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Study of Protein Concentrate and Physical Properties for Each Wheat Germ and Defatted Wheat Germ in Biscuits Processing

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Abstract: The wheat germ is an important secondary product known to be important in containing high protein, oil, carbohydrates, minerals and phenolic compounds. It has been used in many industries. The aim of study is produce a defatted wheat germ and protein concentrate powdered each wheat germ powder. The results of the chemical analysis of the defatted wheat germ , protein concentrate showed that the percentage of protein in the protein concentrate compared with the defatted wheat germ was (71.5, 34.26%) respectively, the percentage of ash, moisture, fat and carbohydrates in the protein concentrate 3.5, 5.3, 0.93 and 35.37%, respectively, the defatted wheat germ increased to 5.6, 7.3, 2.25 and 68.33%, respectively. The standard biscuit was manufactured using the replacement ratio of 5, 10% of the wheat flour in the protein concentrate powder and the defatted wheat germ powder. physical properties were carried out for biscuit samples. The highest percentage of spread factor was obtained for the sample in which the protein concentrate was replaced by 10% that 148.91. The results of the sensory evaluation showed significant differences between the biscuit control sample and all samples were with in acceptable limits.

Keywords: Wheat Germ, biscuit, protein concentrate.

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Introduction:

Wheat germ considered is a by-product in milling industry, which makes up about 2-3% of the wheat grain and can be completely separated in pure from the grain during the milling process. It is a functional food with nutritional, health and therapeutic value and has a vital role to play in human nutrition. It is rich in protein with a percentage of 25-30% with the high percentage of essential amino acids, including Arginine, Lysine and Threonine, The ratio of fat is between 8 and 14%. The WG is characterized by its high content of unsaturated fatty acids, including oleic acid, linoleic acid and alpha linolenic acid.

The percentage of ash is between 3-5%. It is rich in mineral elements potassium, magnesium, zinc, Phosphorus, and the percentage of fiber between 1.5-4.5 %, while the proportion of carbohydrates ranged 44-54 % (1,2). Wheat germ contains some important phytochemical compounds that play a role as antioxidants, including flavonoids, steroids, octacosatols, glutathione, and alpha tocopherol, which are present at 0.79-1.27 mg / g (3,4). WG is a cheap source of raw materials in the food and chemical industries. Mahmoud *et al*., (5) noted that the addition of 7% wheat germ to

experimental animal house diets reduced cholesterol, increased HDL and reduced LDL compared to animals fed on the standard diet. Ammar (6) indicated that the addition of the wheat germ to the functional drink resulted in an increase in the values of soluble total solids and pH values, as well as the content of the phenolic compounds and the antioxidant activity and did not affect the color of the product. Abbas *et al*.,(7) indicated that The addition of 2% wheat germ to sweet whey and butter milk improved aerodynamic properties and antioxidant activity as well as improved sensory properties of the product. Wheat germ is one of the most efficient plant proteins. It has a high protein content, and food companies are seeking to produce healthy and functional foods supported by natural products, including biscuit, which is a low-cost processed food that is widely consumed. They are cheaper than traditional snacks that are easy to use at home and travel and are available in different shapes and sizes that can be consumed from all age groups and stored at room temperature (8,9). And to obtain a biscuit with a balanced nutritional value that requires the reinforcement of other materials with a high nutritional value in addition to the lack of impact on the characteristics of the manufacturing so the study aimed to produce a Concentrate wheat Germ of defatted wheat Germ and study the chemical composition of the powder defatted wheat Germ and Concentrate protein wheat germ and production of biscuit and support at different levels of The powder defatted and protein Concentrate of the wheat Germ and the physical tests of the product and sensory evaluation.

Materials and methods:

1. **Sample of wheat germ:** The wheat germ was obtained from one of the mills and then the sample was removed from the impurities and the model was grinded using a laboratory mill then the fat was extracted from the wheat germ flour and the powder was prepared accordance. Gustavo *et al*.,(10) using 1/5 (Weight / size) and leave the defatted powder was dried at room temperature for 24 hours to dispose of the solvent, with an mill and then sieved into a 0.2mm size sieve and apply freezing at -18 ° C until use
2. **Protein Concentrate sample:** The protein Concentrate of the powder defatted wheat germ was prepared in accordance with (11).
3. **Chemical analysis of defatted wheat germ and concentrate protein wheat germ**: Proximate analysis of samples was determined according to AOAC (2005)(12). The Treatment were analyzed for moisture, ash, protein, fat, carbohydrate (by difference).
4. **Preparation of Biscuits:** Biscuits were prepared without and with defatted wheat germ protein and concentrate protein wheat gram at two different levels (5, 10 g/100g Wheat flour). The recipe used for biscuit is presented in (Table 1). Biscuits were prepared as the procedure described by AACC (10-50B) (13).

Table (1): Ingredients used for biscuits preparation.

Ingredients	Control (T1)	T2	T3	T4	T5
Wheat flour(g)	225	212.5	200	212.5	200
Sucrose (g)	130	130	130	130	130
DWGP (g)**	-	12.5	25	-	-
CPGP(g)***	-	-	-	12.5	25
Butter(g)	64	64	64	64	64
Sodium bicarbonate(g)*	2.5	2.5	2.5	2.5	2.5
Salt(g)	2	2	2	2	2
Glucose solution(ml)	33	33	33	33	33
Water(ml)	16	16	16	16	16

*** (8.9 g dissolved glucose in 150 ml water)**
**** defatted wheat germ**
***** Concentrate protein wheat gram.**

5. **Physical Properties of Biscuits:** Biscuits fortified with defatted wheat germ, protein concentrate and control was evaluated objectively to determine the best level of defatted, protein concentrate and control that maintained biscuit quality. The following properties of biscuits were evaluated:
   a) Weight: It is calculated by taking the weight of 6 tablets of the models and then taking the rate.
   b) Width (w): Calculated by placing 6 tablets of the model of monoclonal form one by the other and then managed 90 degrees and take a second and third reading and extract the rate.
   c) Thickness (t): Calculated by placing 6 tablets of the model on top of each other. The height of these disks is measured and the rate is taken.
   d) Spread Ratio: Calculated by dividing the width of the biscuit (w) by the thickness of the biscuit (t) AACC(13).

   Spread ratio = Width (w) / Thickness (t)

   e) Spread factor: Calculated according to the following equation: AACC(13).

   Spread factor = (Spread ratio of sample / Spread ratio of control) x100

6. **Sensory evaluation:** the sensory evaluation of Usman *et al*., (14) for standard biscuits and biscuits containing defatted wheat germ powder , protein Concentrate powder was carried out with 5% and 10% substitution by experienced by 10 panelists chosen from the teaching staff, graduated students and technicians of the department of of Food Science, College of Agriculture, University of Baghdad.
7. **Statistical analyses:** The complete random design (CRD) was used to analyze the different parameters of the experiment. significant were tested between the mean using least significant difference (LSD) test at P <0.05 SAS(15) program for statistical analysis was used.

Results and Discussions:

Chemical analysis of defatted wheat germ powder, protein concentrate powder:

(Table 2) shows the chemical composition of defatted wheat germ powder, protein concentrate. It was observed that the protein content was 34.26 and 71.5% respectively. The

results showed that the percentage of fat in the samples 2.25 and 0.93% respectively, and ash 5.6 and 3.52 % respectively, results showed that the percentage of Moisture in the samples 7.3 and 5.3% respectively. When calculating carbohydrates, the values were 68.33 and 35.37% respectively. The results showed a significant increase ($P < 0.05$) in the percentage of protein in the protein concentrate of the wheat germ compared to the defatted wheat germ powder. This corresponds to Hassan *et al*., (16), which indicated that the protein content in the protein concentrate was 71.5% The results were consistent with Mao and Hua (17), who confirmed high protein content and low moisture content, fat, ash and carbohydrates in the walnut protein concentrate compared with the defatted wheat germ .

Table (2): Proximate analyses of defatted wheat gram and Concentrate protein wheat Germ.

Sample	Moisture%	Ash%	Protein%	Fat%	Carbohydrates%
A	7.3	5.6	34.26	2.25	68.33
B	5.3	3.5	71.5	0.93	35.37
LSD	1.63 *	0.824 *	5.94 *	3.07 *	8.91 *

A: defatted wheat germ B: concentrate wheat germ . * P<0.05.

Effect of replacing defatted wheat germ powder and protein Concentrate powder of the wheat germ on the physical Properties of the biscuits produced:

(Table 3) shows the results of the effect of defatted wheat germ powder and protein concentrate powder of the wheat germ on the physical Properties (weight, width, thickness, spread ratio and spread factor) of the biscuits samples produced from wheat flour and wheat germ powder. the results showed the increase in the percentage of spread factor in the biscuit samples where wheat flour was replaced by the protein concentrate, while the spread factor was decreased in the biscuit samples where the wheat flour was replaced with the defatted wheat germ powder. These results are consistent with Muhammad *et al*., (18), who confirmed the low spread factor in the biscuit samples where the wheat germ powder was replaced by the defatted wheat germ from the wheat flour.

This may be due to the increase of the sites of water-loving materials, thus increasing the viscosity ratio which reduces the spread factor. Shivani and Sudha (19) reported that rapid partitioning of free water to hydrophilic sites during mixing increased dough viscosity, thereby limiting cookie spread. The spread factor is one of the most important tests to be performed in the biscuit samples (20). This may be due to the role of the protein concentrate and the high protein content and functional characterized by the absorption capacity of water and the capacity of absorption of fat and the impact on the thickness of the biscuit and its ability to absorb the largest amount of water and its effect on the propagation coefficient and May also be due to the effect of the decrease in the percentage of gluten found in wheat flour with the increase in the percentage of replacement at the protein concentrate, which leads to a decrease in the proportion of gluten to papyrus which is an undesirable character in the manufacture of biscuit and to break the upper surface of the biscuit, which is good qualities in the biscuit (21).

Table (3): Physical Properties of Biscuits.

Sample	Weight (gm)	Width (w)	Thickness (t)	Spread ratio	Spread factor
T1	25.15	6.25	1.35	4.62	100
T2	26.54	5.43	1.12	4.84	104.76
T3	25.75	5.95	1.20	4.95	107.14
T4	26.67	7.50	1.15	6.52	141.16
T5	26.39	7.23	1.05	6.88	148.91
LSD	2.4NS	*0.43	0.012NS	*0.73	*5.62

*** (P <0.05), NS: Not significant**

Effect of replacing wheat germ powder removed with the defatted wheat germ and protein concentrate of the wheat germ on the final product and the quality of the produced biscuits:

(Table 4) shows the effect of substituting wheat flour with the defatted wheat germ powder and the protein concentrate of the wheat germ on the specific characteristics of the biscuits. The control of the rest of the groups in terms of external appearance and top surface characteristics, the presence of cracks on the top surface is of the important things that indicate the prevalence of biscuit tablets, and characteristic of the manufacture of biscuit standard. The treatment of control in the rest of the characteristics of the sensory evaluation was also decreased. The scores of the sensory evaluation decreased by increasing the percentage of replacement, but the results of the rest of the biscuit models remained with in acceptable limits. This indicates that the percentage of replacement with the defatted wheat germ and protein Concentrate of the wheat germ was acceptable in terms of taste, flavor and general acceptance. These results agreed with Ahmed *et al*., (22), which confirmed low general acceptance and some sensory evaluation characteristics with increased replacement ratio with wheat defatted germ powder.

Table (4): Sensory characteristics of biscuits

specific characteristics	Class	T1	T2	T3	T4	T5	LSD
Appearance	20	18.3	17.2	16.75	17.4	16.2	*1.32
Characteristics surface	15	12.7	11.8	11.25	12.5	11.35	*0.27
Texture	10	8.5	8.75	7.25	7.5	6.5	*0.12
Colour	10	8.2	7.7	7.1	7.4	6.1	*0.52
Flavour	25	20.5	18.15	17.2	17.4	16.75	*0.41
Crispness	10	9.1	8.5	7.75	8.78	7.85	0.07NS
acceptability	10	8.5	8.12	7.5	7.8	7.15	1.52NS
Total	100	85.8	80.22	74.8	78.78	71.9	*3.67

NOTE: The result is a mean and standard deviation of 10 panel member. All means with the same subscript are not significantly different at 5% Level of significance.

Conclusion:

Our results concluded that the ratio of substitution (5.10)% of wheat flour with defatted wheat gram and protein concentrate wheat Germ had an effect on the physical properties, especially the increase of the percentage of the Spread factor of biscuits. The percentage of replacement 5% was the best in external appearance and top surface characteristics and flavor and

general acceptance of biscuits of the replacement ratio of 10% compared to the control sample . The high protein content in the protein Concentrate wheat Germ makes it a good protein source in food applications

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