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Fawaz S. Mohamed*

Sabra S. Yaseen*

Food Sciences Dept., College
of Agriculture, University of
Tikrit, Tikrit, Iraq

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**A Study of Some Chemical And Rheological Properties
In Wheat Flour And Soya Flour**

ABSTRACT

The study was conducted in (the general for grain processing and Tikrit University. Which included the effect of adding low-fat soybeans, whether as flour wheat, on the chemical composition and rheology concentrations. The results showed the presence of significant differences in humidity, as the highest moisture content was recorded in the sample with a concentration of 15%, reaching 12.300, while there were no significant differences in the concentration of 15, 20 and 25% for protein. Significant differences in ash for the different concentrations compared to the two control groups, as well as the same for fibers.

As for carbohydrates the highest value was recorder for wheat flour control. Significant differences was also recorded in the rheological properties, which included farinograph and amylograph, as the addition of low soybeans improved the rheological characteristic such as stability absorption, viscosity, and others.

There fore this research aims at raise the nutritional value when using this compound flour in the manufacture of different backed products.

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Introduction:

One of the nutritional problems in most of the developing world is protein calorie malnutrition. The strategic use of inexpensive high protein of cereal – staple foods is highly recommended to upgrade the nutritional status of many people (Hasler, 2002). Adding soy ingredients to backed products influence textural and sensory properties (vittadini and vodovotz, 2003).

The seeds contain 25-55% protein content and thus it surpasses in terms of protein content on all field crops, as the protein content in soybeans increases by twice the protein content of pea seeds, three times over wheat grains and oats, and four times over the corn and barley grains. Lysine is found in soy flour at a rate (8) times what it is in wheat (Ribotta., 2005). Soy protein is closer in terms of chemical and physical properties to animal protein, as it contains all the essential amino acids for humans and animals in proportions close to the needs and its seeds contain 18 -24% of fats

* Corresponding author: E-mail: sabraa.saad@tu.edu.iq

(Ndife, 2014). About 32% of the total oilseeds put on the world market were formed in 1965, and this percentage rose to 52.12% in 1996 (preparation of soy flour (Sabanis, 2009).

Materials and methods

Preparation of soy flour

Ground defatted soya flour purchased from oil extraction and refinery factory (Baghdad).

Was blended with the wheat flour levels 15, 20 and 25% for 10 min to ensure homogeneity using a mixer.

Chemical tests: Chemical tests were conducted for flour manufactured fortified with low-fat soybeans as follows:

Con.80: wheat flour extraction 80%

A15: wheat flour 85% +15 soya flour

A20: wheat flour 80%+20% soya flour

A25: wheat flour 75%+25% soya flour

Soya100: wheat flour 100%

Moisture Determination

The moisture percentage was estimated according to the method suggested by the A.O.A.C (1984) using Burton Infra-Tec type 2010 and according to the specifications followed in Quality Control - Iraq.

Protein Determination

The percentage of nitrogen in the grains was estimated by micro-Kjeldhal method according to what was stated in (48-11) A.A.C.C (2002), then multiplied by 5.7 to extract the protein percentage.

Ash Determination

Ash percentage was determined using standard method no. A.O.A.C (1984).

Fat Determination

The percentage of fat in the flour samples fortified with soybeans was estimated separately using Soxhlet extraction units, the use of the solvent Diethyl ether and the above-mentioned concentrations based on the method mentioned in A.O.A.C. (1984).

Fiber Estimate: Crude Fiber

The fibers were estimated according to the method mentioned by Pearson (1970).

Rheological tests for wheat flour and products manufactured or fortified with low-fat soybeans with addition rates (15, 20, 25) %

Farinograph test

This examination was performed in the laboratory of the General Company for Grain Processing in Baghdad according to the method suggested by AACC (1984). Using the Farinograph device prepared by Brabender Company, using a tank with a capacity of 300 gm, the variables were obtained:

1- Water Absorption: It is the amount of water needed at a temperature of 30°C to reach the mature dough to a line of 500 bartender units.

2 - Dough Development Time: It is the time in minutes from adding water until the dough reaches the desired consistency at the highest point in the forinograph curve at the 500-unit line.

3 - Dough Stability Time: It is the time in minutes, starting from touching the curve to the line of 500 brabender units until the start of its departure from this line.

Amylograph Test

This examination was performed in the laboratory of the General Company for Grain Processing in Baghdad according to the method suggested by AACC (1984). As he used a melograph device prepared by Brabender Company, and using a tank with a capacity of 300 gm, the parameters were obtained:

1- The mixer: It is a fast-rotating mixer surrounded by a cabinet with a constant temperature in order to maintain the temperature of the dough during mixing as well as the relative humidity and upon testing the flour, an appropriate amount of water is added to it commensurate with the moisture of the flour and when mixing and the formation of gluten at a temperature of 30 C ° in the mixing unit

2- The temperature of the transformation at the beginning of gelatinization (blood).

3- Maximum Viscosity.

4- Maximum Viscosity Temperature.

By increasing the temperature at a rate of 1.5 degrees per minute, the starch begins to gelatinize, which increases the viscosity, and for this viscosity it corresponds to the alpha-amylase enzyme that attacks the starch and reduces the viscosity and the maximum viscosity obtained depends on the amount of the enzyme. Then it is deduced from the change in the viscosity of a suspension composed of flour to be tested and distilled water while it is being heated Regularly at a temperature of 30 ° C, this test is important to verify the characteristics of the baking, as it is related to the activity of amylase enzymes in the flour.

Results and Dissection

Chemical analysis:

Table (1) the chemical composition of wheat flour with an extraction and fortified with low-fat soybeans in different levels 15, 20, 25%. The most important characteristics of the consumer's perception in food, which greatly affect the chemical and physical properties, as well as affect the flavor and texture (Loman et al., 2016).

Table (1): Wheat flour with an extraction rate of 80% and fortified with low-fat soy flour in different concentrations (calculated based on dry weight).

Samples	Moisture (%)	Protein (%)	Fats (%)	Ash (%)	Fiber (%)	Carbohydrates (%)
Con.80	12.633 a	11.667 c	1.566c	1.033e	2.550e	70.561a
A15	12.300 b	12.067bc	2.013b	1.463a	2.953d	69.204b
A20	12.467 b	12.367 b	2.233b	1.103d	3.946b	67.884c
A25	12.000 c	12.667 b	2.260b	1.206c	3.356c	56.511d
Soya100	9.900 d	35.733 a	7.667a	1.330b	7.433a	37.937e

- Values represent an average of three replicates.
- Different letters indicate the presence of significant differences in the level of probability ($p \leq 0.5$)

Where the moisture content of wheat flour was 12.633%, while the lowest in low soybean flour was 9.900%, while wheat flour with an extraction rate of 80% and fortified with soybeans with a concentration of 20% recorded the highest percentage in moisture if it reached 12.467% as shown in the table. The same significant superiority in wheat flour compared to other types of flour, while wheat flour fortified with low fat soybeans with a concentration of 25% recorded the lowest moisture content, and this is due to the fact that soybean flour contains a greater amount of total dry solids with high properties. (Kim et al., 2006).

Those who reported that increasing the percentage of soy flour reduces the moisture content of soybean flour with wheat flour added to it.

Protein

Soy protein is one of the essential proteins for use as soy flour, as the addition of low-fat soy flour increases the protein content and essential amino acids and thus has a greater potential to overcome malnutrition in the world (Creamer and Baldwin., 1999). Where it is noticed from the table that there are significant differences in protein percentages between wheat flour with an extraction rate of 80% and low-fat soy flour, as it reached 11.66% in the first, while it was recorded in the second 35.73%. If wheat flour with an extraction rate of 80% and fortified with low-fat soybeans and with a concentration of 25%, the percentage of protein was significantly, reaching 12.66%, followed by the concentration of 20%, then 15%, with a value of 12.3% and 12.06%, respectively. The low-fat soy flour with a content of 100% gave the highest value in protein, at 35.73%, which is consistent with what was mentioned (Evonic et al., 2010). When they conducted many studies of the protein

content prepared from soy flour, it was observed that a gradual increase occurred with an increase in the level of soy flour, which led to an increase in protein values. The reason is due to the fact that soy flour contains the highest amount of protein.

Fats

Soybeans are rich in fat and soybeans are classified as oil seeds and are often used to make soybean oil. The fat content in them ranges around 18% of the dry weight and contains unsaturated fatty acids and few saturated fatty acids. The results in Table (1) show that there are significant differences with a level ($p \leq 0.05$) in the fat percentage of the components of wheat flour and soybeans and in different concentrations if it is significantly superior to the low fat soy flour with a value of 7.66%, followed by wheat flour fortified with low-fat flour at a concentration of 25%, then a concentration of 20% and finally a concentration of 10%, as it reached 2.01%. The flour gave the product the lowest value in the fat content as it reached 1.56%. The increase in the fat content could be due to an increase in the percentage of soybeans in the flour mixture and this is consistent with what was mentioned (hafez, 1996), where he mentioned Soybean flour contains 20-24% Fats, while wheat flour contains 0.9 – 0.11% and most of it is mostly unsaturated fats.

Ash

The fat content of ash is an important feature that indicates the efficiency of the flour used in production. Table (1) shows the presence of significant differences in the ash content of wheat flour and low-fat soybean flour with different proportions (15, 20, 25)%, as wheat flour fortified with low flour with a concentration of 25% recorded the highest percentage in ash, reaching 1.46%. Compared with other types, this is in agreement with what was mentioned by (Kim et al., 2006), where he mentioned an increase in the percentage of ash with an increase in the percentage of soy flour, as the proportion of ash increased with the increase of fortification, and this is consistent with what was mentioned (Casper et al., 2012) followed by wheat flour fortified with low-fat soy flour. With a concentration of 20%, then a concentration of 15%, reaching 20% and 15%, respectively.

Fiber

Soybeans contain high amounts of both soluble and insoluble fiber, and these fibers may cause flatulence and diarrhea in some people who are allergic to soy (Mostafa, 2007). The soluble fiber in soybeans is considered healthy as it ferments with colon bacteria, leading to the formation of chain-bound fatty acids that improve colon health and reduce the risk of colon cancer. From Table (1), there are significant differences in the fiber content, as the low soybean flour alone scored 7.43%, followed by 20%, reaching 3.94%, while 25% and 15% gave the lowest concentration. Table (1) shows the chemical composition of wheat flour with an extraction rate of 80% and fortified with low-fat soybeans and in different proportions (15%, 20%, 25%), where it was found that the moisture content is an important factor in determining the quality of the grains as it is one of the most important characteristics. In the consumer's negative perception in food, it greatly affects the chemical and physical properties as well as the flavor and texture (Casper et al., 2012). Where the moisture content of wheat flour ranged 12.63%, while the lowest was 9.90% in soybean flour, while wheat flour with an extraction rate of 80% and fortified with low flour with a concentration of 20% recorded the highest percentage of moisture, reaching 12.46%. The same table also shows a significant superiority in wheat flour compared to other types of flour, while wheat flour fortified with low-fat soybeans with a concentration of 25% recorded a lower value in moisture content and this is due to the fact that soy flour contains a greater amount of total dry solids with high fermentation properties compared to wheat flour, and this is in agreement with what was mentioned (Vergas et al., 2008). It was reported that an increase in the percentage of soy flour reduces the moisture content of soy flour to which wheat flour is added.

Carbohydrates

Soy contains a low amount of carbohydrates and this is very important for people who suffer from diabetes as it does not raise blood sugar after food (Makker et al., 2014). Table (1) notes the presence of significant differences in the carbohydrate content of the studied models, where wheat flour with an extraction rate of 80% recorded the highest value in carbohydrates, reaching 70.57%, while the lowest value was recorded in the carbohydrate content at a concentration of 20%, and this

is consistent with what was mentioned (Loman et al., 2016). Whereas carbohydrate content values increased when fortified with low-fat soybeans compared to the standard sample of soybean flour.

Table (2): The farinograph readings for wheat flour and compound flour with different substitution ratios

Samples	Absorption rate	Time required to develop /min	Stability /min	Degree of softening / FU
Con.80	60.167 e	4.900 e	6.667 b	15.667 e
A15	63.567 d	6.267 d	5.033 d	71.333 b
A20	65.233 c	6.533 c	5.333 c	35.000 c
A25	67.033 a	7.733 b	6.600 b	20.333 d
Soya100	65.900 b	17.267 a	11.333 a	90.670 a

- Values represent an average of three replicates.
- Different letters indicate the presence of significant differences in the level of probability ($p \leq 0.5$)

The table represents three replicates

The main aim of studying the rheological properties of any material is to find a law of mechanical behavior. In other words, the specialist in rheology seeks an equation linking effort to the reality or fields of deformation (Medic, 2014). While the rheological tests of the dough are being prepared an important indicator to know the strength of the flour dough, as it shows the effect of the forces exerting on the glutinous network and the number of forces that the dough can withstand. For this purpose, the farinograph device was used in this study as the farinograph curves give an idea of the rate of absorption, mixing, strength of the dough, etc.

Water absorption

The water absorption of flour is defined as the amount of water at a temperature of 30 degrees, which is required to crystallize the ideal consistency of the dough, which is 500 B.u. It is proportional to the quantity and quality of protein, the percentage of broken starch, the surface area of the flour grains, and the validity of the grain. Table (2) notes the absorption of flour to water and notes that there are significant differences in the absorbance of the substitution ratios of wheat flour with low soy flour at concentrations of compared to the standard sample (the standard group) (Mustafa et al., 2007). The percentage and quality of protein is of great importance in the water absorption characteristic of flour because it is necessary for the formation of the glutinous network as it is noted from the table that the percentage of flour absorption of water increases with the increase in the protein present in compound flour with different substitution ratios if a large capacity to absorb water compared to the gluten of wheat flour alone (Kawamoto et al., 2013).

Access time

It is the time in minutes from the start of operation of the device until the farinograph touches the line of 500 units of Brabender (B.u), which is the stage after which comes the process of absorbing the flour components into the water and in which the dough is formed or built by absorbing all the water added to it. From Table (2), it is noted that the arrival time is more than the standard treatment at the level of repudiation. Various sources indicate that the shortening of the dough's arrival time to the 500 B.u line is a desirable trait, which means that the percentage of gluten is good, which helps to accelerate the formation of the pulp, the gluteal network, as I mentioned (Evonik, 2010). One of the factors affecting the arrival time characteristic is the amount of gluten formed in the dough, so the speed of its formation leads to shortening the arrival time, i.e., the arrival of the dough to the required consistency. Compound flour from reaching the desired

consistency also indicates that the prolonged arrival time may be due to the weak consistency of the dough and its dissolution due to the weakening of the formed glutinous network (Vargas-Bello-Perez et al., 2008).

Ripening time

It is the time in minutes from adding the water until the streak reaches the highest value, and thus the glutinous network may have been formed or completed. Table (2) shows that there are significant differences between the types of compound flour at substitution levels compared to the standard formula (the control group). As it is noticed that there is a decrease in the ripening time and for all treatments from the standard or control treatment, while the ripening time has increased in the low standard soybean flour.

Stabilization time

It is the time in minutes between the arrival time and the departure time of the farinograph line of 500 units of brabender, and it may also be called stability and it indicates the suitability of the flour for the production of bread. Table (2) shows the presence of significant differences in the stability time between the standard treatment of wheat flour and low-fat soybean flour. For the replacement percentages samples. While it was significantly more than the substitution level over the standard treatment for wheat flour,

and it was significantly less than the standard treatment for low soy flour. This indicates the strength of soybean flour, which is characterized by its high quality compared to weak wheat flour, and the reason for the decrease in stability may be the increase in the proportion of fiber and non-glutinous protein, and thus reduce the proportion of gluten and thus reduce stability (Under sander et al., 2007).

Table (3): The effect of adding low-fat soybean flour in different proportions on the properties of amylograph on wheat flour (20% extraction):

Sample	The temperature for the onset of gelatinization(C ^o)	The degree of viscosity at the beginning (B.u)	Temperature for the end of gelatinization (C ^o)	The degree of viscosity of the end of gelatinization(B.u)
Con.80	61.4000 d	12.333 b	91.4333 d	1008.330 a
A15	61.3667 d	12.000 c	89.4667 e	592.667 b
A20	62.9000 c	11.000 d	95.8000 c	254.000 c
A25	65.5330 b	10.333 e	105.1330 a	205.670 d
Soya100	91.4000 a	19.000 a	98.8667 b	81.000 e

- Values represent an average of three replicates.
- Different letters indicate the presence of significant differences in the level of probability ($p \leq 0.5$)

The numbers in the table represent the store of three replicates.

This device is used to record changes in the viscosity of the flour suspension in water during its regular heating and is important in verifying the characteristics of baking, as it is used to study the effectiveness of the activity of the alpha-amylase enzyme, and this test gives information about what happens to the dough piece during the first periods of it being placed in the oven. Table (3) shows the differences between compound flour and produced from low soy flour with a substitution ratio of and the standard treatment on the other hand, from which it is noticed that there are significant differences between compound flour with the mentioned substitution ratios and the standard treatment at a probability level of 0.05. This difference in the amillograph curve reading of the different types of compound flour may be due to the difference in enzyme activity in low-fat soybeans compared to the enzyme present in wheat flour (Kawamoto et al., 2013).

Conclusion:

The present study was carried out to produce flour wheat and defatted soy. Defatted spy flour was added to wheat flour extraction 80% at levels 51, 20, 25% was added to wheat flour extraction 80%

chemical composition, rheological properties were studied the results showed that adding defatted soya flour improved all rheological properties. Also protein and Fat increased.

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دراسة بعض الخواص الكيميائية والريولوجية لدقيق القمح ودقيق الصويا

فواز صالح محمد سبراء صالح ياسين

قسم علوم الاغذية ، كلية الزراعة ، جامعة تكريت ، تكريت ، العراق

الخلاصة

أجريت الدراسة في (الشركة العامة لتصنيع الحبوب) والتي تضمنت تأثير إضافة فول الصويا المنخفض الدهن سواء كدقيق او في المنتجات المخبوزة على التركيب الكيميائي والريولوجي وبتراكيز مختلفة بلغت (15، 20، 25) % . وظهرت النتائج وجود فروق معنوية في الرطوبة اذ بلغ اعلى محتوى رطوبي في العينة ذو تركيز 15% اذ بلغت 12.64، في حين لم تكن هناك فروق معنوية في تركيز 15 ، 20 ، 25 % للبروتين كذلك لم تسجل فروق معنوية في محتوى الدهن لنفس التركيزات بينما سجل فروق معنوية في الرماد للتركيزات المختلفة مقارنة بمجموعتي السيطرة وكذلك الحال نفسه للألياف اما للكربوهيدرات فقد سجلت اعلى قيمة لها في كمنترول طحين القمح اذ بلغت 70.57 واكل قيمة في تركيز 20 % اذ بلغ 67.91 . كما سجلت فروق معنوية في الخواص الريولوجية والتي تضمنت الفارينوغراف والامليوغراف حيث أدت إضافة فول الصويا المنخفض الى تحسين الصفات الريولوجية كالاتصاف الثباتية او الاستقرارية، اللزوجة وغيرها. لذلك يهدف هذا البحث لرفع القيمة الغذائية عند استخدام هذا الدقيق المركب في تصنيع المنتجات المدعمة المختلفة.

الكلمات المفتاحية : طحين الصويا ، الاختبارات الكيميائية ، الاختبار الريولوجي.