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SUPPLENENTATION OF PASTA BY DEBITTERED FENUGREEK

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ABSTRACT

The target of this work is to remove bitterness from fenugreek flour, produce pasta supplemented with debittered fenugreek flour and studying the effect of this supplementation on the nutritional quality, cooking quality and organoleptic properties of produced pasta. Results of this research may be summarized in the following :

1-Bitterness of fenugreek flour was removed by water or 50% ethanol alcohol .

2-Production of pasta with high nutritional values, quality, and organoleptical properties should be produced from semolina supplemented with 5% or 10% debittered fenugreek flour.

3-It should be advised to produce this type of supplemented pasta .

INTRODUCTION

Pasta, produced from hydrated semolina which is rich in carbohydrate, and protein. It is known to be deficient in the essential amino acid lysine but at the same time contains an appreciable quantities of the amino acid methionine (Seyam *et al.*, 1976). Matsuo and Irvine (1970) reported that gluten of medium strength could be used for the production of spaghetti with optimum cooking quality. Matsuo and Dexter (1980) reported that durum wheat milling produced semolina with a bright yellow color, a low speck count and uniform granulation. Because of these constraints, the yield of semolina is never as high as flour yield in commercial mills, the yield of durum semolina varies from about 63 to 68% . They also reported that semolina streams contained protein and ash from 11.2 – 14.3 and 0.49 – 1.10% respectively. Morad *et, al* (1980) produced macaroni by using wheat flour blended with 2, 4, and 6% of high protein low starch flours of lupin and defatted soy bean. They found that increasing lupin or defatted soy bean flours increased volume and weight of macaroni . Augustin *et, al.* (1989) showed that total dietary fiber (TDF) is the portion of plant products not digested in human digestive system. There are two components of TDF being water – insoluble and water soluble. Insoluble fiber includes cellulose, himicellulose, and lignin. These constituents provide bulk to the diet and are associated with the prevention of diverticulitis as well as being an aid to prevent constipation since they tend to draw water into the bowel.They are thought to bind bile acids, leading to the excretion of cholesterol.Soluble fibers, although not fibrous in nature, include pectins, gums and mucilages and are found mostly in fruits, vegetables, legumes, barley and oats.

The cooking quality of spaghetti is a measure of its water absorption capacity (Cooked weight, cooking loss, and cooking tenderness) (Grzybowki and Donnelly, 1979).Good quality of macaroni products should absorb water at least equal of their original weight and/or four times of their original volume to swell (Dexter *et al.*, 1994). Bahnassey *et al.* (1986) found that the high

yellow pigment content of durum semolina is one of the desirable qualities which attribute in the production of pasta products. They added that color value of the fortified spaghetti decreased as the level of legume flour or protein concentrate. They also reported that mineral contentent of legume flour, protein concentrates and fortified spaghetti was considerably higher than that of semolina or control spaghetti.

Fenugreek *(Trigonella Foenum graecum L.)* is an annual herbaceous plant of the leguminous family, widespread in certain countries of the mediteraneansea and Asia.The seeds are rich in protein which ranges from 20 – 30%, lysine and minerals such as calcium, iron, and zinc (Hidvegi *et al.* 1984).Fenugreek seeds is reported to have antidabetic and hypocholesterolaemic properties in both animals and man. Activity is attributed to saponin and high fiber content, (Al-Habori and Roman 1998) . Only fenugreek was among the top of ten plants indicated for diabetes which are of the most commonly recommended herbal medicines (Haddad *et al.*, 2003). The nutritional quality of various foods may be improved by supplementation with legumes to increase protein content and improve the balance of essential amino acids (Pollared *et al.*, 2002).

This work aims to remove bitterness from fenugreek flour, produced pasta from semolina supplemented with debittered fenugreek flour and studying the effect of this supplementation on the nutritional quality, cooking quality and organoleptic properties of produced pasta .

MATERIALS AND MESTHODS

Materials :

1-Fenugreek seed variety Giza-2 obtained from legume Breeding Res. Sec. Field crops Res. Institute, Agric. Res. Cent., Giza, Egypt.

2-Durum wheat kernels, variety Ben sewif-3 were obtained from wheat breading Res. Sec., Field Crops Res. Inst. Agric. Res Center, Giza, Egypt.

Methods :

1- preparation of fenugreek flour.

Fenugreek seeds were hand cleaned washed with water, then sun dried. Seeds were roasted in electric oven at 130 C° for 1 hr before being milled, then ground using a stone mill the fenugreek flour sived through screen No. 40 ., the flour kept in tight container at 3 – 5 C°, through this study.

2- preparation of Semolina

Durum wheat kernels were cleaned, conditioned to 15 % moisture content (4 hrs period). Then milled using semolina machine model German No. 279002 at the Crops Technology Research Section, Food Technology Research Institute, Giza, Egypt . Semolina granules size were (150 – 450 mm.) kept in tight container at 3 – 5 C° through this study.

3- Preparation of debittered fenugreek flour.

Debittered fenugreek flour were prepared with two methods as follows.

A- Frist method, extraction of fenugreek flour bitterness was by soaking fenugreek flour in ethanol 50% (1 : 5) with constant agitation for 6 hrs.

B- Second method, extraction of fenugreek flour bitternes was by soaking Fenugreek flour in water (ratio 1 : 10) at room temperature with constant agitation for 6 hrs. After soaking with each methods, the mixture was centrifugated at 5000 rpm. for 15 min. After centrifugation, debittered fenugreek flour (Precipetate) was drayed by air drier oven at 40 C°., then stored at 3 – 5 C° in tight container.

4- preparation of semolina/debittered fenugreek flour blends.

The mixtures of semolina / debittered fenugreek flour was done by supplemented semolina with 5 and 10 % debittered fenugreek flour produced from each method of bitterness extraction as mentioned before. Then semolina blends were kept in tight container at 3-5 C° until pasta products were processed .

5- processing of pasta products.

Pasta was processed in the De Ma Co (De Francis Machine Corporation) semi – scale laboratory extruder, according to the method described by Dexter and Matsuo (1977) as follows : One kg of each prepared mixtures were mixed with the required amount of water 30 – 33 % . After the completed addition of water mixing was continued at moderate speed for 8 minutes. The premixed dough was then placed in the vacuum mixer of De maco and extruder at a rate of 21 rpm, 25 C° and 45 cm^3 Hg/Cm^2. The obtained dough was then progressed from the extruder auger to the pasta die. An extension tube was added to ensure uniform hydration of the pasta dough perior to extrusion. The pasta was dried at 40 C° for 29 hrs then packed in polyethylene bags and stored at room temperature until analysis.

6- Analytical methods

The raw material used for the production of pasta as well as the produced pasta were analyzed for moisture, crude protein, fat, dietary fiber (soluble – insoluble), and Ash according to methods AOAC (1990).Total carbohydrate was determined by differences.

7- Determination of minerals.

Zinc, Manganes, Iron, and calcium were determined in the studied samples before and after making pasta, by using a pye Unicom sp 1900 atomic absorption spectroscopy technique as described by AOAC (1990).

8- Energy calories .

Energy value was calculated by multiplying protein and crbohydrates percentages by 4.5 and fat percentage by 9.0

9- cooking quality of pasta.

The cooking quality i, e. the percentage weight increase, the percentage volume increase and cooking loss were measured using the method described by Walsh and Gilles (1971).

10- Sensory evaluation.

Appearance, color, flavor, tenderness, and stikiness of the pasta were evaluated organoleptically as described by Matz (1969) . Ten panelists from Food Technology Research Institute (Geza, Egypt) were asked to evaluate organoleptically the different characteristics of eash pasta sample with 20 score for each of appearance, color, flavor, tenderness, and stickness with total scorces (100).

RESULTS AND DISCION

Fotificaton of semolina with fenugreek flour should improve the nutrition value of produced pasta. However fenugreek flour was rich in protein, dietary fiber and mineral especially Zn, Min, Fe and Ca. as shown in Table (1) .

Table (1): Chemical composition and Mineral contents of fenugreek flour and semolina (on dry weight basis) .

Samples*	Constituents										
	Protein %	Fat %	Ash %	Dietary fiber %		Total dietary fiber %	Total carbohy Drates %	Mineral / contents mg / 100 gm			
				Insoluble	Soluble			Zn	Mn	Fe	Ca
Fenugreek	29.30	8.50	3.62	15.79	12.86	28.65	29.93	5.0	3.86	15.0	35.0
Semolina	14.2	1.75	0.73	1.6	2.40	4.00	79.47	2.65	1.87	7.33	13.35

*** Mean of three replicates.**

From Table (1) it is clear that fenugreek flour is higher than semolina in proteins, fats, ash and dietery fibers (29.30% vs. 14.20%, 8.50% vs. 1.75%, 3.62% vs. 0.73%, and 28.65% vs. 4.0% respectively. While semolina is higher in total carbohydrates (79.47 %) than fenugreek flour (29.93). mineral content of fenugreek flour is higher in the elements of Zinc, Manganese, Iron and calcium than in semolina (5.0 vs. 2.65, 3.86 vs. 1.87, 15.0 vs. 7.33 and 35.0 vs. 13.35 mg / 100 gm. Respectively El. Kady *et, al.* (1991) . reported that fenugreek seeds are rich in protein and mineral content than in any cereals. Therefore addition of fenugreek flour to semolina in producing pasta products lead to pasta with high nutritional values.

When we discus the data mentioned in Table (2) it is clear that when we add fenugreek in which bitterness was removed by ethanol 50% it was found that 5% and 10% of non bitter Fenugreek flour produced pasta with higher chemical components of ash, protein, and dietry fiber , it was found that 10% gave more improvement than 5% addition (ash, proteins, fats and dietary fibers were, increased by 47.7vs. 23.1; 21.7vs. 10.73; 76.25 vs. 50.62; 47.0vs. 23.40 % respectively). While total carbohydrates and total calories decreased by increased Fenugreek flour addition.

Table (2): Chemical composition of pasta and pasta supplemented with Fenugreek. flour in which bitterness was removed by elthnol 50%.(on dry weight basis) .

Samples*	Constituents							
	Ash %	Protein %	Fat %	Dietary fiber %		Total dietary fiber %	Total carbhy drates%	Total calories/100 gm
				insoluble	soluble			
Semolina (control)	0.70	13.23	1.6	2.6	2.4	5.00	79.47	385.20
Semolina+ 5% fenugreek flour	0.80	14.65	2.41	3.25	9.92	6.17	75.97	384.17
Semolina + 10% fenugreek flour	0.96	16.10	2.82	3.91	3.44	7.35	72.77	380.86

*** Mean of three replicates.**

From Table (3), when bitterness was removed from Fenugreek flour by water, it was found that the general behaviour took the same trend as in ethanol extraction. Pollared *et, al.* (2002) reported that, the nutritional quality of various foods may be improved by supplementation with legume grains to increase protein content and improve the balance of essential amino acid. Moreover supplementation pasta with debittered Fenugreek produced pasta, which may be used as a therapeutic food. Al-Habori and Raman (1998) reportea that Fenugreek seed powder have antidiabetic and hypocholesterolaemic properties in both animal and human.

Table (3):Chemical composition of pasta and pasta supplemented with Fenugreek in which bitterness was removed By water (on dry weight basis) .

Samples*	Constituents							
	Ash %	Protein %	Fat %	Dietary fiber %		Total dietary fiber %	Total carbhy-drates%	Total calories/ 100 gm
				Insoluble	Soluble			
Semolina (control)	0.65	13.23	1.6	2.6	2.4	5.00	79.52	385.40
Semolina + 5% fenugreek flour	0.73	14.18	2.63	3.35	2 90	6.25	76.21	385.23
Semolina +10% fenugreek flour	0.90	15.97	3 10	4.15	3.0	7.15	72.88	383.3

*** Mean of three replicates.**

Results represented in Table (4) revealed that mineral content increased by increasing Fenugreek flour percent, in which bitterness was removed by ethanol 50%, therefore when added treated Fenugreek flour increased for example from control to 10 %, mineral content increased by 12.2, 10.5, 14.9 and 16.7 for Zn, Mn., Fe and Ca. repectively.

One the other hand data mentioned in Table (5) revealed that when water was used in removing bitterness from Fenugreek it is clear that mineral content behaved in the same manner as in ethanol extraction without significant differences. For example when the add treated Fenugreek flour

with water, increased from control to 10%, the mineral increased by 10.6, 8.2, 12.8 and 15.9 mg / 100 gm. for Zn, Mn, Fe, and Ca respectively.

Table (4): Mineral contents in pasta product supplemented with Fenugreek flour in which bitterness was removed by ethanol 50% (mg/100gm on dry weight basis) .

Sample*	Mineral contents (mg / 100gm)			
	Zn.	Mn.	Fe	Ca.
Semolina (control)	2.55	1.81	7.05	13.28
Semolina+5% Fenugreek flour	2.75	1.90	7.65	14.40
Semolina+10% Fenugreek flour	2.86	2.00	8.10	15.50

* Mean of three replicates.

Table (5): Mineral contents in pasta product supplemented with Fenugreek flour in which bitterness was removed by water. (on dry weight basis) .

Sample*	Mineral contents (mg / 100gm)			
	Zn.	Mn.	Fe	Ca.
Semolina (control)	2.55	1.81	7.05	13.28
Semolina+5% Fenugreek flour	2.70	1.87	7.60	14.35
Semolina+10% Fenugreek flour	2.82	1.96	7.95	15.40

* Mean of three replicates.

Refering to data in Table (6), one should say that there is increase in all cooking qualities parameters (weight, volume and cooking loss) by increasing addition of treated Fenugreek by ethanol 50% . to semolina. At 10% treated fenugreek addition, the increasing in weight and volume were 15.05 and 9.37% compared with the control. Moreover cooking loss was 4.4% compared with the control (7.0%) this improvement my be due to the increasing in protein content. Bergman *et, al* (1994) showed that the high protein content in the pasta, might provide a superior framework of denaturated protein. That could trap starch molecules preventing their loss during cooking and ultimately decreased the cooking loss.

Table (6): Cooking quality of pasta and pasta supplemented with Fenugreek flour in which bitterness was removed by ethanol 50% .

Sample*	Cooking quality				
	Weight gm.	Increasing %	Volume cm^3	Increasing %	Cooking loss %
Semolina (control)	34.00	0.0	32.00	0.0	7.00
Semolina+5% Fenugreek flour	36.50	+7.35	33.00	3.12	5.00
Semolina+10% Fenugreek flour	39.12	+15.05	35.00	9.37	4.40

* Mean of three replicates.

We should concentrate in case of results Table(7) on the real range in which assured improvement in cooking quality occurs by adding 5%

Fenugreek. flour in which bitterness was removed by water compared with the control. It is clear that nearly all cooking qualities parameters decreased when 10% Fenugreek flour was added compared with the control. Finally all cooking qualities parameters were actually improved when pasta product was supplemented with 10% or 5% fenugreek flour in which bitterness was removed by ethanol 50%

Table (7): Cooking quality of pasta and pasta supplemented with Fenugreek in which bitterness removed by water.

Sample*	Cooking quality				
	Weight gm.	Increasing %	Volume cm^3	Increasing %	Cooking loss %
Semolina(control)	34.00	0.0	32.00	0.0	7.00
Semolina+5% Fenugreek flour	33.00	- 2.94	30.30	- 5.13	5.65
Semolina+10% Fenugreek flour	32.0	- 5.88	28.0	- 12.5	4.30

*** Mean of three replicates**

From Table (8), it is obvious that pasta produced by addition of Fenugreek in which bitterness was removed by ethonal 50%, tenderness was quite more than the control which is considered great improvement in cooking quality.This may be due to the incidence of some hydrocollidal materials such as mucopolysaccharides and mucilage. In other organoleptic properties treated pasta decreased very little than the control, such decrease did not effect on organoleptic properties of pasta produced as a whole Table (8).

Table (8): Values of the organoleptic properties of cooked pasta and pasta supplemented with debittered Fenugreek flour by ethanol 50%.

Cooked pasta **	Organoleptic properties of pasta					
	Appearance 20	Color 20	Flavor 20	Tenderness 20	Stickiness 20	Total score 100
Semolina (control)	20	19	19	17	19	94
Semolina + 5% Fenugreek flour	19	18	19	18	19	93
Semolina + 10% Fenugreek flour	18	18	18	18	20	92

**** Mean of three replicates.**

It is clear from data in Table (9) that the treated pasta with 10% Fenugreek had brownish color compared with the control. This may be due to the absence of some conjugating material such as mucilage. Therefore in this case 5% treated Fenugreek flour should be used instead of 10% addition.

Table (9): Values of the organoleptic properties of cooked pasta and pasta supplemented with debittered Fenugreek flour by water.

Cooked pasta **	Organoleptic properties of pasta					
	Appearance 20	Color 20	Flavor 20	Tenderness 20	Stickiness 20	Total score 100
Semolina (control)	20	19	19	17	19	94
Semolina + 5% Fenugreek flour	18	18	19	17	18	90
Semolina + 10% Fenugreek flour	16	15	17	16	17	81

** Mean of three replicates.

CONCOLUSION

It may be conclouded that when ethanol 50% was used in removing bitterness from Fenugreek flour, pasta could be prepar.ed from semolina supplemented with 5–10 % treated Fenugreek flour with good technological, nutritional and organoleptical properties while in case of using water in extraction of bitterness from fenugreek flour the percent of treated Fenugreek addition should not exceed 5 % . Also another important function of addition of treated fenugreek to semolina is its effect to decrease fats in human blood which cause the dispersion active insulin in diabetics therefore sugar content was reduced in the blood, moreover the decrease of fats did not allow its precipitation on the walls of arteres, thus lowering the formation of clots in coronary arteres of hart. Therefore it should be advised to produce this type of supplemented pasta to use it as a therapeutic food for peoples suffering from malnutrition, hyperglycemia and hypercholesterolemia (Al-Habori and Raman 1998).

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تدعيم المكرونة بدقيق الحلبة المنزرع المرارة

السيد عباس مبارك

معهد بحوث تكنولوجيا الأغذية – مركز البحوث الزراعية – الجيزة .

يهدف هذا البحث إلى ما يلي :

١- إزالة المرارة من دقيق الحلبة .

٢- تدعيم المكرونة بدقيق الحلبة المنزوع المرارة .

٣- دراسة تأثير ذلك التدعيم على القيمة الغذائية وخصائص الطبخ والصفات الحسية للمكرونة المنتجة.

وقد ظهر من نتائج البحث ما يلي :

أ - إزالة المرارة من دقيق الحلبة بالماء أو بكحول الايثانول ٥٠% .

ب- إنتاج مكرونة ذات جودة غذائية وجودة طبخ وجودة حسية عالية بتدعيم السموليا بـ ٥%دقيق حلبة منزوع المرارة بالماء أو ١٠% دقيق حلبة منزوع المرارة بكحول الايثانول ٥٠% مقارنة بالمكرونة الغير مدعمة (الكنترول) .

جـ- وعلى ذلك يوصى بإنتاج مكرونة مدعمة بـ٥% أو ١٠% دقيق حلبة منزوع المرارة .