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Isolation and Molecular Characterization of Processed Soybean Waste for the Development of Synbiotic Yogurt

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Abstract: Soybean has good nutritional and functional properties, which are essential for human physiology. Okara, a residue from soybean processing industries has a distinct profile of nutrients and phytochemicals. Therefore, the current study was planned to investigate the functional importance of okara. In the first phase of this study, okara was isolated from soybean and characterized in terms of protein, fat, ash, soluble dietary fiber, and insoluble dietary fiber. Furthermore, the okara flour was characterized using FT-IR (Fourier transform infrared spectroscopy), and micrograph images were obtained using SEM (scanning electron microscope). In the second phase of study, synbiotic (prebiotics + probiotics) yogurt was prepared with 3% concentrations of okara. Treatments were named as OFY_o (control), OFY_1 (probiotics), and OFY_2 (3% okara + probiotics). Yogurt was subjected to physicochemical, antioxidant, microbiological, and sensory analysis. The addition of okara significantly affected nutritional and antioxidant attributes of yogurt ($p < 0.05$). The results indicated that adding 3% okara affected the protein, fat, water holding capacity, and color. Total phenolic contents, DPPH (2,2-diphenyl-1-picrylhydrazyl) activity and ABTS (2,2′-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) activity increased due to the addition of okara. Likewise, the highest total viable count (8.25 log CFU/mL) and probiotic count (8.98 log CFU/mL) were noted in yogurt with 3% okara. Okara has dietary fibers; this dietary fiber acts as a prebiotic source for probiotic *L. Rhamnosus*. This shows that okara has a different prebiotic potential. The addition of okara has promising potential for the development of functional food.

Keywords: yogurt; soybean; functional food; okara; synbiotic; probiotics; antioxidants

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1. Introduction

Nowadays, a healthy, balance diet is an effective strategy to reduce the risk of infections and boost the human physiology [1]. However, functional foods or fortified foods provide positive effects on the human body, such as lowering the risk of disease, improving some enzymatic functions, and having various important benefits for animal or human health [2]. According to leatherhead food research market 2016, functional foods is the world largest market. Dairy products occupy 22% and the second biggest market is cereal which accounts for 33% [3]. The dairy sector is progressively adding useful ingredients to conventional food items, such as fermented milk. Therefore, by adding different value, added food products develop into new food products as well as increase their characteristics [4].

Nutritional researchers have identified that supplemented and fortified foods or food products from natural resources is one of the best ways to improve nutrient intake with minimal side effects. Supplemented and fortified foods are produced by adding any food which contains vitamins, minerals, amino acids, or any herb or botanical components or any food waste prepared by extraction, concentration, or combination of food. Nutrition scientists are trying to fortify food products by using natural resources such as fruits, vegetables, cereals, or its by-product [5]. The popularity of fortification of dairy products with prebiotics and probiotics continues to increase because it fulfills consumers' demand for flavorful foods that complete their health needs [6]. Furthermore, recent advances show that the consumption of probiotics can contribute to improving human health and preventing various diseases [7]. Probiotics are live microbes; therefore, they need a portion of food for their survival and growth in the gut. In the development of probiotic food products (food containing beneficial bacteria), prebiotic substances (food for bacteria) are added that might promote a positive interaction in human physiology; these foods are called synbiotic foods. The combination of probiotics and prebiotic food or food products may enhance the stability and shelf life of the final product [8]. Fruits and vegetables are natural sources of prebiotics, although the majority of regularly eaten foods are deficient in prebiotic content [9].

The production of plant-based foods is currently growing and producing a lot of waste materials. Food industries are trying to improve the food products by using food waste material and this helps to overcome environmental pollution through waste management produced during the processing of fruits and vegetables [10]. Soybeans are eaten all around the world in a variety of dishes, including soups, sauces, and fermented items [11].

During the processing of soybean and its product (soymilk and tofu), a huge amount of waste material is produced, known as "okara". For the preparation of soy beverages (soy milk), 1 kg of dried soybean beans generates approximately 1.4 and 1.8 kg of fresh okara [12]. The Japanese word "okara" means "honorable hull" or "soy pulp." Okara is often referred to as soy pulp or tofu dregs [13,14]. This large amount of agricultural waste has become a potential hazard to the environment because it has high moisture and protein contents that are highly susceptible to decomposition. Okara is an inexpensive source of nutrients, such as carbohydrates, protein, lipids, vitamins and minerals. Due to their rich source of nutrients, okara is now used to formulation of functional foods including beverages, ice-creams and yogurt etc. [15].

The food safety and health advantages of probiotic bacteria, combined with other products, such as ice cream, fermented milk, and yogurt, are also considered. Yogurt and probiotics go well together since dairy products are the major source of supplemental probiotics. One of the primary probiotic bacteria in yogurt is *Bifidobacterium*, along with *L. acidophilus*, *L. casei*, *L. plantarum*, and others. However, it impacts rheological behavior, raises product viscosity, and can create shear-thinning behavior. Supplementation of aloe vera in yogurt change its physicochemical and organoleptic properties [16]. Consequently, the main focus of this study was to isolate and characterize the okara flour and evaluate the effect of okara fortification on the physicochemical, antioxidant, microbial, and sensory attributes of yogurt.

2. Materials and Methods

2.1. Experimental Study

Raw soybean requisite for the research was purchased from Ayub Agriculture research institute Faisalabad. Milk of buffalo was purchased from local dairy farm of Faisalabad. Yogurt culture (*Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus*) and probiotic (*L. Rhamnosus)* in freeze-dried form for the preparation of okara fortified yogurt were used and taken from the Food Safety and Biotechnology Laboratory, Department of food sciences, Government College University Faisalabad. All chemicals used in the current study were purchased from Merck KGaA chemical company. The research was

conducted at different laboratories of Government Colleges University Faisalabad and University of Agriculture Faisalabad.

2.2. Isolation of Soybean By-Product (Okara)

Okara was isolated from soybean according to Guimaraes et al.'s (2018) [2] method, with some modification. The soybean was cleaned to remove impurities and soaked for 12 h at 25 °C. Afterward, the soybean was drained and rinsed. The weight of the soaked soybean was calculated. Then, it was crushed and ground in a grinder with distilled water at a ratio of 1:10. The soybean–water mixture was placed on the stove (100 °C/4 min). Then, the soybean fusion was filtered to detach the soy milk and okara. This water-soluble extract was dried at 40 °C overnight; afterward, dried okara samples were ground by a microsieved shaker. Later, the fine powder of okara was kept in a freezer at −18 °C and stored.

2.3. Compositional and Molecular Characterization of Okara Flour

Protein (Kjeldahl's apparatus), fat (soxhlet apparatus), ash (muffle furnace), and total dietary fiber (enzymatic gravimetric analysis) were determined according to AOAC (2000) Official Methods of Analysis [17]. Structural and functional components of okara flour samples were determined by electron scanning microscope (SEM) and Fourier transforms infrared (FT-IR) spectroscopy, respectively. SEM and FT-IR were performed by method followed by Lin et al. (2020) [18].

2.4. Preparation of Okara Fortified Yogurt

Yogurt was prepared according to Jayarathna et al. (2018) [19]. Figure 1 shows the schematic diagram for the development of okara fortified yogurt. Raw buffalo milk was pasteurized at 80–90 °C for 5 min and cooled to 41–42 °C. Next, 1 L of milk was poured into three containers, and yogurt cultures *S. thermophilus* and *L. delbrueckii subsp. bulgaricus* was added to each container. OFY_o is the control sample without okara and *L. Rhamnosus.* 2.5% of *L. Rhamnosus* were inoculated in the other two milk samples; however, OFY_1 contains only *L. Rhamnosus*, and OFY_2 had 3% okara flour along with *L. Rhamnosus*, and the samples were kept in an incubator for 4–6 h. Afterward, the yogurt sample was stored at 4 °C for 20 days and analyzed after 5 days.

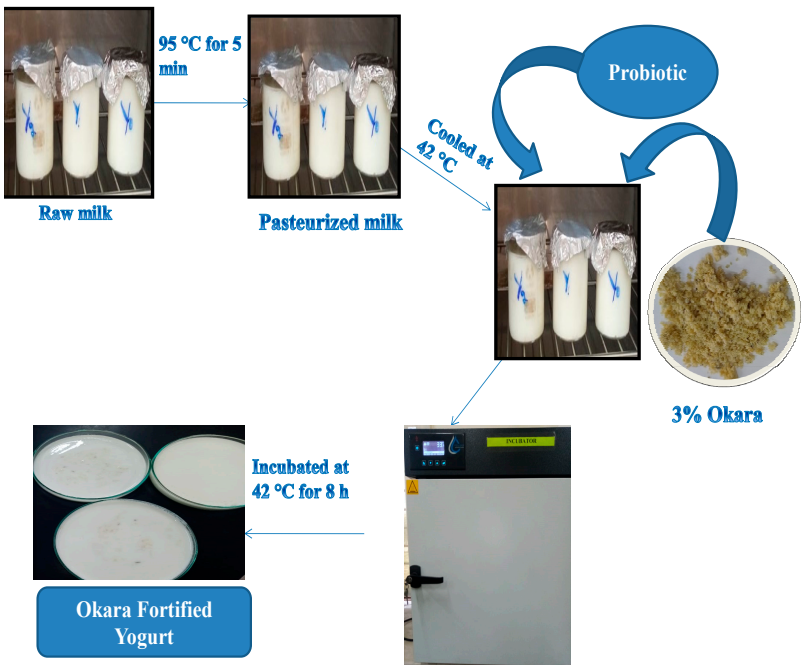

Figure 1. Schematic diagram of okara fortified yogurt (Synbiotic yogurt).

2.5. Physicochemical Analysis of Yogurt

Protein, ash, and fat was measured according to AOAC (2000) Official Methods of Analysis [17] and pH, acidity, water holding capacity measured according to method adopted by Grasso et al. (2020) [20]. Roslan et al. (2021) employed the technique to measure the color parameters of synbiotic yogurts using the color meter CR-400 [21].

2.6. Antioxidant Analysis

Antioxidant analysis (TPC, DPPH activity, and ABTS activity) of all yogurt samples was measured according to the method followed by Peng et al. (2019) [22]. The yogurt samples were extracted by homogenizing 1 g yogurt sample in 5 mL of 70% ethanol using a homogenizer (FSH-2A), followed by overnight shaking at 4 °C for 120 rpm in an incubator shaker (thermostable IS-20R, America), then centrifuged this solution by using a benchtop centrifuge machine at 5 °C for 15 min and the extract was stored at −15 °C.

2.6.1. Total Phenolic Contents

The samples extract, and gallic acid standard solutions were analyzed by transferring 25 µL of each into 96 well microplates, mixing with 25 µL Folin–Ciocalteu phenol reagents already diluted in water at 1:3 ratios (v/v), and incubated for 15 min at room temperature. These incubated mixtures were then mixed with 200 µL of water and 25 µL of 10% (w/v) Na_2CO_3 and incubated for 60 min. Gallic acid solutions were used as standards, then the standard curve of gallic acid (3.125–200 µg/mL) was plotted (r^2 = 0.999). Afterward, absorbance was measured using a microplate reader (765 nm).

2.6.2. 2,2-Diphenyl-1-picrylhydrazyl (DPPH) Activity

An amount of 10 µL of ethanolic extract of yogurt sample was mixed with 0.1 mM DPPH in 290 µL solution of methanol. Then the solution was put in an incubator at 37 °C for 35 min, using 96 well microplates to measure the 517 nm absorbance. A standard curve of Trolox (0–0.75 mM/mL) was plotted, and the sample quantification was expressed as mM TE/mL.

2.6.3. 2,2′-Azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) Activity

The ABTS (7 mM) was dissolved in potassium persulfate solution (140 mM) and incubated (25 °C) in the dark for 12–16 h to allow the generation of ABTS radical cation (ABTS). The prepared ABTS was diluted with ethanol to attain an absorbance value of 1.0 ± 0.02 at 734 nm. An aliquot (10 µL) of each yogurt sample extract and 290 µL of the prepared ABTS solution were 205 mixed in 96 well microplates, and the absorbance was read at 734 nm after 6 min at 25 °C using a microplate reader. A standard curve of Trolox (0–0.75 mM/mL) was plotted, and the sample quantification was expressed as mM TE/mL.

2.7. Microbiological Analysis

2.7.1. Total Viable Count (TVC)

The total viable count was performed according to Jayaratha et al. (2018) [19]. An MRS agar and peptone water solution was prepared using 8.9 g/L for the dilution sample. Dissolved 15 g of plate count agar in 1 L of distilled water and sterilized at 121 °C for 15 min. The tenfold dilution series were prepared by taking 9 mL of normal saline solution into sterile test tubes with the help of a micropipette and adding 1 mL of yogurt sample to this solution. Then the dilution was poured on the prepared media plate. These samples were incubated at 36 °C for 24 h. A colony counter calculated the average number of microbial colonies from the dilution.

2.7.2. Probiotic Count (PC)

The probiotic count was calculated by the modified protocol of Marafon et al. (2011) [23]. Probiotic counts were carried out by plating on MRS agar. 1 mL sample of OFY_1 and OFY_2 was diluted by taking 9 mL of peptone water into the sterile test tube. Then, the dilution

was poured on the prepared media plate. These samples were incubated at 37 °C for 48 h. The probiotic count was calculated at log CFU/mL, and experiments were performed every 5th day during refrigerated storage.

2.8. Sensory Analysis

Sensory analysis was performed according to method adopted by Roslan et al. (2021) [21]. Sensory analysis of yogurt was evaluated by panelists (10 faculty members, 10 MS students and 10 Ph.D. students). The age of panelists varied between 26 and 45, who first presented the okara attributes (color, aroma, texture, taste, and overall acceptability). After that, their remarks were recorded on the hedonic scale, 1 for immensely disliked and 9 for highly liked.

2.9. Statistical Analysis

At each time, analyses were conducted in triplicate. Results correspond to the mean ± standard deviation of the mean. For the physicochemical, antioxidant, and microbial analysis, the results were subjected to the (ANOVA) to detect significant differences ($p < 0.05$) among treatments (OSY_o, OSY_1, and OSY_2) [24].

3. Results and Discussion

3.1. Compositional Analysis of Okara Flour

Okara composition is mainly affected by water phase extraction technique, added water, or ground soybean. The details of the major components have been given in Table 1. Okara also contains a considerable amount of protein, fat, ash, and dietary fibers. Its major components are dietary fiber and complex carbohydrates. Okara also contains a considerable amount of Linoleic acid, oleic acid, palmitic acid, linolenic acid, and stearic acid. Okara contains monosaccharides and oligosaccharides such as glucose, raffinose, sucrose, sarch, fructose, etc. These findings are correlated to Yoshida et al. (2020) [25], who studied the okara and described its nutritional composition. Li et al. (2012) also found okara's major components are dietary fiber (42–58%), protein (15–33%), and fat (8–10%) [13].

Table 1. Nutritional composition of okara flour.

Parameter	Okara Flour
Protein%	15.68 ± 0.24
Fat%	7.54 ± 0.08
Ash%	10.85 ± 0.15
Insoluble fiber%	40.76 ± 0.16
Soluble fiber%	5.97 ± 0.08
Total fiber%	46.73 ± 0.23

All the values are taken as the average of 3 ($n = 3$). Values are represented as mean ± SD (at 5% level of significance).

3.2. Scanning Electron Microscope (SEM) of Okara Flour

SEM was used for the analysis of the morphology of any food product. The SEM images illustrate a sample's surface structure and particle characteristics (size and pore). Okara flour demonstrated a rough (Figure 2) and hollow surface. Okara particles have wrinkled or aggregative surface and less dispersed. This open structure may be due to heat waves and an increase in the absorption capacity of okara. Okara flour's rough structure was observed due to the presence of dietary fiber. The scanning electron microscope showed that this food waste has a rough structure because it contains cellulose, hemicellulose, and polysaccharides.

The same behavior was observed by Lin et al. (2020) [18]; their study demonstrates the SEM images of unfermented, fermented, and Microwave-treated dietary fiber of okara showed a rough structure.

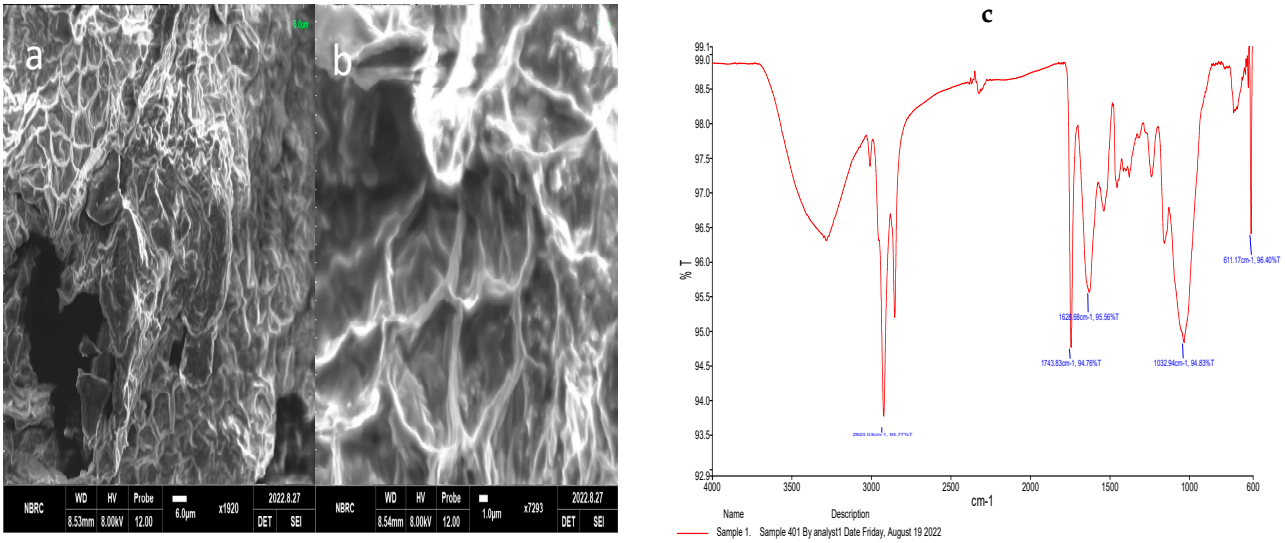

Figure 2. Scanning Electron Micrograph (SEM) images and Fourier transform infrared spectroscopy (FT−IR) of okara flour (**a**) hollow sphere, (**b**) rough structure, and (**c**) spectrum of okara flour.

3.3. Fourier Transform Infrared Radiation (FT-IR) of Okara Flour

FT-IR determined the functional groups of okara samples. The infrared radiation spectra gave special bonds indicating the particular functional groups. In the okara sample prepared from soybean, O-H stretching was observed at 2923.03 cm^{-1}, which indicates the presence of vibration of polymer and hydrogen bond of water, which showed the presence of cellulose and hemicelluloses. However, a band shift led to a change in the functional group at 1743 cm^{-1} with C-H stretching, representing the presence of cellulose polysaccharide structure. The peak near 1628.68 cm^{-1} indicates the presence of carboxyl group and C = O bonds. In comparison, FT-IT spectra at 1032.94 cm^{-1} indicate the presence of C-O-H bonds of sugar molecules in cellulose and hemicellulose (Figure 2). The absorption of high end at 611.17 cm^{-1} characteristic of β-glycoside bonds suggests the presence of hemicellulose.

The same behavior was observed by Lin et al. (2020) [18]; their study demonstrates the FT-IR spectra of unfermented, fermented, and Microwave-treated okara's dietary fiber showed a strong and broad absorption peak that was used to determine the okara's functional groups.

3.4. Physicochemical Analysis of Yogurt

In this study, we analyzed the physicochemical (pH, moisture, protein, fat, ash contents, and water holding activity) characteristics of okara fortified yogurt during 20 days of cooled storage. The pH average value ranged between 4.53 and 3.66; therefore, okara yogurt showed, significantly ($p < 0.05$), a decrease in trend compared to the control yogurt (Figure 3); this is similar to the results confirmed by Gurbuz et al. (2021) [26]. The addition of the okara decreases the pH in yogurt. This decrease in pH was due to the conversion of lactose content of milk into lactic acid, which increased the product's acidity. Free probiotics in the yogurt use the product's simple sugar molecules (fiber) for their survival, and lactose is converted to lactic acid by fermentation. Due to okara dietary fiber, probiotics have more carbohydrates converted into lactic acid in okara fortified yogurt, decreasing the pH level. On the other hand, acidity increases. OFY_2 moisture, protein, ash content, and water holding capacity was shown significantly ($p < 0.05$) more than in other treatments (Figure 3). The average values of moisture, protein, ash, and water holding capacity on the 20th day of storage are 78.29%, 3.92%, 12.54%, and 79.78%, respectively. Fat content shows a significant ($p < 0.05$) decrease in the OFY_2 trend because okara is an excellent source of dietary fiber. Dietary fiber chemically binds the fat molecules. Therefore, the average value of fat in OFY_2 is 1.78%. The results are coincide with the findings of Anjum et al. (2022) [27].

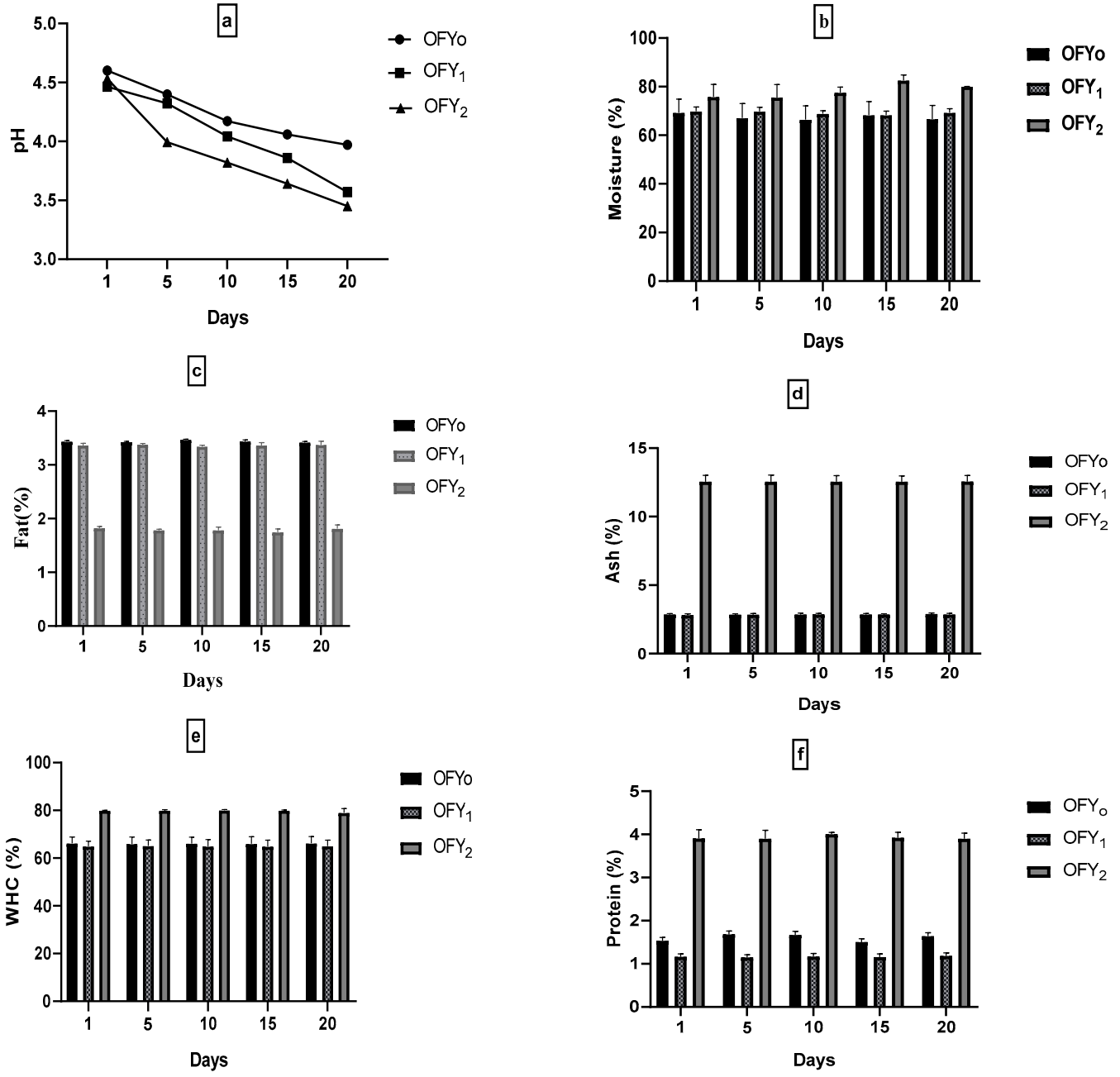

Figure 3. (**a**) pH, (**b**) moisture, (**c**) fat, (**d**) ash, (**e**) water holding capacity (WHC), and (**f**) protein contents of different yogurt treatments. Results are expressed as mean with standard deviation bar.

3.5. Colour Analysis

The color of yogurt is one of the significant quality characteristics influencing consumer acceptability and attractiveness [21]. Most yogurts are white and thick, but many commercial brands are artificially colored. The values obtained for the color coordinates of the fresh and okara fortified yogurt preparations are presented in Table 2. The concentration of okara in yogurt affects the color parameter. Therefore, color parameter indicates a significant difference ($p < 0.05$) among different treatments.

Table 2. Color properties of simple yogurt (OFYo), yogurt with probiotic (OFY_1), and okara fortified yogurt (OFY_2).

Sample	Lightness (L*)	Redness-Greenness (a*)	Yellowness-Blueness (b*)
OFY_o	97.56 ± 0.4 ^{b}	−4.42 ± 0.09 ^{b}	10.75 ± 0.16 ^{b}
OFY_1	97.78 ± 0.2 ^{a}	−4.35 ± 0.08 ^{c}	10.70 ± 0.14 ^{c}
OFY_2	97.56 ± 0.2 ^{b}	−4.60 ± 0.09 ^{a}	11.35 ± 0.09 ^{a}

All the values are taken as the average of 3 (n = 3). Means within the same column marked with different letters differ significantly ($p < 0.05$).

Current findings coincide with the statistical data of Roslan et al. (2021) [21], who observed the physicochemical, microbial, and sensorial properties of okara fortification in fermented milk.

3.6. Antioxidant Potential

Total phenolic contents, DPPH activity, and ABTS activity average value of yogurt supplemented with okara are presented in Figure 4a–c. Mean values of TPC, DPPH activity, and ABTS activity in OFY_2 are shown to have highly significant differences ($p < 0.05$). This fact must confirm Quintana results that observed okara and fermented okara are both important sources of antioxidants [28]. The average TPC, DPPH activity, and ABTS activity in OFY_2 is 1.93 mg GAE/mL, 1 mM TE/mL, and 1.18 mM TE/mL, respectively. Therefore, okara is a rich source of phytochemicals; when added to the product, this will increase the phytochemicals profile of the product. Dry okara is a rich source of antioxidants such as TPC (130 mg GAE/100 g), FC (2 mg QE/100 g), DPPH activity (34.7%) and ABTS activity (37.84%) [29]. Therefore, okara could be added in different food items. It enhances the functional as well as therapeutic potential of food items and used for treatment of different diseases.

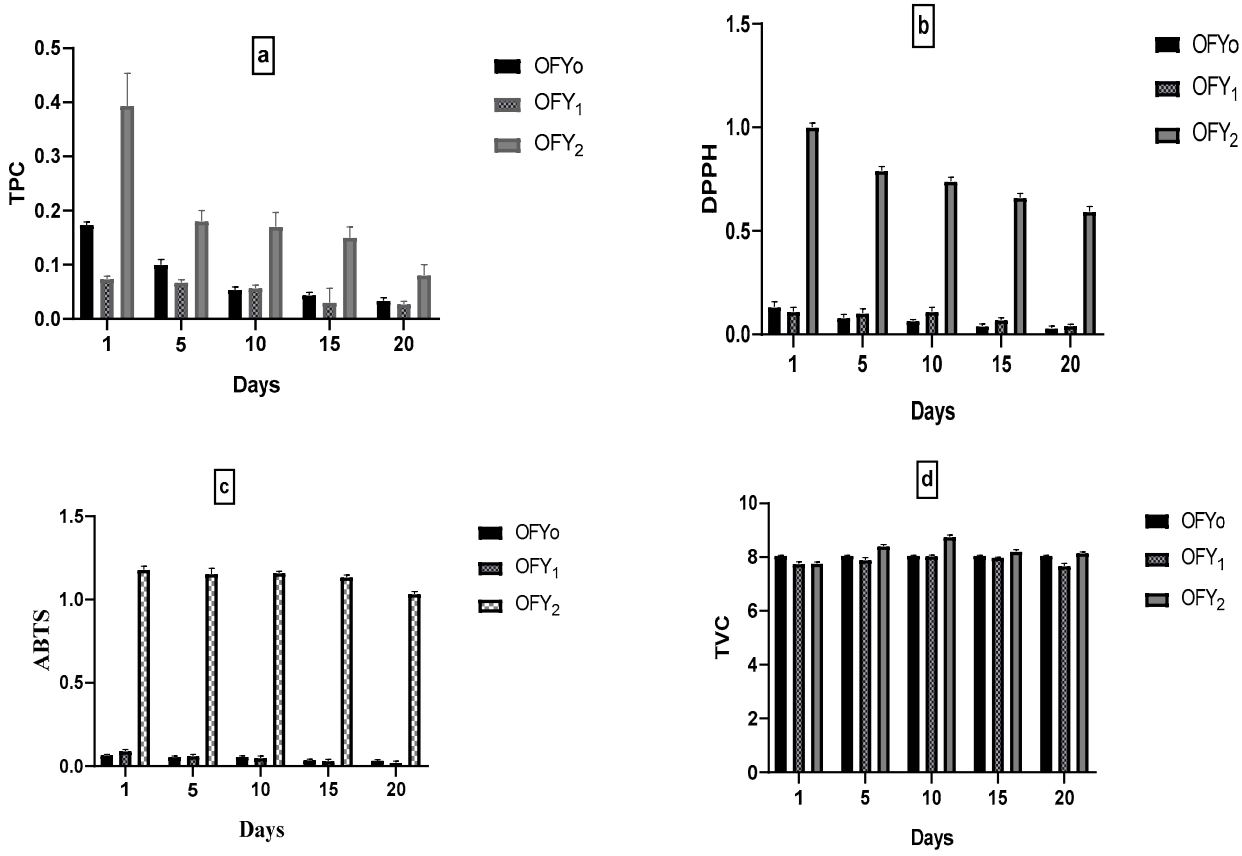

Figure 4. *Cont.*

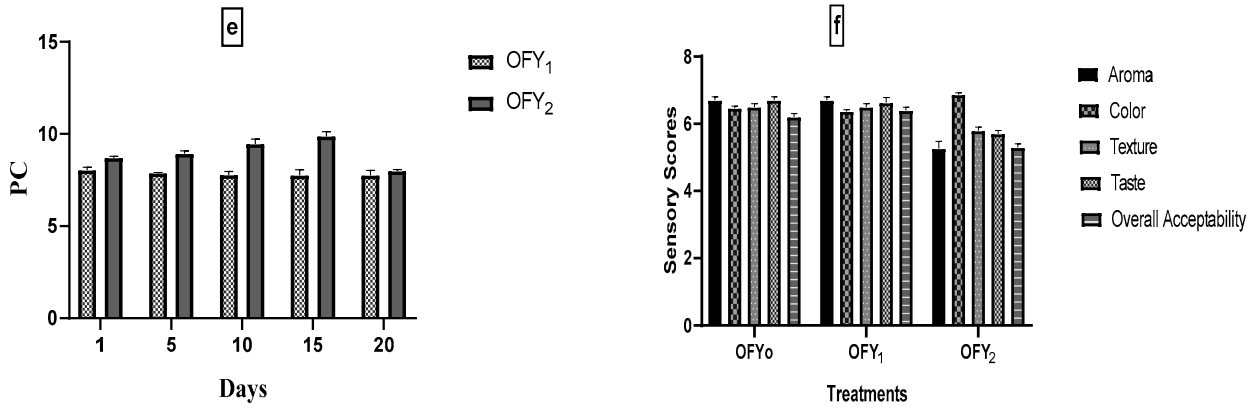

Figure 4. (**a**) Total phenolic contents, (**b**) DPPH activity, (**c**) ABTS activity, (**d**) total viable count, (**e**) probiotic, and (**f**) sensory evaluation of different yogurt treatments. Results are expressed as mean with standard deviation bar.

3.7. Microbial Analysis

Results regarding the total viable count of okara fortified yogurt under the different storage conditions were shown in Figure 4d. The statistical results were highly significant ($p < 0.05$) for all treatments. The given behavior indicates that total viable counts increased with time length in traditional yogurt and yogurt without okara and okara fortified yogurt. The total viable count increased for the 1st week and then decreased with the storage period. Average values of the total viable count of traditional yogurt are 8.06 log CFU/mL on the 1st day of storage and yogurt without okara (OFY_1) and okara fortified yogurt contains 7.75 log CFU/mL and 7.76 log CFU/mL, respectively. The highest total viable count (8.75 log CFU/mL) was shown in okara fortified yogurt on the 10th day of storage then decrease to 8.15 log CFU/mL on the 20th day of storage. The reason is that okara has dietary fibers and complex carbohydrates that have the prebiotic potential for *L. Rhamnosus* and other microorganisms. Therefore, microorganism's growth was increased. Results of the probiotic count (*L. Rhamnosus*) of okara supplemented yogurt under the different storage conditions were shown in Figure 4e. Evaluating the key effect, *L. rhamnosus* count was found to be influenced by the prebiotic, their interaction, and shelf life. In 1st week of storage, the average probiotic count (*L. Rhamnosus*) values fell between 7.83 and 9.45 log CFU/mL. Variation in the probiotic count is based on prebiotic utilization. Total counts of *L. Rhamnosus* in OFY_1 and OFY_2 increased up to 2 weeks then slowly reduction was seen. In the end, an average number of probiotics was observed at 7.76 and 7.98 log CFU/mL in OFY_1 and OFY_2, respectively. Increased probiotic count with time is a responsible reduction in pH that causes acidification. Therefore, this can prohibit the further growth and survival of bacteria. The TVC and PC behavior of OFY are due to presence of dietary fiber and sugar molecules. Okara has dietary fibers and this dietary fiber acts as a prebiotic source for probiotic *L. Rhamnosus*. This study's results conclude that okara fortified yogurt is also called synbiotic yogurt because it has prebiotic as well as probiotic potential. The values were also similar to the trend of Ibrahim et al. (2022) [30], who worked on the fortification of okara and probiotic in ice cream, and their results show that okara increase the probiotic count (7.89 log CFU/mL) of ice cream.

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3.8. Sensory Analysis

Results regarding the aroma, color, taste, texture, and overall acceptability of okara fortified yogurt were shown in Figure 4e. After formulation of yogurt (day 1), panelists observed (Figure 1) the three yogurts by comparing to the control yogurt; adding okara had little effect on the yogurt's color because milk is usually white or light yellow. Okara was white and yellow when combined with probiotic yogurt, and it did not significantly alter the samples' mean color scores. Regarding the mean color score of yogurt results of core, the fortification of okara enhanced the yogurt's colors. According to consumer acceptability, the taste of the yogurt may change if the amount of okara fibers is increased. The yogurt that contained probiotics received the best organoleptic rating. Okara has a beany taste and slight smell. An increased amount of okara has made the yogurt texture thick and sandier, making them less preferred. Therefore, the fortification of okara had an effect the consumer perceptions. The average sensory score of OFYo and OFY_1 was not significantly different, but other mean values have significant impacts ($p < 0.05$). Syneresis of yogurt was observed after the 5th day of storage. The same trend was reported by Roslan et al. (2021) [21]. They found that okara fortification in yogurt could be less preferred (3.9) because panelists lacked a habit or tradition of consuming fermented soy products.

4. Conclusions

Probiotic-containing products are showing promising trends worldwide. Food production and processing industries generate a massive amount of food-based waste material. An amount of 1 kg of soybean produced 1.1 kg of waste material (okara) during soymilk production. This study isolates the okara from soybean and characterized its chemical composition. Scanning electron microscope images shows rough structure due to presence of dietary fiber. Fourier transforms infrared (FT-IR) spectroscopy graphs described okara functional groups cellulose, hemicelluloses, and polysaccharides. Furthermore, okara significantly affected yogurt's total viable count and probiotic count over 20 days of storage. Okara slightly increased yogurt's total phenolic contents, DPPH activity, and ABTS activity. Fortifying okara for the development of functional food could be a way to reduce health maladies. In the present study, the significant role of 3% okara in corporation on the nutritional and therapeutic attributes of the end product while minimally affecting the organoleptic properties was observed. Three-percent okara fortified yogurt was proven to be a synbiotic product.

Novelty of Product

Milk and its fermented products are most challenging in the dairy fermentation industry due to the short shelf life. Soybean by-product (okara), a potential prebiotic source, was found to minimally cause the yogurt to increase the shelf life as well as the viability of probiotics (*L. Ramahnosus*). The function of okara not only supports the growth of probiotics, but is scientifically proven to strengthen the digestive system and reduce the possibility of developing diseases, including cardiovascular diseases, diabetes, constipation, and bowel cancer.

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