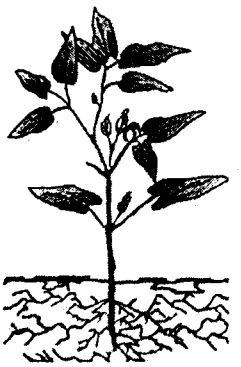


79
Annals
Agric. Sci.,
Ain Shams Univ.,
Cairo, 54(1), 79- 87, 2009

UTILIZATION OF SOME PLANT PROTEIN ISOLATE AND THEIR EFFECTS ON QUALITY OF LOCAL MACARONI

[6]

Abo El-Naga[1], M.M.; Nadia[1] M. Abd El-Motaleb and E.M. Ayman[1]
1- Food Technology Research Institute, Agricultural Research Center, Giza, Egypt

Keywords: Soybean, Wheat germ, Apricot kernel, Protein isolate, Macaroni, Sensory evaluation

ABSTRACT

Deficiency of protein in diet is considered one of the problems which negative affect on public health. Thus, in this study wheat flour (72%) was fortified individually with protein isolate from soybean, wheat germ and apricot kernel at 5 and 10% levels for production macaroni (spaghetti). The results showed that protein isolate from soybean, wheat germ and apricot kernel were 90.25, 83.15 and 80.16% respectively. Chemical analysis showed that protein percent increased in fortified spaghetti by increasing percentage of protein isolate compared with control sample (unfortified). The limiting amino acids in spaghetti fortified with soybean, wheat germ and apricot kernel protein isolate at level 10% were methionine and cystine, while in spaghetti control sample (unfortified) was lysine. Biological value showed that spaghetti fortified with 10% soybean, wheat germ and apricot kernel protein isolate were 69.59, 68.01 and 66.01 respectively, while it was 61.06 in control sample. The protein digestibility increased in fortified spaghetti by increasing percent of protein isolate compared with control sample. The cooking quality test demonstrated that weight, volume and total soluble solids increased, while firmness decreased in fortified spaghetti compared with control sample. Measurement of color by Hunter revealed little changes in fortified spaghetti compared with control sample. Sensory evaluation indicated that no significant difference between control and spaghetti samples.

INTRODUCTION

The interest in pasta production is increasing all over the world. Nowadays pasta is made not only from semolina, but also from wheat flour or wheat flour plus semolina and even in some countries from mixtures of farinaceous from various cereals **(Trank *et al* 2004)**.

The use of wheat in the form of pasta products is considerably more widespread in the world of today than its use in bread making. Pasta nearly world wide acceptance is attributed to its low cost, ease of preparation, versatility, offering considerable advantage in that, sensory attributes, quickly digested and stored for relatively long periods of time without undergoing appreciable deterioration **(Nathalie *et al* 2005)**.

Cereal products are widely consumed as a source of energy as well as protein. Pasta produced from semolina, hard and soft wheat flour is typically rich in carbohydrate but not in protein. It is known to be deficient in the essential amino acids, such as, lysine and to a lesser amount of thrionine and methionine **(Soh *et al* 2006)**.

Zaki *et al* (2004) reported that soybean products have been the chief source of protein for millions of people in the world. **Bolendi and Zayas (1995)** mentioned that wheat germ is an excellent source of protein thus it could be utilized to overcome protein deficiency. **Abd El-Aal *et al* (1986)** showed that, the apricot kernel are considered a

(Received January 17, 2009)
(Accepted February 14, 2009)

high protein value and suitable for incorporation into both normal and dietetic foods.

The aim of this study was to investigate the chemical analysis, amino acids, protein efficiency ratio, biological value, in-vitro protein digestibility, cooking quality and sensory evaluation of macaroni (spaghetti) fortified with some plant protein isolate.

MATERIALS AND METHODS

Materials

- Hard wheat flour (72% extraction) was obtained from North Cairo Mills Company, El-Hoda Mill, Shobra El-Kheima, Egypt.
- Defatted soybean flour was obtained from Food Technology Research Institute, Agricultural Research Center, Giza, Egypt.
- Wheat germ was obtained from South Cairo Mills Company, Cairo, Egypt.
- Apricot fruits *(prunus armeniaca)* were obtained from Horticulture Research Institute, Agricultural Research Center, Giza, Egypt.

Methods

Preparation of defatted wheat germ flour

Wheat germ was crushed by blender (Braun, Germany), then the oil was extracted by n-hexane in a soxhlet apparatus for 24 hr with changing the solvent several times. The defatted wheat germ flour was passed through a 60 mesh sieve (British Standard Screen) according to method of **Hettiarachchy *et al* (1996)**.

Preparation of defatted apricot kernel flour

The pits were removed from the tissues by hand, washed with water and sun dried for 3 weeks. The dried pits were crushed by manual cracking. The kernels were boiled for 30 min. in sodium bicarbonate 0.1%, then soaked for 48 hr, in distilled water to remove bitterness material (amygdalin) and shelled (brown skin), after that the kernels were dried at50°C in a forced draught air oven. The apricot kernels were ground to pass through a 60 mesh sieve to get kernels flour. After that the oil was extracted from apricot kernel flour by n-hexane in a Soxhlet apparatus for 24 hr., and the defatted flour was air dried at room temperature, according to method of **Abd El-Aal *et al* (1986)**.

Preparation of protein isolate

Protein isolate was prepared according to the method of **Chavan *et al* (2001)** as follow: one k.gm of flour was suspended in 10 liters distilled water, then pH was adjusted to 9.0 by using 1 N NaOH. The suspension was shaked for 1 hr at room temperature. After centrifugation at 3000 xg for 30 min. the extract was adjusted to pH 4.2 for defatted soybean flour, pH 4 for defatted wheat germ flour and pH 4.3 for defatted apricot kernel flour by 1N HCL. The precipitate was recovered by centrifugation at 3000 xg for 30 min. The precipitate was washed with distilled water several times and then neutralized by IN NaOH to pH 7. The neutralized precipitate was dried by using an oven under vacuum at 40°C then milled by using household mill and sieved through 60 mesh. Finally kept in refrigerator until it used as replacement materials of wheat flour (72% extraction) individually at levels 5 and 10%.

Processing of spaghetti

Spaghetti was processed by using Matic 1000 Simac Machine Corporation (Millano, Italy) according to method of **Tudorica *et al* (2002)**.

Chemical analysis

Protein, fat, crude fiber and ash were determined according to the methods of **AOAC (2000)**. Carbohydrates were calculated by difference.
Amino acids were estimated by using Amino Acid Analyzer (LC 3000 eppendorf-Germany) according to the method of **Rubin *et al* (1975)**.

Chemical scores (CS) were calculated according to equation of **FAO/WHO/UNU (1985)**. Whereas:

$$CS = \frac{\text{mg of amino acid per 100 g of test protein}}{\text{mg of amino acid per 100g of reference protein}} \times 100$$

The amino acid that showed the lowest proportion was termed the limiting amino acid.

Protein efficiency ratio (PER) was calculated using the equation of **Alsmeyer *et al* (1974)**: PER = - 0.684 + 0.456 (leucine) -0.047 (proline).

Biological value (BV) was calculated using the equation of **Mitchell and block (1946)**: BV = 49.9 + 10.53 (PER).

Protein digestibility

The in-vitro protein digestibility was estimated according to method of **Santosh and Chauhan (1986)**.

Cooking quality

Weight, volume, total soluble solids (TSS) and firmness were determined using the methods described by **Frank and Anton (2002)**.

Measurement of color

Color of spaghetti samples were measured for each sample using a spectrophotometer with color scale (Hunter, Lab. Scan XE, Reston, VA). Color standard (X = 77.26, Y = 81.94 and Z = 88.14). color was expressed in terms of lightness (L-value), redness (a-value) and yellowness (b-value).

Sensory evaluation

Appearance, color, taste and stickiness of cooked spaghetti were evaluated as described by **Matz (1959)**.

Statistical analysis

The obtained data were analyzed using Statistical Analysis System **SAS (1996)**.

RESULTS AND DISCUSSION

Chemical composition of raw materials

Chemical composition of raw materials and their protein isolate were illustrated the data in **Table (1)**. The results revealed that the protein content in defatted soybean flour, defatted wheat germ flour and defatted apricot kernel flour were 47.31, 32.57 and 30.14% respectively, while protein isolate reached 90.25, 83.15 and 80.16% respectively. Also, the results showed that the fat content in defatted soybean flour, defatted wheat germ flour and defatted apricot kernel flour were 3.55, 2.05 and 3.67% respectively, while in protein isolate the fat reached 0.29, 0.18 and 1.83% respectively. From the same table, it is obvious that the fiber content in defatted soybean flour, defatted wheat germ flour and defatted apricot kernel flour were 3.56, 5.23 and 2.89% respectively, while in protein isolate the fiber reached 0.89, 0.67 and 1.64% respectively. At the same time the results showed that the ash content in defatted soybean flour, defatted wheat germ flour and defatted apricot kernel flour were 7.75, 4.92 and 4.12% respectively, while in protein isolate the ash reached 3.26, 2.50 and 3.83% respectively. It can be seen from the same table that the carbohydrates content in defatted soybean flour, defatted wheat germ flour and defatted apricot kernel flour were 37.83,55.23 and 59.18% respectively, while in protein isolate the carbohydrates reached 5.31, 13.50 and 12.54% respectively. In addition to, the protein, fat, fiber, ash and carbohydrates contents in wheat flour (72%) were 11.90, 1.45, 0.72, 0.58 and 85.35 respectively. These results are in full agreement with those obtained by **Abd El-Aal *et al* (1986), El-Bardeny *et al* (1991) and Hettiarachchy *et al* (1996)**.

Chemical composition of spaghetti

Results in **Table (2)** showed the chemical composition of spaghetti fortified with different levels of protein isolate, from the mentioned results, it clear that values of protein, fiber and ash in fortified spaghetti were gradually increased by increasing percent of protein isolate compared with control sample. On the contrary, fat and carbohydrates were gradually decreased by increasing percent of protein isolate compared with control sample.

Amino acids profiles, chemical score, PER and BV

Results of amino acids profiles **(Table 3)**, chemical score **(Table 4)**, protein efficiency ratio (PER) and biological value (BV) **(Table 5)**, exhibited that, the limiting amino acids in spaghetti fortified with soybean, wheat germ and apricot kernel protein isolate at level 10% were methionine and cystine, while in spaghetti control sample (unfortified) was lysine. This results agree with that mentioned by **Faqir *et al* (2005)** who found that lysine is the limiting amino acid in wheat flour. They declared also that the shortage of energy, protein and essential amino acids are the main problems of human nutrition in developing and under developed countries. The nutritional quality can be improved by increasing protein content and limiting amino acids especially lysine. Quality evaluation by amino acid scoring procedure is considered to be more accurate than animal assays used for predicting protein quality of foods. They also illustrated that, protein provides amino acids in the diet, which are required in the body to regulate

Table 1. Chemical composition (%) of raw materials (on dry weight basis)*

Samples	Protein	Fat	Fiber	Ash	Carbohydrates
Wheat flour (72%)	11.90	1.45	0.72	0.58	85.35
Defatted soybean flour	47.31	3.55	3.56	7.75	37.83
Defatted wheat germ flour	32.57	2.05	5.23	4.92	55.23
Defatted apricot kernel flour	30.14	3.67	2.89	4.12	59.18
Soybean protein isolate	90.25	0.29	0.89	3.26	5.31
Wheat germ protein isolate	83.15	0.18	0.67	2.50	13.50
Apricot kernel protein isolate	80.16	1.83	1.64	3.83	12.54

* Each value is mean duplicate determination

Table 2. Chemical composition (%) of spaghetti (on dry weight basis)*

Samples	Protein	Fat	Fiber	Ash	Carbohydrates
Spaghetti (control)	11.97	1.43	0.79	0.61	85.20
Spaghetti (5% soybean protein isolate)	16.64	1.20	0.81	0.85	80.50
Spaghetti (10% soybean protein isolate)	20.65	1.18	0.82	0.96	76.39
Spaghetti (5% wheat germ protein isolate)	16.05	1.19	0.80	0.89	81.07
Spaghetti (10% wheat germ protein isolate)	19.16	1.12	0.81	0.91	78.00
Spaghetti (5% apricot kernel protein isolate)	15.52	1.21	0.84	0.95	81.48
Spaghetti (10% apricot kernel protein isolate)	18.36	1.20	0.86	1.13	78.45

* Each value is mean duplicate determination

Table 3. Amino acids profiles of spaghetti (g/100g protein)

Amino acids	Spaghetti (control)	Spaghetti (10% SPI)*	Spaghetti (10% WGPI)**	Spaghetti (10% AKPI)***
Isoleucine	1.43	2.15	1.89	1.75
Leucine	3.89	5.98	5.77	5.37
Lysine	0.16	2.67	2.27	1.23
Methionine	0.19	0.51	0.60	0.39
Cystine	0.54	0.40	0.30	0.28
Phenylalanine	0.57	1.66	1.75	1.62
Tyrosine	0.18	1.51	2.70	1.51
Threonine	0.27	2.10	1.13	0.93
Valine	0.42	1.80	1.96	1.21
Alanine	1.32	1.68	1.25	1.91
Arginine	4.70	2.83	1.37	1.19
Aspartic acid	3.31	4.35	4.16	4.20
Glutamic acid	3.76	5.91	5.96	5.17
Glycine	0.50	1.81	1.30	1.71
Histidine	0.75	1.57	1.35	1.17
Proline	0.55	3.58	4.79	4.83
Serine	0.39	2.89	1.80	1.44

* SPI = Soybean protein isolate
** WGPI = Wheat germ protein isolate
*** AKPI = Apricot kernel protein isolate

Table 4. Chemical score

Amino acids	FAO/WHO/UNU (1985) (g/100 gm protein)	Spaghetti (control)	Spaghetti (10% SPI)	Spaghetti (10% WGPI)	Spaghetti (10% AKPI)
Isoleucine	4.0	35.75	53.75	47.25	43.75
Leucine	7.0	55.57	85.42	82.42	76.71
Lysine	5.5	2.90*	48.54	41.27	22.36
Methionine + systine	3.5	20.85	26.00*	25.71*	19.14*
Phenylalanine + tyrosine	6.1	12.29	51.96	72.95	51.31
Threonine	4.0	6.75	52.50	28.25	23.25
Valine	5.0	8.40	36.00	39.20	24.2

* Limiting amino acids

Table 5. Protein efficiency ratio (PER) and biological value (BV) of spaghetti

Evaluation	Spaghetti (control)	Spaghetti (10% SPI)	Spaghetti (10% WGPI)	Spaghetti (10% AKPI)
Protein efficiency ratio (PER)	1.06	1.87	1.72	1.53
Biological value (BV)	61.06	69.59	68.01	66.01

growth, repair, maintenance and replacement of tissues. Essential amino acids are required in adequate amounts in the daily diet because these cannot be synthesized in the human body. The total protein content and the contribution that essential amino acids make to the total are the most important factors from a nutritional point of view. In general can be said that malnutrition is one of the major problems of public health especially in the developing countries. These countries increase in population, consequently increase demand of foods. Because of animal protein is either scare or expensive, the way to overcome this problem is to search of unconvention as a new protein source for use in food ingredients. On the other side, protein efficiency ratio (PER) in spaghetti fortified with 10% soybean, wheat germ and apricot kernel protein isolate were 1.87, 1.72 and 1.53 respectively, while in spaghetti control sample was 1.06. On the other hand, biological value (BV) in spaghetti fortified with 10% soybean, wheat germ and apricot kernel protein isolate were 69.59, 68.01 and 66.01 respectively, while in spaghetti control sample was 61.06.

In-vitro protein digestibility

With regard to protein digestibility, the obtained results in **Table (6)** demonstrated that spaghetti fortified with soybean, wheat germ and apricot kernel protein isolate at levels 5 and 10% were 69.73, 70.92, 68.15, 68.53, 65.16 and 67.42% respectively compared with the control sample (unfortified) which gave 63.12%. It is evident from these results that spaghetti fortified with soybean protein isolate was the best protein digestibility followed by spaghetti fortified with wheat germ protein isolate, then, spaghetti fortified with apricot kernel protein isolate.

Cooking quality of spaghetti

In relation to cooking quality of spaghetti samples the results presented in **Table (7)** indicated that weight, volume and total soluble solids were gradually increased by increasing percent of protein isolate compared with control sample. On the contrary, firmness was slightly decreased compared with control sample. In the same context

Table 6. Protein digestibility (%)*

Samples	Protein digestibility (%)
Spaghetti (control)	63.12
Spaghetti (5% soybean protein isolate)	69.73
Spaghetti (10% soybean protein isolate)	70.92
Spaghetti (5% wheat germ protein isolate)	68.15
Spaghetti (10% wheat germ protein isolate)	68.53
Spaghetti (5% apricot kernel protein isolate)	65.16
Spaghetti (10% apricot kernel protein isolate)	67.42

* Each value is mean duplicate determination

Table 7. Cooking quality of spaghetti

Samples	Initial weight (gm)	Weight after cooking (gm)	Increase in weight (%)	Initial volume (cm^3)	Volume after cooking (cm^3)	Increase in volume (%)	Total soluble solids (%)	Frimness (lb / in)
Spaghetti (control)	50	149.08	198.16	40	125.49	213.72	7.85	0.18
Spaghetti (5% soybean protein isolate)	50	150.05	200.10	40	128.23	220.57	7.92	0.17
Spaghetti (10% soybean protein isolate)	50	152.81	205.62	40	129.54	223.85	7.98	0.16
Spaghetti (5% wheat germ protein isolate)	50	153.48	206.96	40	129.00	222.50	8.18	0.17
Spaghetti (10% wheat germ protein isolate)	50	155.05	210.10	40	131.25	228.12	8.62	0.16
Spaghetti (5% apricot kernel protein isolate)	50	153.58	207.16	40	129.24	223.10	8.20	0.16
Spaghetti (10% apricot kernel protein isolate)	50	156.07	212.14	40	131.66	229.15	8.91	0.15

Hummel (1966) mentioned that good quality macaroni products should absorb water at least twice of their weight and swell to three or four times their origin a volume. Also, the results were in good agreement of **Matsuo and Irvine (1970)** who reported that both protein quality and quantity affect spaghetti cooking quality properties.

Changes occurred in color spaghetti

Color as a matter of visual perception is an important consideration in food product development because food color and appearance are usually the first impressions to register in the consumer's mind **(Salama, 2002)**.

The effect of fortified spaghetti with soybean, wheat germ and apricot kernel protein isolate at levels 5 and 10% on color characteristics of spaghetti samples presented in **Table (8)**. From the results it can be seen that spaghetti fortified with soybean, wheat germ and apricot kernel protein isolate caused an decrease in the L (lightness) and b (yellowness). Meanwhile a (redness) values were increased when compared with control sample.

Sensory evaluation

In respect of sensory evaluation of spaghetti, the presented results in **Table (9)** indicated that no significant differences between control sample and

Table 8. Hunter color parameters of spaghetti*

Samples	L	a	b
Spaghetti (control)	75.35	2.17	15.21
Spaghetti (5% soybean protein isolate)	75.11	2.21	15.10
Spaghetti (10% soybean protein isolate)	75.01	2.25	15.01
Spaghetti (5% wheat germ protein isolate)	75.09	2.29	15.08
Spaghetti (10% wheat germ protein isolate)	74.47	2.35	14.97
Spaghetti (5% apricot kernel protein isolate)	74.95	2.33	15.0
Spaghetti (10% apricot kernel protein isolate)	74.89	2.40	14.87

* Each value is mean duplicate determination

Table 9. Sensory evaluation of spaghetti*

Samples	Appearance (25)	Color (25)	Taste (25)	Stickiness (25)	Total (100)
Spaghetti (control)	21.8±1.62a	23.4±1.07a	23.0±1.15a	22.1±1.97a	90.3±4.30a
Spaghetti (5% soybean protein isolate)	22.7±1.25a	22.9±1.20a	22.3±1.06a	22.7±1.49a	90.6±4.45a
Spaghetti (10% soybean protein isolate)	21.9±1.45a	22.5±1.08a	22.1±1.20a	21.7±1.49a	88.2±4.85b
Spaghetti (5% wheat germ protein isolate)	22.5±1.58a	22.4±1.71a	22.4±1.51a	22.5±1.90a	89.8±5.81a
Spaghetti (10% wheat germ protein isolate)	22.2±0.92a	22.2±1.03a	22.0±0.94a	22.4±1.07a	88.8±3.61a
Spaghetti (5% apricot kernel protein isolate)	22.5±0.71a	22.4±0.70a	22.0±1.25a	22.4±0.52a	89.3±2.21a
Spaghetti (10% apricot kernel protein isolate)	22.3±1.16a	22.6±0.84a	22.1±0.88a	22.50±85a	89.5±2.84a
L.S.D. (0.05)	5.26	7.92	2.10	1.21	1.29

* Values flowed by the same letter within the same column were not significantly differences
Values are mean ± Standard deviation

spaghetti samples for all items (appearance, color, taste and stickiness) except total of spaghetti fortified with 10% soybean protein isolate.

In conclusion, because of bakery products are consumed worldwide, therefore there is urgent need for fortification of bakery products with high quantity protein source in order to improve nutritional quality of protein consumed by many people, thereby, can be ameliorate the diet of low income level population groups.

REFERENCES

Abd El-Aal, M.H.; M.A. Hamza and E.H. Rahma (1986). In vitro digestibility, physicochemical and function properties of apricot kernel protein. **Food Chem., 19 (3): 197-211.**

Alsmeyer, R.H.; A.E. Cunningham and M.L. Happich (1974). Equations predict PER from amino acid analysis. **Food Tech., 28(7): 34-40.**

AOAC (2000). Official Methods of Analysis, 17 Ed. Association Official Analytical Chemists, Washington, D.C, USA.

Bolendi, V. and J.F. Zayas (1995). Wheat germ protein flour solubility and water retention. **J. of Food Sci., 60(4): 845-848.**

Chavan, U.D.; D.B. McKenzie and F. Shahidi (2001). Functional properties of protein isolates from beach pea (Lathyrus maritime SL.). **Food Chem., 74 (2): 177-187.**

El-Bardeny, A.E.; A.M. Abd El-Salam and S.M. Saad (1991). Studies on ultilization of wheat germ in the production of enriched bread. **Annals of Agric. Sci., Mohstohor, 29 (1): 223-238.**

FAO/WHO/UNU (1985). Energy and protein requirements. Report of joint FAO/WHO/UNU. Expert Consultation. **World Health Organization. Technical Report, Series 724 WHO, Geneva.**

Faqir, M.A.; A. Ijaz; S. Masood and P. Imran (2005). Amino acid composition of spring wheats and losses of lysine during chapatti baking. **J. Food Composition and Analysis, 18: 523-532.**

Frank, A. and L. Anton (2002). Physical and cooking quality of spaghetti made from whole-wheat durum. **Cereal Chem., 79(4): 504-510.**

Hettiarachchy, N.S.; V.K. Griffin and S.R. Gnana (1996). Preparation and functional properties of protein isolate from defatted wheat germ. **Cereal Chem., 73(3): 364-367.**

Hummel, C. (1966). Macaroni Products Manufacture, Processing and Packing. pp. 31-34. Second Completely Rev. Ed. Food Trade Press. Ltd. London.

Matsuo, R.R. and G.N. Irvine (1970). Effect of gluten on the cooking quality of spaghetti. **Cereal Chem., 47(2): 173-179.**

Matz, S.A. (1959). The Chemistry and Technology of Cereal as Food and Feed. pp. 274-320. The Avi. Publishing Company INC.

Mitchell, H. and J. Block (1946). The correlation of the amino acids composition of protein with their nutritive value. **Nutrition abstract and review, 16 (2): 249-278.**

Nathalie, V.; S.D. Douglas; M.E. Elias and K. Shahyarf (2005). Quality of spaghetti made from full and partial waxy durum wheat. **Cereal Chem., 82(1): 93-100.**

Rubin, M.; D.R. Schoonouer and E.H. Bossard (1975). Amino acid profiles of corn and soybean meal by a modified analysis techniques. **Poult. Sci. J., 54(5): 1811.**

Salama, M.F. (2002). Effect of natural antioxidants on the baking quality and stability of cakes. **Egypt. J. Food Sci., 30(2): 269-287.**

Santosh, K. and B.M. Chauhan (1986). Effect of domestic processing and cooking on in vitro protein digestibility of moth bean. **J. of Food Sci., 51(4): 1083-1089.**

SAS (1996). Statistical Analysis System. SAS User's Guide: System for Windows. Version 4.10 (release 6.12 TS level 0020) SAS Inc. Cary. North Carolina, USA.

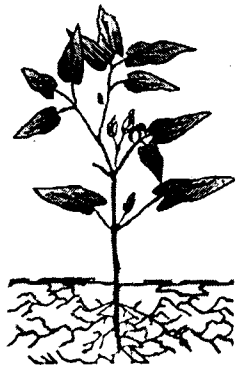
Soh, H.N.; M.J. Jissons and M.A. Turker (2006). Effect of starch granule size distribution and elevated amylase content on durum dough rheology and spaghetti cooking quality. **Cereal Chem., 83(5): 513-519.**

Trank, A.M.; R.Y. Saujanya and J.D. Todd (2004). Extrusion properties and cooking quality of spaghetti containing buckwheat bran flour. **Cereal Chem., 81(2): 232-236.**

Tudorica, C.; V. Kuri and C. Brennan (2002). Nutritional and physicochemical characteristics of dietary fiber enriched pasta. **J. Agric. Food Chem., 50(2): 347-356.**

Zaki, S.M.; M.M. Abo-El Naga and A.M. Gaafar (2004). The qualities of some bakery products fortified with papaya and soy flour. **Egypt. J. Agric. Res., 82(30): 311-325.**

حوليـــات العلـــوم الزراعية
جامعة عين شمس ، القاهرة
مجلد(٥٤)، عدد (١)، ٧٩-٨٧، ٢٠٠٩



الاستفادة من بعض البروتينات النباتية المعزولة وتأثيرها على جودة المكرونة المحلية

[٦]

محمد مبروك أبوالنجا[١] - نادية محمود عبدالمطلب[١] - أيمن عزت محمد[١]
١- معهد بحوث تكنولوجيا الأغذية - مركز البحوث الزراعية - الجيزة - مصر

الموجـــز

يُعد نقص البروتين بالوجبة الغذائيـــة مـــن أحـــد المشاكل التى تؤثر سلبيًا على الصحة العامة ومن هنا ففى هذه الدراسة تم تدعيم دقيق القمـــح اســـتخلاص (٧٢%) بالبروتينات المعزولة من فول الصويا وجنين القمح ونواة المشمش كلاً على حده بنسبة ٥ ، ١٠% لإنتاج المكرونة الاسباجتى وأوضحت النتائج أن نسبة البروتينات المعزولة من فول الصويا وجنين القمـــح ونواة المشمش كانـــت ٩٠,٢٥، ٨٣,١٥، ٨٠,١٦% على التوالى وبالتحليل الكيميائى للمكرونة الاسباجتى المدعمة بالبروتينـــات المعزولـــة زادت بهـــا نـــسبة البروتين كلما زادت نسبة الاستبدال بالمقارنة بعينـــة الكنتـــرول ، كمـــا أظهـــرت النتـــائج أن المكرونـــة الاسباجتى المدعمة بنـــسبة ١٠% مـــن البروتينـــات المعزولة من فول الصويا وجلين القمح ونواة المشمش كان المثيونين والسستين همـــا الحمـــضان الأمينيـــان المحددان فى كل منهم، بينما كان الليسين هو الحمض الأمينى المحدد فى المكرونة الاسباجتى غير المدعمة (الكنترول)، كما أظهر التقييم البيولـــوجى أن القيمـــة الحيوية للمكرونة الاسباجتى المدعمة بنسبة ١٠% من البروتين المعزول من فول الصويا وجنين القمح ونواة المـــشمش كانـــت ٦٩,٥٩، ٦٨,٠١، ٦٦,٠١ علـــى التوالى بالمقارنة بعينة المكرونـــة الاســـباجتى غيـــر المدعمة (الكنترول) حيث بلغـــت ٦١,٠٦ وبالنـــسبة للقيمة الهضمية للبـــروتين فقـــد زادت فـــى عينـــات المكرونة بزيادة نسبة البروتين المعـــزول بالمقارنـــة بعينة الكنترول وإضافة لـــذلك فـــإن اختبـــار اللـــون بواسطة جهاز Hunter فقد حدث تغير بسيط فى اللون بالمكرونة المدعمة بالمقارنـــة بـــالكنترول وبالنـــسبة لاختبار جودة المكرونـــة الاســـباجتى فقـــد زاد وزن وحجم المكرونة الاســـباجتى وكـــذلك زادت المـــواد الصلبة الكلية بينما قلت الصلابة كلمـــا زادت نـــسبة البروتين المعزول بالمقارنة بعينـــة الكنتـــرول. كمـــا أظهر التقييم الحسى للمكرونة الاسباجتى عدم وجـــود فروق معنويـــة بـــين عينـــات المكرونـــة المدعمـــة والكنترول.

تحكيـــم: أ.د على صالـــح ضبش
أ.د سعيد محمد منصور