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Production of Lavash bread enriched with whole pumpkin seed powder: investigation of physicochemical properties during storage

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ABSTRACT

In this research, the production of Lavash bread enriched with pumpkin seed powder and its physicochemical properties were investigated. Independent variables include different concentrations of pumpkin seed powder (2.5, 5, 7.5, and 10 grams per kilogram of flour) and storage time during one week according to the statistical design table, and dependent variables include pH, acidity, water absorption, percentage Protein, ash, fat, sugar, zeleny, gluten and gluten index were. All experiments were done in three replicates (n=3) with completely random sampling. Data analysis was done using Design Expert13 software. The results of the tests showed that in this research all the answers were significant ($p<0.05$). An increase in pH from 6.26 to 6.29 and a decrease in flour acidity from 2.6 to 1.6 were observed. In addition, the increase in the use of the enrichment agent caused changes in water absorption from 127.1 to 127.8 percent, protein from 1.371 to 1.377, ash from 1.031 to 1.041, fat from 1.029 to 026. 1, sugar from 0.24 to 0.31, Zeleny index from 89.2 to 89, wet gluten from 29.1 to 32.7, gluten index from 81 to 83 in flour ($p<0.05$) . Also, the mutual effects of the amount of pumpkin seed powder and storage time on the amount of protein, fat and sugar of bread showed a significant difference, which caused an increase in fat and protein and a decrease in sugar. The overall results showed that the use of pumpkin seed powder significantly improved most of the physical and chemical quality parameters of enriched Lavash flour and bread. It was also found that the use of pumpkin seed powder as a relatively cheap and efficient source can be used to produce quality bread with nutritional value and desirable physicochemical properties. The result, according to the findings, it can be generally stated that the use of 3.5 to 5.5 grams of pumpkin powder to enrich each kilogram of flour resulted in favorable physicochemical properties in bread.

1-Introduction

Wheat is always one of the primary sources of food during human life. Starch in wheat has played a vital role in providing human energy. Moreover, the nutrients contained in this grain (proteins, fatty acids, vitamins, fiber, etc.) will satisfy the human need for many nutrients. Additionally, to providing the energy needed by humans, wheat has played a vital role in the field of maintaining human health [1]. The gluten present in wheat creates a special viscoelastic structure in wheat flour dough, which makes the products made from this type of dough more delicious, and the use of wheat flour has become very popular in the field of preparing bread, pasta, noodles, and other food products [2].
According to the results of researches, every Iranian person gets about 40 to 50% of the energy and about 45% of the daily protein he needs through the consumption of bread. consequently, reducing the quality and diversity of people's food can cause various types of nutrient deficiencies or diseases caused by it.

The lack of highly consumed nutrients can increase the risk of suffering from a series of diseases such as kwashiorkor, marasmus, ketosis, or cause slow growth, slow wound healing and increased susceptibility to infections. Also, lack of low-consumption nutrients can be effective in the development or suffering of mental disability, poor growth, perinatal complications and degenerative diseases related to aging [3]. Among the various strategies presented in the field of dealing with malnutrition and lack of nutrients, we can mention creating more variety in the food basket, consuming more cheap food, using supplements and food enrichment [4].

Increasing the level of micronutrients increases the quality of enriched food and creates positive effects on the health of people who eat it. In addition, enrichment can affect all or a wide range of people in each community and create more effects than other strategies to deal with nutrient deficiency, including the use of supplements [5].

Pumpkin (Cucurbita maxima) is one of the members of the gourd family. The fruit of this plant is rich in different organic substances, carotene and glucose. Besides, pumpkin seeds are rich in various minerals such as zinc, potassium, magnesium, manganese, selenium, copper and molybdenum [5].

In a research, Patel (2013) examined the nutritional value of pumpkin seeds and the possibility of using them as food enrichment. The results showed that pumpkin seed powder, as a rich source of protein, fiber, minerals, unsaturated fatty acids and phytosterols, has attracted the attention of many nutritionists and food manufacturing companies to this substance and is used on an industrial scale to enrich other foods.

Gomez et al. (2013) investigated the effects of using soybean flour to enrich bread. The results indicated that the properties of firmness, cohesion, gum state and chewiness of bread increased by adding whole soybean flour. The content of protein, dietary fibers and minerals such as calcium, zinc, magnesium, copper and phosphorus increased with the increase in the amount of soybean flour consumed. However, the use of different enrichment levels did not affect the lipid content of breads. In addition, the results showed that bread without enrichment factor and bread containing 30% soy flour were most acceptable [7].

Rizlow et al. (2014) investigated the use of chickpeas, lentils, and beans to enhance the nutritional, textural, and sensory characteristics of white bread. The results of this research showed that the use of legumes to enrich flour caused an increase in the amount of free amino acids in the product. However, the use of legumes caused a decrease in protein digestibility in enriched breads compared to control. Also, the sensory studies indicated that the use of bean, lentil and chickpea powder made the final product acceptable enough [8].

Apostol et al. (2018) investigated the feasibility of using pumpkin seed powder to enrich flour. The results obtained by this group indicated that the pumpkin seed powder used had 42.75% protein, 12.28% lipid, 37.4% carbohydrate and 26.64% edible fiber. In addition, the powder used contained high amounts of potassium, magnesium, iron and copper. This material is also a rich source of essential amino acids such as valine, histidine, isoleucine, leucine, threonine and methionine. Finally, the researchers concluded that pumpkin seed powder can be used as an excellent source for flour enrichment because of its high nutritional value [9].

Bohlal et al. (2019) investigated the health benefits and physicochemical, nutritional and technological properties of flour enriched with lentils. In this research, 6 different levels of flour were used in the formulation of wheat flour and lentil powder. The results showed that the nutritional parameters such as the amount of ash, protein, fat and energy index increased as a result of the enrichment of flour compared to non-enriched flour. Carbohydrate content in all enriched samples was lower than control flour. Clarity, whiteness index and gluten strength values decreased with increasing amount of lentil powder used. Also, the results showed that flour enrichment with the used treatments decreased the water absorption power of dough. The conclusion of this research has indicated that the enrichment of flour up to 20% with lentil powder can improve the nutritional quality and the health consequences of its consumption on humans [10].

Considering that no research has been done on the production of lavash bread enriched with whole pumpkin seed powder and investigating its physicochemical characteristics, the purpose of this research is to investigate the effect of different percentages of whole pumpkin seed powder on the characteristics of enriched lavash bread and flour.

2- Materials and methods

2-1- Materials

The pumpkin was bought from the Tehran market. All chemicals used were purchased from Merck, Germany. The devices used were Ohass Swiss pH meter, DA7250 NIR model, I095 index device, German Kloton Schorperten and TL300 centrifuge.

2-2- Preparation of the sample

In order to prepare the samples, the flour produced by Shirvan Flour Company, Cherdavel, Ilam, was used with a mixing percentage of 50% strong wheat and 50% weak wheat. The produced flour was quarantined for 48 hours. Then, to prepare complete pumpkin seed powder, first, the seed was separated from the pumpkin and dried in a dryer with hot air flow until it reaches 9% moisture. To prepare complete powder, dried samples were ground and passed through 40 mesh. Pumpkin seed powder was added to lavash flour in the amount of (2.5, 5, 7.5 and 10 grams per kilogram of flour). Flour without adding pumpkin seed powder was considered as

control sample. Then, according to Table No. 1, the treatments were prepared.

The dough mixing time, the temperature of the water used and the amount of salt used, as well as the yeast, baking time and oven temperature were considered the same in all samples.

Table1- Treatments of produce Lavash bread

treatment	Pumpkin Seed(grkg^{-1}flour)	Storage time, day, (hours))
1	5	3.5(84h)
2	5	0
3	2.5	5.25(126h)
4	7.5	5.25
5	10	3.5(84h)
6	5	3.5(84h)
7	5	7(168h)
8	5	3.5(84h)
9	2.5	1.75(42h)
10	7.5	1.75(42h)

(1) $index = \frac{Gram\ amount\ of\ gluten\ passed\ through\ the\ centrifuge\ net}{The\ grams\ of\ gluten\ did\ not\ pass\ through\ the\ centrifuge\ net} \times 100$

2-3- Measuring the physicochemical properties of flour

2-3-1- pH and acidity test

It was done by pH meter and based on national standard number 37. The amount of acidity of the flour was done according to the national standard 103 and the titration method.

2-3-2- Ash, water absorption and Zelani index

All the tests of ash, water absorption and Zeleny index were done using NIR device

2-3-3- Gluten index

Flour gluten measurement was done according to the National Standard No. 103 and using a salt gluten device.

2-3-4- Moist gluten (index)

The index test was done by using the index device.

2-3-5- flour protein

Measuring the amount of protein in each flour sample enriched with whole pumpkin seed powder in this research was done using the method of Khademi et al. [11]. In this method, 2 grams of flour from each sample was first weighed. Weighed flour was transferred to a test tube. 3.5 grams of potassium sulfate and 0.1 grams of copper sulfate were added to each test tube. Next, 20 ml of concentrated sulfuric acid was added to the test tubes. Also, some blank samples were prepared by adding all the mentioned chemicals and without flour samples. Then the samples were exposed to 300°C temperature for 40 minutes and then 90 minutes to 420°C temperature. After that, the samples were given time to reach a temperature of 50 to 60 °C. Each sample was transferred to an Erlenmeyer flask and 50 ml of distilled water, 70 ml of 32% sodium hydroxide solution and 30 ml of

boric acid solution containing 4% of the tracer were added to each sample. Finally, 0.2 normal sulfuric acid was used for titration of samples. Finally, nitrogen content and protein content were calculated using the following formulas.

(2)

$$\textit{Percentage of nitrogen content of each sample} = 1000 \times \textit{weight of each bread sample}/\ 100 \times 14 \times \textit{normality of sulfuric acid}\ (\textit{blank titration amount} - \textit{titration amount of each sample})$$

(3)$$\textit{Protein percentage of each sample} = \textit{The percentage of nitrogen content of the sample} \times 5/70$$

2-3-6- flour fat

To measure the amount of fat in flour samples enriched with whole pumpkin seed powder, Khademi et al.'s method was used [11]. In this method, first 5 grams of each flour sample was transferred to the test tube and the fat of the sample was extracted by adding petroleum ether. In order for the extraction process to be done completely, the mixture was incubated for 2.5 to 3 hours. Then by placing the sample in the oven, the ether was evaporated and the remaining substance included the fat of each sample. Finally, the amount of fat percentage in each sample was calculated using the following formula.

(4)$$\textit{Fat percentage} = (\textit{The weight of the sample used for fat extraction}\ /\textit{Weight of extracted fat}) \times 100$$

2-3-7- Whole flour sugar

Determining the amount of total sugar in bread was done using the method of Mashaeikhi et al [4].

2-3-8- Analysis of whole pumpkin seed powder

Analysis of pumpkin seed powder was done by AOAC (2005) method.

2-3-9- Statistical analysis

In this project, in order to investigate the main and bilateral effects of the samples, their variance analysis and also the graphs were drawn using Design Expert[13] software.

3-Results and Discussion

The analysis of the components of the whole pumpkin seed powder can be seen in Table 2. The results showed that pumpkin seed flour has a high percentage of protein and oil, which can create useful properties in flour.

Table2- Analysis of pumpkin seed powder

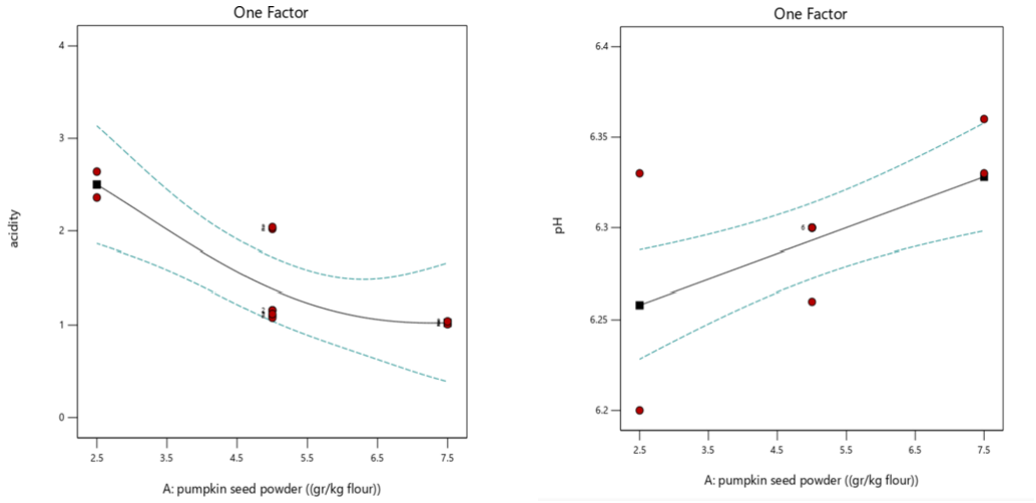
parameters	Amount (%)
Humidity	5.24
Oil	42.11
Protein	23.2
Fiber	2.1
Carbohydrate	22.1

Ash	5.34
pH	6.82

3-1 pH and acidity of flour

The results of pH and acidity test with increasing amount of pumpkin seed powder are shown in Figure 1. The results of the statistical analysis of the treatments show a significant difference ($p<0.05$).

The increase in pH in different treatments reaches a maximum of 29.6, which can generally be said that with the increase of pumpkin seed powder (Figure 1-a), the pH increases, which can probably be due to the relatively higher pH of the pumpkin flour used has affected the pH and increased it in different treatments. These results were contrary to the results obtained by Khademi et al., who did not observe a significant effect on pH as a result of using different amounts of pumpkin seed powder in the preparation of cake, while in research on the effect of using pumpkin powder on dietary biscuits, similar results were achieved [12]. The amount of acidity reduction (Figure 1-b) in different treatments reaches a maximum of 1.6, which can be said that the amount of acidity decreases with the increase of pumpkin seed powder. These results were not consistent with the results obtained by Scarton et al. in preparing muffins from pumpkin powder [13]. In addition, our results in this research were similar to Glink et al.'s results [1]. This group showed a significant decrease in acidity as a result of increasing the use of pumpkin powder in bread preparation.



b a

Fig1. diagram of the effects of using pumpkin seed powder on pH and acidity

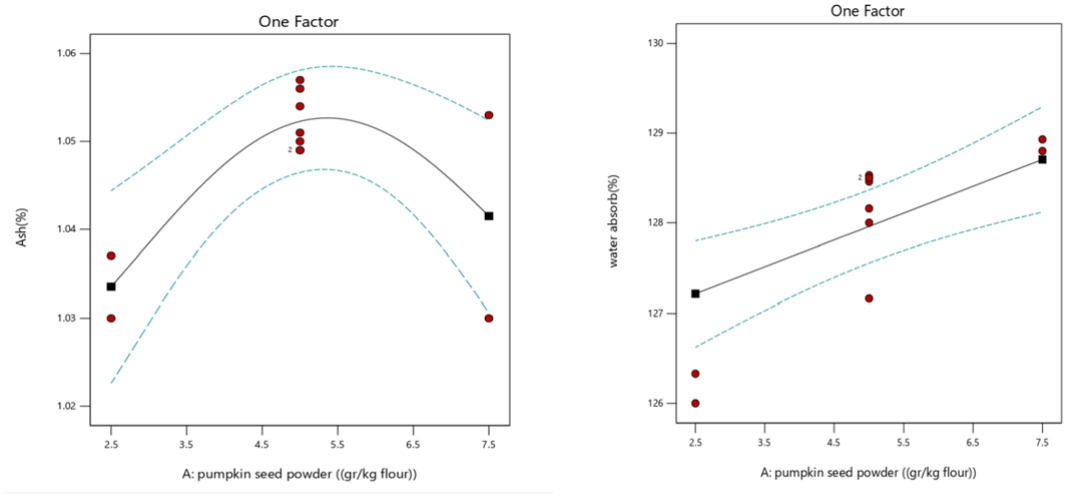
3-2 water and flour ash absorption

The results of the water absorption and flour ash test with increasing the amount of whole pumpkin seed powder are shown in Figure 2. The results of the statistical analysis of the treatments show a significant difference ($p<0.05$). The increase in water absorption (Figure 2-a) in different treatments reaches a maximum of 127.8, which can generally be said that with the increase of pumpkin seed powder, the

amount of water absorption increases, which can be due to the soluble and insoluble fibers of pumpkin seed powder which have high water absorption ability. In addition, the results obtained by Soukkary also corresponded to the results obtained in this research. In this study, Soukkary used different amounts of pumpkin seed powder to enrich bread flour. The results of this research showed a significant increase in the amount of water absorption as a result of increasing the amount of pumpkin seed powder used.

Soukkary and Yu reported similar results regarding the increase in flour water absorption as a result of the use of sunflower seed protein concentrate. The observed increase in water absorption can be caused by the high-water absorption ability of pumpkin seed powder and especially the proteins in this seed [14, 15].

The results of the ash test (Figure 2-b) showed that the use of 2.5 to 5 grams of pumpkin seed powder increases the amount of ash, and after that, according to the graph, the ash amount decreases. The results of the statistical analysis of the treatments show a significant difference ($p<0.05$). The amount of ash increase in different treatments reaches a maximum of 1.041, which in general can be said that with the increase of pumpkin seed powder, the amount of ash increases, which is probably due to the high number of solutes in the consumed pumpkin seed powder, which on ash has had an effect and has increased it in different treatments. Soukkary et al also obtained similar results in their research on the use of pumpkin powder in flour enrichment. Their results indicated a significant increase in the amount of ash due to the use of pumpkin seed powder compared to the control. Similar results were reported by Scarton and Soukkary. The findings of Skarton et al. showed that there is a significant relationship between the increase in the use of pumpkin powder and the amount of flour ash [13 and 14].



b a

Fig2. diagram of the effects of using pumpkin seed powder on water absorb and ash

3-3- protein, fat and sugar of flour

The results of protein, fat and sugar tests of flour with increasing amount of pumpkin seed powder are shown in Figure 3. The

results of the statistical analysis of the treatments show a significant difference ($p<0.05$). The amount of protein increase in different treatments reaches a maximum of 1.377, which can generally be said that with the increase of pumpkin seed powder (Figure 3-b), the amount of protein increases, which is probably due to the high protein content of the pumpkin flour consumed which has influenced the amount of protein and has increased it in different treatments. Sukari had reported a significant increase in the amount of protein in flour, dough and bread produced by increasing the use of pumpkin seed powder for flour enrichment [14]. Considering that pumpkin seeds are considered as a rich source of proteins, increasing the amount of protein as a result of increasing the use of this substance can be justified. In Dalalat et al.'s research, with the increase in the amount of pumpkin flour, the amount of protein in the biscuits produced decreased significantly, which was not in line with this research [12].

The results of flour fat test with increasing amount of pumpkin seed powder are shown in Figure 3-a. The results of the statistical analysis of the treatments show a significant difference ($p<0.05$). The amount of fat increase in flour in different treatments reaches a maximum of 1.026, which in general can be said that with the increase of pumpkin seed powder, the amount of fat increases, which can probably be due to the higher amount of fat in the consumed pumpkin flour, which has an effect on fat and it can also be said that considering that pumpkin seeds are a rich source of fat, the use of this food item to enrich white flour, which is the result of milling the starchy part of wheat and has low fat, causes an increase in fat in different treatments. Gomez et al have also presented similar results in the field of enrichment of bakery flour with pumpkin seed powder. This research group showed that a 5-15% increase in the use of pumpkin seed powder in flour enrichment caused a significant increase in the amount of fat [2]. The results obtained in this research were in accordance with the results obtained by Gomnik et al. In this research, a significant increase in the amount of fat was reported as a result of the increase in the use of pumpkin seed powder for flour enrichment [16].

The results of the flour sugar test are shown in Figure 3-c. The results of statistical analysis of the treatments show a significant difference ($p<0.05$). The amount of sugar increase in different treatments reaches a maximum of 0.31, which can generally be said that the amount of sugar increases with the increase of pumpkin seed powder. Skarten and colleagues in a study in which pumpkin seed powder was used to enrich flour to make muffins showed no change in sugar levels as a result of the use of different amounts of pumpkin seed powder and control[13].These results are contrary to the results obtained in this research. . Dalalat et al showed in a study that with the increase in the amount of pumpkin flour, the amount of sugar in the biscuits increased significantly [12].

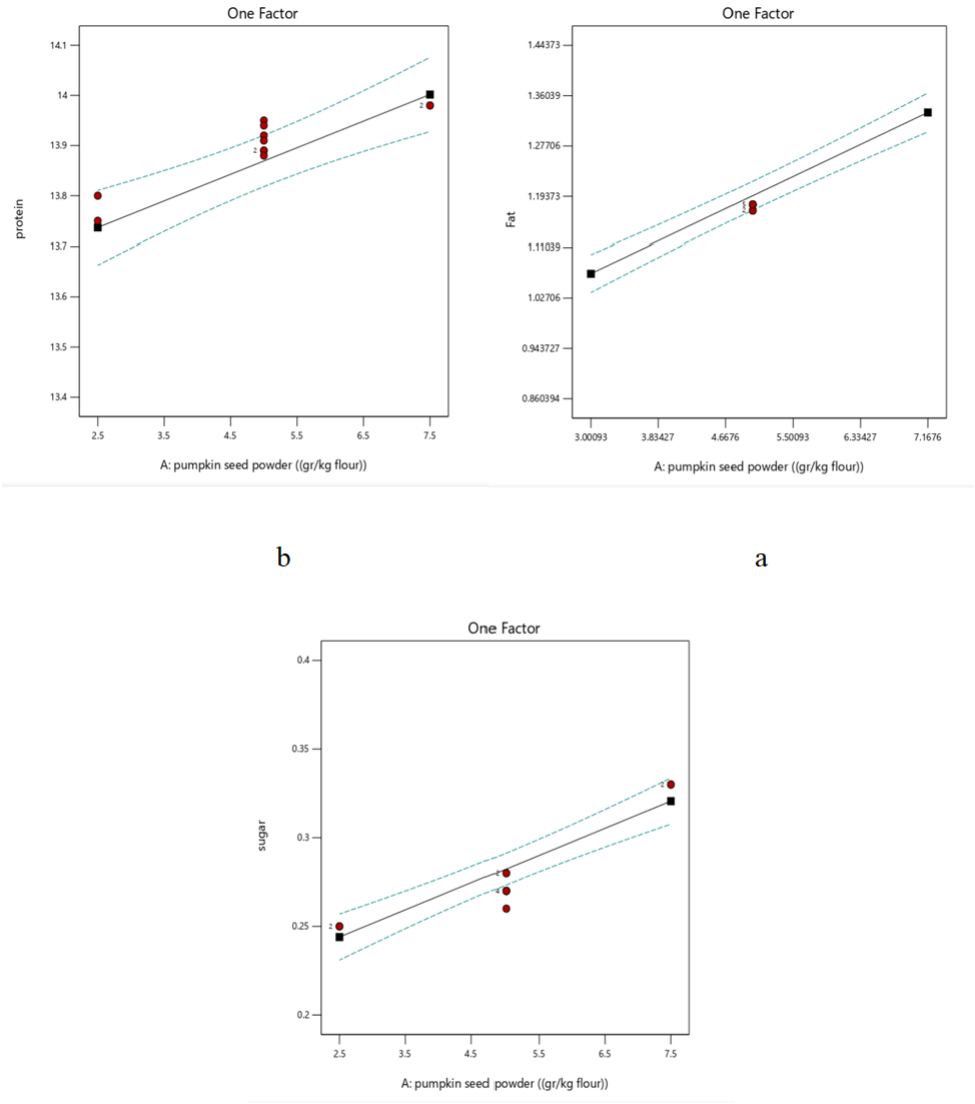


Fig3. diagram of the effects of using pumpkin seed powder on protein, fat and carbohydrate

3-4- Zeleny, gluten and moist gluten indices (index)

The results of Zeleny, gluten, and moist gluten (index) tests with increasing amount of whole pumpkin seed powder are shown in Figure 4. The results of the statistical analysis of the treatments show a significant difference ($p<0.05$). The increase in Zeleny flour (Figure 4-B) in different treatments reaches a maximum of 8.89, which can be said to increase with the increase in pumpkin seed powder, which is probably due to increased elasticity and increased gluten resistance, which pumpkin seed powder contains a high amount of protein. In research on the effect of enriching flour with pumpkin powder to prepare cake, Kiani et al showed a significant increase in Zeleny index as a result of enriching flour with pumpkin powder [17]. The amount of gluten increase (Figure 4-c) in different treatments was maximum 31.2% in flour ($p<0.05$). In general, it can be said that the amount of

gluten decreases with the increase of pumpkin seed powder. The results of this graph show the significance of the effect of using pumpkin seed powder on reducing the amount of gluten. The results of this research are consistent with the results of Gomnik et al. In research on the effect of enriching wheat flour with pumpkin seed powder and examining the properties of dough and bread production, Gomnik et al. reported a reduction in gluten content as a result of using higher levels of pumpkin seed powder. Nevertheless, the results of this research showed an increase in elasticity as a result of using higher amounts of enrichment material. In another study, they reported results consistent with our results [16 and 17]. In this research, which investigated the structural effects of using pumpkin seed powder on the structure of dough and bread production, it was shown that the use of the enriching substance reduced the amount of gluten compared to the control flour, considering that pumpkin seed powder does not contain gluten, it can be inferred that increasing the amount of use of this substance for flour enrichment causes a decrease in the total amount of gluten produced in the enriched flour. As a result, the results obtained in this research are justifiable.

The results of wet gluten test (index) with increasing amount of pumpkin seed powder are shown in Figure 4-a. The results of the statistical analysis of the treatments show a significant difference ($p<0.05$). The increase of wet gluten in different treatments reaches a maximum of 83%, which can generally be said to increase the amount of wet gluten index with the increase of pumpkin seed powder. Probably, this phenomenon was caused by the interaction between proteins in pumpkin seed powder and bread wheat gluten. These results were in agreement with the results obtained by Gumming et al. This group also showed in their investigations that the increase in the use of pumpkin seed powder caused an increase in the gluten index in the enriched flour [16].

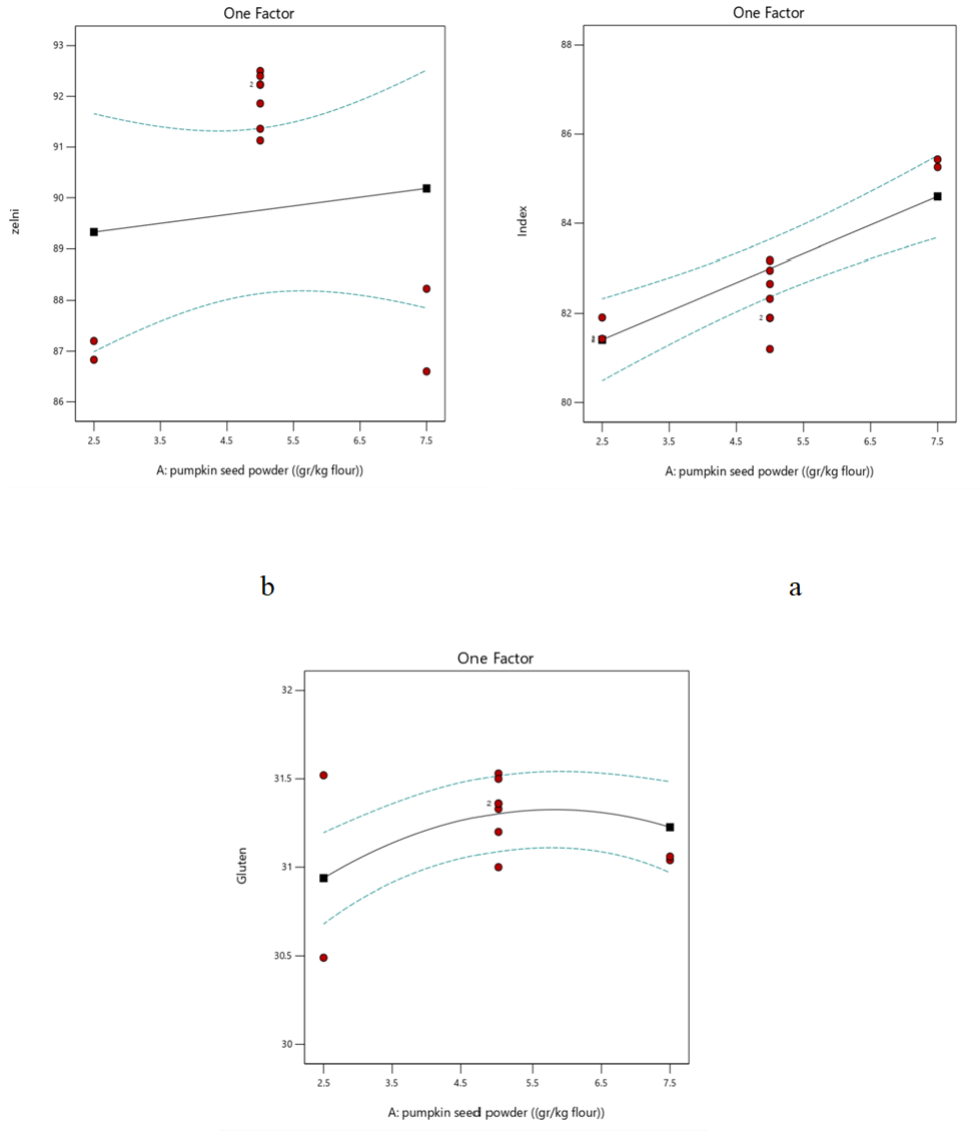


Fig4. diagram of the effects of using pumpkin seed powder on zeleny

5-3- interaction effects of pumpkin seed powder and storage time on protein, fat, and sugar of bread

Figure 5 shows the results of the test of the interaction effects of pumpkin seed powder and storage time on protein, fat and carbohydrate of bread. The results of the statistical analysis of the treatments showed a significant difference ($p<0.05$). The analysis of the obtained results showed that the variables of the amount of pumpkin seed powder consumed and the duration of storage have significant effects on the amount of protein in bread (Figure 5-A). So that increasing the amount of pumpkin seed powder used, as well as prolonging the storage time of the bread, has increased the amount of protein. In the research, it was shown that increasing the use of pumpkin seed powder to enrich rice bread caused a significant increase in the amount of protein in the product [18, 19]. These results can be attributed on the one hand to the high amount of protein in pumpkin seeds, and on the other hand, the increase in storage time through the reduction of bread moisture, and on the other hand, through the

biochemical interactions carried out by the microorganisms in the bread and the production of some proteins or amino acids by them can cause this result. Figure (5-B) shows the results of the test of interaction effects of pumpkin seed powder and storage time on bread fat. In this figure, the results of the statistical analysis of the treatments show a significant difference ($p<0.05$). The analysis of the obtained results showed that the variables of the amount of pumpkin seed powder consumed and the duration of storage have significant effects on the amount of bread fat. The obtained results showed that increasing the amount of enrichment as well as increasing the storage time caused an increase in the fat content of bread. Probably, because pumpkin seeds have a significant amount of oil, the increase in fat content as a result of increasing the use of pumpkin seed powder can be justified. In addition, the chemical changes resulting from the activity of microorganisms in bread during the storage period and on the other hand, the decrease in bread moisture during this period can cause a relative increase in the amount of fat in the bread during the storage period. Dabash et al showed that the use of pumpkin seed powder increases the fat content of rice bread [19].

Figure (5-C) shows the results of the test of bilateral effects of pumpkin seed powder and storage time on the sugar of bread. In this figure, the results of the statistical analysis of the treatments show a significant difference ($p<0.05$). The analysis of the obtained results showed that the variables of the amount of pumpkin seed powder consumed and the duration of storage have significant effects on the amount of sugar in bread. The results of this research showed a significant relationship between the amount of enrichment and the length of bread storage with the amount of total sugar in the bread. In the mentioned graph, increasing the storage period and increasing the enrichment has caused a decrease in the total sugar content of the bread. The obtained results indicate that the use of 3 to 5.5 grams of pumpkin seed powder per kilogram of flour has generally reduced the amount of sugar in bread. However, the use of amounts higher than 6.5 grams per kilogram of pumpkin seed powder increased the amount of sugar in the produced bread [20 and 21].

These results can be justified according to the activity of bacteria and their use of sugar during the storage period of the product. In research, it was shown that increasing the use of pumpkin powder decreased the amount of sugar in bread [18]. This finding was not consistent with the results obtained in this research. This inconsistency could be due to the difference in the number of pumpkin compounds.

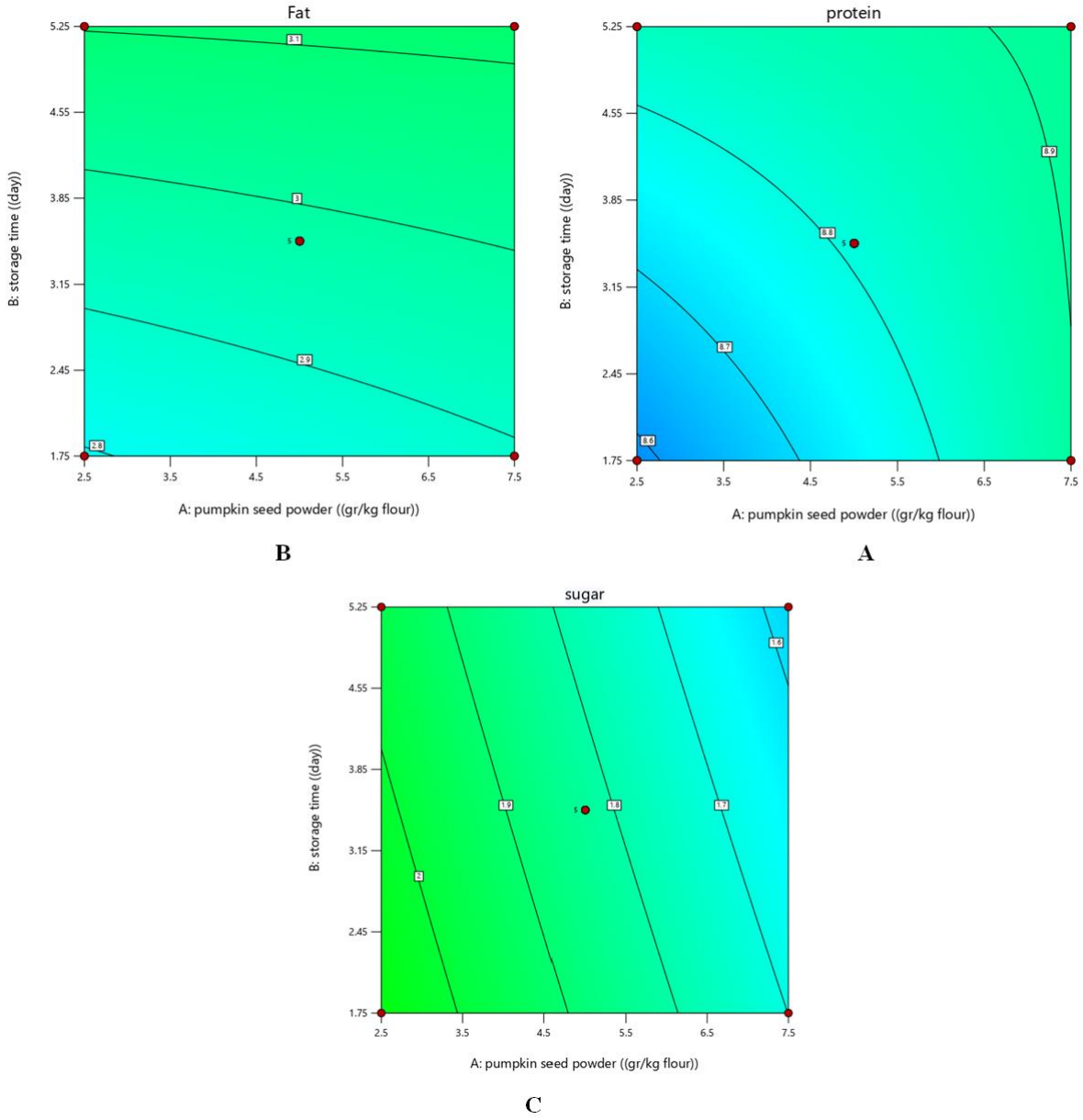


Fig5. diagram of interaction effect in storage time on protein, fat and carbohydrate

4 – Conclusion

The results obtained in this research showed that the use of pumpkin seed powder to enrich flour increases most of the physicochemical indicators of enriched flour, including pH, acidity, ash, water absorption, Zeleny index, gluten index, wet gluten (index), protein, fat and sugar. In addition, the findings of this research showed significant effects between the amount of flour enrichment and the duration of bread storage with protein, fat and total sugar indicators. As a result, according to the findings, it can be generally stated that the use of 3.5 to 5.5 grams of pumpkin powder to enrich each kilogram of flour resulted in favorable physicochemical characteristics of bread.

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تولید نان لواش غنی شده با پودر کامل تخم کدو تنبل: بررسی ویژگیهای فیزیکوشیمیایی در طول نگهداری

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چکیده

در این پژوهش به بررسی تولید نان لواش غنی شده با پودر تخم کدو تنبل و ویژگیهای فیزیکوشیمیایی آن پرداخته شد. متغیرهای مستقل شامل غلظتهای مختلف پودر کامل تخم کدو تنبل (۲/۵، ۵، ۷/۵ و ۱۰ گرم در هر کیلوگرم آرد) و زمان نگهداری در طول یک هفته مطابق جدول طرح آزمایشات و متغیرهای وابسته شامل pH، اسیدیته، خاکستر، جذب آب، شاخص زلنی، شاخص گلوتن، گلوتن مرطوب(ایندکس)، پروتئین، چربی و قند بود. تمامی آزمایشات در سه تکرار (n=۳) با نمونه‌گیری کاملاً تصادفی انجام شد. آنالیز داده ها با استفاده از نرم افزارDesign Expert13 انجام گرفت. نتایج آزمایشات نشان داد که در این تحقیق تمامی پاسخها معنی دار بود (p<۰/۰۵). افزایش pH از ٦/٢٦ به ٦/٢٩ و کاهش اسیدیته آرد از ٢/٦ به ١/٦ مشاهده شد. بعلاوه افزایش استفاده از عامل غنی کننده سبب تغییرات مقادیر جذب آب از ۱۲۷/۱ به ۱۲۷/۸ درصد، پروتئین از ۱/۳۷۱ به ۱/۳۷۷، خاکستر از ۱/۰۳۱ به ۱/۰٤۱، چربی از ۱/۰۲۹ به ۱/۰۲٦ ، قند از ۰/۲٤ به ۰/۳۱ ، شاخص زلنی از ۸۹/۲ به ۸۹/۸ ،گلوتن مرطوب(ایندکس) از ۲۹/۱ به ۳۲/۷ ، شاخص گلوتن از ۸۱ به ۸۳ در آرد گردید (p<۰/۰۵). همچنین اثرات متقابل میزان پودر کامل تخم کدو تنبل و زمان نگهداری بر روی میزان پروتئین، چربی و قند نان، اختلاف معنی داری را نشان داد که سبب افزایش چربی و پروتئین و کاهش میزان قند شد. نتایج کلی نشان داد که استفاده از محدوده بین ۳ تا ۵ گرم پودر تخم کدوتنبل به‌طور معنی‌داری سبب بهبود اکثر پارامترهای کیفی فیزیکی و شیمیایی آرد و نان لواش غنی‌شده گردید. همچنین مشخص گردید که استفاده از پودر کامل تخم کدوتنبل به‌عنوان یک منبع نسبتاً ارزان و کارآمد می‌تواند در جهت تولید نان با ارزش غذایی و ویژگی‌های فیزیکوشیمیایی مطلوب مورد استفاده قرار گیرد.