Journal of Food Science and Technology (Iran)

Homepage:www.fsct.modares.ir

Scientific Research

The Effect of Saffron Powder and Saffron Petals on the Physicochemical and Antioxidant Properties of Cheese

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ARTICLE INFO

Article History:

Received: 2024/09/21

Review: 2025/10/04

Accepted: 2025/10/11

Keywords:

Cheese,
Natural Antioxidant,
Physicochemical Properties

DOI: **10.48311/fsct.2026.83885.0**

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ABSTRACT

In recent years, there has been a growing tendency to use herbal powders, which are considered one of the important sources of antioxidants, for the production of new products that provide a healthy life for consumers. Therefore, this study was conducted with the aim of investigating the effect of enrichment with saffron and saffron petal powders on the physicochemical properties, antioxidant activity, and total phenolic compounds of cheese. Saffron and saffron petal powders were added to the cheese samples at a level of0.05%. Initially, sensory evaluation of the cheese samples was considered, and subsequently all tests including pH evaluation, acidity, moisture, color indices, antioxidant activity, and total phenolic compounds were carried out. The highest average acidity levels were related to the S samples (cheese sample containing saffron) (0.0096%) and P samples (cheese sample containing saffron petal powder) (0.0095%), respectively, and the lowest acidity was observed in the control sample. The highest average moisture content was observed in the S treatment (cheese sample containing saffron) (59.23%). By adding saffron and saffron petal powders to the cheese samples, *a** index increased compared to the control sample, and the *L** and *b** indices showed a significant difference ($p < 0.05$) with the control sample. The highest amount of total phenolic compounds (0.052 mg Gallic acid/100 g of sample) and antioxidant activity (48.65%) were related to the S (cheese sample containing saffron) and PS (cheese sample containing saffron powder and saffron petal powder) samples, respectively, and the lowest amount was related to the control sample. The addition of herbal powders to cheese samples improved the physicochemical properties, increased antioxidant activity and total phenolic compounds compared to the control sample, and the use of these herbal ingredients is recommended for the production of diverse and high nutritional value.

1- Introduction

Food safety and quality are fundamental concerns for both consumers and the food industry, particularly since foodborne infections have shown an increasing trend in recent years [1]. Dairy products, due to their exceptional nutritional value, are widely consumed worldwide; therefore, their fortification with bioactive compounds introduces a new generation of functional foods designed to meet the growing demands of health-conscious consumers [2].

Milk and dairy products, regarded as indicators of human development, possess antioxidant properties that play an important role in preventing oxidative damage in the human body [3]. Among them, cheese — one of the most important dairy products — is a rich source of essential nutrients such as vitamins, amino acids, and minerals [4]. Consumers around the world increasingly prefer cheeses free from synthetic additives such as artificial flavors and colorants; thus, the nutritional value, safety, health benefits, and sensory characteristics of cheese have gained considerable importance.

A review of previous studies shows that the effects of *Moringa* [5], coriander [6], spinach powder [7], tomato extract [8], and grape pomace [9] on cheese characteristics have been investigated. The addition of saffron to yogurt was studied by Gaglio *et al*., [10], and Aktypis *et al*., (2018) examined the incorporation of saffron into sheep cheese [11].

Saffron (*Crocus sativus* L.) is a small perennial plant belonging to the Iridaceae family. Iran is one of the major global producers of saffron, with its export value exceeding 300 billion rials annually [12]. The stigmas of this plant, known as saffron, are widely used in the food industry (as an aromatic spice and natural coloring agent) and in the pharmaceutical industry due to their anti-obesity, anti-inflammatory, anti-atherosclerotic, antigenotoxic, and anticytotoxic properties. These properties are mainly attributed to its bioactive compounds such as phenolics, crocin, picrocrocin, crocetin, and safranal, which are responsible for its health-promoting and unique sensory characteristics. The antioxidant activity of saffron compounds has been linked to anti-aging effects and the enhancement of overall health [12].

It is noteworthy that most previous studies have primarily focused on the pharmacological and antioxidant effects of the active constituents in saffron stigmas—particularly crocin, the major pigment compound—whereas a large quantity of saffron petals is discarded as waste during the processing of the spice each year. Therefore, finding effective ways to utilize or valorize these by-products is of great importance [12]. Saffron petals represent a valuable plant source rich in polyphenolic compounds. Several studies have demonstrated that the petals of *Crocus* species contain a wide range of flavonoids, glycosides, and anthocyanins [13]. In one study, powdered extract of saffron petals was used as a natural colorant in pomegranate juice with low red color intensity, showing good color and anthocyanin stability during heating and storage [14]. Other studies have also reported the antidepressant, anti-tyrosinase, and antioxidant properties of saffron petals [15]. Furthermore, a significant correlation between the antioxidant activity of plant materials and their phenolic content has been established [16].

Given the limited research conducted on this topic and considering the antioxidant, nutritional, and desirable flavor characteristics of saffron, the present study aimed to investigate the effects of saffron powder and its petals on the physicochemical and antioxidant properties of lactic cheese.

2- Materials and Methods

2-1- Materials

Low-fat cow's milk (1.5% fat) was obtained from the dairy farm of Shahid Bahonar University of Kerman. The starter culture (Chr. Hansen, Denmark), salt (Taban Co., Iran), and saffron and saffron petal powders were purchased from reputable herbal stores in Birjand, Iran.
The chemical reagents used in this study included calcium chloride (Merck, Germany), rennet (Chr. Hansen, Denmark), sodium hydroxide (Sigma, USA), phenolphthalein indicator (Sigma, USA), sodium carbonate (Merck, Germany), Folin–Ciocalteu reagent (Merck, Germany), and DPPH (2,2-diphenyl-1-picrylhydrazyl) (Sigma, USA).

2-2- Preparation of Cheese Samples

The collected milk was transferred to the pilot plant of the Department of Food Science and Technology. The milk was pasteurized at 72 °C for 15 s, then immediately cooled to 35 °C, after which saffron and saffron petal powders were added.
Calcium chloride (0.15 g per kg of milk) was then incorporated, followed by the addition of a mixed starter culture containing *Streptococcus thermophilus*, *Lactobacillus delbrueckii* subsp. *bulgaricus*, *Lactococcus lactis* subsp. *lactis*, and *Lactococcus lactis* subsp. *cremoris*. The fermentation process was continued until the pH reached 6.2. Subsequently, rennet (0.06%, w/w) was added to induce coagulation. The curd was collected in a clean cheesecloth and pressed under a weight for 12 h to remove whey. The resulting cheese was cut into small cubes and immersed in 4% brine (prepared using the sample's whey) and stored at 4 °C [17].

In the preliminary sensory evaluation, cheese samples containing different concentrations of saffron and saffron petal powders were examined. Among the tested levels, the 0.05% concentration received the highest sensory score and was selected for further physicochemical and antioxidant analyses.

Table 1 Description of Experimental Treatments

Row	The name of the treatments	Description
1	C	**Control**
2	P	**Cheese containing saffron petal powder**
3	S	**Cheese containing saffron powder**
4	SDP	**Cheese containing saffron powder added during pasteurization**
5	PS	**Cheese containing a mixture of saffron powders and saffron petals**

2-3- Cheese Analyses

2-3-1- Determination of pH and Titratable Acidity

Twenty grams of finely chopped cheese samples were diluted with distilled water to a final volume of 250 mL. Then, 25 mL of the filtrate was transferred into a beaker, and the pH was measured using a digital pH meter (Knick, Germany).
For titratable acidity, the sample solution was titrated with 0.1 N NaOH until reaching a pH of 8.1. The acidity percentage was calculated according to the following equation:

$$\text{Acidity (lactic acid\%)} = \frac{(V_{\text{NaOH}} \times N_{\text{NaOH}} \times 0.009)}{W_{\text{sample}}} \times 100$$

where $V_{\text{NaOH}}$is the volume (mL) of NaOH consumed, $N_{\text{NaOH}}$is its normality, and $W_{\text{sample}}$is the weight (g) of the cheese sample.

2-3-2- Determination of Moisture Content

Ten grams of each cheese sample were weighed and transferred to a glass plate. The plates were placed in an oven at 105 °C and dried until a constant weight was achieved [8]. The moisture content was then calculated based on the weight loss of the sample.

2-3-3- Determination of Color Parameters

The color characteristics of cheese samples were measured using a colorimeter (TES-135A, Taiwan). The obtained color parameters included L^*, a^*, and b^* values, where L^* represents lightness (ranging from black to white), a^* indicates the red/green axis, and b^* represents the yellow/blue axis.

2-3-4- Determination of Antioxidant Activity by DPPH Method

The antioxidant activity of cheese samples was determined using the DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging assay.
First, the cheese samples were dried. Then, 5 g of each sample was extracted with 25 mL of 80% ethanol using a magnetic stirrer for 24 h at room temperature. The extracts were filtered through Whatman filter paper and used for the DPPH assay.

For the assay, 2 mL of the extract was mixed with 2 mL of 0.2 mM ethanolic DPPH solution. The mixture was kept in the dark for 30 min, and absorbance was measured at 517 nm using a UV–visible spectrophotometer. The control sample consisted of DPPH solution without extract.
A decrease in absorbance indicates higher radical scavenging activity, corresponding to stronger antioxidant capacity [18]. The percentage of DPPH radical scavenging activity (RSA) was calculated as:

$$\text{DPPH RSA (\%)} = \frac{A_{\text{control}} - A_{\text{sample}}}{A_{\text{control}}} \times 100$$

where A_{control} and A_{sample} are the absorbance values of the control and sample, respectively.

2-3-5- Determination of Total Phenolic Content

To determine the total phenolic content, 0.5 g of the cheese sample was weighed, and 10 mL of 80% ethanol was added. The mixture was extracted for 24 hours at room temperature with continuous stirring. The extract was then centrifuged at 4000 rpm for 10 minutes, and the clear supernatant was used for analysis.

For the preparation of the working Folin–Ciocalteu reagent, 2.5 mL of the reagent was mixed with 10 mL of distilled water and homogenized. Subsequently, 5 mL of 2% sodium carbonate (Na_2CO_3) solution was added to 1 mL of the clarified extract. After standing for 5 minutes at room temperature, 1 mL of the Folin–Ciocalteu reagent was added to the mixture. The samples were then kept in the dark for 30 minutes. Finally, the absorbance of the samples was measured at 760 nm using a UV–Vis spectrophotometer.

The results were expressed as milligrams of gallic acid equivalent (GAE) per 100 g of cheese sample [19].

2-3-6- Sensory Evaluation of Cheese Samples

Sensory evaluation was performed by 12 panelists, including postgraduate students and faculty members of the Department of Food Science and Engineering, Shahid Bahonar University of Kerman, aged between 20 and 45 years. The panelists were familiar with cheese, saffron, and their sensory characteristics. A nine-point hedonic scale test was used to evaluate color, aroma, texture, and overall acceptability, ranging from *9 (excellent)* to *1 (very poor)* [17].

2-3-7- Statistical Analysis

Statistical analysis of the data was carried out based on a factorial experiment in a completely randomized design (CRD). The results were reported as mean ± standard deviation (SD). Analysis of variance (ANOVA) and Duncan's multiple range test (DMRT) were used to compare the means at 95% and 99% confidence levels using SAS software.

3- Results and Discussion

3-1- pH

According to the analysis of variance results, the interaction effects of saffron powder, saffron petal powder, and storage time on the pH of cheese samples were statistically significant ($\mathbf{p}<0.01$). Based on the overall mean values, the highest pH was observed in SDP, S, and PS samples, respectively, with the SDP treatment showing a significant difference ($\mathbf{p}<0.05$) compared to the other treatments.

The addition of saffron powder and its petal powder led to an increase in pH compared with the control sample. This increase can be attributed to the phenolic and antioxidant compounds present in saffron, such as crocin, flavonoids, and anthocyanins, which possess antimicrobial properties. These compounds may inhibit the activity of lactic acid bacteria, thereby reducing lactic acid production and resulting in a higher pH value [20].

Furthermore, the compounds found in saffron petals—particularly anthocyanins—exhibit metal ion–chelating properties and can interact with calcium and phosphorus ions present in the cheese curd. Such interactions may disturb the buffering equilibrium, indirectly contributing to an increase in pH [21].

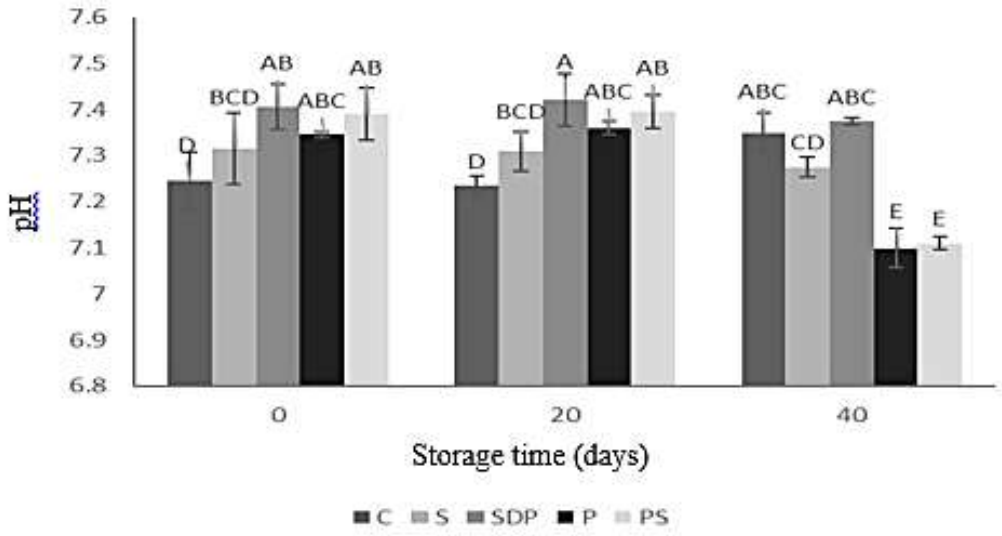

Figure 1 The effect of different treatments on the pH of cheese samples during 40 days of storage at 4 °C

Different uppercase letters indicate a significant difference in means at a significance level p< 0.05

3-2- Acidity

The analysis of variance results indicated that the addition of saffron powder and saffron petal powder had no significant effect on the acidity of the cheese samples. However, storage time had a significant effect on acidity at the 1% level (**p**<0.01). The lowest mean acidity was observed in the control sample, while the highest values were recorded in the S, P, SDP, and PS samples, respectively. Nevertheless, no significant differences (**p**<0.05) were observed among the treatments.

Acidity is considered an important indicator of the functional properties of cheese during the storage period [22,23]. Sameen (2009) reported that the ripening time and the amount of starter culture used significantly influence the acidity of cheese [23]. According to previous studies, the addition of plant-based powders can affect the microbial activity in cheese, leading to changes in both pH and acidity [24].

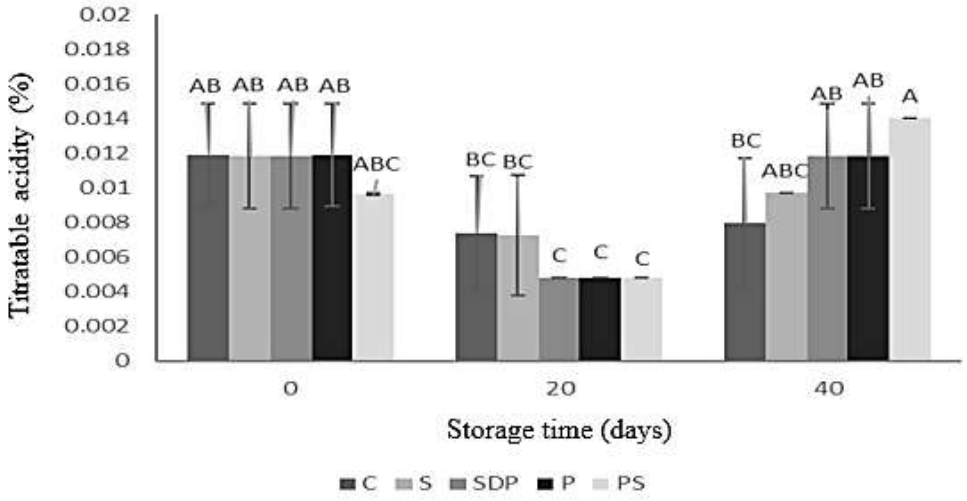

Figure 2 The effect of different treatments on the Titratable acidity of cheese samples during 40 days of storage at 4 °C

Different uppercase letters indicate a significant difference in means at a significance level $p< 0.05$

3-3- Moisture Content

The interaction effect of saffron powder, saffron petal powder, and storage time on the moisture content of the cheese samples was significant at the 1% level (**p**<0.01). The highest mean moisture content was observed in the SDP sample. Overall, the mean moisture content decreased during the storage period.

The main factor influencing the changes in the dry matter content of cheese is the water-binding capacity of proteins. The higher the number of polar groups in the protein network, the greater the water absorption, resulting in a lower percentage of dry matter [25]. Arjmand *et al*., (2015) also reported that increasing the proportion of walnut powder in cheese formulation led to higher moisture content due to the presence of moisture-retaining compounds such as fibers and proteins [26]. Similarly, the presence of components such as fibers, proteins, and carbohydrates in plant-based powders can enhance water absorption and moisture retention [27].

The highest moisture content observed in the SDP treatment may be attributed to the presence of hydrophilic and moisture-absorbing compounds in saffron powder. Saffron contains bioactive components such as polyphenols, flavonoids, crocin, and soluble polysaccharides, which possess polar functional groups (e.g., –OH) capable of forming hydrogen bonds with water molecules. These compounds increase the water-holding capacity within the cheese curd structure and prevent rapid moisture loss during storage [28]. In addition, plant-based additives can affect the protein network of dairy products, thereby influencing rheological properties and water absorption capacity, which ultimately improve moisture retention and enhance water content [29,30].

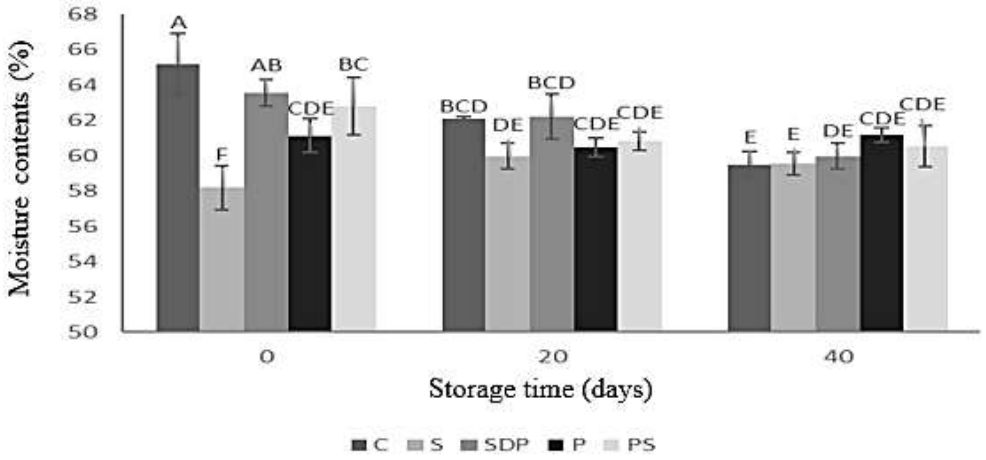

Figure 3 The effect of different treatments on the moisture content of cheese samples during 40 days of storage at 4 °C

Different uppercase letters indicate a significant difference in means at a significance level p< 0.05

3-4- Color Indices

The interaction effects of saffron powder, saffron petal powder, and storage time on the *L** color index were significant at the 1% level (**p**<0.01). The highest mean *L** values were observed in the S and SDP samples, both of which showed significant differences (**p**<0.05) compared to the other treatments.

The increase in the *L** value can be attributed to the uniform distribution of water-soluble saffron pigments within the cheese matrix, particularly in the SDP treatment, where saffron was added during the pasteurization stage, allowing more time for the pigments to penetrate the protein network of the cheese. Crocin, one of the main color compounds in saffron, plays a key role in enhancing the brightness and light reflectance of the cheese surface.

It should be noted that the present results differ from a previous study that reported a decrease in the *L** index with increasing saffron concentration. Such discrepancies may be due to differences in the saffron addition method, processing conditions, and sample characteristics. In that study, a reduction in lightness was observed after the third day of storage, suggesting a darkening effect of saffron under those specific conditions. In contrast, the better pigment diffusion and different pasteurization parameters in the present work may have promoted higher light reflection and brightness [31]. Therefore, technical variations in cheese-making processes and saffron incorporation methods are likely responsible for the observed differences—an aspect that warrants further investigation in future studies.

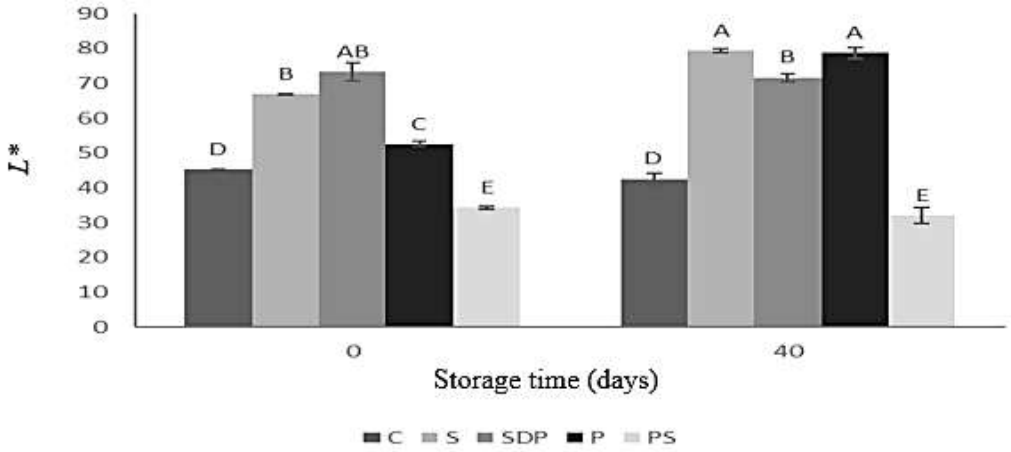

Figure 4 The effect of different treatments on the *L** color index of cheese samples during 40 days of storage at 4°C

Different uppercase letters indicate a significant difference in means at a significance level $p < 0.05$

Regarding the ***a**** color index, the addition of saffron powder and saffron petal powder had a significant effect at the 5% level (**p<**0.05), and storage time was significant at the 1% level (**p<**0.01). The highest *a** values were observed in the S, PS, and SDP treatments, while the lowest value was recorded in the control sample, with significant differences at the 5% level.

The increase in redness in these treatments can be attributed to the presence of crocetin, one of the red–orange pigments of saffron. Crocetin, which is primarily fat-soluble, can interact with proteins or lipids in the cheese matrix after incorporation, thereby increasing the intensity of redness (*a**) in the samples [31].

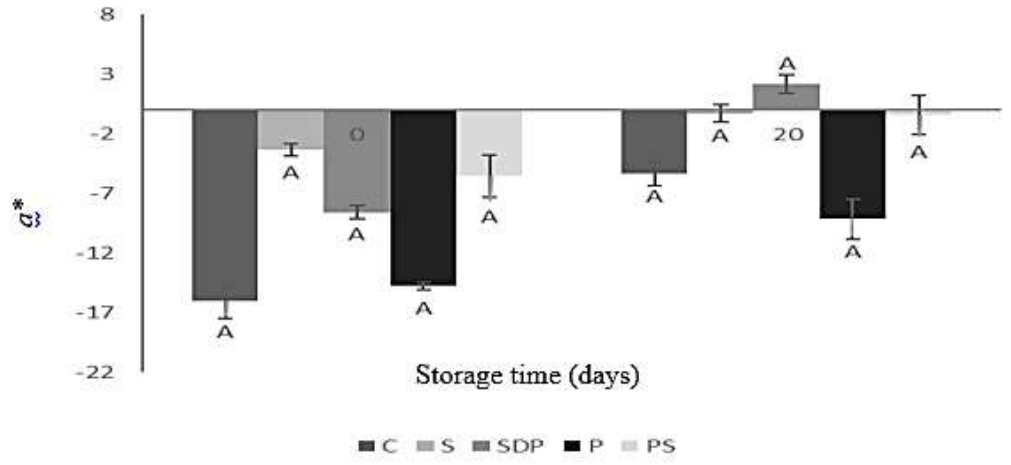

Figure 5 The effect of different treatments on the *a** color index of cheese samples during 40 days of storage at 4 °C

Different uppercase letters indicate a significant difference in means at a significance level p< 0.05

The interaction effect of saffron powder, saffron petal powder, and storage time on the *b** color index was significant (**p<**0.01). The highest *b** values were observed in the SDP and S samples, showing significant differences compared to the control (**p<**0.05). The yellow color of saffron is mainly attributed to the presence of crocin, a water-soluble compound that strongly affects the yellowness index. Adding saffron during the pasteurization stage (SDP) likely facilitated better penetration of pigments into the protein matrix of the cheese. Crocin, by forming hydrogen bonds with proteins and polysaccharides, achieved higher dispersion and stabilization within the curd network, resulting in greater yellowness compared to other treatments [31].

In a study by Lin *et al*., (2012), cheese supplemented with saffron showed a decrease in the *L** index, indicating lower brightness compared to the control. The *a** values for all cheeses were negative, while the *b** index was most affected by saffron, making saffron-containing cheeses appear more yellow [18].

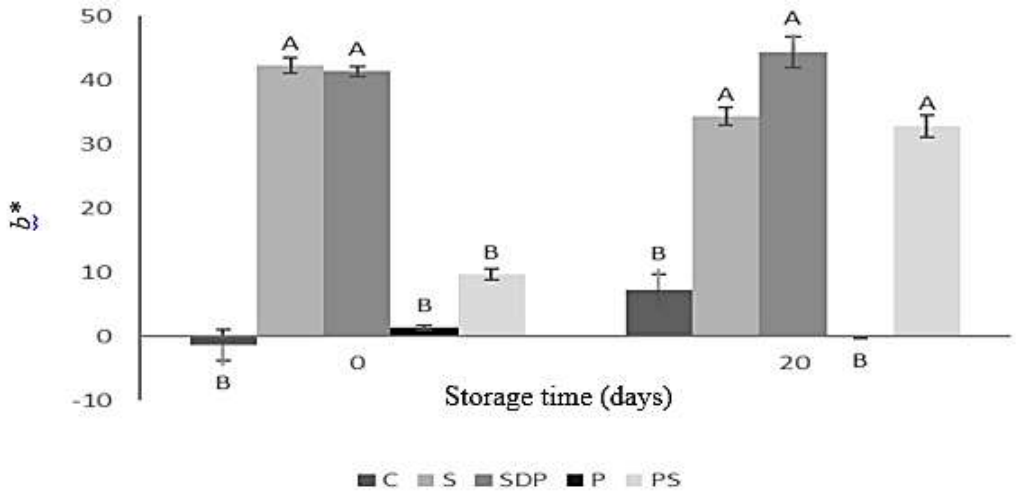

Figure 6 The effect of different treatments on the *b** color index of cheese samples during 40 days of storage at 4 °C

Different uppercase letters indicate a significant difference in means at a significance level p< 0.05

3-5- Total Phenolic Compounds

Analysis of variance indicated that the addition of saffron powder and saffron petal powder had a significant effect on the total phenolic content of the cheese samples (**p**<0.05). The highest mean total phenolic content was observed in the S sample, while the lowest was found in the control. This increase is likely attributed to the presence of phenolic compounds in saffron and its petals, including anthocyanins, flavonoids, and crocins. These compounds, as potent bioactive agents with antioxidant properties, can prevent lipid and protein oxidation, thereby improving the stability and extending the shelf life of the cheese [32].

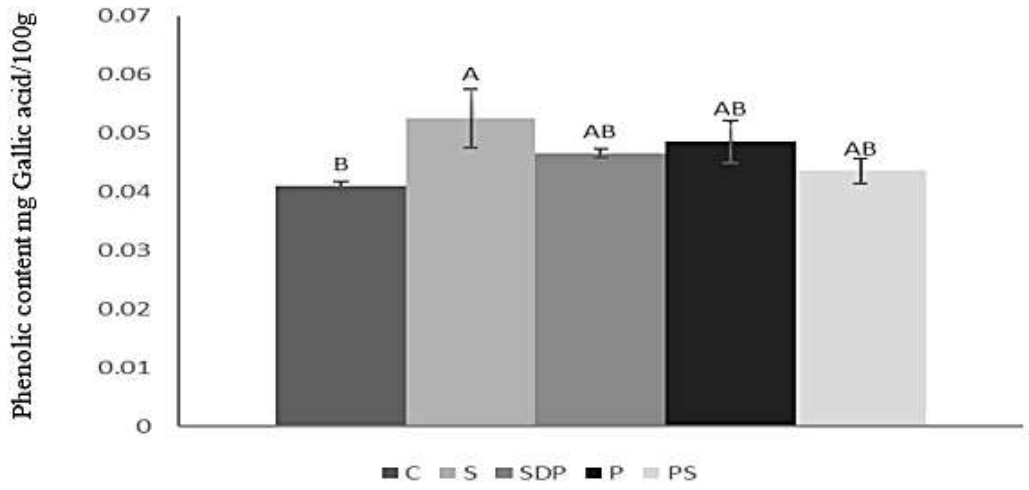

Figure 7 The effect of different treatments on the phenolic compounds of cheese samples during 40 days of storage at 4 °C

Different uppercase letters indicate a significant difference in means at a significance level $p< 0.05$

3-6- Antioxidant Activity by DPPH Assay

In the evaluation of antioxidant capacity, the addition of saffron powder and saffron petal powder had a significant effect at the 5% level (**p**<0.05). The highest mean antioxidant capacity was observed in the PS (48.65), SDP (47.70), S (46.37), and P (46.25) samples, showing significant differences (**p**<0.05) compared to the control (43.60).

The incorporation of saffron and petal powders into the cheese samples increased the total phenolic content and antioxidant activity of the samples. Cheese naturally contains only small amounts of antioxidant compounds, which are partly retained due to interactions with milk proteins. However, water-soluble, low-molecular-weight compounds are often lost in whey [33], resulting in low antioxidant activity in plain cheese.

Adding saffron powders and petal powders, due to their antioxidant compounds, can enhance the antioxidant properties of cheese. The presence of phenolic compounds and antioxidant activity in these plant materials has been well established. In one study, Akan *et al*., (2021) reported that adding black cumin, rosemary, and thyme powders increased the DPPH radical scavenging activity in Lor cheese samples. They also observed that cheese containing a combination of powders exhibited higher antioxidant activity than cheese containing a single powder [34].

Other studies have shown that the antioxidant capacity of saffron stigmas exceeds that of tomato and carrot plants [35]. The medicinal and antioxidant importance of the main compounds in saffron stigmas, including carotenoids, crocin, picrocrocin, and safranal—which are responsible for color, taste, and aroma, respectively—has been emphasized. The high antioxidant capacity of saffron has largely been attributed to crocin, the primary pigment [32,36].

Overall, the strong antioxidant activity of saffron stigmas may result from the synergistic effects of their bioactive compounds, which should not be overlooked [37,38]. The findings also indicated a

correlation between the antioxidant activity of saffron stigmas and their phenolic content, suggesting that spices rich in phenolic and flavonoid compounds exhibit higher antioxidant potential.

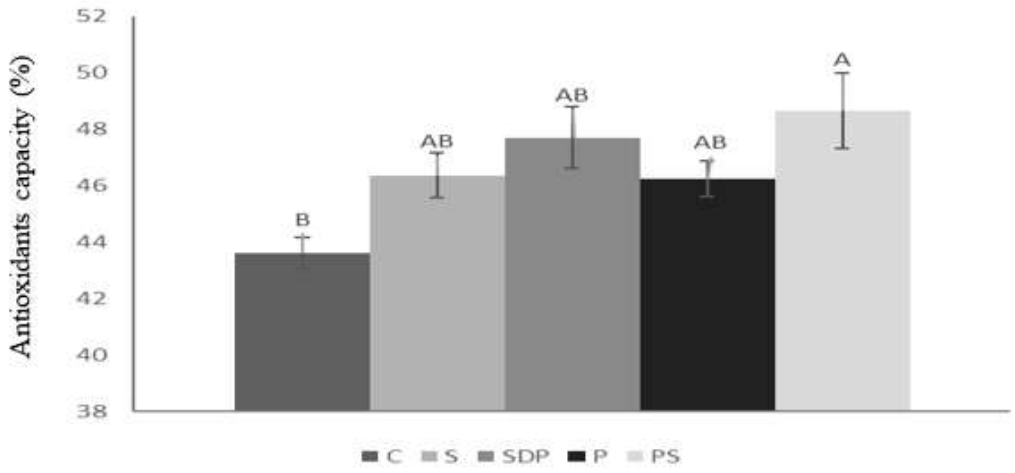

Figure 8 The effect of different treatments on the antioxidant properties of cheese samples during 40 days of storage at 4 °C

Different uppercase letters indicate a significant difference in means at a significance level $p< 0.05$

3-7- Sensory Evaluation

The sensory attributes of the product, including texture, color, aroma, flavor, and overall acceptance, play a significant role in consumer preference. In this study, the effect of adding saffron powder and saffron petal powder on the sensory characteristics—namely color, texture, aroma, flavor, and overall acceptance—of cheese samples was evaluated over a 40-day storage period.

According to the analysis of variance, the interaction effect of saffron powder, saffron petal powder, and storage time on the color attribute was significant at the 5% level (**p**<0.05). Regarding the color of the samples, based on the overall mean, the P and SDP treatments received higher scores compared to the control (**p**<0.05).

Figure 9 The effect of different levels of saffron powders and saffron petals on the color of cheese samples at 4 degrees Celsius during 40 days of storage

The addition of saffron powder and saffron petal powder had a significant effect on the aroma and flavor of the cheese samples (**p<**0.01). Based on the overall mean, the S sample received the highest scores for aroma and flavor compared to the control, with a significant difference (**p<**0.05). Furthermore, at the end of the storage period, the treated samples performed better in terms of aroma and flavor compared to the control.

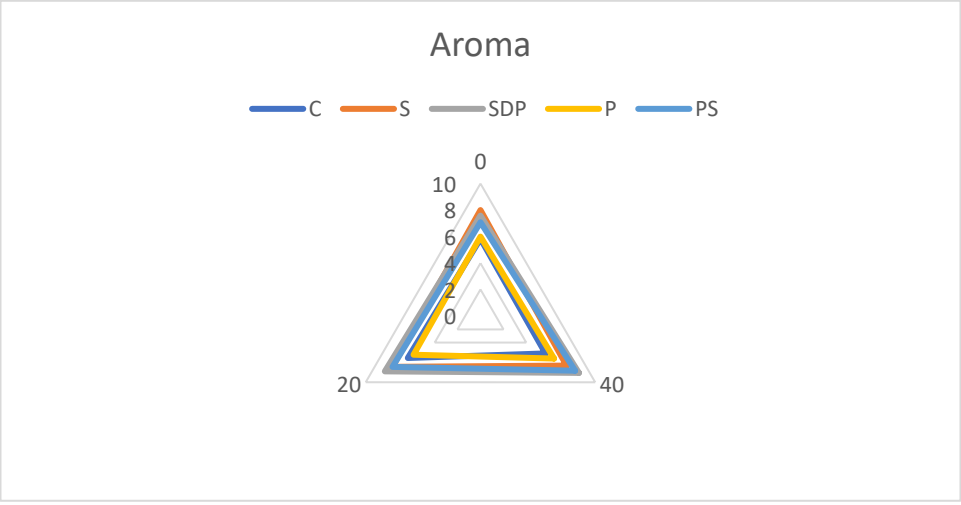

Figure 10 The effect of different levels of saffron powders and saffron petals on the aroma of cheese samples at 4 degrees Celsius during 40 days of storage

Analysis of variance indicated that the addition of saffron powder, saffron petal powder, and storage time had no significant effect on the texture of the cheese samples. Moreover, no significant differences were observed between the treated samples and the control.

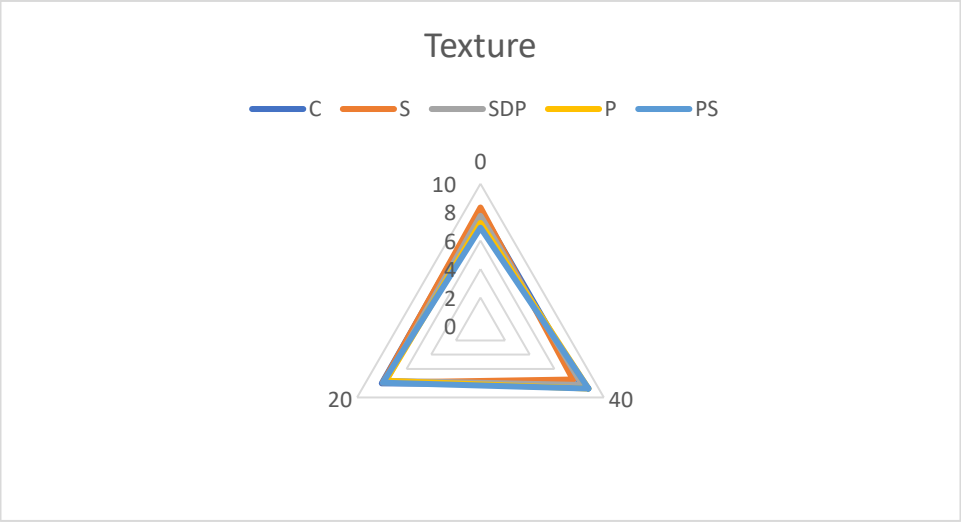

Figure 11 The effect of different levels of saffron powders and saffron petals on the texture of cheese samples at 4 degrees Celsius during 40 days of storage

The addition of saffron powder and saffron petal powder had a significant effect on the overall acceptance of the cheese samples (**p**<0.01). Considering the overall mean, the highest overall acceptance scores were observed in the PS and S treatments, with significant differences (**p**<0.05) compared to the control. At the end of the 40-day storage period, the treated samples demonstrated better overall performance than the control.

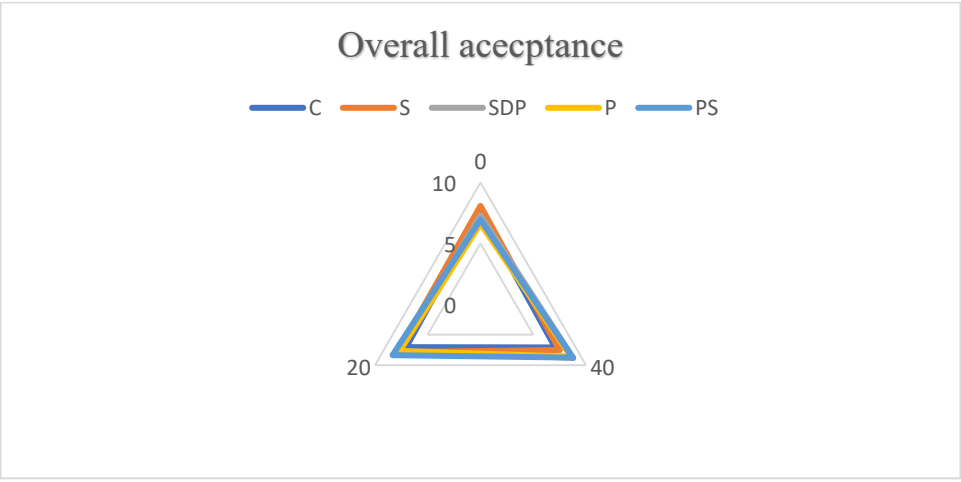

Figure 12 The effect of different levels of saffron powders and saffron petals on the overall acceptance of cheese samples at 4 degrees Celsius during 40 days of storage

4- Conclusion

The use of herbal powders and spices in the food industry has gained attention due to their antioxidant properties, flavoring potential, and

their ability to enhance the appearance and appeal of food products. Overall, the results of this study indicated that the incorporation of saffron powder and its petals increased the total phenolic content and antioxidant activity compared to the control sample. Considering the high antioxidant capacity of saffron and its petals, they can be used as natural sources of antioxidants in the food and pharmaceutical industries. Since saffron petals are a by-product of saffron production that is currently discarded as waste, their utilization in the food industry can not only enhance food safety but also prevent the loss of a valuable by-product.

5- References

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مقاله علمی_پژوهشی

اثر تأثیر پودر زعفران و گلبرگ زعفران بر ویژگی‌های فیزیکوشیمیایی و ضد اکسایشی پنیر

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اطلاعات مقاله

تاریخ های مقاله :

تاریخ دریافت: ۱۴۰۳/۰۶/۳۱

تاریخ داوری: ۱۴۰۴/۰۷/۱۲

تاریخ پذیرش: ۱۴۰۴/۰۷/۱۹

کلمات کلیدی:

پنیر،

ضداکسایش طبیعی،

خواص فیزیکوشیمیایی.

DOI: 10.48311/fsct.2026.83885.0

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چکیده

در سال‌های اخیر، تمایل برای استفاده از پودرهای گیاهی که یکی از منابع مهم ضد اکسایشی‌ها به شمار می‌روند، برای تولید محصولاتی جدید که فراهم‌کننده یک زندگی سالم برای مصرف‌کنندگان می‌باشد؛ مورد توجه قرار گرفته است؛ بنابراین، این تحقیق با هدف بررسی تأثیر غنی‌سازی با پودر زعفران و گلبرگ آن بر خواص فیزیکوشیمیایی، ضداکسایشی و ترکیبات فنولی کل پنیر صورت گرفت. پودرهای زعفران و گلبرگ آن به میزان ۰/۰۵ درصد به نمونه‌های پنیر اضافه شد. ابتدا ارزیابی حسی نمونه‌های پنیر مورد بررسی قرار گرفت و در ادامه تمامی آزمایش‌ها از جمله ارزیابی pH، اسیدیته، رطوبت، شاخص‌های رنگی، فعالیت ضداکسایشی و ترکیبات فنولی کل انجام شد. بیشترین میانگین میزان اسیدیته به ترتیب مربوط به نمونه‌های S (نمونه پنیر حاوی زعفران) (۰/۰۰۹۶٪) و P (نمونه پنیر حاوی پودر گلبرگ زعفران) (۰/۰۰۹۵٪) و کمترین اسیدیته در نمونه شاهد مشاهده شد. بیشترین میزان میانگین رطوبت در تیمار S (۵۹/۲۳٪) مشاهده شد. با افزودن پودر زعفران و گلبرگ زعفران به نمونه‌های پنیر شاخص a^* نسبت به نمونه شاهد افزایش و شاخص‌های L^* و b^* تفاوت معنی‌داری ($p<0.05$) با نمونه شاهد داشتند. بیشترین میزان ترکیبات فنولی کل (۰/۰۵۲ میلی گرم گالیک اسید/۱۰۰ گرم نمونه) و فعالیت ضداکسایشی (۴۸/۶۵٪) به ترتیب مربوط به نمونه‌های S (نمونه پنیر حاوی زعفران) و PS (نمونه پنیر حاوی پودر زعفران و پودر گلبرگ زعفران) و کمترین میزان مربوط به نمونه شاهد بود. افزودن پودرهای گیاهی به نمونه‌های پنیر باعث بهبود ویژگی‌های فیزیکوشیمیایی، افزایش خواص ضداکسایشی و ترکیبات فنولی‌کل نسبت به نمونه شاهد گردید و استفاده از این مواد گیاهی برای تولید محصولات متنوع و با ارزش غذایی بالا توصیه می‌گردد.