PRODUCTION OF SOUPS USING DIFFERENT PLANT WASTE PRODUCTS

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Abstract

Peach seed protein concentrate (PSPC) was used as a substitute in preparing meat soup at levels of 0, 50 and 100%. Each of peas peel and potato peel was used to replace 50% of peas grains or potatoes, respectively for preparing dried vegetable soup.

It was ascertained that using 50% PSPC as meat substitution in meat soup was recommended. Crude protein, crude fibers, essential amino acids content, percent satisfaction of consuming 150g and color were increased. Meanwhile, slight changes were noticed in lipids, ash and other studied organoleptic characteristics.

Replacing 50% peas grains or peeled potatoes by peas peel or potato peel, was profitable for preparing dried vegetable soup. The prepared soup was characterized by high crude protein, crude fibers, essential amino acids, PS/150, texture, acceptability, low lipids, carbohydrates content and energy value.

It could be concluded that lower amount of beef soup substituted with 50% PSPC and vegetables soup substituted with 50% of each of potato peel and pea peel will give the same nutritional value of the unsubstituted beel and vegetable soups. Moreover, the increase in crude fibers content was possibly being beneficial to human health.

INTRODUCTION

The precooked dehydrated foods such as soup mixtures are most important in the production of the convenient foods, which cover a large part of the world food market. The next largest amounts are accounted for by institution, hotel, hospital, restaurant, home and military use. The advantages of the pre-cooked dehydrated soups are fairly summarized in the following: 1. Their protection from enzymatic and oxidative spoilage, 2. Their stability at room temperature over long period of time (6-

12 months), 3. The fact that these types of food do not need cooling preservation, 4. Their quite nutritive value, particularly as sources of proteins and ready for reconstitution in a short time especially for working families, 5. Their light weight for shipping, 6. Their availability at all times of the year (Woodroof, 1975).

The raw ingredients used in soup manufacture are available in many sizes and shapes from slices and flakes to powder. In developed countries, precooked dehydrated soups are available for a long time in greater varieties. While in Egypt, soup mixes are increasing in popularity and demand at a rapid rate. The shortage in national production of such soups is covered by importing these products from abroad, which in most cases have a taste and overall acceptability not reasonable for the local food habits. For these reasons, attempts for preparing local soup mixes having high acceptability and nutritive value for consumer are important and necessary.

The technological processes of soups include several steps such as sorting, peeling, cutting, cooking, dehydration, mixing of ingredients and packaging. These soups or mixes should maintain their quality during the sterilization or dehydration processes necessary for preservation as well as maintain their chemical composition and quality under storage conditions (Luh and Woodroof, 1975).

Flynn and Fox (1981) studied the proximate composition and mineral content of 17 types of dried soup representing both meat and vegetable types from 3 manufacturers, retailed in Ireland. They found that moisture content ranged from 1.4 to 6.6% with a mean value of 4.5%, while the protein content was in the range of 1.3-3.0% with average of 2.2%, fat content ranged from 0.8 to 3.7% with a mean of 1.6%. The corresponding value for carbohydrate was in the range of 4.9-17.8% with an average of 10.1%. Average energy content was 268 $\pm$ 58 k cal/serving. The minerals content was sodium 878 $\pm$ 124, calcium 34 $\pm$ 18, and iron 0.8 $\pm$ 0.36 mg/serving.

Ibrahim *et al.* (1989) prepared three types of cooked dried soups. They found that calcium, iron and potassium contents ranged between 9.4-23.8, 10.0-18.0 and 125.2-184.5 mg/100g, respectively in three types of cooked dried soups. The dry soups could satisfy the requirements of iron as recommended by FAO/WHO (1985).

Osman *et al.* (1991) prepared three different types of different percentages of precooked dehydrated soups from chicken, vegetables and legumes. The best vegetable soup mix contain peas, potato, carrot, cabbage, tomato, onion, beef or chicken, meat, salt, black pepper, starch and hydrogenated oil. Fresh vegetables were cleaned, sorted, peeled, cut and cooked under pressure. The cooked components were air dried and formulated in different ratios to obtain the soup mixes. The chemical composition of meat-vegetable soup and chicken vegetable soup in percentage, was as follow: moisture 6.27 and 6.14, protein 15.47 and 16.56, fat 13.02 and 12.42, ash 16.28 and 15.79, fibers 3.56 and 3.56, reducing sugars 9.85 and 9.86, non reducing sugars 2.22 and 2.22, starch 39.60 and 39.59%, respectively. The produced soups were rich in minerals and vitamins. Preparation of these soups before servings demand mixing soup with boiling it for 13 min only. The quality of the dried product remained six months of storage at room temperature.

MATERIALS AND METHODS

Materials:

Peach seeds were used to prepare protein concentrate, which was used to substitute the meat at levels of 0, 50 and 100% in preparing meat soup. The meat soup formula was used according to Shaheen (1993) and the recipe was used as follows:

Ingredient	Weight %	Ingredient	Weight %
Dehydrated round beef cut	8.9	Parsley	0.8
Corn starch	22.3	Black pepper	1.6
Sheep fat	18.1	Cardamom	0.4
Skimmed milk	3.2	Laurel leaves	0.4
Dextrose	2.4	Red color	0.4
Gelatin	1.3	Mono-sodium glutamate	3.2
Onions	0.8	Table salt	36.2

Each of peas peel and potato peel was used to replace 50% of peas grains and potatoes, respectively for preparing dried vegetable soup. The formula used was according to Shaheen (1993). The recipes of the control soup (A) and the trial substituted soup (B) were as follows:

Ingredient	A %	B %
Corn starch	27.2	27.2
Onion	13.8	13.8
Carrots	13.0	13.0
Peas	6.3	3.15
Pea peel	0.0	3.15
Potatoes	6.0	3.0
Potato peel	0.0	3.0
Tomato powder	4.0	4.0
Cabbage	2.3	2.3
Celery	8.0	8.0
Parsley	0.5	0.5
Black pepper	0.2	0.2
Mono-sodium glutamate	3.5	3.5
Table salt	15.2	15.2

Green pea and potato peels were rinsed and dried in an oven at 70°C for 10 hr. Each of the air-dried peels were ground in Wiley mill a 20 mesh sieve to separate the coarse particles from the flour (Mona et al., 1985). The flour of green pea and potato peels was used in the estimation of proximate chemical composition and protein quality.

Several processes were applied to the vegetables engaged including sorting, grading, shelling or peeling, cleaning and cutting before the cooking step. Green peas was shelled to obtain the grains and washed to remove any impurities. Potatoes were cleaned by water, abrasively or abraded peeled by carborundum and into cubes (5 mm) by cutting machine. Carrot (without vine) was cleaned by water, abraded then cut into cubes (5 mm) by the cutter machine.

The white cabbage leaves were washed and cut into flakes by the cutting machine. The prepared vegetables and other ingredients were cooked in a pressure cooking pan –Model-Seb, capacity six liters. The cooked raw materials were dried at 65°C then ground into fine flour containing about 6.8% moisture content. The flour was passed through a laboratory sieve to give a homogenous size of particles. The soup mixture was filled in aluminum foil packages and kept for analysis.

Dried beef and vegetable soups

The preferable ratio of dried soup to water was obtained by measuring the organoleptic properties such as taste, odor, color, texture, appearance and overall acceptability for the prepared dishes. The organoleptic properties were scored by ten semitrained judges.

Methods:

Preparation of peach-seed-protein products

Seeds were crushed and followed by fine grinding in an electrical mill. Oil was extracted by using hexane as a solvent through performing 3-4 successive soaking for each batch of ground seeds. The obtained miscella from soaking trial were collected, mixed, filtered and desolventized under vacuum at a temperature not exceeding 55°C. The extracted oil was dried over anhydrous sodium sulfate, filtered and stored in dark bottles at low temperature till usage. After oil extraction, the remaining filtrates were desolventized under vacuum at temperature not exceeding 55°C to obtain meals. The defatted meals were powdered to pass through 60-mesh sieve to separate hulls and flours.

Peach-seed protein concentrate was prepared for meals according to the method described by Baket et al. (1979). The soluble constituents of the flour were eliminated with six times of 20 minute extraction process by water. The slurry was filtered under vacuum through Whatman No 40 filter papewr followed by washing with one volume of 80% ethanol. The obtained protein concentrate was dried under vacuum at 55°C for 4 hr, ground, sifted, packed in polyethylene page and stored in a refrigerator.

Meat was boiled in sufficient amount of water, and fat tissues (external and internal muscular) were removed. The meat was then vacuum dried at 65°C ± 2 for about 6 hr. Similarly onions and parsley were dried. Finally all powdered ingredients were mixed together, kneaded with fat, formed into cubes (3.1 x 2.1 x 1.3 cm) and wrapped in aluminum foil.

Chemical analysis

Moisture, crude protein, ash, crude fibers and lipids contents were determined according to AOAC (1995). The data were calculated as percentage on dry matter basis. Lipids were extracted using Sochslet apparatus and petroleum ether as a solvent. Acid, peroxide, iodine and saponification values of extracted lipids were determined (AOAC, 1995). The Nitrogen Free Extract (NFE) was calculated by difference of the following portions:

NFE = 100 – (% Protein + % lipid + % ash + % Fiber)

Energy value (EV) was calculated by multiplying protein by 4.0, carbohydrates by 4.0 and fat by 9.0.

Amino acids in proteins wastes and their products were determined according to the method described by Pellet and Young (1980). A known weight of each sample containing 100mg protein was hydrolyzed in sealed evacuated Pyrex test tubes with 10 ml of 6N HCl at 110°C for 24 hr. The hydrolysate was filtered and completed to 100 ml with distilled water, 5 ml of the hydrolysate were evaporated to dryness in a rotary evaporator. Amino acids were determined using Beckman Amino acids Analyzer apparatus at the Center Laboratory, Faculty of Agriculture, Cairo University.

Tryptophan was colorimetrically determined in the alkaline hydrolysate of the samples and analyzed according to the method of Blauth *et al.* (1963). Approximately 100 mg of each sample was accurately weighed and digested in a sealed tube with saturated barium hydroxide solution (14%) for 24 hr in an oven at 120°C. After complete hydrolysis, the excess of alkali was neutralized to pH 7.0 with carbon dioxide stream gas and the hydrolysate was filtered. The excess carbon dioxide was removed by moderate heating and the solution was diluted to 100 ml with distilled water. Then determining the tryptophan concentration in this diluted solution was carried out at

460 nm. using a carl Zeiss spectrophotometer. A standard calibrated curve was carried out by using known concentrations of tryptophan.

As indicated by the amino acid composition (gm/100 gm on weight basis), grams consumed to cover the daily requirement for adult man from each of the essential amino acids was calculated using the daily dietary allowances given by USRDA (RDA, 1989) as follows:

$$\text{GDR (gm)} = \frac{\text{Daily requirements x 100}}{\text{Essential amino acid (gm/100g)}}$$

The percent satisfaction of each essential amino acid from consumed 150 grams (P.S./150%) was calculated as follows:

$$\text{PS/150\%} = \frac{\text{Essential amino acid (gm/100g) x 100}}{\text{Daily requirements (gm)}}$$

Organoliptic Evaluation

Methods of analysis

The scoring system adopted was evaluated, according to the method described by Gafar et al. (1971), as follows:

Quality attributes	Score
Color	15
Odor	15
Texture	20
Taste	25
Overall acceptability	75

Grade A (fancy) receiving at least 80% of the scores.

Grade B (medium) receiving at least 70% of the scores.

Grade C (standard) receiving at least 60% of the scores.

Grade D (substandard) receiving at least 50% of the scores.

Soup samples receiving less than 50% of the score were rejected.

RESULTS AND DISCUSSION

The data in Table 1 indicates that moisture and carbohydrates contents gradually decreased in beef soup by increasing substituted peach seed protein concentrate (PSPC) to 50 and 100%. The rate of decrease reaches 27.9 and 15.4% for moisture and carbohydrates content in beef soup made from 50% substituted PSPC, respectively. Further reductions were found by increasing peach-seed-protein concentrate (PSPC) level to 100% being 39.7 and 16.4% for moisture and carbohydrates, respectively. Slight changes in lipids and ash contents were noticed and may be due to PSPC substitution.

On the contrary, increasing the level of PSPC in dry beef soup markedly increased crude protein and crude fibers. The increment in the above respective parameters reached 9.5 and 950.0% in beef soup substituted with 50% PSPC. More increment (20.6 and 1900%) was found in 100% PSPC soup.

Regarding Table 2, the increase in crude protein content of beef soup substituted with 100% PSPC was accompanied by remarkable increment in its essential amino acids content. The increases in essential amino acids content subsequently enhanced the percent satifaction of consuming 150 g (PS/150) and lowered the gram daily requirement (GDR) of soup cube containing 100% PSPC instead of beef.

Table 1. Chemical composition (% dry bases) and energy value (Kcal/100 g) of dried beef soup made from beef substituted with peach seed protein concentrate (PSPC).

Composition	Beef cube 100%	Substitution levels	
		PSPC (100%)	50% Beef + 50% PSPC
Moisture content	6.8	4.1	4.9
Crude protein	12.6	15.2	13.8
Lipids	20.9	19.4	19.9
Ash	36.0	35.9	36.0
Crude fibers	0.2	4.0	2.1
Carbohydrates	30.5	25.5	28.1
Energy value	360	338	347

Table 2. Amino acids content (g/100g sample), gram daily requirement (GDR) and percent satisfaction of consuming 150g (PS/150) of soup cube from beef substituted with PSPC.

Amino acids	FAO/WHO/ UNU	Meat soup			PSPC soup		
		AA g/100g sample	GDR	PS/150	AA g/100g sample	GDR	PS/150
Isoleucine	0.819	1.02	80	187	1.06	77	194
Leucine	1.197	0.87	138	109	0.98	122	123
Lysine	1.008	0.55	183	82	0.68	148	101
Threonine	0.567	0.41	138	108	0.49	116	130
Trytophan	0.315	0.12	263	57	0.13	242	62
Valine	0.819	0.49	167	89	0.56	146	102
Histidine	1.008	0.80	126	119	0.98	103	146
Methionine+Cystein	1.071	0.41	261	57	0.54	198	76
Phenyl alanine+Tyrosine	1.197	0.94	127	118	1.08	111	135

Organoleptic evaluation of beef soup cube substituted with 100% PSPC significantly improved its color and had significant effect on its acceptability compared to the 100% beef cube. Whereas, odor, texture and taste had statistically significant decrement. On the other side, it is worthy to note that beef cube substituted with 50% PSPC had statistically no significant effect on each of color, odor, texture, taste and acceptability.

Table 3. Organoleptic evaluation of beef cube substituted with peach seed protein concentrate (PSPC).

Treatment	Color 15	Odor 15	Texture 20	Taste 25	Acceptability 25
Beef cube (100%)	12.0 B	13.1 A	17.6 A	22.7 A	21.7 A
PSPC (100%)	13.1 A	11.8 B	15.9 B	20.6 B	20.8 A
50% Beef + 50% PSPC	12.2 B	12.3 AB	16.9 AB	21.3 AB	21.0 A

Efforts were made to study the effect of substituting 50% of peas peel instead of pea grains and 50% of potato peel instead of potatoes in the preparation of vegetables soup. The data in Table 4 shows remarkable increase in crude protein and crude fibers content of substituted soup reaching 21.0 and 130% compared to the control vegetables soup. On the contrary, moisture, lipids and carbohydrates content as well as energy value decreased subsequently. The higher crude protein content of substituted soup affected markedly on enhancing all studied essential amino acids (Table 5). The high content of essential amino acids content of substituted vegetables soup led to substantial decreases in GDR and enhancing PS/150. Moreover, the substituted soup characterized by significant higher texture and acceptability as compared to the control one. Whereas, color, odor and taste showed significant increases (Table 6).

From the above mentioned data, it could be concluded that beef soup made from beef substituted with 50% PSPC and vegetables soup substituted with 50% of each of potato and pea peels were characterized by high fibers content and low energy value. There is certain amount of evidence that fibers in the diet may reduce the apparent available energy from fats and proteins, amounting to an overall fall of about 5% in the availability of dietary energy (FAO/WHO/UNU, 1985). In addition, the all individual essential amino acids calculated as percentage dry matter exceeded those of the control ones. Therefore, lower amounts of the aforementioned substituted supply soups will more of the daily requirements of adult man and will give the same nutritional value of the unsubstituted soups. Moreover, the increase of crude fibers content of the produced soups due to substitution treatments could be beneficial to a human health by lowering blood cholesterol and glucose levels and might reduce the risk of colon cancer. These observations are in agreement with those obtained by Kahlon *et al.* (1990); Dawoud *et al.* (1998) in their studies on certain vegetables, fruits and seed oil flours.

Table 4. Chemical composition (% dry basis) and energy value (Kcal/100g) of dried vegetables soup substituted with potato peels and peas peels.

Composition	Substitution levels	
	Vegetables soup %	Substituted soup %
Moisture content	3.51	2.62
Crude protein	8.12	9.77
Lipids	0.59	0.43
Ash	3.42	3.67
Crude fibers	3.28	7.58
Carbohydrates	84.59	78.55
Energy value	376	357

Table 5. Amino acids content (g/100g sample), gram daily requirement (GDR) and percent satisfaction of consuming 150g (PS/150) of dried vegetables soup substituted with potato and pea peels

Amino acids	FAO/WHO/ UNU	Vegetable soup			Substituted soup		
		AA g/100g sample	GDR	PS/150	AA g/100g sample	GDR	PS/150
Isoleucine	0.819	0.24	341	44	0.31	264	57
Leucine	1.197	0.52	701	65	0.66	181	83
Lysine	1.008	0.40	252	60	0.50	202	74
Threonine	0.567	0.41	138	108	0.58	98	153
Trytophan	0.315	0.09	350	43	0.10	315	48
Valine	0.819	0.25	328	46	0.27	303	49
Histidine	1.008	0.29	348	43	0.36	280	53
Methionine+Cystein	1.071	0.31	345	43	0.51	210	71
Phenyl alanine+Tyrosine	1.197	0.50	239	63	0.66	181	83

Table 6. Organoleptic evaluation of dried vegetable soups substituted with potato and pea peels.

Treatment	Color 15	Odor 15	Texture 20	Taste 25	Acceptability 25
Control	12.6 A	12.7 A	16.0 B	22.3 A	20.5 B
Substituted souo	13.2 A	13.2 A	18.3 A	22.9 A	22.4 A

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إنتاج الشوربة باستخدام بعض المخلفات النباتية

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تم استخلاص البروتينات المركزة من بذور الخوخ لاستخدامها فى تصنيع شوربة اللحم بنسب صفر ، ٥٠ ، ١٠٠% كما استخدمت كل من قشور البزلاء ودرنات البطاطس كل بنسبة ٥٠% مما يقابلها من بذور البازلاء ودرنات البطاطس لتحضير الشوربة الجافة.

دلت النتائج الى أن أستخدام البروتينات المركزة المستخلصة من بذور الخوخ بنسبة ٥٠% أدت الى الحصول على أعلى صفات فى نسبة البروتين الخام ، الألياف الخام ، الأحماض الأمينية الأساسية وأنسب المواصفات الحسية.

أدى أستبدال ٥٠% من بذور البازلاء ودرنات البطاطس بما يقابلها من قشور كل منهما فى تحضير الشوربة الى الحصول على أعلى مواصفات فى نسبة البروتين الخام ، الألياف الخام ، الأحماض الأمينية الأساسية ، القوام ، PS/150 ، القبول العام بينما انخفضت نسبة الليبيدات والكربوهيدرات وكمية الطاقة. من ذلك يمكن استخدام كميات أقل من شوربة اللحم المستبدل بها ٥٠ % من اللحم ب ٥٠% من اللحم بالبروتينات المركزة المستخلصة من بذور الخوخ ، شوربة الخضار التى استبدل بها ٥٠% من بذور البازلاء ودرنات البطاطس بما يقابلها من القشور لتعطى نفس القيمة الغذائية للشوربة غير المستبدلة كما أن زيادة محتوى الألياف فى المنتجات السابقة ذو تأثير ايجابى على صحة الانسان.