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EVALUATION OF SPAGHETTI SUPPLEMENTED WITH DEFATTED SOYBEAN AND WHEAT GERM FLOUR.

Nadia H. A. Assem
Bread and Pasta Res. Dep., Food Techn, Res. Institute, Agriculture Research Center, Giza, Egypt.

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ABSTRACT: ***The aim of this investigation was to produce spaghetti supplemented with 5, 7.5 and 10% wheat germ and 5, 7.5 and 10% defatted soybean flour to improve the nutritional value All samples of spaghetti were analyzed for chemical composition , cooking properties, sensory evaluation and amino acids content . The results of chemical composition showed high protein content and fat by increasing the addition of wheat germ and defatted soybean in spaghetti. Sensory evaluation and cooking properties for spaghetti supplemented with 5 and 7.5% defatted soybean gave the best values compared to the 10%.supplementation The best treatments, resulting from the sensory evaluation results, were analyzed for amino acids. Essential and non essential amino acid levels were found to be higher than the control. Also. total amino acids was higher in samples supplemented to wheat germ and defatted soybean when compared to control.***

Key words: ***spaghetti, defatted soybean, wheat germ, chemical composition.***

INTRODUCTION

Wheat is the most important cereal because it used for the preparation of many products such as bread and pasta. Pasta has become a major growth segment of the cereal foods industry. Although spaghetti and noodles continue to dominate the U.S. market, consumption of novel pasta products has been rising substantially.

Soybean is an extremely versatile, flexible food. The protein content of soybean seed is about 40% for the defatted flake after the hulls and oil were removed. (Erdman *et al*., 1987). For centuries, soybean and soybean products have been the chief source of protein for millions of people in the world. Soybean is native to Eastern Asia, playing significant nutritional role in that region as does wheat in the United States. (Brandi, 1997).

Wheat germ is a unique source of concentrated nutrients for human consumption. Wheat germ has a high concentration of protein (ranged from 22 to 32%), rich in essential amino acids, such as lysine, methionine and therionine. Wheat germ can be used as an effective supplement for improving the nutritional value of cereal mixture. (Bakr and El-Bedawy,1990 and Doongai and Vali, 1992).

The aim of this study was to produce spaghetti containing defatted soybean and wheat germ flours in different levels to improve its nutritional value.

The present investigation was carried out to study the effect of defatted soybean and wheat germ with different levels on chemical composition, amino acid content, physical characteristics of cooking quantities and sensory evaluation of spaghetti

MATERIALS AND METHODS

1- Materials:

1.1. Durum (semolina)(Sohag 2)

Durum semolina was obtained from Agriculture Research Center, *Ministry of Agriculture, Giza, Egypt.*

1.2. wheat germ

It was obtained from South Cairo Mills Company , Cairo, Egypt.

1.3. Defatted soybean flour

Defatted soybean flour was obtained from Food Technology Research Institute, Agriculture Research Center, Giza, Egypt.

2- Methods:

2.1. Preparation of wheat germ and defatted soybean:

Wheat germ was crushed in the blender. Wheat germ and defatted soybean flour were dried by heating in electric air draught oven at 105^{o}C for 24 hrs over night. The dry wheat germ and defatted soybean flour were ground by UPX cyclone mill to pass through 60 mesh. The flours were stored at 4 C in refrigerator until used.

2.2. Preparation of different blends of spaghetti:

Different blends of spaghetti were prepared by partial replacement of semolina with levels of 5, 7.5 and 10% of wheat germ and defatted soybean flour while the control spaghetti was prepared from semolina only.

3.Preparation of spaghetti:

3.1. Spaghetti was processed using a Domco franice machine Coporation semi-commercial scale Laboratory extruder according to the method described by Dexter and Mastuo (1977) and modified by Dexter *et al*.,(1990).

The different blends of spaghetti substituted with wheat germ and soybean flour were processed according to the following conditions:

Extrusion temperature 50^{o}C

Extrusion rate 21 r.p.m.

Vaccum 45 cm Hg/cm.

Absorption of water differing from blend to another.

Spaghetti drying:

The spaghetti was dried for 24hr at 60°C with relative humidity from 75 to 85% (Dexter *et al.,*1990).

4. Analytical methods:

4.1. the samples of spaghetti were chemically analyzed. Moisture, crude fiber, crude protein, fat and ash were determined according to the methods described in the A.O.A.C (2000). Total carbohydrates were calculated by differences.

4.2. Minerals:

Minerals were determined according to the method described in A.O.A.C.(2000).

4.3. Determination of amino acids:

Amino acids were determined according to the method described by Pellet and Young (1980). A known weight of each sample 20 mg protein was hydrolyzed with two ml of 6NHCl at 110°C for 24 hrs. the hydrolyzate was filtered, and brought into 20 ml with distilled water. Five ml of the hydrolyzate were evaporated to dryness in a rotary evaporator and amino acids were determined with a LKB4151 Alpha amino acid analyzer equipped with LKB 2220 recording integrator.

4.4. Determination of color (Hunter methods):

The color of different levels of spaghetti was measured according to the Hunter method (Mc Guive, 1992).

4.5. Physical characteristics of cooked spaghetti:

4.5.1. Determination of spaghetti cooking qualities.

The weight, volume and the amount of absorbed water during cooking of spaghetti were determined by cooking 25 g of each sample in one litter of boiling water for twenty minutes according to the method of Dexter *et al*.(1990).

4.5.2. Determination of cooking loss (total soluble solids):

Total soluble solids of cooking liquid were estimated according to the method Walash and Cilles (1971). The residue weight was calculated as a percentage based on the uncooked product weight.

4.6. Sensory evaluation of spaghetti:

The quality of cooked spaghetti were evaluated by panelists from the staff of Food Technology Research Institute, Agriculture Research center, Giza, Egypt. Cooked spaghetti samples were organoleptically evaluated for, appearance, color, stickiness, tenderness, taste, and flavor. The evaluation was accomplished according to the method of Dexter *et al.*(1990).

4.7. Statistical analysis:

The data obtained from, sensory evaluation was Statistical analyzed by the test significant differences (L.S.D.) at the 0.05 level probability procedure according to Snedecor and cochran (1980).

RESULTS AND DISCUSSION

1.Chemical composition of spaghetti:

The results presented in Table (1) show the chemical composition. It could be observed that the control contained the lowest value of protein, ether extract, ash and fiber , while the highest value in total carbohydrates. The treatment show the protein content, ether extract, ash and fiber were increased in spaghetti substituted with wheat germ and defatted soybean.. The high content of fiber and ash in samples due to the high content of fiber and ash in wheat germ compared to control.

Table (1): Chemical composition of dried spaghetti produced from different levels of wheat germ and defatted soybean flours with semolina.

Treatments	Moisture %	Crude protein %	Ether extract %	Ash %	Fiber %	Total carbohydrates %
Control *	8.80	15.56	1.63	0.63	0.60	72.78
1	9.50	16.97	3.29	0.92	1.32	68.00
2	8.90	17.44	5.58	1.00	1.74	65.34
3	9.40	18.85	7.83	1.08	2.72	60.12

*** Spaghetti produced from semolina flour**
(1) Spaghetti produced from 90% flour + 5% wheat germ + 5% defatted soybean.
(2) Spaghetti produced from 85% flour + 7.5% wheat germ + 7.5% defatted soybean.
(3) Spaghetti produced from 80% flour + 10% wheat germ + 10% defatted soybean .

2.Minerals of spaghetti:

From the results in Table(2), it could be noticed that the control contained the lowest value of Ca, Fe and Zn, while supplemented semolina flour with wheat germ and defatted soybean gave high contents of these minerals and increased by increasing the different levels of additions. These results agree with the findings of Soliman(1998) .

Table (2): Mineral content of spaghetti produced from different levels of wheat germ and defatted soybean flours with semolina (mg/100g).

Treatments	Ca	Fe	Zn
Control *	130.7	0.58	0.79
1	222.0	3.20	4.91
2	259.5	3.45	5.01
3	262.75	3.75	5.53

*** Spaghetti produced from semolina flour**
(1) Spaghetti produced from 90% flour + 5% wheat germ + 5% defatted soybean.
(2) Spaghetti produced from 85% flour + 7.5% wheat germ + 7.5% defatted soybean
(3) Spaghetti produced from 80% flour + 10% wheat germ + 10% defatted soybean.

3. Color of Spaghetti:

Color measurements included L, A, and B values of different levels of wheat germ and defatted soybean flours after mixing with (semolina) to prepare spaghetti.

Results in Table (3) show that , the lightness (L) in control sample had highest value while A (green-red) and B (blue-yellow) had less values. Moreover, the A and B values were increased with

increasing replacement levels wheat germ and defatted soybean . Samples became darker than control as the eddition level increased.

Table (3): Effect of adding wheat germ and defatted soybean flours with different levels on color of spaghetti.

Treatments	L **	A***	B ****
Control *	59.50	2.13	14.42
1	58.92	3.96	16.98
2	58.59	3.80	17.21
3	56.81	3.73	17.77

*** Spaghetti produced from semolina flour**
**** L: lightness , *** A: (green-red) , ****B: (blue-yellow)**
(1) Spaghetti produced from 90% flour + 5% wheat germ + 5% defatted soybean
(2) Spaghetti produced from 85% flour + 7.5% wheat germ + 7.5% defatted soybean
(3) Spaghetti produced from 80% flour + 10% wheat germ + 10% defatted soybean

4. Cooking Properties:

Data of cooking properties (volume, weight and loss of total solids) are determined and presented in Table (4). The volume, weight and loss% of total solids increased by increasing the different levels of wheat germ and defatted soybean flours when mixed with semolina wheat flour. This increment due to increase the water absorption of supplement doughs were high than control and this lead to weakening the network of gluten.

Table (4): Effect of adding different levels of wheat germ and defatted soybean with wheat flour (semolina) on spaghetti cooking properties.

Treatments	Increase in volume %	Increase in weight %	Total solids loss %
Control *	294.35	233.1	1.92
1	299.21	250.9	1.99
2	308.4	260.5	3.68
3	310.0	266.5	5.42

*** Spaghetti produced from semolina flour**
(1) Spaghetti produced from 90% flour + 5% wheat germ + 5% defatted soybean
(2) Spaghetti produced from 85% flour + 7.5% wheat germ + 7.5% defatted soybean
(3) Spaghetti produced from 80% flour + 10% wheat germ + 10% defatted soybean

5. Sensory evaluation of spaghetti

Sensory evaluation of cooked spaghetti samples were shown in Table (5). Treatments containing 5% wheat germ and 5% defatted soybean flour gave higher overall scores, while the another treatments gave as control or less than control in overall scores. This may be due to the differents in stickiness, tenderness and appearance.

Table (5): Sensory evaluation of spaghetti produced from adding different levels of wheat germ and defatted soybean flours mixed with. (semolina).

Treatments	Appearance (15)	Color (15)	Stickiness (15)	Tenderness (15)	Taste (20)	Flavor (20)	Overall scores (100)
Control *	13	13	15	15	20	20	96
1	14	14	15	15	20	20	98
2	14	15	14	14	20	20	97
3	13	15	12	12	20	20	92
L.S.D.	1.006	1.012	1.98	1.0302	--	--	2.430

*** Spaghetti produced from semolina flour**
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(2) Spaghetti produced from 85% flour + 7.5% wheat germ + 7.5% defatted soybean
(3) Spaghetti produced from 80% flour + 10% wheat germ + 10% defatted soybean.

From these results, it could be concluded that the best treatments concerning the overall scores were with 5% wheat germ +5 % defatted soybean and 7.5% wheat germ +7.5% defatted soybean to produce spaghetti.

6. Amino acid of the best spaghetti:

Amino acids of the best spaghetti were presented in Table (6). data show of supplemented spaghetti gave highest ratios in essential and nonessential amino acids. Also, total amino acid compare with control were increased by increasing the wheat germ and defatted soybean flour.

Table (6): Amino acid composition of the best spaghetti produced from different levels of wheat germ + defatted soybean flours mixed with semolina (mg/g protein).

Amino acids	Control*	1	2	FAO/WHO **
Essential				
Lysine	2.8	3.3	3.5	5.50
Threonine	2.4	2.9	3.3	4.0
Valine	4.0	4.1	4.2	5.0
Methionine	1.97	1.5	1.30	3.5
Isoleucine	3.0	3.1	3.2	4.0
Leucine	6.2	6.7	7.4	7.0
Phenyle alanine	4.0	4.3	4.5	5.60
Histidine	2.0	2.1	2.2	
Arginine	4.2	4.7	5.1	
Non Essential				
Serine	4.2	4.8	5.6	
Aspartic	5.4	6.6	7.4	
Clutamic	27	24.6	26.1	
Glycine	3.2	3.9	3.8	
Alanine	3.4	3.8	4.2	
Tyrosine	1.2	1.7	2.1	
Proline	1.1	1.3	1.6	
Cystine	1.0	0.8	0.5	
Total amino acids	77.07	80.2	86.0	

*** Spaghetti produced from semolina flour**
**** Protein reference pattern (1989)**
(1) Spaghetti produced from 90% flour + 5% wheat germ + 5% defatted soybean
(2) Spaghetti produced from 85% flour + 7.5% wheat germ + 7.5% defatted soybean.

CONCLUSION

It could be concluded that addtion wheat germ and defatted soybean flour, in blends of semolina to produce spaghetti improved nutritional value and in essential amino acids. the results show adding 7.5% wheat germ + 7.5% defatted soybean flour was the best ratio in nutritional value, cooking properties and sensory evaluation of spaghetti.

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تقييم المكرونة الاسباجيتى المدعمة بدقيق فول الصويا منزوع الدهن و كذلك دقيق جنين القمح

نادية حسنى علي عاصم

قسم بحوث الخبز و العجائن– معهد بحوث تكنولوجيا الأغذية – مركز البحوث الزراعية – الجيزة – مصر.

الملخص العربي

يهدف هذا البحث إلى إنتاج مكرونة جيدة الطبخ و عالية في الأحماض الأمينية و لقد استخدم في هذا البحث دقيق جنين القمح و دقيق فول الصويا منزوع الدهن. بنسبة ٥%، ٧.٥%، ١٠%. و تم تقدير التركيب الكيماوي للمكرونة بعد التصنيع و كذلك اللون و صفات الطبخ و الصفات الحسية و كذلك الأحماض الأمينية لأفضل العينات.

و قد أظهرت النتائج ارتفاع المحتوى البروتينى و الدهن بزيادة النسب المضافة من دقيق جنين القمح و دقيق فول الصويا منزوع الدهن فى عينات المكرونة . أما التقييم الحسي و صفات الطبخ، فقد أظهرت أن المكرونة المدعمة ب ٥%، ٧.٥% من دقيق جنين القمح و دقيق فول الصويا منزوع الدهن أعطت أحسن القيم بالمقارنة بـ ١٠%. و أفضل العينات المدعمة تم لها إجراء تقدير الأحماض الأمينية و أظهرت ارتفاع في الأحماض الأمينية الأساسية و غير الأساسية و كذلك ارتفاع نسبة الأحماض الأمينية الكلية مقارنة بالكنترول.

Evaluation of spaghetti supplemented with defatted soybean …….

Nadia, H.A. Assem

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