey of Hardaliye	Skewness	Kurtosis	Factor Load.
1. Some features of Hardaliye come to my mind quickly.	,707	-1,353	,802
2. I know what Hardaliye looks like.	,681	-1,412	,801
3. I can easily remember the image of Hardaliye.	,764	-1,212	,801
4. I can recognize Hardaliye among other drinks.	,681	-1,412	,801
5. I am aware of what Hardaliye is.	,687	-1,397	,802
6. It is difficult for me to imagine Hardaliye in my mind.	,357	-1,564	,770
7. Hardaliye is a traditional beverage.	,104	-1,416	,883
8. Hardaliye is often consumed in my family.	,830	-,038	,678
9. I know the smell of Hardaliye.	,553	-1,460	,810
10. Hardaliye is a non-alcoholic beverage.	-,261	-,996	,964
11. Hardaliye does not contain artificial sugar.	-.433	-.122	,949
12. Hardaliye contains high energy.	-,536	-.463	,973
13. Hardaliye helps blood production.	-.585	-,532	,983
14. Hardaliye is a useful beverage.	-.530	-.566	,990
15. Hardaliye has high nutritional values.	-.419	-,543	,978
16. Hardaliye is a beverage from the Thrace region.	-.236	-1,079	,972
17. Water can be consumed with Hardaliye.	-,231	-.411	,954
18. Coffee can be consumed with Hardaliye.	-.179	-,056	,938
19. Soda can be consumed with Hardaliye.	-.222	-,196	,943
20. Hardaliye can be consumed with alcoholic beverages.	-,551	,325	,890
21. Hardaliye is a beverage of animal origin.	-,080	-1,942	,575
22. Hardaliye is a beverage of plant origin.	-.239	-,783	,935
23. Hardaliye is a probiotic beverage.	-,641	,095	,903
24. Hardaliye should be consumed under the supervision of a doctor.	-.244	-1,685	,563
25. Some foods can cause poisoning when consumed with Hardaliye.	-.326	-1,653	,504
26. Hardaliye is a functional beverage.	-.414	-.227	,930
27. Hardaliye is a beverage that should be consumed carefully and has various harmful effects.	-.138	-1,732	,511
28. People with overweight problems should not consume Hardaliye.	-1,431	,048	,838
29. Hardaliye is not suitable for vegetarians and people on a vegan diet	-,204	-,813	,574
30. Excess consumption of Hardaliye is dangerous.	-.382	-1,630	,538
Total variance: 63,128% ; KMO : .750; x^2 :635,256, p<.001			

Table 2 EFA Results for Hardaliye Consumption Obstacles Survey

Hardaliye Consumption Obstacles Survey	Skewness	Kurtosis	Factor Load.
1. Expensive	-.599	-,210	,723
2. Not easy to find in markets	-.530	1,564	,930
3. Lack of regular supply	,223	-.445	,872
4. Far from sales points	-,564	1,465	,950
5. Difficult to search, find and supply	-,564	1,465	,950
6. Few sales areas	-,482	1,769	,948
7. Low trust in manufacturers	-,653	1,129	,631
8. No superiority over other beverages	-.219	-,103	,455
9. Insufficient information about the products	-,601	,178	,753
10. Not tastier than other drinks	-,171	-.595	,561
11. Not looking tasty and attractive	-.376	-,086	,525
12. Not enough brands	-.334	,178	,651
Total variance: 54,726% ; KMO : 0.856; x^2 :105,238, p<.001			

Table 3 EFA Results for Hardaliye Reasons for Preference Survey

Hardaliye Reasons for Preference Survey	Skewness	Kurtosis	Factor Load.
1. Hardaliye contains many vitamins and minerals.	-,262	,877	,975
2. Hardaliye is beneficial for my health.	-.489	1,361	,980
3. Hardaliye is a nutritious.	-.489	1,361	,980
4. Hardaliye has high nutritional values.	-,343	1,078	,989
5. Hardaliye is natural.	-.299	1,115	,986
6. Hardaliye has natural ingredients.	-.299	1,115	,986
7. Hardaliye does not contain artificial ingredients.	-,141	1,335	,963
8. Hardaliye is produced without disturbing the nature of the products.	,008	1,682	,941
9. Hardaliye is produced and packaged with an environmentally approach.	,028	1,112	,854
10. Animals are not harmed in the production of Hardaliye.	-,087	1,488	,897
11. Animal rights are not violated in the production of Hardaliye.	-,087	1,488	,897
12. The appearance of Hardaliye is beautiful.	-,890	1,465	,881
13. The consistency and texture of Hardaliye is good.	-,724	1,791	,965
14. Hardaliye tastes good.	-,584	1,507	,978
15. Hardaliye is affordable.	-,784	1,305	,949
Total variance: 90.06% ; KMO : .950; x^2 :1035,108, p<.001			

Introduction

Table 4 Reliability Analysis Findings of the Surveys

Surveys	Cronbach's Alpha	N
Awareness of Hardaliye	,970	30
Obstacles of Hardaliye Consumption	,896	12
Reasons for Preference of Hardaliye	,992	15

Table 5 Age Distribution of Participants

	Demographic Feature	f	%
Age Status	18-25 Age Range	120	40.0
	26-33 Age Range	35	11.7
	34-41 Age Range	44	14.7
	42-49 Age Range	36	12.0
	50-57 Age Range	34	11.3
	Age 58 and Over	31	10.3
	Total	300	100.0

Table 6 Gender Distribution of Participants

	Demographic Feature	f	%
Gender	Female	185	61.7
	Male	115	38.3
	Total	300	100.0

Table 7 Distribution of Participants' Hometowns

	Demographic Feature	f	%	Demographic Feature	f	%
Hometown	Adana	18	6.0	Malatya	5	1.7
	Amasya	5	1.7	Manisa	4	1.3
	Ankara	18	6.0	Mardin	6	2.0
	Artvin	3	1.0	Mersin	5	1.7
	Aydın	10	3.3	Nevsehir	12	4.0
	Balikesir	21	7.0	Rize	13	4.3
	Bursa	10	3.3	Sakarya	7	2.3
	Canakkale	5	1.7	Samsun	9	3.0
	Cankiri	4	1.3	Sivas	7	2.3
	Corum	4	1.3	Tekirdag	15	5.0
	Denizli	7	2.3	Tokat	17	5.7
	Elazig	3	1.0	Trabzon	4	1.3
	Erzurum	12	4.0	Tunceli	5	1.7
	Istanbul	6	2.0	Uşak	4	1.3
	Izmir	10	3.3	Van	10	3.3
	Kastamonu	5	1.7	Yalova	7	2.3
	Kayseri	4	1.3	Yozgat	5	1.7
	Kirikkale	5	1.7	Zonguldak	7	2.3
	Kocaeli	5	1.7	Total	300	100.0
	Konya	3	1.0			

Introduction

Table 8 The participants' "Have You Heard of Hardaliye Before?" Distribution of Answers to the Question

	Demographic Feature	f	%
"Have you heard of Hardaliye before?"	Yes	107	35.7
	No	193	64.3
	Total	300	100.0

Table 9 "Do you consume any functional beverage?" Distribution of Answers to the Question

	Demographic Feature	f	%
"Do you consume any functional beverages?"	Yes	96	32.0
	No	204	68.0
	Total	300	100.0

Table 10 The participants were asked "What is the Main Ingredient of Hardaliye?" Distribution of Answers to the Question

	Demographic Feature	f	%
"What is the main ingredient of Hardaliye?"	I do not know	193	64.3
	Grape	88	29.3
	Grapes and Mustard	19	6.3
	Total	300	100.0

Table 11 Descriptive Analysis Results of Survey on Hardaliye Awareness

Awareness Survey of Hardaliye	**Min.**	**Max.**	**Average**	**SS**
1. Some features of Hardaliye come to my mind quickly.	1	5	2.12	1.53
2. I know what Hardaliye looks like.	1	5	2.14	1.55
3. I can easily remember the image of Hardaliye.	1	5	2.08	1.50
4. I can recognize Hardaliye among other drinks.	1	5	2.14	1.55
5. I am aware of what Hardaliye is.	1	5	2.15	1.56
6. It is difficult for me to imagine Hardaliye in my mind.	1	5	2.54	1.58
7. Hardaliye is a traditional beverage.	1	5	2.82	1.53
8. Hardaliye is often consumed in my family.	**1**	**4**	**1.66**	**.74**
9. I know the smell of Hardaliye.	1	5	2.22	1.51
10. Hardaliye is a non-alcoholic beverage.	1	5	3.15	1.40
11. Hardaliye does not contain artificial sugar.	1	5	2.80	1.06
12. Hardaliye contains high energy.	1	5	2.92	1.13
13. Hardaliye helps blood production.	1	5	2.97	1.15
14. Hardaliye is a useful beverage.	1	5	3.00	1.18
15. Hardaliye has high nutritional values.	1	5	2.99	1.19
16. Hardaliye is a beverage from the Thrace region.	**1**	**5**	**3.26**	**1.45**
17. Water can be consumed with Hardaliye.	1	5	2.93	1.19
18. Coffee can be consumed with Hardaliye.	1	5	2.83	1.11
19. Soda can be consumed with Hardaliye.	1	5	2.86	1.13
20. Hardaliye can be consumed with alcoholic beverages.	1	5	2.69	.96
21. Hardaliye is a beverage of animal origin.	1	3	2.04	.97
22. Hardaliye is a beverage of plant origin.	1	5	3.02	1.30
23. Hardaliye is a probiotic beverage.	1	5	2.71	.97
24. Hardaliye should be consumed under the supervision of a doctor.	1	3	2.12	.89
25. Some foods can cause poisoning when consumed with Hardaliye.	1	3	2.16	.89
26. Hardaliye is a functional beverage.	1	5	2.84	1.09
27. Hardaliye is a beverage that should be consumed carefully and has various harmful effects.	1	3	2.07	.89
28. People with overweight problems should not consume Hardaliye.	1	3	2.58	.82
29. Hardaliye is not suitable for vegetarians and people on a vegan diet.	1	5	2.44	1.00
30. Excess consumption of Hardaliye is dangerous.	1	3	2.19	.89

Table 12 Descriptive Analysis Results of the Survey on Obstacles to Hardaliye Consumption

Hardaliye Consumption Obstacles Survey	**Min.**	**Max.**	**Average**	**SS**
1. Expensive	2	5	4.07	.83
2. Not easy to find in markets	2	5	4.26	.59
3. Lack of regular supply	3	5	4.27	.52
4. Far from sales points	**2**	**5**	**4.28**	**,60**
5. Difficult to search, find and supply	2	5	4.28	,60
6. Few sales areas	2	5	4.23	.58
7. Low trust in manufacturers	2	5	4.01	.68
8. No superiority over other beverages	**1**	**5**	**3.31**	**.87**
9. Insufficient information about the products	2	5	4.24	.69
10. Not tastier than other drinks	1	5	3.35	.97
11. Not looking tasty and attractive	1	5	3.32	.85
12. Not enough brands	2	5	3.89	.70

Table 13 Descriptive Analysis Results of Hardaliye Reasons for Preference Survey

Hardaliye Reasons for Preference Survey	Min.	Max.	Average	SS
1. Hardaliye contains many vitamins and minerals.	**1**	**5**	**3.33**	**.92**
2. Hardaliye is beneficial for my health.	1	5	3.29	.85
3. Hardaliye is a nutritious.	1	5	3.29	.85
4. Hardaliye has high nutritional values.	1	5	3.31	.89
5. Hardaliye is natural.	1	5	3.30	.89
6. Hardaliye has natural ingredients.	1	5	3.30	.89
7. Hardaliye does not contain artificial ingredients.	1	5	3.24	.87
8. Hardaliye is produced without disturbing the nature of the products.	1	5	3.18	.85
9. Hardaliye is produced and packaged with an environmentally approach.	**1**	**5**	**3.02**	**.72**
10. Animals are not harmed in the production of Hardaliye.	1	5	3.07	.78
11. Animal rights are not violated in the production of Hardaliye.	1	5	3.07	.78
12. The appearance of Hardaliye is beautiful.	1	5	3.13	.73
13. The consistency and texture of Hardaliye is good.	1	5	3.23	,80
14. Hardaliye tastes good.	1	5	3.27	.83
15. Hardaliye is affordable.	1	5	3.26	.77

Table 14 Descriptive Analysis Results of Surveys

Scale	N	min.	Max.	Average.	SS	Skewness	Kurtosis
Awareness of Hardaliye	300	1.00	4.00	2.55	.89	-,627	-,623
Obstacles to Hardaliye Consumption	300	2.17	5.00	3.96	,49	-.358	1,460
Reasons for Preference Hardaliye	300	1.00	5.00	3.22	.79	-.238	1,294

Table 15 Differentiation of the Average Scores Obtained from the Awareness of Hardaliye According to the Age of the Participants

Variable	Age	f	X̄	SS	*F*	*p*	*Group Difference*
Awareness of Hardaliye	(1) 18-25 Age Range	120	2.60	1.00	4,617	**,000**	**1 →4** **4 →5** **4 →6**
	(2)26-33 Age Range	35	2.46	.83			
	(3) 34-41 Age Range	44	2.39	1.06			
	(4)42-49 Age Range	36	2.06	.76			
	(5) 50-57 Age Range	34	2.90	,41			
	(6) 58 Years and Over	31	2.86	,42			

Table 16 Differentiation of the Average Scores Obtained from the Awareness of Hardaliye According to the Gender of the Participants

Variables	Gender	f	X̄	SS	*t*	*p*
Awareness of Hardaliye	Female	185	2.61	.85	1,402	,162
	Male	115	2.46	.95		

Table 17 Differentiation of the Average Scores Obtained from the Awareness of Hardaliye According to the Participants' Hearing of Hardaliye

Variables	Hearing of Hardaliye Before	f	X̄	SS	*t*	*p*
Awareness of Hardaliye	Yes	107	3.43	,25	18,862	**,000**
	No	193	2.06	.73		

Table 18 Differentiation of the Average Scores Obtained from the Awareness of Hardaliye According to the Status of Any Functional Beverage Consumed by the Participants

Variables	Any Functional Beverage You Consume	f	X̄	SS	*t*	*p*
Awareness of Hardaliye	Yes	96	2.99	.90	6,152	**,000**
	No	204	2.34	,81		

Table 19 Differentiation of the Average Scores Obtained from the Awareness of Hardaliye According to the Participants' Knowledge of the Main Ingredient of Hardaliye

Variables	Main Ingredient of Hardaliye	f	X̄	SS	*t*	*p*
Awareness of Hardaliye	I do not know	193	2.06	.73	-18,862	,000
	Grape	107	3.43	,25		

Table 20 Differentiation of the Average Scores Obtained from the Obstacles of Hardaliye Consumption According to the Age of the Participants

Variable	Age	f	X̄	SS	*F*	*p*	*Group Difference*
Obstacles to Hardaliye Consumption	(1) 18-25 Age Range	120	3.91	,63	3,611	**,003**	**1 →2**
	(2)26-33 Age Range	35	4.21	.35			**2 →5**
	(3) 34-41 Age Range	44	3.89	,36			
	(4)42-49 Age Range	36	4.10	,31			
	(5) 50-57 Age Range	34	3.80	,48			
	(6) 58 Years and Over	31	3.96	.04			

Table 21 Differentiation of the Average Scores Obtained from the Obstacles of Hardaliye Consumption According to the Gender of the Participants

Variables	Gender	f	X̄	SS	*t*	*p*
Obstacles to Hardaliye Consumption	Female	185	3.92	.51	-1,863	,063
	Male	115	4.03	.45		

Table 22 Differentiation of the Average Scores Obtained from the Obstacles of Hardaliye Consumption According to the Participants' Hearing of Hardaliye

Variables	Hearing of Hardaliye Before	f	X̄	SS	*t*	*p*
Obstacles to Hardaliye Consumption	Yes	107	3.78	,49	-5,024	**,000**
	No	193	4.06	,46		

Table 23 Differentiation of the Average Scores Obtained from the Obstacles of Hardaliye Consumption According to the Status of Any Functional Beverage Consumed by the Participants

Variables	Any Functional Beverage You Consume	f	X̄	SS	*t*	*p*
Obstacles to Hardaliye Consumption	Yes	96	3.85	.61	-2,618	**,009**
	No	204	4.01	,42		

Table 24 Differentiation of the Average Scores Obtained from the Obstacles of Hardaliye Consumption According to the Participants' Knowledge of the Main Ingredient of Hardaliye

Variables	Main Ingredient of Hardaliye	f	X̄	SS	*t*	*p*
Obstacles to Hardaliye Consumption	I do not know	193	4.06	,46	5,024	**,000**
	Grape	107	3.78	,49		

Table 25 Differentiation of the Average Scores Obtained from the Reasons for Preference Hardaliye According to the Age of the Participants

Variable	Age	f	X̄	SS	*F*	*p*	*Group Difference*
Reasons for Preference Hardaliye	(1) 18-25 Age Range	120	3.36	,81	20,133	**,000**	**1 →4**
	(2)26-33 Age Range	35	3.46	.65			**2 →4**
	(3) 34-41 Age Range	44	3.33	,48			**3 →4**
	(4)42-49 Age Range	36	2.15	.90			**5 →4**
	(5) 50-57 Age Range	34	3.29	,36			**6 →4**
	(6) 58 Years and Over	31	3.40	,37			

Table 26 Differentiation of the Average Scores Obtained from the Reasons for Preferece Hardaliye According to the Gender of the Participants

Variables	Gender	f	X̄	SS	*t*	*p*
Reasons for Preference Hardaliye	Female	185	3.21	.72	-.248	,805
	Male	115	3.23	.89		

Table 27 Differentiation of the Average Scores Obtained from the Reasons of Preference Hardaliye According to the Participants' Hearing of Hardaliye

Variables	Heard of Hardaliye Before	f	X̄	SS	*t*	*p*
Reasons for Preference Hardaliye	Yes	107	3.99	,43	18,643	**,000**
	No	193	2.79	.58		

Table 28 Differentiation of the Average Scores Obtained from the Reasons for Preference Hardaliye According to the Status of Any Functional Beverage Consumed by the Participants

Variables	Any Functional Beverage You Consume	f	X̄	SS	*t*	*p*
Reasons for Preference Hardaliye	Yes	96	3.75	.58	8,948	**,000**
	No	204	2.97	.75		

Table 29 Differentiation of the Average Scores Obtained from the Reasons for Preference Hardaliye According to the Participants' Knowledge of the Main İngredient of Hardaliye

Variables	Main Ingredient of Hardaliye	f	X̄	SS	*t*	*p*
Reasons for Preference Hardaliye	I do not know	193	2.79	.58	-18,643	**,000**
	Grape	107	3.99	,43		

Table 30 Analysis of Hypothesis According to the Socio-Demographic Characteristics of the Participants

Hypotheses	Accept	Rejection
"H1: Awareness of Hardaliye differ according to consumer age"	✓	
"H2: Awareness of Hardaliye differ according to consumer gender"		✓
"H3: Awareness of Hardaliye differ according to previous knowledge level of Hardaliye"	✓	
"H4: Awareness of Hardaliye as a functional beverage differ from other bevarages"	✓	
H5: Awareness of Hardaliye differ based on knowledge about the main ingredient"	✓	
"H6: Obstacles for consumption of Hardaliye differ according to their age"	✓	
"H7: Obstacles for consumption of Hardaliye differ according to their gender"		✓
"H8: Obstacles for consumption of Hardaliye differ according to previous knowledge level of Hardaliye"	✓	
"H9: Obstacles for consumption of Hardaliye as a functional beverage differ from other bevarages"	✓	
"H10: Obstacles for consumption of Hardaliye differ based on knowledge about the main ingredient"	✓	
"H11: Consumers preferences of Hardaliye changes according to their age"	✓	
"H12: Consumers preferences of Hardaliye changed depending on gender"		✓
"H13: Consumers preferences of Hardaliye change according to their previous information level about it"	✓	
H14: Consumers preferences of Hardaliye change because of its functional properties"	✓	
"H15: Consumers preferences of Hardaliye change according to their knowledge about the main ingredient"	✓	

TÜBİTAK

ULAKBİM

FHTI

JOURNAL OF FOOD HEALTH AND TECHNOLOGY INNOVATIONS

SEPTEMBER VOL 5, NO 10 (2022)

ISSN 2667-5803