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Abstract:

Quantity and quality of dietary protein considered to be a nutritional problem and the search for inexpensive and quality protein foods considered as a vital mission to improve and enhance the nutritional quality of bread as it had been recognized as a stable food in Egypt., Hence this study aims to examine the effect of mixing defatted soy flour (DSF) and wheat flour on the breads' quality in addition to investigate the effects of these mixtures on growth and kidney function in young rats. Different flour mixtures of wheat and DSF were used in preparing of tested breads which were subjected to sensory evaluation. Thirty six young male albino rats 50-70 g were divided into six groups and fed the experimental diets for 4 weeks as follows: group (1) Control group fed on basal diet; group (2) fed on 100% protein from defatted soy flour (DSF 100%); group (3) fed on 100% protein from wheat flour (W 100%); group (4) fed on 90% protein from wheat flour and 10% DSF protein (W 90%+ DSF 10%); group (5) fed on 85% protein from wheat flour and 15% DSF protein (W 85%+ DSF 15%), and group (6) fed on 80% protein from wheat flour and 20% DSF protein (W 80%+ DSF 20%). Biological evaluation was undertaken by determination of body weight gain, Feed Efficiency Ratio (FER) and protein Efficiency Ratio (PER); and at the end of the experimental period blood was collected and serum total protein, albumin, globulin, uric acid, creatinine and serum urea was determined. Results indicated that wheat 100% bread had the highest score in overall quality and acceptability, followed by bread of wheat 90%+ DSF 10%, whereas the bread of wheat 80%+ DSF 20% had the lowest score value. And the biological and biochemical results showed that the addition of DSF to wheat flour enhanced the protein quantity and quality of bread as illustrated by increments of weight gain and FER values of groups fed on wheat and DSF mixtures, and by increasing of serum total protein in group fed mixtures of wheat and DSF; on the other hand serum urea was significantly ($P \leq 0.05$) increased on mixture of

wheat and SDF at 15and 20% levels. The results of this study revealed that, the addition of 10 and 15% DSF to wheat bread have good acceptability and it can be used to enhance the quantity and quality of wheat bread protein.

Key words: Wheat, Soy, sensory evaluation, rats, growth, serum total protein, kidneys function.

Introduction:

Malnutrition and poverty poses a major challenge to low-income families in developing nations and are very critical for a growing child (**Ikpeme-Emmanuel *et al.*, 2012**). In most of developing countries both quantity and quality of dietary protein considered to be a major nutritional problem. Therefore, the search for inexpensive and quality protein foods considered as a vital mission for food researchers to improve and enhance the nutritional quality of bread as it had been recognized as a stable food in Egypt. The typical Egyptian per capita of daily bread was approximately 392 g baladi bread/day (**Shehata and Mohamed, 2015**); and it was estimated to be the one of the main source of daily energy and protein intake with legumes, as reported by **Breisinger *et al.* (2013)** who stated that, Egyptian diet characterized by poor dietary diversity with high dependence on cereals and cheap food.

In recent years, there has been a considerable interest in the effects of soybean and soy-based products in human health (**Ali *et al.*, 2005**). It was hypothesized that, addition of soy flour to bread improves the protein quantity and quality in order to increase the protein intake and improving of nutritional status for those who are in danger of malnutrition (**Mahmoodi *et al.*, 2014**). Soy is a complete high quality protein, which could be added to a wide variety of products to enhance the nutritional quality of foods (**Endres *et al.*, 2003**). Hence this study aims to examine the effect of mixing soy flour and wheat flour on the quality attributes of tested breads prepared from varied mixtures of wheat and soy flours at different levels, in addition to investigate the biological and biochemical effects of these mixtures on growth, blood proteins and serum urea, creatinine and uric acid as an indicator of kidney function in *young* rats in order to develop more nutritionally bread.

Materials and Methods:

Wheat flour (all purpose flour) was obtained from local market in Cairo- Egypt, and defatted Soy flour (DSF) was purchased from agriculture research center, Giza-Egypt; and samples of both flours were subjected to chemical composition analysis in order to estimate: moisture, protein, fat, ash and fiber.

Chemical analysis:

Protein was estimated by Micro Kjeldahl according to the method of AOAC (2000). Fat, ash and fiber were estimated according to **AOAC (2000)**. Carbohydrate was calculated by difference. The data in Table (1) showed the chemical composition of wheat and DSF, and the result of wheat composition was in line with that of **Khorshid *et al.* (2011)**.

Table (1): Chemical composition of wheat flour and defatted soy flour DSF represented as g % (Mean ± S.D).

	Moisture	Protein	Fat	Fiber	Ash	Carbohydrate
DSF	5.93±1.08	50.93±0.55	4.52±1.69	2.9±0.16	6.58±0.35	29.92± 0.27
Wheat flour	12.19± 0.01	12.33±0.09	1.49±0.01	1.24±0.01	0.79±0.08	72.17± 0.82

Sensory Evaluation:

Bread loaf was prepared according to the standard formula (**Long, 1991**), and tested breads (Control wheat bread and breads containing 10, 15 and 20% DSF) were subjected to orgranoleptic evaluation. Panelists (10 members) were asked to rank various samples for color, aroma, texture, and taste on 11-point scale of zero (dislike extremely) to 10 (like extremely), the overall quality then was calculated according to the method mentioned by **Kramer and Twigg (1966)**. Samples of tested breads were provided to panelists in identical white trays, coded with 3-digit random numbers and served at the same time. Water was served in between samples assessment to enable panelists rinse properly and neutralize carryover flavors in their mouth.

Experimental design:

Thirty six young male albino rats of Sprague Dawely strain weighing 50-70 g were taken from animal house of Egyptian Organization for

Biological Products and Vaccines. (VACSERA) Cairo-Egypt, and housed individually in a wire cages at 25°C. Rats were then divided into six groups (of 6 rats each) as follows: Control group (1) fed on a basal diet, and the other 5 groups fed the experimental diets for 4 weeks as follows: group (2) fed on 100% protein from defatted soy flour (DSF 100%); group (3) fed on 100% protein from wheat flour (W 100%); group (4) fed on 90% protein from wheat flour and 10% protein from defatted soy flour (W 90%+ DSF 10%); group (5) fed on 85% protein from wheat flour and 15% protein from defatted soy flour (W 85%+ DSF 15%), and group (6) fed on 80% protein from wheat flour and 20% protein from defatted soy flour (W 80%+ DSF 20%).

Standard basal diet was prepared with modification according to **Reeves *et al.* (1993)**. The experimental diets were prepared by adding of wheat and DSF flours to the expense of casein, corn oil and starch to produce the required protein levels (10%) from wheat, DSF and their mixtures in accord to the chemical composition of wheat and DSF flours.

Table (2): Composition of control and experimental diets (at 10% protein level), represented as g/ kg diet.

	Control	DSF 100%	Wheat 100%	W90%+ DSF 10%	W 85%+ DSF 15%	W 80% + DSF 20%
Casein	125.00	--	--	--	--	--
Wheat	--	--	811.00	730.00	690.00	649.00
DSF	--	196.00	--	20.00	29.00	39.00
Corn Starch	668.00	612.00	4.00	65.00	95.00	126.00
Corn Oil	100.00	91.00	88.00	88.00	89.00	88.00
Minerals Mixture #	40.00	40.00	40.00	40.00	40.00	40.00
Vitamins Mixture *	10.00	10.00	10.00	10.00	10.00	10.00
Choline Chloride	2.00	2.00	2.00	2.00	2.00	2.00
Cellulose	50.00	44.00	40.00	40.00	40.00	41.00
Cod Liver Oil	5.00	5.00	5.00	5.00	5.00	5.00

Minerals mixture prepared according to **Campell (1961)**.

* Vitamins mixture prepared according to **Hegested *et al.* (1941)**.

Biological evaluation of tested diets was undertaken by determination of body weight gain, food intake, Feed Efficiency Ratio (FER) and protein Efficiency Ratio (PER) in young rats. The FER and PER were calculated for each group according to the method described by **AOAC (2000)**.

Biochemical analysis:

At the end of the experimental period, animals were lightly anesthetized with diethyl ether, and blood was collected from the hepatic portal vein. Blood samples were collected and centrifuged at 3000 rpm for 15 min to separate serum, which stored at -20°C until further biochemical analysis. Serum total protein was determined according to the method of **Gornall *et al.* (1949)**, where serum albumin were determined using the method described by **Doumas and Biggs (1971)**, serum globulin were calculated by subtracting serum albumin from serum total protein. The method of **Caraway (1955)** was used to determine serum uric acid, while serum creatinine level was measured by the method of **Bohmer (1971)** and serum urea was determined according to **Marsch *et al.* (1965).**

Statistical analysis:

The statistical analysis was conducted according to **Snedecor and Cochran (1967)**, using one way analysis of variance technique (ANOVA). The significant difference among means evaluated by least significant difference (L.S.D) method at levels of probability $P \leq 0.05$ and $P \leq 0.01$.All the data analysis was performed using SPSS software (Version 16; SPSS Inc Chicago., USA).

Results and Discussion:

Figure (1 and 2) showed that, the wheat 100% bread had the highest score in overall quality, followed by bread of wheat 90% + DSF 10%, whereas the bread of wheat 80%+ DSF 20% had the lowest score value. These results were in agreement with the findings of **Ribotta *et al.* (2010)** who found that soy-wheat flour in ratio of 90:10 w/w showed a major improving effect on dough rheological properties, and with **Mashayekh *et al.* (2008)** who concluded that, adding of 3-7% defatted soy flour produced a good bread loaf comparable to wheat bread. **Dhingra and Jood (2004)** concluded that soy flour could be added to bread flour up to level of 10% without any significant change in organoleptic characteristics. On the other hand, adding of 20% DSF to wheat resulted in poor quality of bread, which could be due to the fact that, soy flour increased solubility of the wheat gluten, producing a weakening of the gluten network (**Perez *et al*., 2008**) and decreasing availability of water to build up in gluten network **(Roccia *et al*., 2009)**. Furthermore, **Qian *et al.* (2006**) showed that, adding of soy protein powder depresses loaf volume, gives poor crumb characteristics and decreases acceptability by consumers, and **Julianti *et al.* (2015)** illustrated that, as the level of soybean flour increases, the decrease in specific volume was more remarkable, and the incorporation of soy proteins changes the properties of bread. In addition, **Mashayekh *et al.* (2008)** concluded that, overall acceptability score significantly decreased with increasing DSF substitution levels.

 **A**	 **A1**
 B	 B1

 C	 C1
 D	 D1

Fig. (1): Control wheat bread (A- A1), wheat 90%+ 10% DSF (B-B1), Wheat 85 %+ DSF 15% (C-C1) and Wheat 80%+ DSF 20% (D-D1).

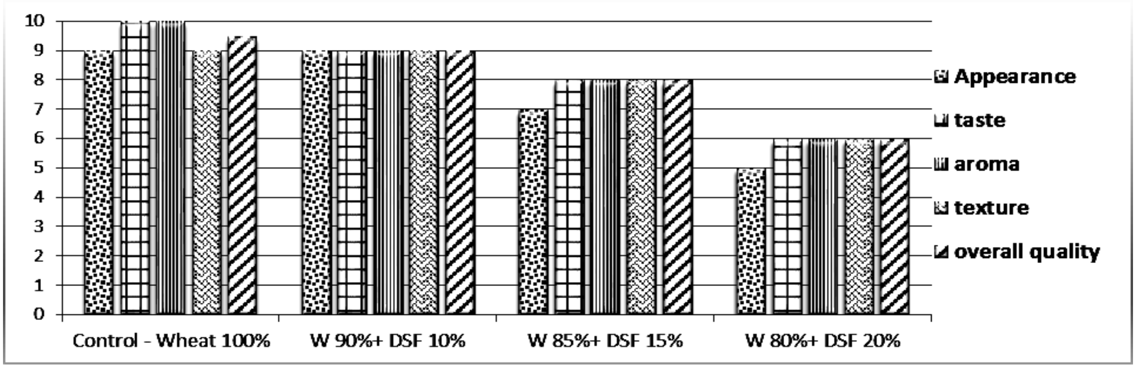

Fig. (2): Mean score values for quality attributes of Control wheat bread, wheat 90%+ 10% DSF (B- B1), Wheat 85%+ DSF 15% and Wheat 80%+ DSF 20%.

Results demonstrated in Table (3) showed that, rats group fed on DSF 100 % as the sole source of protein has a non significant lower FER and PER values, on the other hand group fed on wheat 100% illustrated significant ($P \leq 0.01$) decrements in weight gain, FER and PER when compared with the control group. However, there was a difference in the food intake of the rats fed on mixtures of wheat and DSF which may be attributed to the different composition of the diets, probably the characteristic taste of soy or its odor, thereby making it more acceptable (**Silva *et al.*, 2015**). The result concerning the weight gain, FER and PER of rats group fed on wheat 100% were in agreement with recent study of **Mahmoodi *et al.* (2014)** who reported that rats fed on wheat had the lowest body weight gain, and furthermore **Chou (1983)** confirmed that, cereal preparations are not adequate to meet the requirements of a growing child. On the other hand group fed on DSF 100% showed lower values than that of control group for weight gain, FER and PER, and at the same time it was significantly higher than that of group fed on wheat 100%. That was in harmony with the recent findings of **Silva *et al.* (2015)** who reported that, the growth of rats fed soy protein-based beverage and soy-based formula was lower than those fed cow's milk based formula. These results could be explained on the basis that, soy contains many kinds of anti-nutritional factors, such as trypsin inhibitor, lectin, α-amylase inhibiting factor, goitrin, soybean antigen (**Gu *et al.*, 2010**). These anti-nutritional factors affect the nutritional value (**Sun and Qin, 2005**); and inhibit animals growth by the action of trypsin inhibitor and lectin. Furthermore, to reduce the anti-nutritional content, soy must be subjected to thermal treatment before consumption (**Gu *et al.*, 2010**).

Table (3): Effect of wheat and DSF protein on weight gain (g/day), food intake (g/day), FER, PER and selected protein metabolism parameters in *young* rats (Mean+ S.E).

	Control	DSF 100%	Wheat 100%
Weight Gain g	63.00± 1.03	62.33± 1.09	47.33± 0.42**
Food intake g	194.83± 1.56	195.67± 0.88	245.17± 2.7**
FER	0.33± 0.01	0.32± 0.01	0.19± 0.01**
PER	3.23± 0.05	3.19± 0.04	1.93± 0.03**
Serum Total Protein mg/dl	5.56± 0.02	5.33± 0.04**	5.15± 0.02**
Serum Albumin mg/dl	2.51± 0.06	3.56± 0.02**	3.12± 0.05**
Serum Globulin mg/dl	3.05± 0.07	1.77± 0.03**	2.03± 0.04**
Serum Urea mg/dl	36.76± 0.17	61.91± 0.29**	69.84± 0.33**
Serum Creatinine mg/dl	0.25± 0.02	0.27± 0.02	0.27± 0.02
Serum Uric Acid mg/dl	1.23± 0.09	1.30± 0.01	1.16± 0.04

* Significant differences from control at P≤ 0.05. ** Significant differences from control at P≤ 0.01.

From table (3) it could be noticed that rats group fed on DSF and wheat had a significant increase in serum urea (61.91± 0.29 mg/dl)as compared with that of control group (36.76± 0.17 mg/dl), and the result for DSF was in agreement with that of **Song *et al.* (2016)** who illustrated that, soy protein increased the metabolism of non essential amino acids and sulfur-containing amino acids in the liver, indicating increased amino acid degradation in rats which could be related to the methionine limitation in soy protein, and in this condition the non essential amino acids are abundantly available, but since these amino acids cannot be used in body protein synthesis, due to the lack of methionine, they are deaminated to produce urea.

Table (3) and Figure (3) showed that, groups fed on DSF and wheat had significantly ($P \leq 0.01$) lower levels of serum total protein (5.33+ 0.04 and 5.15+ 0.02 mg/dl., respectively) and globulin (1.77± 0.03 and 2.03± 0.04 mg/dl, respectively) as compared to control group (3.05± 0.07mg/dl), which could be due to the fact that is DSF and wheat are relatively low in methionine and lysine respectively, in addition soy contains anti-nutritional factors that could affect nutrient availability (**Lonnerdal, 1994**) which could impair the biosynthesis of plasma protein. As shown in table (3), there was a significant increase of serum urea in rats groups fed on DSF 100% and wheat 100%, this was in agreement with **Rubio *et al.* (1995)** who reported that, high urea values are associated with disturbances in protein metabolism and increased protein degradation, while the imbalance of amino acids resulting in an increments of amino acid catabolism. In addition the insignificant increase of uric acid in group fed on DSF was in harmony with the finding of **Garrel *et al.* (1991)** who reported, uric acid increased after ingestion of soy protein compared to casein.

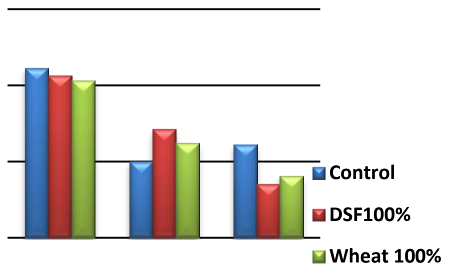

Fig. (3): Mean serum total protein, albumin and globulin of rats groups fed on DSF and wheat as the main source of protein.

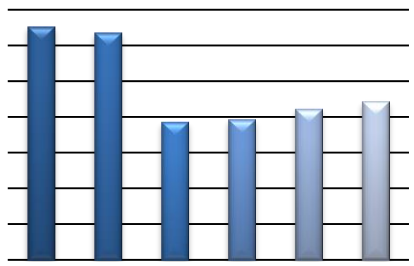

Fig. (4): Mean FER values of rats groups fed on wheat and DSF protein and their mixtures at varied levels.

From Table (4) and Figure (4) it could be noticed that the addition of DSF to wheat at level of 15 and 20% resulted in an increase in body weight gain, FER and PER values ($P \leq 0.05$ and $P \leq 0.01$ respectively), on the other hand the increment in FER and PER were insignificant at 10% DSF level when compared with wheat 100% group. These could be due to the fact that, wheat protein is deficient in the essential amino acid (lysine), and the addition of soy may enhance to lesser extent the amino acid balance of wheat at 15 and 20% levels. This result was in agreement with the report of **Sharaf (2005)** who illustrated that, the reason of adding DSF to wheat flour was to enhance quantity and quality of protein because wheat flour considered as being low quality protein, based on that, the addition of DSF to wheat improves the protein quality of the mixtures as indicated by increased FER and PER values in groups fed on W 85%+ DSF 15% and W 80%+ DSF 20% and in turn enhanced the growth of these rats groups when compared with group fed on wheat only. Moreover, in the bread baking industry, the soybean is used to increase the bread protein value and protein content from 8 - 9% up to 16% (**Ribotta *et al.*, 2010**).

Table (4): Effect of feeding different levels of wheat and DSF protein on weight gain (g/day), food intake (g/day), FER and PER in *young* rats (Mean+ S.E).

	Weight Gain g	Food intake g	FER	PER
Wheat 100%	47.33± 0.42	245.17±2.70	0.19±0.01	1.93±0.03
W 90%+ DSF 10%	49.83± 1.08	253.67±1.84**	0.20±0.01	1.97±0.03
W 85%+ DSF 15%	52.00± 2.07*	245.67±2.67	0.21±0.02*	2.12±0.09*
W 80%+ DSF 20%	58.00±1.55**	261.00±0.45**	0.22±0.01**	2.22±0.06**

* Significant differences from wheat 100% at P≤ 0.05. ** Significant differences from wheat 100% at P≤ 0.01.

It could be noticed from table (5) that only rats group fed on mixture of wheat 80%+ SDF 20% showed significant increment of serum total protein in comparison with the wheat 100% group. On the other hand, addition of DSF at 10, 15 and 20% to wheat resulted in significant increase of serum albumin (P≤ 0.05) with decrements of serum globulin in comparison with the wheat 100% group. This result indicated that, the addition of DSF at varied levels enhanced the protein biosynthesis due to the enhancing of protein quality especially at 20% level, and the fact that, In ordinary white bread, protein content ranges from 8 to 9% and by including soybean, the protein content can be made up to 16% (**Sharaf, 2005 and Ribotta et al. 2010**). The enrichment of bread and other cereal based foods with legume flours is recommended particularly when protein utilization is inadequate, and this could be due to the fact that legumes are high in protein and lysine the limiting amino acid in most cereals (**Jideani and Onwubali, 2009**).

Table (5): Effect of feeding different levels of wheat and DSF protein on serum total protein, albumin and globulin levels in young rats (Mean+ S.E).

	Serum Total Protein mg/ dl.	**Serum Albumin mg/ dl.**	**Serum Globulin mg/ dl.**
Wheat 100%	5.15± 0.02	3.12± 0.05	2.03± 0.04
W 90%+ DSF 10%	5.16± 0.03	3.53± 0.22*	1.63± 0.07*
W 85%+ DSF 15%	5.21± 0.02	3.53± 0.13*	1.68± 0.13
W 80%+ DSF 20%	5.24± 0.03*	3.85± 0.16**	1.39± 0.16**

* Significant differences from wheat 100% at P≤ 0.05. ** Significant differences from wheat 100% at P≤ 0.01.

The result of present study concerning serum total protein and albumin could be explained on the basis that, consumption of diet containing vegetable protein may retard kidney damage by lowering the glomerular filtration rate and urinary albumin excretion, and soy protein sustain adequate growth rate in rats and infants (**Tovar *et al.*, 2002**).

Table (6): Effect of feeding different levels of wheat and DSF protein on serum urea, creatinine and uric acid levels in *young* rats (Mean+ S.E).

	Serum Urea mg/ dl.	**Serum Creatinine mg/ dl.**	**Serum Uric Acid mg/ dl.**
Wheat 100%	69.84± 0.33	0.27± 0.01	1.16± 0.04
W 90%+ DSF 10%	69.91± 0.33	0.29± 0.01	1.23± 0.01
W 85%+ DSF 15%	62.85± 0.30**	0.28± 0.01	1.25± 0.01
W 80%+ DSF 20%	59.36± 0.28**	0.28± 0.01	1.28± 0.01

* Significant differences from wheat 100% at P≤ 0.05. ** Significant differences from wheat 100% at P≤ 0.01.

Table (6) illustrated that, both groups of rats fed on w 85%+DSF 15% or 20% showed significant ($P \leq 0.01$) decrease in serum urea when compared with the group of wheat 100% or the control group; and non significant increments in serum uric acid levels. In a recent study by **Ebuehi and Okafor (2015)** they observed that, when rats fed supplemented soy flour bread at 10- 40% levels, the rats showed significant decrease in the creatinine and urea compared to control fed on wheat bread 100%, and this result was in line with the results of current study concerning the serum urea level of rats groups fed on wheat and DSF mixtures.

In conclusion the adding of DSF to wheat bread was supporting the growth and it could be used at 10 and 15 % level, which may enhance the protein quantity and quality of wheat bread especially for those groups who are at risk of protein deficiency.

References:

1. **Ali A. A.; Velasquez, M.; Hansen C.; Mohamed, A., and Bhathena, S. (2005):** Modulation of carbohydrate metabolism and peptide hormones by soybean isoflavones and probiotics in obesity and diabetes. J. Nut. Biochem. 16 (2005): 693–699.

2. AOAC (2000): **Official methods of analysis of the association of official analytical chemists (17th ed.,). Gaithersburg, MD, USA: Association of Official Analytical Chemists.**

3. **Bohmer, H. B. (1971):** Micro- determination of creatinine. Clin. Chem. Acta. 32: 81-85.

4. **Breisinger, C.; Riffai, P.; Ecker, O.; Abuismail, R.; Waite, J.; Abdelwahab, N.; Zohery, A.; El-Laithy, H., and Armanious, D. (2013):** Tackling Egypt's rising food insecurity in a time of transition. Joint IFPRI-WFP Country Policy Note. Washington, DC: International Food Policy Research Institute; Rome: World Food Program.

5. **Caraway, W. (1955):** Determination of serum urate. Am. J. Clin. Path. 25: 840.

6. **Campbell, J.A. (1961):** Methodology of protein evaluation. Nutrition Doc. R. 10Led., 37. WHO. June Meeting. New York.

7. **Chou, C. (1983):** Studies on the use of soybean food in infant feeding in China and the development of formula 5410. UN Univ. Press. Food Nutrition Bulletin. 5 (1): February 1983.

8. **Dhingra, S. and Jood, S. (2004):** Effect of flour blending on functional, baking and organoleptic characteristics of bread. Int. J. Food Sci. Tech. 39: 213–222.

9. **Doumas, B.T. and Biggs, H.G. (1971):** Albumin standard and measurement of serum albumin with bromocresol green. Clin. Chem. Acta. 31: 78.

10. **Ebuehi, O. and Okafor, H. (2015):** Defatted soy flour supplementation of wheat bread ameliorates blood chemistry and oxidative stress in wistar rats. .Nig. Q. J. Hosp. Med. 25(3):156-63.

11. **Endres, J.; Barter, S.; Theodora, P., and Welch, P. (2003):** Soy-enhanced lunch acceptance by preschoolers. J Am Diet Assoc. 103: 346 – 51.

12. **Garrel, D.R.; Verdy, M.; PetitClerc, C.; Martin, C. B., and Hamet, P. (1991):** Milk- and soy-protein ingestion (1991): acute effect on serum uric acid concentration. Am. J. Clin. Nutr. 53: 665–9.

13. **Gornall, A.C.; Bardawill, C.J. and David, M.M. (1949):** Determination of serum protein. J. Biol. Chem. 177: 751.

14. **Gu, C.; Pan, H.; Sun, Z., and Qin, G. (2010):** Effect of Soybean Variety on Anti-Nutritional Factors Content, and Growth Performance and Nutrients Metabolism in Rat. Int. J. Mol. Sci., 11: 1048-56.

15. **Hegsted, D.M.; Mills, R.C.; Elvehjem, C.A. and Hart, E.B. (1941):** Salt mixture. J. Biol. Chem., 138: 459.

16. **Ikpeme-Emmanuel, C.A.; Ekpeyoung, I.O. and Igile, G.O. (2012):** Chemical and protein quality of soybean (glycine max) and tigernut (cyperus esculentus) based weaning food. J. Food Res., 1 (2): 246-54.

17. **Jideani, V. and Onwubali, F. (2009):** Optimization of wheat-sprouted soybean flour bread using response surface methodology. Afr. J. Biotechnol., 8(22): 6364-6373.

18. **Julianti, E.; Rusmarilin, H. and Era, R. (2015):** Functional and rheological properties of composite flour from sweet potato, maize, soybean and xanthan gum. J. Saudi Soci. Agri. Sci. In Press, Available online 5 June 2015.

19. **Khorshid, A.M.; Assem, N.; Abd-El-Motaleb, N. and Fahim, J. (2011):** utilization of flaxseeds in improving bread quality. Egypt. J. Agric. Res., (1): 241- 250.

20. **Kramer, A. M., and Twigg, B. A. (1966):** Fundamentals of quality control for the food industry, AVI Publishing Co, Westport, CN. PP: 120.

21. **Long, K.A. (1991):** Acceptance of bread with partial replacement of wheat bread flour by potato products in selected regions of the USSR and USA. Ph.D. dissertation, Virginia tech ,black sbury. VA- USA.

22. **Lonnerdal, B. (1994):** Nutritional aspects of soy formula. Acta. Paediatr. Suppl. 402:105-108.

23. **Mahmoodi, M. R.; Mashayekh, M., and Entezar M. H. (2014):** Fortification of Wheat Bread with 3-7% Defatted Soy Flour Improves Formulation, Organoleptic Characteristics, and Rat Growth Rate. Int J Prev Med. 2014 Jan; 5(1): 37–45.

24. **Marsch, W. H; Fingerhut, B., and Miller, H. (1965):** Automated and manual direct methods for the determination of blood urea. Clin. Chem. 11: 624-27.

25. **Mashayekh, M.; Mahmoodi, M., and Entezari, M. (2008):** Effect of fortification of defatted soy flour on sensory and rheological properties of wheat bread. Inter. J. F. Sci Tech. 43(9): 1693-1698.

26. **Perez, G.T.; Ribotta, P.; Steffolani, M.E., and Leon, A.E. (2008)**: Effect of soybean proteins on gluten depolymerization during mixing and resting. J. Sci. Food Agri. 88(3): 455-463.

27. **Qian, H.; Zhou, H., and Gu, J. (2006):** Effect of different kinds of soy protein powder on breadmaking properties. Trans Chinese Soci. Agri. Eng. 22(10): 233-236.

28. **Reeves, P.G.; Forrest, H.N., and Fahey, G.C. (1993):** AIN-93 Purified Diets for Laboratory Rodents: Final Report of the American Institute of Nutrition Ad Hoc Writing Committee on the Reformation of the AIN of 67A Rodent Diet. J. Nut., 123: 1939- 1951.

29. **Ribotta, P.D.; Perez, G.T.; Anon, M.C., and Leon, A.E. (2010):** Optimization of additive combination for improved soy-wheat bread quality. Food Bioprocess Tech. 3 (3):395-405.

30. **Roccia, P.; Ribotta, P.; Pérez, G., and León, A. (2009):** Influence of soy protein on rheological properties and water retention capacity of wheat gluten. LWT Food Sci. Tech. 42 (1): 358-362.

31. **Rubio, L.A.; Grant, G.; Scislowski, P.; Brown, D.; Bardocz, S., and Pusztai, A. (1995):** The utilization of lupin (Lupinus angustifolius) and faba bean globulins by rats is poorer than of soybean globulins or lactalbumin but the nutritional value of lupin seed meal is lower only than that of lactalbumin. J. Nutr. 125 (8):2145-2155.

32. **Sharaf, K. H. (2005):** Interaction effect of iron enrichment and defatted soybean supplementation to wheat flour on the protein digestibility and growth in growing rats. J.Edu. Sci. 17(4): 81-91.

33. **Shehata G. A., and Mohamed M. E. (2015):** Some Economic Aspects of Wheat Crop in Egypt with Emphasis on Baladi Bread Manufacturing in Alexandria Governorate. Int. J. Soc. Sci. Hum. 5 (6): 501-508.

34. **Silva, M.L.; da Grac, P.; Speridiao, L.; Marciano, R.; Amâncio, O. M.; de Morais, T. B., and de Morais, M.B. (2015):** Effects of soy beverage and soy-based formula on growth, weight, and fecal moisture: experimental study in rats. J Pediat. (Rio J). 91(3):306- 12.

35. **Snedecor, G.W., and Cochran, W.G. (1967):** Statistical methods. 6th ed., The Iowa state University Press, Ames, U.S.A.

36. **Song, S.; Hooiveld, G.; Li, M.; Zhao, F.; Zhang, W.; Xu, X.; Muller, M.; Li, C., and Zhou, G. (2016):** Dietary soy and meat protein induce distinct physiological and gene expression changes in rats. J. Sci. Rep. 6: 1- 12.

37. **Sun, Z.W., and Qin, G.X. (2005):** Soybean antigens and its influence on piglets and calves [in Chinese]. Acta Zoonutrim. Sinica. 17: 20–24.

38. **Tovar, R.; Murguia, F.; Cruz, C.; Pando, R.; Salinas, C.; Chaverri, G.; Rotter, R., and Torres, N. (2002):** A Soy protein diet alters hepatic lipid metabolism gene expression and reduces serum lipid and renal fibrogenic cytokines in rats with chronic nephritic syndrome. J. Nut. 132 (9): 2562-2569.

إضافة دقيق الصويا في خبز القمح وأثره على النمو ووظائف الكُلى في الفئران الصغيرة

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الملخص:

إن نوعية وكمية البروتين بالوجبات الغذائية تعتبر من المشاكل الغذائية ويعتبر البحث عن اطعمة بروتينية رخيصة الثمن وذات جودة بروتين مرتفعة تعتبر مهمة حيوية لتحسين القيمة الغذائية للخبز، حيث انه من الاصناف الرئيسية بالوجبات في مصر. لذا تهدف الدراسة الى اختبار اثر خلط دقيق الصويا منزوع الدهون مع دقيق القمح على جودة الصفات الحسية للخبز الناتج، بالاضافة الى دراسة اثار تلك المخاليط على النمو ووظائف الكلي في الفئران الصغيرة. تم استخدام مخاليط مختلفة من دقيق القمح ودقيق الصويا منزوع الدهن في اعداد الخبز المختبر ومن ثم تقييم جودة الصفات الحسية للخبز الناتج. كما تم استخدام ستة وثلاثون فأرا من نوع البينو وزن ٥٠–٧٠ جم وتم تقسيمهم الى ستة مجموعات كما يلي: مجموعة (١) تغذت على الوجبة الضابطة، مجموعة (٢) وتغذت على ١٠٠% بروتين دقيق الصويا منزوع الدهن، مجموعة (٣) وتغذت على ١٠٠% بروتين من دقيق القمح، مجموعة (٤) وتغذت على ٩٠% بروتين من دقيق القمح و١٠% بروتين من دقيق الصويا منزوع الدهن، مجموعة (٥) وتغذت على على ٨٥% بروتين من دقيق القمح و١٥% بروتين من دقيق الصويا منزوع الدهن وجموعة (٦) وتغذت على على ٨٠% بروتين من دقيق القمح و٢٠% بروتين من دقيق الصويا منزوع الدهن. وتم التقييم البيولوجي بواسطة قياس معدل الزيادة في وزن الجسم، معدل كفاءة الغذاء ومعدل كفاءة البروتين، كما تم بنهاية التجربة تقدير البروتين الكلي بمصل الدم، الالبيومين، الجلوبيولين، حمض البوليك، الكرياتينين اليوريا بمصل الدم. اظهرت نتائج الدراسة حصول خبز القمح ١٠٠% على اعلى درجات تقييم الجودة الكلية والتقبل، وتبعه الخبز المصنوع من ٩٠% دقيق القمح + ١٠% دقيق الصويا منزوع الدهن، بينما كان الخبز المصنوع من ٨٠% دقيق قمح + ٢٠% دقيق الصويا منزوع الدهن هو الاقل بكل التقييمات. اظهرت النتائج البيولوجية والبيوكيميائية ان اضافة دقيق الصويا منزوع الدهن الى دقيق القمح قد اسهم في تحسين كمية ونوعية البروتين بالوجبات المقدمة للفئران حيث وضح ذلك من خلال زيادة معدل

اكتساب الوزن ومعدل كفاة الغذاء للمجموعات التي تغذت على مخاليط دقيق القمح والصويا منزوع الدهن، وكذلك ارتفاع مستوي البروتين الكلي بمصل الدم في المجموعات التي تغذت على تلك المخاليط من دقيق القمح والصويا، كما ارتفع معنويا مستوى اليوريا بمصل الدم في المجموعات التي تغذت على خليط دقيق القمح + ١٥أو٢٠% من دقيق الصويا منزوع الدهن. اوضحت نتائج تلك الدراسة ان هناك تقبل جيد للخبز المصنوع من خليط القمح + ١٠أو١٥% من دقيق صويا منزوع الدهن، والتي يمكن ان تسهم في تحسين كمية ونوعية بروتين خبز القمح.

الكلمات الاسترشادية: القمح- الصويا- التقييم الحسي- الفئران- النمو- البروتين الكلي بمصل الدم- وظائف الكلى.