

# Using Household Fruit and Vegetable Waste in Recipes to Reduce Kitchen Food Waste and their Nutritional and Functional Values

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## ABSTRACT

The formation of food waste brings numerous issues such as inefficient use of nutrients, social injustice, and economic and ecological losses. The aim of this study is to reduce fruit and vegetable waste, which are among the most common kitchen wastes, with new recipes, and to explore the advantages they provide to human health. The study developed 20 different recipes using parts typically considered waste in the kitchen, like stems, stalks, and peels from 11 fruits and 9 vegetables, and calculated their nutritional values using the BEBIS program (Nutrition Information System). Additionally, the functional properties of the fruit and vegetable waste used in the study were examined in light of scientific literature. Results showed that parts of fruits and vegetables considered as waste might have valuable nutritional properties, such as being a good source of dietary fiber, antioxidants, vitamins, and minerals. Among the recipes created with fruit waste, the chocolate balls with pomegranate peel powder had the highest energy value (4255.3 kcal), the sweet chicken with orange flavor had the highest protein content (122.1 g), and the watermelon dessert had the highest fiber content (25.3 g). Among the recipes made with vegetable waste, the puff pastry with leek leaves had the highest energy value (2740 kcal), and the savory cake with cauliflower and potatoes contained the most protein (222.2 g) and fiber (184.1 g). Using parts like stems, peels, and leaves considered food waste in recipes also imparts functional properties to the recipes. The food waste used in this study possesses properties in the literature such as anti-cancer, antimicrobial, antiviral, anti-inflammatory, prevention of neurological disorders, and anti-obesity, anti-diabetes, and anti-aging effects.

**Keywords:** Food waste, Vegetables, Fruit, Functional food, Gastronomy

## Mutfakta Gıda Atıklarının Azaltılması Amacıyla Eysel Meyve-Sebze Atıklarının Tariflerde Kullanılması ve Oluşturulan Tariflerin Besinsel ve Fonksiyonel Değerleri

### ÖZ

Gıda atık oluşumu; besinlerin etkin kullanılamaması, sosyal adaletsizlik, ekonomik ve ekolojik kayıplar gibi birçok sorunu beraberinde getirmektedir. Bu çalışmanın amacı, mutfaklarda en fazla oluşan atıklardan meyve ve sebze atıklarının yeni tariflerle azaltılması ve bu atıkların sağlık ve beslenme yönüyle insan sağlığına kazandırdığı avantajları araştırmaktır. Çalışmada 11 meyve ve 9 sebzenin genellikle mutfakta atık olarak düşünülen sap, gövde, kabuk gibi kısımlarından 20 farklı tarif geliştirilmiş ve bu tariflerin besin değerleri BEBİS programı (Beslenme Bilgi Sistemi) kullanılarak hesaplanmıştır. Ayrıca çalışmada kullanılan meyve ve sebze atıklarının fonksiyonel özellikleri bilimsel literatür ışığında irdelenmiştir. Sonuç olarak, atık olarak görülen meyve ve sebze kısımlarının beslenme açısından değerli özellikler olan; iyi bir diyet lifi, antioksidan, vitamin ve mineral kaynağı olduğu belirlenmiştir. Çalışma kapsamında meyve atıkları ile oluşturulan tarifler arasında en yüksek enerji değerine sahip ürün nar kabuğu tozlu çikolatalı toplar (4255.3 kcal), en yüksek protein portakal aromalı tatlı tavuk (122.1 g) ve en yüksek lif karpuzlama (25.3 g) olurken,

sebze atıkları ile oluşturulan tarifler arasında en yüksek enerji değerine sahip ürün pırasa yapraklı milföy böreği (2740 kcal), en yüksek protein (222.2 g) ve lif (184.1 g) içeren karnabaharlı patatesli tuzlu kek olmuştur. Yiyeceklerde gıda atığı olarak görülen sap, kabuk, yaprak vb. kısımlarının kullanımı aynı zamanda yapılan tariflere fonksiyonel özellikler kazandırmaktadır. Bu çalışmada kullanılan gıda atıklarının literatürde antikanser, antimikrobiyal, antiviral, antiinflamatuvar, nörolojik bozuklukları önleme, obezite diyabet ve yaşlanma karşıtı gibi özelliklere sahip olduğu görülmüştür.

**Anahtar Kelimeler:** Gıda atığı, Sebze, Meyve, Fonksiyonel gıda, Gastronomi

## INTRODUCTION

Food waste includes foods purchased by consumers, restaurants and food and beverage manufacturers, but not consumed by customers in businesses and individuals at home [1]. Food waste is decomposable organic substances of animal and vegetable origin resulting from food service, cooking, preparation, sale, storage and transportation [2]. Edible food waste refers to unused, damaged products and foods that can be eaten before being thrown away [3]. The problems caused by food waste can be addressed in two dimensions. The first of these include inability to use resources economically, efficiently and effectively; increasing poverty in the world, facing hunger and deteriorating socio-economic situation [4]. Another problem caused by food waste takes place at an ecological level. Food waste causes an increase in greenhouse gas emissions released into nature and wasteful use of soil and water. [5].

Every day, one in eight people in the world goes to bed hungry, and more than 20,000 children die due to malnutrition and hunger. The FAO estimates that one-third of the world's food production is lost or wasted. If even one-quarter of the food wasted or lost globally were saved, 840 million hungry people could be fed [6, 7]. Every year, 198 million hectares of land are used to grow wasted food, representing 173 billion cubic meters of wasted water. Additionally, the time and labor wasted in the production, transportation, and marketing of foodstuffs also contribute to these losses [5]. Studies report that annual food waste in Turkey is 26 million tons, with fruits and vegetables ranking first among wasted foods [8, 9]. It is known that, in our country, fruits and vegetables suffer from 10-50% food loss due to mistakes made during and after harvest, depending on the variety and species. While this rate is higher in underdeveloped countries, it is lower in developed countries [10]. Many countries and international organizations are working against food waste to prevent negative outcomes such as environmental pollution, poor resource use, social injustice, disruption of ecological balance, and climate change caused by food waste [11]. In his study on sustainability, Gülsöz [12] determined that most vegetables and fruits have a low environmental impact; however, hard fruits (e.g., apples) and root and tuber vegetables are resistant to spoilage and, therefore, have lower greenhouse gas emissions than sensitive vegetables and fruits (e.g., strawberries, cucumbers).

Some of the advantages of creating new recipes from food waste, as reported in the literature, are as follows: increasing the nutritional value of the recipe to which it is added [13-15], providing dietary fiber and reducing the

glycemic index [16, 17], and increasing the phenolic compound content [18-21]. Additionally, the compounds contained in food waste have been found to help prevent neurodegenerative diseases and cancer [22], regulate the body's metabolic activities [16, 23], and help prevent and fight obesity and diabetes [24, 25]. Furthermore, scientific literature reports that garden cress seed flour and tangerine peel powder can be used to enhance the nutritional and physical properties of cakes [26]. Cauliflower leaf powder can enrich cookies [27], some food waste can be used in the production of sherbet [28], and using banana peel powder instead of wheat flour in cakes has been found to have antimicrobial properties and positive effects on antioxidant and nutritional value [29]. It has also been reported that dried watermelon peel extract has functional and nutritional properties, including vitamin and mineral content [30]. Similarly, the amount of phenolic substances in apples varies across different parts, with the highest amount of total phenolic substances located in the apple peel [31]. The total phenolics, essential phenolics, and ascorbic acid content in orange, grapefruit, and lemon peels are higher than in the peeled parts of the fruit. It has been found that the total polyphenol and iron content in lemon peels are significantly higher than those in peeled oranges, grapefruits, and their peels [32].

Fruits and vegetables, as one of the most important food groups in people's daily diets, hold great significance for health and nutrition. Today, there are numerous studies on food waste, nutrition, and sustainability. Unlike other branches of science, gastronomy can offer a more active solution to the waste problem locally and within food businesses. In this context, practical studies aimed at preventing waste are of great importance. In this study, recipes were created by utilizing the waste parts of fruits and vegetables, such as peels, stems, or leaves, with the aim of reducing kitchen food waste and incorporating these parts into human nutrition. Additionally, another goal of this study is to highlight the nutritional and health importance of the wasted parts of vegetables and fruits.

## MATERIALS and METHODS

This study was primarily a research and application attempt, carried out in three stages. First, a literature review was conducted to identify food waste components suitable for use in the application study. The second stage involved identifying products frequently encountered as food waste that could be used in recipe creation based on the obtained data. In the first stage, keywords such as "food waste, recipes made from food waste, nutritional value potential of food waste in general, negative effects of food waste" were used to select

studies relevant to the general framework of our research. In the second stage, new recipes were designed using seasonal fruits and vegetables, incorporating unused parts like peels, roots, and leaves. These recipes were repeated an average of 2-3 times to identify and standardize the successful ones.

For the third stage, the BEBIS 9 (Nutrition Information System) program was used to analyze the nutritional values of the designed recipes. A literature review was conducted to gather nutritional data (carbohydrates, fat, protein, water, minerals, and vitamins) for parts like peels and stems, which are not included in BEBIS, using

resources within seasonal and local constraints. The nutritional values of the standardized recipes were subsequently calculated using the BEBIS program. Furthermore, searches for studies on the functional properties and health benefits of the vegetables and fruits used in our recipes were conducted using YÖKTEZ, Google Scholar, PubMed, and Science Direct databases. Keywords included the names and nutritional values of the specific products used in the recipes (e.g., “cucumber peel and its nutritional value”). Details of all research stages are presented in the accompanying table (Table 1).

Table 1. Details about the research

Research Basic Steps	Themes	Titles Presented
Document analysis	Key words: General Turkish and English theses and articles on “food waste, food waste, environmental/health effects of food waste”	Introduction
Product Design from Fruit and Vegetable Waste	Recipes were created from seasonal vegetables and fruits, successful recipes were identified and standardized with an average of 2-3 repetitions.	Results/Recipes Created from Vegetable and Fruit Waste
Nutritional Value Calculation (BEBIS)	Turkish and English keywords regarding nutritional values were used for each vegetable and fruit used in the recipes.	Results/Recipes Created from Vegetable and Fruit Waste
Literature Review on Functional Features of Recipes	Key Words: vegetable/fruit Latin name and nutritional value, vitamin, mineral, chemical content	Results/General Functional Properties of Recipes Composed of Vegetables and Fruits

## RESULTS and DISCUSSION

### Zero Waste Recipes Developed to Reduce Vegetable Waste

#### Puff Pastry with Leek Leaf

The recipe for leek leaf and puff pastry involves the following ingredients: 70 g of the leaf part of the leek, the green part of 3 stalks of leek, 350 g of potato (2 medium-sized), 75 g of onion (1 small-sized), 60 mL of olive oil (5 tablespoons), 490 g of puff pastry (7 pieces), 18 g of egg yolk (1 piece), 100 mL of water (½ cup), 10 g of salt (2 teaspoons), 1 g of black pepper (½ teaspoon), and 4 g of red pepper flakes (1 teaspoon).

Onions and oil were added to the pan and sautéed until the onions slightly changed color. When this happened, finely chopped leeks were added. The mixture was stirred for 2-3 minutes before grated potatoes were added. The ingredients were mixed for a few more minutes, then 1 tea glass of water and spices were added. Once the vegetables absorbed the water, they were removed from the stove. The puff pastry, which had been taken out of the freezer to thaw, was placed on a rectangular tray measuring 40x27 cm lined with wax paper. Four pieces of puff pastry were rolled out with a rolling pin or by hand and placed on the bottom of the tray, extending 3-4 cm over both edges. One and a half puff pastry sheets were placed on each long side of the rectangular tray, and the pieces were pressed together to seal. Small holes were pricked in the puff pastry with a fork to prevent it from rising too much. The prepared mixture was added to cover the bottom of the tray. The puff pastry sheets hanging from the edge of the tray were folded over the

mixture. The top was brushed with egg yolk and baked in the oven at 200°C for 25-30 minutes. The dish was allowed to cool slightly before serving.

The BEBIS analysis results were as follows: The total energy content was 2740.2 kcal, with each slice containing 182.68 kcal. The pastry contained 675.5 g of water, 40.6 g of protein (6%), 181.4 g of fat (59%), and 236.9 g of carbohydrates (35%). It also included 19.4 g of fiber, 59.5 g of polyunsaturated fatty acids, and 227.4 mg of cholesterol. In terms of vitamins, the pastry provided 1144.6 µg of vitamin A, 1.0 mg of carotene, 13.5 mg of vitamin E, 1.4 mg of vitamin B1 (thiamine), 0.4 mg of vitamin B2 (riboflavin), 1.3 mg of vitamin B6 (pyridoxine), 248.1 µg of total folate, and 111.8 mg of vitamin C. The mineral content included 5045.0 mg of sodium, 2102.4 mg of potassium, 4391 mg of calcium, 176.3 mg of magnesium, 564.8 mg of phosphorus, 10.0 mg of iron, and 4.4 mg of zinc.

#### Cauliflower and Potato Salted Cake

The recipe included the following ingredients: 250 g of cauliflower root (1 large cauliflower root), 100 g of cauliflower leaf (5-6 branches), 180 g of chicken egg (raw, 3 pieces), 220 g of potato (raw, without skin, 1 medium size), 50 g of cheddar cheese condiment (1 tea cup), 220 g of wheat flour (2 cups), 10 g of baking powder (1 pack), 100 mL of olive oil seasoning (1 tea glass), 245 g of full-fat yogurt (1 glass), 16 g of table salt (iodized, 1 tablespoon), 2 g of red pepper powder (1 teaspoon), and 1 g of black pepper (1 teaspoon).

The flower parts of the cauliflower were separated. The remaining root part was washed and cleaned, then

reduced by processing it through a food processor. The leaf part of the cauliflower was finely chopped. Eggs and salt were placed in a bowl and whisked until they turned white. Olive oil, yogurt, flour, baking powder, and spices were added and whisked until the ingredients were combined. Cauliflower root, leaves, grated potato, and grated cheddar cheese were then added and mixed. A 28x28 cm Pyrex tray was greased, and the mixture was added. It was baked in a preheated oven at 200°C for 45-50 minutes. Once browned, it was taken out of the oven and served.

The BEBIS analysis results were as follows: The total energy content was 2401.2 kcal, with each slice containing 150.07 kcal. The cake contained 581.8 g of water, 222.2 g of protein (15%), 140.3 g of fat (21%), and 959.7 g of carbohydrates (65%). It also included 184.1 g of fiber, 13.7 g of polyunsaturated fatty acids, and 813.9 mg of cholesterol. In terms of vitamins, the cake provided 783.1 µg of vitamin A, 1.1 mg of carotene, 16.5 mg of vitamin E, 0.7 mg of vitamin B1, 1.6 mg of vitamin B2, 0.7 mg of vitamin B6, 173.1 µg of total folate, and 43.7 mg of vitamin C. The mineral content included 10,147.6 mg of sodium, 14,227.3 mg of potassium, 2,994.5 mg of calcium, 519.5 mg of magnesium, 2,818.6 mg of phosphorus, 135.0 mg of iron, and 89.4 mg of zinc.

### **Creamy Carrot Peel Soup**

The recipe included the following ingredients: 120 g of carrot peel, 15 g of butter (1 tablespoon), 8 g of raw garlic (2 cloves), 40 g of cream (30% fat, 4 tablespoons), 20 g of wheat flour (2 tablespoons), 1200 mL of drinking water (6 cups), 10 g of iodized table salt (2 teaspoons), 2 g of black pepper (1 teaspoon), and 1 g of dry turmeric (½ teaspoon).

In this soup recipe, the butter was melted in a pot, and 2 tablespoons of flour were added, roasting until the flour smell disappeared. Hot water, chopped carrot peels, garlic, and spices were then added and cooked until it boiled. The cream was added and boiled for another 15 minutes. After removing it from the stove, the mixture was blended to achieve a smooth consistency. This recipe made 4 portions of soup. Additionally, carrot peels that were peeled at different times could be kept in the freezer for future soup-making.

The BEBIS analysis results for the creamy carrot peel soup were as follows: The total energy content was 321.8 kcal, with each portion containing 80.45 kcal. The soup contained 1235.0 g of water, 3.8 g of protein (5%), 25.5 g of fat (71%), and 19.2 g of carbohydrates (24%). It also included 1.0 g of fiber, 0.7 g of polyunsaturated fatty acids, and 66.8 mg of cholesterol. In terms of vitamins, the soup provided 236.3 µg of vitamin A, 0.1 mg of carotene, 0.6 mg of vitamin E, 0.0 mg of vitamin B1, 0.1 mg of vitamin B2, 0.1 mg of vitamin B6, 5.2 µg of total folate, and 1.5 mg of vitamin C. The mineral content included 3941.9 mg of sodium, 148.8 mg of potassium, 173.6 mg of calcium, 58.2 mg of magnesium, 69.9 mg of phosphorus, 5.7 mg of iron, and 4.1 mg of zinc.

### **Pastry with Radish Leaves**

The recipe included the following ingredients: 120 g of radish leaf, 50 g of onion (1 small size), 4 g of raw garlic (1 clove), 30 g of olive oil seasoning (3 tablespoons), 55 g of wheat flour (1 tea glass), 16 g of wheat starch (2 tablespoons), 1 g of baking powder (½ teaspoon), and 5 g of iodized table salt (1 teaspoon).

The radish leaves were washed thoroughly and chopped into small pieces. Oil and onion, chopped into small cubes, were added to the pot. After the onions were roasted, radish leaves and garlic were added. The radish leaves were cooked until they released their water. If there was excess water after cooling, it was squeezed out with the help of cheesecloth. In a separate bowl, flour, starch, baking powder, spices, and the cooked and squeezed radish leaves were added and kneaded. Approximately 15 balls the size of a walnut were obtained. They were placed on a baking tray lined with baking paper and baked in a preheated oven at 180°C for about 40 minutes until golden brown. They were preferably served with garlic yogurt.

The BEBIS analysis results were as follows: The total energy content was 535.0 kcal, with each piece containing 35.6 kcal. The pastry contained 165.6 g of water, 11.2 g of protein (8%), 31.2 g of fat (48%), and 63.0 g of carbohydrates (44%). It also included 3.4 g of fiber, 3.1 g of polyunsaturated fatty acids, and 0.3 mg of cholesterol. In terms of vitamins, the pastry provided 47.8 µg of vitamin A, 0.1 mg of carotene, 3.7 mg of vitamin E, 0.1 mg of vitamin B1, 0.0 mg of vitamin B2, 0.1 mg of vitamin B6, 11.8 µg of total folate, and 4.3 mg of vitamin C. The mineral content included 2,422.7 mg of sodium, 805.7 mg of potassium, 946.8 mg of calcium, 91.5 mg of magnesium, 153.3 mg of phosphorus, 5.1 mg of iron, and 0.9 mg of zinc.

### **Crispy Potato Sticks with Potato Skins**

The recipe included the following ingredients: 400 g of potato (raw, in shell, 2 pieces), 50 g of cheddar cheese, 5 g of iodized table salt (1 teaspoon), 1 g of black pepper, 2 g of hot/shark pepper powder (½ teaspoon), and 30 mL of olive oil seasoning (3 tablespoons).

The minced meat was placed in a pot and roasted over low heat. After it changed color, 3 tablespoons of oil were added. Onion, green pepper, and finely chopped eggplant peels were added and mixed. Once the vegetables were roasted, tomatoes and spices were added and cooked. The lavash bread was divided in half, and 1 tablespoon of the mixture was placed at the tip. Some grated cheddar cheese was added to cover the mixture. The edges of the lavash bread were folded inward to form a triangle. It was put in the toaster, with oil spread on it, and baked until both sides of the lavash were golden brown. This recipe yielded 10 lavash toasts.

The BEBIS analysis results were as follows: The total energy content was 456.1 kcal, with each piece containing 28.5 kcal. The dish contained 272.8 g of water, 16.1 g of protein (15%), 19.7 g of fat (39%), and 51.5 g of carbohydrates (47%). It also included 4.6 g of fiber, 0.8 g

of polyunsaturated fatty acids, and 45.0 mg of cholesterol. In terms of vitamins, the dish provided 267.9 µg of vitamin A, 0.3 mg of carotene, 1.2 mg of vitamin E, 0.3 mg of vitamin B1, 0.2 mg of vitamin B2, 0.6 mg of vitamin B6, 74.3 µg of total folate, and 71.9 mg of vitamin C. The mineral content included 2,380.8 mg of sodium, 1,314.1 mg of potassium, 346.7 mg of calcium, 103.6 mg of magnesium, 314.2 mg of phosphorus, 3.3 mg of iron, and 2.9 mg of zinc.

### Lavash Toast with Eggplant Peels

The recipe included the following ingredients: 350 g of lavash bread/flatbread (5 pieces), 150 g of eggplant skin, 40 mL of olive oil seasoning (4 tablespoons), 80 g of onion (1 medium size), 35 g of green/bell pepper (1 medium size), 90 g of raw tomato (1 small size), 100 g of raw minced beef, 100 g of cheddar cheese, 5 g of hot pepper paste with tomato (1 teaspoon), 4 g of iodized table salt, and 2 g of black pepper.

The minced meat was placed in a pot and roasted over low heat. After it changed color, 3 tablespoons of oil were added. Onion, green pepper, and finely chopped eggplant peels were added and mixed. Once the vegetables were roasted, tomatoes and spices were added and cooked. The lavash bread was divided in half, and 1 tablespoon of the cooked mixture was added to the tip. Some grated cheddar cheese was placed over the mixture. The edges of the lavash bread were folded inward to form a triangle. It was put in the toaster, with oil spread on it, and baked until both sides of the lavash were golden brown. This recipe made 10 lavash toasts.

The BEBIS analysis results were as follows: The total energy content was 1926.9 kcal, with each piece containing 192.6 kcal. The dish contained 423.5 g of water, 72.3 g of protein (15%), 98.2 g of fat (45%), and 188.9 g of carbohydrates (40%). It also included 19.6 g of fiber, 7.4 g of polyunsaturated fatty acids, and 153.9 mg of cholesterol. In terms of vitamins, the dish provided 696.0 µg of vitamin A, 1.1 mg of carotene, 9.5 mg of vitamin E, 0.5 mg of vitamin B1, 0.9 mg of vitamin B2, 0.7 mg of vitamin B6, 183.1 µg of total folate, and 65.2 mg of vitamin C. The mineral content included 4,382.9 mg of sodium, 1,577.6 mg of potassium, 872.0 mg of calcium, 211.3 mg of magnesium, 1,008.2 mg of phosphorus, 6.4 mg of iron, and 11.0 mg of zinc.

### Breakfast Appetizer with Cucumber Peel

The recipe includes the following ingredients: 90 g of white cheese condiment, 1 g of coriander root (1 teaspoon), 15 mL of olive oil seasoning (1 and a half tablespoons), 1 g of red pepper (1 teaspoon), and 30 g of cucumber peel (from 1 cucumber).

Cucumber peels were ground with a hand processor. Cheese, coriander powder, chili pepper, and olive oil were added and processed through a food processor. The mixture was placed on a serving plate and consumed for breakfast. The ingredients made 2 portions of a breakfast appetizer.

BEBIS results were as follows: The total energy content of the breakfast appetizer with cucumber peel was 461.3 kcal, and the energy in one portion was 230.6 kcal. It contained 49.2 g of water, 14.6 g of protein (14% of energy), 35.2 g of fat (73% of energy), and 14.2 g of carbohydrates (14% of energy). The fiber content was 2.9 g, with 2.2 g of polyunsaturated fatty acids and 48.8 mg of cholesterol. It also included 351.8 µg of vitamin A, 0.5 mg of carotene, 2.1 mg of vitamin E, 0.0 mg of vitamin B1, 0.4 mg of vitamin B2, 0.2 mg of vitamin B6, 45.0 µg of total folate, and 0.3 mg of vitamin C. The mineral content included 934.4 mg of sodium, 294.8 mg of potassium, 412.5 mg of calcium, 39.3 mg of magnesium, 363.8 mg of phosphorus, 2.8 mg of iron, and 3.5 mg of zinc.

### Red Beetroot Peel Tarator

The recipe included 120 g of red beetroot peel (equivalent to 5 medium-sized beetroots), 20 mL of olive oil seasoning (2 tablespoons), 8 g of table salt (iodized, 1 teaspoon), 250 g of full-fat yogurt (1 bowl), 4 g of raw garlic (1 clove), and 10 g of walnuts (2 pieces).

The red beets were thoroughly washed and peeled. The peeled beetroot skins were cut into small pieces using a food processor. They were then placed in a pan and fried with 2 tablespoons of olive oil. One teaspoon of salt was added. Separately, yogurt was mixed with 1 crushed clove of garlic in a bowl. This mixture was combined with the roasted red beetroot peel. The dish was served topped with coarsely ground walnuts. The ingredients made 3 portions of this appetizer. Once peeled, the beets could be stored in the freezer for future use in this recipe.

BEBIS results were as follows: The total energy content of the red beetroot peel dish was 478.4 kcal, with one portion containing 159.4 kcal. It had 218.8 g of water, 11.5 g of protein (11% of energy), 36.4 g of fat (77% of energy), and 12.7 g of carbohydrates (12% of energy). The fiber content was 0.5 g, with 7.4 g of polyunsaturated fatty acids and 25.2 mg of cholesterol. The vitamin content included 111.8 µg of vitamin A, 0.1 mg of carotene, 5.1 mg of vitamin E, 0.1 mg of vitamin B1, 0.5 mg of vitamin B2, 0.2 mg of vitamin B6, 33.1 µg of total folate, and 3.1 mg of vitamin C. The mineral content included 3234.0 mg of sodium, 475.2 mg of potassium, 330.2 mg of calcium, 62.3 mg of magnesium, 293.6 mg of phosphorus, 32.2 mg of iron, and 1.4 mg of zinc.

### Tomato Crusted Cracker

The recipe included 200 g of tomato peel, 220 g of wheat flour (equivalent to 2 cups), 80 g of black olives (about 20 pieces), 10 g of black cumin (1 tablespoon), 10 mL of olive oil seasoning (1 tablespoon), 4 g of dried thyme (1 teaspoon), 4 g of hot/sharp pepper powder (1 teaspoon), and 8 g of iodized table salt (1 teaspoon).

The tomato peels and olives were processed in a food processor until finely ground. The mixture was placed in a kneading bowl, and the other ingredients were added. By kneading, a dough of non-sticky consistency was formed. The dough was then baked in the oven at 180°C

for 15-20 minutes. The ingredients yielded approximately 20 crackers. If the tomatoes are not used immediately after peeling, they can be stored in the freezer for later use. Additionally, when making canned tomatoes, the peeled tomato skins can be utilized in this recipe.

The BEBIS analysis results were as follows: The total energy content was 995.1 kcal, with each portion containing 49.75 kcal. The crackers contained 92.2 g of water, 46.8 g of protein (11%), 32.4 g of fat (16%), and 326.0 g of carbohydrates (74%). They also included 12.1 g of fiber, 4.8 g of polyunsaturated fatty acids, and 0.1 mg of cholesterol. In terms of vitamins, the crackers provided 95.9 µg of vitamin A, 0.5 mg of carotene, 3.0 mg of vitamin E, 0.4 mg of vitamin B1, 0.2 mg of vitamin B2, 0.2 mg of vitamin B6, 67.3 µg of total folate, and 23.8 mg of vitamin C. The mineral content included 4,942.2 mg of sodium, 2,697.5 mg of potassium, 513.0 mg of calcium, 365.4 mg of magnesium, 242.4 mg of phosphorus, 11.8 mg of iron, and 8.4 mg of zinc.

### Zero Waste Recipes Developed to Reduce Fruit Waste

#### Baked Halva with Tangerine

The recipe included the following ingredients: 150 g of tahini halva, 50 mL of milk (¼ cup), 10 g of grated tangerine peel (1 tablespoon), and 15 g of raw almonds (approximately 15 pieces).

The halva was cut into cubes and placed in a bowl. It was then crushed with a fork, and milk was added to help melt the halva. A tablespoon of tangerine zest and coarsely ground raw almonds were added and mixed in. The mixture was divided among soufflé bowls. It was baked in the oven at 180°C until golden brown. This recipe yielded two portions of baked halva.

The BEBIS analysis results were as follows: The total energy content was 780.7 kcal, with each portion containing 390.35 kcal. The dish contained 44.3 g of water, 20.8 g of protein (10%), 41.9 g of fat (46%), and 88.1 g of carbohydrates (44%). It also included 7.6 g of fiber, 15.7 g of polyunsaturated fatty acids, and 5.0 mg of cholesterol. In terms of vitamins, the dish provided 23.5 µg of vitamin A, 0.0 mg of carotene, 5.4 mg of vitamin E, 0.5 mg of vitamin B1, 0.2 mg of vitamin B2, 0.1 mg of vitamin B6, 65.8 µg of total folate, and 0.6 mg of vitamin C. The mineral content included 48.8 mg of sodium, 412.4 mg of potassium, 151.8 mg of calcium, 241.2 mg of magnesium, 555.0 mg of phosphorus, 5.1 mg of iron, and 6.7 mg of zinc.

#### Lemon Zest and Pistachio Custard

The recipe includes the following ingredients: 600 mL of full-fat cow's milk (3 cups), 20 g of corn starch (1.5 tablespoons), 25 g of wheat flour (2 tablespoons), 80 g of sugar (½ cup), 20 g of pistachios (without shells, 2 tablespoons), 20 g of lemon peel (2 tablespoons), 2.5 g of vanillin sugar or vanilla (½ pack), and 5 g of butter (1 teaspoon).

To prepare the pudding, the milk, flour, starch, sugar, and previously dried and ground lemon peel were combined in a pot. The mixture was cooked over medium heat, with continuous stirring, until it thickened. Care was taken not to overcook or let the mixture brown, ensuring a smooth pudding texture. As the mixture began to thicken, the heat was reduced to low for better control. Once the pudding had thickened to the desired consistency, the heat was turned off. The sugared vanilla, butter, and ground pistachios were added and stirred well to combine all the ingredients thoroughly. The pudding was poured into serving plates and allowed to cool in the refrigerator. This recipe made approximately 3 portions of pudding.

The BEBIS analysis results were as follows: The total energy content was 1035.5 kcal, with each portion containing 345.1 kcal. The pudding contained 531.7 g of water, 28.1 g of protein (11%), 36.6 g of fat (31%), and 148.1 g of carbohydrates (58%). It also included 15.0 g of fiber, 2.2 g of polyunsaturated fatty acids, and 65.1 mg of cholesterol. In terms of vitamins, the pudding provided 223.6 µg of vitamin A, 0.2 mg of carotene, 1.6 mg of vitamin E, 0.4 mg of vitamin B1, 1.1 mg of vitamin B2, 0.3 mg of vitamin B6, 68.1 µg of total folate, and 11.6 mg of vitamin C. The mineral content included 272.7 mg of sodium, 1,115.3 mg of potassium, 758.3 mg of calcium, 110.1 mg of magnesium, 679.3 mg of phosphorus, 2.4 mg of iron, and 3.4 mg of zinc.

#### Chocolate Balls with Pomegranate Peel Powder

The recipe included the following ingredients: 180 g (3 pieces) of raw chicken eggs, 160 g (1 cup) of sugar, 120 ml (slightly more than ½ cup) of olive oil seasoning, 200 ml (1 cup) of full-fat cow's milk, 10 g (1 pack) of baking powder, 5 g (1 pack) of vanillin sugar/vanilla, 220 g (2 cups) of wheat flour, 200 ml (1 pack) of cream (30% fat), 100 g (1 pack) of light dark chocolate, 40 g of hazelnuts, and 20 g (1 tea glass) of pomegranate peel powder.

The eggs and sugar were thoroughly whisked in a bowl. Then, milk, oil, and vanilla were added and whisked together. Following this, flour, pomegranate peel powder, and baking powder were mixed in. The mixture was poured into a greased tray and baked in a preheated oven at 180°C for 40-45 minutes. The baked cake was left to cool. For the topping, the cream was heated on the stove, with dark chocolate added to melt. Once cooled, the cream mixture and ground hazelnuts were kneaded into the cake. Walnut-sized circles were then formed. Optionally, these could be decorated with ingredients such as white chocolate, pistachios, hazelnuts, and coconut. The recipe yielded 30 truffles. Thanks to the added pomegranate peel powder, the fiber content and functional properties of the cake were increased.

The BEBIS analysis results were as follows: The total energy content was 4255.3 kcal, with each piece containing 141.8 kcal. The balls contained 473.1 g of water, 72.1 g of protein (7%), 266.9 g of fat (55%), and 405.8 g of carbohydrates (38%). They also included 22.1 g of fiber, 19.7 g of polyunsaturated fatty acids, and 949.6 mg of cholesterol. In terms of vitamins, the balls provided 1230.0 µg of vitamin A, 0.6 mg of carotene, 31.4 mg of

vitamin E, 0.8 mg of vitamin B1, 1.7 mg of vitamin B2, 0.8 mg of vitamin B6, 184.6 µg of total folate, and 5.4 mg of vitamin C. The mineral content included 1702.0 mg of sodium, 2748.4 mg of potassium, 752.6 mg of calcium, 359.7 mg of magnesium, 2026.4 mg of phosphorus, 25.5 mg of iron, and 8.5 mg of zinc.

### Mini Pie with Apple Peels

The recipe included the following ingredients: 70 g of apple peel (from 2 medium-sized apples), 120 g of raw chicken eggs (2 pieces), 30 g of sugar (slightly more than 1 tea glass), 200 mL of full-fat cow's milk (1 tea glass), 330 g of wheat flour (3 glasses), 10 g of baking powder (1 piece), 5 g of vanillin sugar or vanilla (½ tea cup), 5 g of cinnamon (2 tablespoons), 50 mL of drinking water (3 tablespoons), and 3 g of olive oil condiment (1 heaping tablespoon).

The apple peels that had been peeled beforehand were not thrown away but kept in the deep freezer. For this recipe, 2 medium-sized apples were also peeled. Any missing amount of peels was supplemented with the peels from the freezer. After the apples were grated and the peels chopped into small pieces, they were cooked in a pan on the stove. Sugar was added, and the mixture was cooked over medium heat until the apples released their juice. When the consistency of the apples was neither too dry nor too watery, the heat was turned off. Cinnamon and walnuts were added and mixed in.

To make the tart dough, room temperature eggs, butter, oil, and yogurt were added into a bowl and mixed until creamy. Powdered sugar, starch, baking powder, and vanilla were then added and mixed in. Three cups of flour were added, and the dough was kneaded. Additional flour could be added depending on the dough's consistency, which should be soft and non-sticky.

The dough was shaped into small round balls and placed in greased muffin molds to form a thin bottom layer. The stuffing mixture was added inside. The remaining dough was rolled out with a rolling pin to a thickness of 1 cm and cut into thin strips. These strips were placed on the muffin molds in a wicker pattern. The pies were baked in a preheated oven at 180°C until golden brown. Once cooled, they were served with a sprinkling of powdered sugar. The ingredients made 14 mini pies.

The BEBIS analysis results were as follows: The total energy content was 1637.2 kcal, with each portion containing 116.9 kcal. The pie contained 364.4 g of water, 57.8 g of protein (13%), 32.0 g of fat (15%), and 332.6 g of carbohydrates (72%). It also included 20.1 g of fiber, 3.6 g of polyunsaturated fatty acids, and 527.6 mg of cholesterol. In terms of vitamins, the pie provided 262.0 µg of vitamin A, 0.0 mg of carotene, 3.4 mg of vitamin E, 0.5 mg of vitamin B1, 1.0 mg of vitamin B2, 0.3 mg of vitamin B6, 103.4 µg of total folate, and 2.4 mg of vitamin C. The mineral content included 1448.0 mg of sodium, 1034.6 mg of potassium, 516.5 mg of calcium, 88.8 mg of magnesium, 1476.3 mg of phosphorus, 24.1 mg of iron, and 5.1 mg of zinc.

### Orange Flavored Sweet Chicken

The recipe included the following ingredients: 500 g of chicken breast (2 pieces), 8 g of raw garlic (2 cloves), 30 g of full-fat yogurt (2 tablespoons), 10 g of honey (1 tablespoon), 10 g of pomegranate concentrate (1 tablespoon), 20 g of grated orange peel (2 tablespoons), 10 g of wheat flour (1 tablespoon), 5 g of iodized table salt (1 teaspoon), 4 g of hot/green pepper powder (1 teaspoon), 4 g of dry thyme (1 teaspoon), 2 g of black pepper (1 teaspoon), and 40 g of olive oil seasoning (4 tablespoons).

The chicken was diced and placed in a bowl. Yogurt, honey, pomegranate syrup, orange zest, and spices were added. All ingredients were mixed well and marinated. The mixture was then left to rest in the refrigerator for at least two to three hours. Oil was added to the pan and heated. The marinated chicken from the refrigerator was then placed in the pan and cooked, turning occasionally, until both sides were done. The ingredients made 3 servings.

According to BEBIS results, the total energy content of the orange-flavored sweet chicken was 1040.5 kcal, with each portion containing approximately 346.8 kcal. The nutritional breakdown is as follows: Water 425.0 g, protein 122.1 g (48%), fat 45.4 g (39%), carbohydrates 34.0 g (13%), fiber 2.5 g, polyunsaturated fatty acids 4.8 g, cholesterol 313.4 mg, vitamin A 505.3 µg, carotene 1.9 mg, vitamin E 6.9 mg, vitamin B1 0.5 mg, vitamin B2 0.6 mg, vitamin B6 2.9 mg, total folate 64.0 µg, vitamin C 54.5 mg, sodium 2295.4 mg, potassium 1686.9 mg, calcium 246.1 mg, magnesium 173.0 mg, phosphorus 1136.6 mg, iron 11.7 mg, and zinc 6.1 mg.

### Magnolia with Banana Peel

The recipe included the following ingredients: 1000 mL of full-fat cow's milk (1 pack), 185 g of banana (1 whole banana), 30 g of wheat flour (3 tablespoons), 30 g of wheat starch (3 tablespoons), 150 g of sugar (less than 1 cup), 20 g of chicken egg yolk (1 piece), 15 g of butter (1 tablespoon), 5 g of vanillin sugar or vanilla (1 pack), 131 g of oatmeal biscuits (1 pack), 30 g of hazelnuts (1 handful), and 40 g of banana peel (peel of 1 banana).

For the dessert cream, flour, starch, egg yolk, and sugar were put into a pot. Milk and banana peels were blended together until the peels were thoroughly ground. This banana and milk mixture was then added to the pot, and all ingredients were mixed. The mixture was cooked over medium heat until it boiled and thickened. After removing from heat, butter, sugar, and vanillin were added. The oatmeal biscuits and hazelnuts were processed in a food processor until they reached a flour-like consistency. The cooked cream, processed biscuits, and hazelnuts were layered in a glass or bowl and decorated. The dessert was left to rest in the refrigerator for at least 2-3 hours before consuming. This recipe yielded 5 portions of magnolia.

According to BEBIS results, the total energy content of the banana peel and magnolia dessert was 2524.4 kcal,

with each portion containing approximately 504.8 kcal. The nutritional breakdown is as follows: Water 1010.4 g, protein 67.3 g (10%), fat 105.8 g (34%), carbohydrates 371.2 g (55%), fiber 10.6 g, polyunsaturated fatty acids 6.1 g, cholesterol 524.0 mg, vitamin A 835.7 µg, Carotene 0.4 mg, vitamin E 11.1 mg, vitamin B1 0.8 mg, vitamin B2 2.0 mg, vitamin B6 1.1 mg, total folate 176.6 µg, vitamin C 25.8 mg, sodium 667.4 mg, potassium 2596.6 mg, calcium 1367.3 mg, magnesium 289.3 mg, phosphorus 1567.1 mg, iron 39.8 mg, and zinc 22.0 mg.

### Ice Cream with Ripe Bananas and Strawberries

The recipe included the following ingredients: 185 g of banana (1 medium-sized whole banana), 65 g of frozen strawberries (4 medium-sized), 25 g of sweet almonds (plucked, ½ tea glass), 100 mL of full-fat cow's milk (1 tea glass), 20 g of honey (1 tablespoon), and a teaspoon tip of dry turmeric.

All ingredients were added and processed in a blender. The mixture was then poured into ice cream molds and placed in the deep freezer. It was periodically removed and mixed, or put through an ice cream machine, to eliminate ice crystals. The ice cream was ready to be consumed after being kept in the freezer overnight.

According to BEBIS results, the total energy content of the ripe banana, strawberry, and ice cream mixture was 415.4 kcal, with each portion containing approximately 69.2 kcal. The nutritional breakdown is as follows: Water 244.7 g, protein 11.7 g (12%), fat 17.9 g (39%), carbohydrates 49.8 g (50%), fiber 5.9 g, polyunsaturated fatty acids 3.3 g, cholesterol 9.0 mg, Vitamin A 45.6 µg, carotene 0.1 mg, vitamin E 3.8 mg, Vitamin B1 0.1 mg, vitamin B2 0.3 mg, vitamin B6 0.6 mg, total folate 58.0 µg, vitamin C 46.8 mg, sodium 48.8 mg, potassium 890.9 mg, calcium 163.6 mg, magnesium 115.0 mg, phosphorus 228.1 mg, iron 2.0 mg, and zinc 1.5 mg.

### Apple Cinnamon Pancake

The recipe included the following ingredients: 70 g of apple peel, 120 g of raw chicken eggs (2 pieces), 30 g of sugar (2 tablespoons), 200 mL of full-fat cow's milk (1 cup), 165 g of wheat flour (1.5 cups), 10 g of baking powder (1 packet), 5 g of vanillin sugar or vanilla (1 packet), 5 g of cinnamon (1 teaspoon), 50 mL of drinking water (½ tea glass), and 3 g of olive oil condiment (1 teaspoon).

To prepare the batter, eggs and sugar were added to a mixing bowl and whisked until foamy. The apple peels were blended with ½ glass of water and ground thoroughly, then added to the mixing bowl. Milk, vanilla, flour, baking powder, and cinnamon were also added and whisked together. A few drops of oil were applied to the bottom of a non-stick pan with the help of a brush. Using a tablespoon, the pancake mixture was poured into the pan and cooked on both sides. The plated pancakes could be served with powdered sugar, honey, molasses, or fruits. The ingredients yielded approximately 30 pancakes.

According to BEBIS results, the total energy content of the apple-cinnamon pancakes was 1070.5 kcal, with each pancake containing approximately 35.6 kcal. The nutritional breakdown is as follows: Water 342.0 g, Protein 41.2 g (13%), Fat 30.4 g (21%), Carbohydrates 213.3 g (66%), Fiber 15.5 g, Polyunsaturated fatty acids 2.9 g, Cholesterol 527.6 mg, Vitamin A 262.0 µg, Carotene 0.0 mg, Vitamin E 3.1 mg, Vitamin B1/Thiamine 0.4 mg, Vitamin B2/Riboflavin 1.0 mg, Vitamin B6/Pyridoxine 0.2 mg, Total Folate 86.9 µg, Vitamin C 2.4 mg, Sodium 1446.4 mg, Potassium 757.4 mg, Calcium 508.2 mg, Magnesium 65.7 mg, Phosphorus 1374.0 mg, Iron 23.2 mg, and Zinc 4.3 mg.

### Recipe of the Watermelon Waste

The recipe included the following ingredients: 500 g of watermelon rind (3-4 slices), 100 g of boiled dried chickpeas (less than 1 cup), 100 g of low-fat beef, 20 g of olive oil seasoning (2 tablespoons), 7 g of sumac (1 tablespoon), 80 g of onion (1 small-sized onion), 5 g of hot pepper paste with tomato (1 teaspoon), 1000 mL of drinking water, 14 g of butter (1 tablespoon), 8 g of iodized table salt (1 teaspoon), and 3 g of dry mint (1 tablespoon).

To prepare, the green part of the watermelon peel was peeled thinly, and the white rinds were chopped into cubes. They were covered with water and boiled in a pressure cooker for about 15 minutes. Meanwhile, sumac was soaked in water in a bowl to create a syrupy mixture. In a separate pot, oil and cubed beef were added, and the meat was roasted. Chopped onion was added next, and once the onions became transparent, tomato paste and hot water were mixed in. The mixture was boiled for about 40 minutes to soften the meat. Boiled chickpeas and watermelon peels were then added and cooked for another 15 minutes. The sumac syrup was strained and added to the dish before turning off the stove.

In a small pan, butter was melted and mint was added, being careful not to burn the mint. This mint mixture was poured over the dish and mixed in. The recipe made approximately 4 servings.

According to BEBIS results, the total energy content of this watermelon waste recipe was 551.1 kcal, with each portion containing approximately 137.8 kcal. The nutritional breakdown is as follows: Water 215.5 g, protein 66.7 g (12%), fat 39.4 g (15%), carbohydrates 406.6 g (73%), fiber 25.3 g, polyunsaturated fatty acids 3.2 g, cholesterol 101.1 mg, vitamin A 185.1 µg, Carotene 0.4 mg, vitamin E 4.9 mg, vitamin B1 0.4 mg, vitamin B2 0.4 mg, vitamin B6 0.5 mg, total folate 86.8 µg, vitamin C 9.7 mg, sodium 3261.7 mg, potassium 830.6 mg, calcium 260.3 mg, magnesium 112.8 mg, phosphorus 1086.4 mg, iron 12.4 mg, and zinc 12.5 mg.

### Watermelon Rind Cookies

The recipe included the following ingredients: 350 g of watermelon rind, 200 mL of drinking water (1 cup), 80 g of sugar (1 tea glass), 15 g of lemon (¼ lemon), 330 g of wheat flour (3 cups), 250 g of butter, 20 g of full-fat yogurt



(1 tablespoon), 1 g of baking powder (1 teaspoon), and 65 g of powdered sugar (1 coffee cup).

To prepare, the green skin on the outside of the watermelon rind was peeled thinly, leaving the white part which was chopped into small cubes. These cubes were placed into a pressure cooker, covered with water, and boiled for an additional 15 minutes after boiling. In a separate pot, 1 cup of water, a tea glass of sugar, and ¼ lemon were boiled together, then the boiled watermelon peels were added and cooked for another 20 minutes.

For the cookie dough, butter, yogurt, baking powder, and powdered sugar were put into a kneading bowl and mixed by hand. Flour was slowly added until a soft, non-sticky dough was formed. Stretch film was placed inside a lemon squeezer, and walnut-sized balls of dough were rolled out thinly around the lemon squeezer. The watermelon peel mixture was placed inside and covered with another piece of dough. The cookies were carefully removed with the help of the stretch film and placed on a tray lined with baking paper. They were baked in the oven at 170°C for about 20 minutes until light pink. Once warm, they were served with a sprinkle of powdered sugar. These quantities yielded approximately 30 cookies.

According to BEBIS results, the total energy content of the watermelon crust cookies was 3595.4 kcal, with each cookie containing approximately 119.8 kcal. The nutritional breakdown is as follows: Water 314.2 g, protein 60.7 g (5%), fat 213.2 g (39%), carbohydrates 655.8 g (56%), fiber 19.0 g, polyunsaturated fatty acids 6.0 g, cholesterol 554.5 mg, vitamin A 1639.1 µg, carotene 1.0 mg, vitamin E 5.7 mg, vitamin B1 0.4 mg, vitamin C 8.3 mg, sodium 192.0 mg, potassium 659.5 mg, calcium 203.4 mg, magnesium 67.6 mg, phosphorus 835.5 mg, iron 6.9 mg, and zinc 7.0 mg.

### Profiteroles with Pomegranate Peel Powder

The recipe included the following ingredients: 140 g of wheat flour (1 cup + 3 tablespoons), 240 g of raw chicken eggs (4 pieces), 125 g of butter, 200 g of drinking water (1 cup), 750 mL of cow's milk (1 cup), 120 g of sugar (1 and a half tea glasses), 5 g of vanillin sugar or vanilla (1 pack), 75 g of chocolate sauce (½ pack), and 5 g of pomegranate peel powder (1 teaspoon).

To start, butter and water were boiled together in a small pot. Once the butter melted, 1 glass of flour was added and fried for 2-3 minutes before turning off the stove. The mixture was left to cool for 15-20 minutes. Then, eggs were added one by one, mixing well after each addition. After all the eggs were incorporated, the mixture was rested for approximately 10 minutes. Using a spoon, walnut-sized pieces of dough were placed onto a tray lined with baking paper and baked in a preheated 180°C oven for about 40 minutes until browned.

For the profiterole cream, milk, 3 tablespoons of flour, pomegranate peel powder, sugar, and 1 egg were stirred together in a separate pot until boiling, then cooked for an additional 2-3 minutes before turning off the heat. Vanillin sugar was mixed in afterwards. The prepared cream was

added to the dough using a piping bag, or by halving the profiteroles and filling them. The chocolate sauce was cooked with milk in a small pot and poured over the filled profiteroles. This recipe yielded approximately 20 profiteroles.

According to BEBIS results, the total energy content of the profiterole with added pomegranate peel powder was 3050.3 kcal, with each portion containing approximately 152.5 kcal. The nutritional breakdown is as follows: Water 1076.4 g, protein 79.3 g (11%), fat 162.5 g (47%), carbohydrates 316.8 g (42%), fiber 10.9 g, polyunsaturated fatty acids 7.0 g, cholesterol 1366.4 mg, vitamin A 1441.0 µg, carotene 0.6 mg, vitamin E 9.1 mg, vitamin B1 0.7 mg, vitamin B2 2.8 mg, vitamin B6 0.6 mg, total folate 191.3 µg, vitamin C 9.5 mg, sodium 811.5 mg, potassium 2636.4 mg, calcium 1233.1 mg, magnesium 279.9 mg, phosphorus 1546.8 mg, iron 17.5 mg, and zinc 9.1 mg.

### General Functional Properties of Recipes Composed of Vegetables and Fruits

The concept of food waste, a global problem, is gaining more attention each day. Measures should be taken to address food waste [33]. While solutions are being sought for people who are malnourished and at risk of starvation worldwide, the negative impact on the ecosystem due to excessive production and high consumption, along with the threat of impending food crises, are among the main issues that need resolution. According to the Food Waste Report (2021) by the United Nations Environment Programme, a total of 931 million tons of food is wasted annually worldwide (United Nations Environment Programme (UNEP), 2021) [34]. While there are initiatives to reduce and prevent food waste, it is possible to recycle food waste through various methods and applications without destroying it [35].

In nine recipes created with vegetables, the peel parts of carrots, radishes, potatoes, eggplants, cucumbers, red beets, and tomatoes, the root parts of cauliflower, and the green parts of leeks were used. Most commonly used vegetables have antioxidant effects, providing foods with many important functions such as antitumor, anticancer, antimicrobial, and antiviral properties [36-43]. Some studies indicate that the peel part of vegetables is a richer source of vitamins, minerals, and antioxidants than the pulp [44, 45]. Some of the vegetables used have protective properties against cancer, heart diseases, atherosclerosis, and neurodegenerative diseases [46-48]. Additionally, some unused vegetable peels, leaves, or root parts are an important source of dietary fiber, contributing to digestive health and aiding in the management of obesity and diabetes [23, 49, 50]. The functional properties of some vegetables included in the recipes are as follows: leek leaves are protective against cancer, coronary heart diseases, and atherosclerosis [47]; cauliflower roots are anticarcinogenic and contain dietary fiber and antioxidant compounds [48, 49]; potato peels have high digestibility due to their vitamins, essential amino acids, protein, and dietary fiber [23]; cucumber peels are used in the treatment of various diseases such as cancer, neurological disorders, aging,

and inflammation [49]; red beets have antioxidant, antimicrobial, antiviral, anti-inflammatory, and anticancer properties [51]; tomato peels contain antioxidants and are an excellent source of nutritional and secondary metabolite compounds, mineral matter, vitamins C and E, B-carotene, lycopene, flavonoids, organic acids, and phenolics [37, 38].

In eleven recipes created with fruits, the peel parts of tangerine, lemon, pomegranate, apple, banana, strawberry, orange, and watermelon were used. Since bananas and strawberries are fruits whose consumption decreases when ripe, a recipe utilizing these fruits was included in the study. Apple, banana, watermelon, and pomegranate were used in two recipes each. Most commonly used fruits contain phenolic acids and flavonoids, which have antioxidant properties and contribute to foods with antiviral, antimicrobial, antitumor, and anticancer functions [52-55]. Additionally, the unused parts of some fruit peels are an important source of dietary fiber, supporting digestive health and aiding in the management of obesity and diabetes [16, 17, 56]. Some studies indicate that the peel part of fruits is a richer source of vitamins and minerals than the fleshy part [13, 30, 58]. The functional properties of some fruits included in the recipes are as follows: banana peel is effective against diabetes, heart disease, and hypertension [57]; pomegranate peel is an antimutagenic and anticarcinogenic agent with antimicrobial properties [52, 57]; apple peel has effects against cardiovascular diseases and some cancers, lowers cholesterol levels, and reduces the risk of diabetes [25, 26]; watermelon peel contains more phosphorus, calcium, vitamins A and C, minerals, natural polyphenols, antioxidants, and is a source of carotenoids and lycopene with anticarcinogenic effects [21, 20, 30].

## CONCLUSION

In our study, the aim was to evaluate a portion of food waste that typically remains unutilized in kitchens. The focus was on foods that could facilitate recipe applications and for which calorie calculation methodologies existed in the literature. A total of 20 distinct recipes were developed utilizing data from existing research. In developing these recipes, it wasn't necessary for all ingredients to consist solely of waste. However, suitable waste was selected and combined with products commonly found as waste in kitchens yet normally consumed. After preparing these recipes, their caloric content was calculated using the BEBİS Nutrition Information Program.

Among the vegetable waste recipes, the puff pastry with leek leaves had the highest energy value at 2740 kcal. In contrast, the cauliflower potato salted cake had the highest protein content (222.2 g) and fiber content (184.1 g). For the fruit waste recipes, chocolate balls with pomegranate peel powder had the highest energy value (4255.3 kcal), orange-flavored sweet chicken had the highest protein content (122.1 g), and the watermelon waste recipe had the highest fiber content (25.3 g). The health benefits of the recipes were interpreted based on literature reviews, evaluating their antioxidant, vitamin,

antimicrobial, and anticancer properties, as identified in previous studies.

To ensure the recipes could be easily adopted by individuals at home as well as food industry professionals, standardization in measurements, using spoons, cups, mL, and grams, was implemented. This study, approached from a sustainable nutrition perspective, emphasized local accessibility of ingredients. It also aimed to integrate valuable raw materials like peels, stems, leaves, and ripe fruits into nutrition programs while preventing ecological harm caused by wasting these materials. Nutritional values calculated with the BEBİS Program were shared with each recipe to highlight their health benefits.

Conclusively, the recipes incorporated peel parts of tangerine, lemon, pomegranate, apple, banana, orange, and watermelon, as well as ripe bananas and strawberries. Among vegetables, the peel parts of leek, parsley, carrot, radish, potato, eggplant, cucumber, red beet, tomato, and the root of cauliflower were used. Each of apple, banana, and watermelon was featured in two separate recipes. The scientific literature underscores that these vegetable and fruit parts are rich sources of vitamins, minerals, and essential oils. They contain key nutrients and secondary metabolites, often with superior functional properties compared to consumed portions.

The study found that parts typically seen as waste offer higher health and nutritional benefits than conventional portions. Many fruits and vegetables featured in the research are abundant in phenolic acids and flavonoids. The herbal kitchen wastes used are valuable for their antioxidant, antiviral, antimicrobial, antitumor, anticancer, antidiabetes properties, and their role in preventing cardiovascular and neurodegenerative diseases. They contribute to anti-obesity efforts, protect overall health, supply the body with needed fluids due to their high water content, and strengthen the immune system. It is crucial to develop initiatives such as using food waste in new product designs in gastronomy and to educate gastronomy students on this vital subject.

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