J. Food and Dairy Sci., Mansoura Univ., Vol. ١ (١٢): ٧٤٣- ٧٥٦, ٢٠١٠

QUALITY ATTRIBUTES OF CARROT JAM SUPPLEMENTED WITH PROTEIN CONCENTRATE OF LOOFA SEEDS

El-Massry, Fatma H.; S. M. Youssef and M. E. M. Moussa
Food Technology Res. Institute, Agric. Research Center, Giza, Egypt.

ABSTRACT

Protein concentrate was prepared from loofa seeds and used with levels of ٥،١٠،١٥,٢٠ and ٢٥ % to supplement carrot jams with protein to increase the nutritional value.

The chemical composition of loofa seeds and its protein concentrate were evaluated. The obtained results indicated that the loofa seeds and its protein concentrate contained high amounts of protein , which were ٣٢,٠٦ and ٧٤,٨٣ % (on DWB), respectively. The essential amino acids index (EAAI), biological value (BV) and protein efficiency ratio (PER) were calculated and compared with FAO/WHO/UNU (١٩٨٥) pattern. Functional properties of protein in loofa seeds protein concentrate (L.S.P.C) were evaluated. The chemical composition of prepared carrot jam was studied. The contents of protein and energy values (K. cal./١٠٠ g sample) were increased due to increasing of (L.S.P.C) levels. Meanwhile, fat and carbohydrates were decreased.

Increasing the level of protein concentrate from loofa seeds at levels ٥ -٢٥ % caused to increase the essential amino acids, especially sulpher amino acids.

Sensory evaluation of tested carrot jam enriched with different levels of (L.S.P.C) showed greater sensory quality and preference.

Keywords: loofa (*Luffa aegyptiaca*) seeds, protein concentrate,chemical composition, amino acids and supplementation.

INTRODUCTION

There are a promising increase in plantation of loofa (*Luffa aegyptiaca*) in Egypt because of its profitable over run from the sponge and the seeds which showed higher protein content.

The total yield production from loofa fruits and seeds in Egypt are shown in Table (١).The data indicate that the total annual production of loofa fruit was about ١٨٠٠٠ loofa produced from feddan (Ministry of Agriculture and Land Reclamation, ٢٠١٠).

Table ١: Total area and yield of loofa fruit in Egypt

Items	Data
Total area (feddans)	١٠٩٠٠٠
Yield (loofa fruit/feddan)	١٨٠٠٠
Yield of seeds (g/loofa)	٢٠ - ٣٠
Weight of seeds (g/loofa)	١٣,٩٥
Percentage of hulls (%)	٣٠,٣٠
Percentage of kernel (%)	٦٩,٧٠

The previous research showed considerable amount of protein isolate and protein concentrate of loofa seeds , which may substitute the animal protein, which cannot full fill the requirements of protein needed due to population expansion.

The yield of seeds from the fruit was ٣٣,٥ %, while the kernel was found to possess ٥٠% of the seed weight. The protein and fat contents of the kernel were ٣٩ % and ٤٤ %, respectively (Kamel and Blackman , ١٩٨٢).

Novel sources of protein such as cereals, vegetables, legumes and microorganisms, should be systematically evaluated for their potential as food nutrients (Mona *et al.,* ١٩٩١). Adequate amounts of protein are also vital for adolescents and adults (Whitney *et al.,* ١٩٩٨). Yang and Tsao (١٩٨١), reported that the seeds of loofa cylindrica contain ٧٦٪ protein , ١,٥ % sugar and ١٥,٨ % lipid.

Jaiswal *et al .,* (١٩٨٤), stated that all seeds were rich in essential amino acids and no toxic or unusual amino acid was detected.

On the other hand, Saad (١٩٩٨), reported that the loofa seeds were free from any type of toxic , but, the alkali solution at ٤٪ was used to remove the bitter taste from protein concentrate produced from the loofa seeds.

Accordingly to the same author, loofa seeds retain a suitably high protein content of relatively good quality. ٩٠٪ of protein content (isolate and concentrate) may offers an excellent supplement for many foods. The seeds of this plant may be adequately available in Egypt ; since the fruit is widely used for basing (as a sponge) contains a great number of seeds, which should be removed before selling.

The objective of this study is to evaluate loofa seeds and its protein concentrate and the effect of substitution with loofa seeds protein concentrate (L.S.P.C) on quality attribute, nutritive value and sensory acceptability for carrot jam.

MATERIALS AND METHODS

Materials

loofa *(Luffa aegyptiaca)* seeds were obtained from the Crops Institute Research, Agriculture Research Center, Ministry of Agriculture and Reclamation, Giza, Egypt.

Technological methods

Preparation of loofa seeds

The fruits of loofa were opened and the seeds were cleaned and the hulls were removed manually , and floating the remainder hulls in water followed by air drying, then packaged in polyethylene bags and maintain at room temperature till used.

Preparation of loofa seeds protein concentrate (L.S.P.C)

Whole Loofa seeds (ground meal) were soaked in hexane (١: ١,٥ meal: solvent w/v) for ٢٤ hr at room temperature. After defatted meal was prepared according to the method described by Baker *et al.,* (١٩٧٩) , about ٨٠ % protein was successive extractions.

Preparation of carrot jam

Carrot jam was prepared according to the method described by El-Gindy (١٩٨٢), removing the green parts of carrots, cut into small pieces, cooked with part of sugar and sufficient water. Cooking on low flame until sugar was dissolved; then (٢ g/ kg carrot) of citric acid was add and heating was continued for inspissations until the T.S.S. level was near ٦٨٪.The cooking was stopped when reached ٦٨٪ (T.S.S.). Loofa seeds protein concentrate (L.S.P.C) was added during jam cooking to replace ٥،١٠،١٥،٢٠ and ٢٥٪ levels from carrot fruit.

Analytical methods

Moisture, protein, fat, fiber and ash contents were determined according to the methods described in the AOAC (٢٠٠٣). The carbohydrates were calculated by differences. Caloric values were calculated as sum of multiplying protein and carbohydrates by ٤,٠ and fat by ٩,٠ (AOAC , ٢٠٠٣).

Individual amino acids were determined by using (LKB ٤١٥١) Amino Acid Analyzer (Alpha plus), according to the method described by Pellett and Young (١٩٨٠). Tryptophane, was determined colorimetrically after alkaline hydrolysis of loofa seeds and its protein concentrate according to the method of Blauth *et al.,* (١٩٦٣).

Nutritional value for prepared jam at levels; ٥،١٠،١٥،٢٠ and ٢٥ % of loofa seeds protein concentrate were evaluated according to (RDA ,١٩٨٩). Percent satisfaction of the daily requirement of adult man in protein or energy and essential amino acids (EAA) when consuming ١٥٠ g of jam products (P.S./١٥٠ %) were also calculated.

Amino acids scores (AS) were calculated according the formula reported by FAO/WHO/UNU (١٩٨٥) reference protein as follows:

A.S= EAA (g/١٦g N) of test protein / EAA (g/١٦g N) of the pattern

Essential amino acid index (EAAI) and biological value (B.V.) were calculated according to Oser (١٩٩٥). Also, protein efficiency ratios (PER) were calculated using by three equations as described by Alsmeyer *et al.,* (١٩٧٤) as follows:

PER ١ = ٠,٦٨٤ + ٠,٤٥٦ (Leucine) – ٠,٠٤٧ (Proline).

PER ٢ = ٠,٤٦٨ + ٠,٤٥٤ (Leucine) – ٠,١٥٠ (Tyrosine).

PER ٣ = ١,٨١٦ + ٠,٤٣٥ (Methionine) – ٠,٧٨٠ (Leucine) + ٠,٢١١ (Histidine) – ٠,٩٤٤ (Tyrosine).

The functional properties of the loofa seeds protein concentrate (L.S.P.C) were studied. In this concern nitrogen solubility index (NSI) of (LSPC) was determined according to the method described by Thompson *et al.* (١٩٨٢),whereas emulsion capacity (EC) and emulsion stability (ES) were determined according to the method of Marshall *et al.,* (١٩٧٥) , foaming capacity (FC) and foaming stability (FS) were determined by Dipak and Mukherjee (١٩٨٦) method. Water and oil absorption (WOA) and water oil absorption index(WOAI) were determined according to the method of Beuchat (١٩٧٧).

Sensory evaluation

Sensory was applied organoleptically by ten well-trained panelists, according to Watts *et al.,* (١٩٨٩). Analysis of variance were conducted in accordance with procedures described by Steel and Torrie (١٩٨٠).

Signification differences between treatments means were determined using Duncan's (١٩٨٥).

RESULTS AND DISCUSSION

Chemical composition of loofa seeds and its protein concentrate

Results in Table (٢) shows the change in chemical composition in loofa seeds and its protein concentrate.

Results revealed that the contents of protein , fat , ash, crude fiber and carbohydrates were ٣٢,٠٦،١٤,٧٧،١,٨٥, ٠,٩٤ and ٥٠,٣٨ % and ٧٤,٨٣, ٠,٨٧،١,٨٥،٠,٦٣ and ٢١,٨٢٪ (DWB) in loofa seeds and its protein concentrate, respectively.

Results, also indicate that , loofa seeds contain higher amounts of fat , fiber and carbohydrates than protein concentrate. These results showed higher energy value in loofa seeds compared with its protein concentrate, which were ٤٢٠,٢١ and ٣٦٧,٤١ k.cal./١٠٠g, respectively. This can be explained by the higher fat and carbohydrates.

The nutritional evaluation (GDR= grams consumed to meet the daily requirements of adult man in protein or energy) and (P.S./١٥٠ = percent satisfaction of the daily needs of adult man in protein or energy when consuming ١٥٠ g of the product.) for protein values consumed by adult man were ٢١٦ g ,٦٩% and ٩٠ g and ١٦٦% for loofa seeds and its protein concentrate, respectively.

Table ٢: Proximate composition of loofa seeds and its protein concentrate

Constituents (%)		Loofa seeds	Protein concentrate of loofa seeds
Moisture	WW	٩,١٨	٦,٨٥
	DW	----	----
Protein	WW	٢٩,١٢	٦٩,٧٠
	DW	٣٢,٠٦	٧٤,٨٣
Fat	WW	١٣,٤١	٠,٨١
	DW	١٤,٧٧	٠,٨٧
Ash	WW	١,٦٨	١,٧٢
	DW	١,٨٥	١,٨٥
Fiber	WW	٠,٨٥	٠,٥٩
	DW	٠,٩٤	٠,٦٣
Carbohydrates	WW	٤٥,٧٦	٢٠,٣٣
	DW	٥٠.٣٨	٢١,٨٢
Energy value (k.cal./١٠٠ g)	WW	٤٢٠,٢١	٣٦٧,٤١
	DW	-----	----
GDR for protein (g)	WW	٢١٦	٩٠
	DW	----	----
GDR for energy (g)	WW	٦٩٠	٧٨٩
	DW	----	----
P.S./ ١٥٠ for protein (%)	WW	٦٩	١٦٦
	DW	----	----
P.S./١٥٠ for energy (%)	WW	٢٢	١٩
	DW	----	----

W.W.: Wet weight basis. D.W.: Dry weight basis.
G.D.R.: grams consumed to meet the daily requirement of adult man in protein or energy.
P.S./١٥٠ : percent satisfaction of the daily needs of adult man in protein or energy when consuming ١٥٠ g of the product.

Amino acid composition of loofa seeds and its protein concentrate:

Results of the amino acids for loofa seeds and its protein concentrate are found in Tables (٣ and ٤), There were no noticeable changes found, since histidine recorded the lowest amino acid score (A.S) compared to other essential amino acids (E.A.A).

However, histidine content was higher with about ٢ times more than in case of FAO/WHO/UNU (١٩٨٥) reference. (A.S.) values were ١,٤٩ and ١,٤٨ for protein of loofa seeds and its protein concentrate, respectively, but were rich in phenylalanine+ tyrosine (A.S. = ٣,٩٨ and ٣,٨٥) , respectively.

Anyhow, the loss of protein quality during preparation of protein concentrates as indicated by (B.V.) calculation. (B.V.) for proteins of loofa seeds and its protein concentrate were ٧٠,٥٢ and ٦٢,٦٥ %, respectively. Also, it could be observed that the (EAAI) and (BV) for loofa seeds protein concentrate were decreased compared with loofa seeds, due to expected damage occurred in the essential amino acids during preparation.

Results in Table (٤) indicated the amino acids content of loofa seeds and its protein concentrate as (g /١٠٠ g sample). Also, in this table, GDR values for EAA were calculated. Thus, the protein concentrate caused to increase the nutritional value.

Table ٣: Amino acids content of loofa seeds and its protein concentrate

Amino acids content	FAO/WHO/UNU (١٩٨٥) reference	Loofa seeds		Protein concentrate of loofa seeds	
	g / ١٦ g N	g /١٦ g N	A.S	g /١٦g N	AS
Leucine	١,٩	٦,٥٠	٣,٤٢	٥,٩٧	٣,١٤
Isoleucine	١,٣	٤,٠٩	٣,١٥	٤,٠٥	٣,١٢
Lysine	١,٦	٣,٨٦	٢,٤١	٣,٦١	٢,٢٦
Methionine		١,٨٢		١,٧٣	
Cystine		١,٤٣		١,٣٨	
Phenylalanine		٤,٩٠		٤,٧٤	
Tyrosine		٢,٦٧		٢,٥٨	
Threonine	٠,٩	٣,١٩	٣,٥٤	٣,٠٢	٣,٣٦
Tryptophan	٠,٥	١,٥٥	٣,١٠	١,٥٠	٣,٠٠
Valine	١,٣	٤,٥٩	٣,٥٣	٤,٥١	٣,٤٧
Arginine		١٩,١٠		١٨,٨٥	
Histidine	١,٦	٢,٣٨	١,٤٩	٢,٣٧	١,٤٨
Alanine		٤,٥٦		٤,٠٣	
Glutamic		١٧,٢١		١٥,٣٩	
Glycine		٥,٤٣		٥,٣٢	
Aspartic		٨,٣٢		٨,١٣	
Proline		٥,٤٥		٥,٠٩	
Hydroxyproline		٠,٤٣		٠,٤٠	
Serine		٤,٣٥		٤,٢٩	
Methionine + cystine	١,٧	٤,٢٥	٢,٥٠	٣,١١	١,٨٣
Phenylalanine+ tyrosine	١,٩	٧,٥٧	٣,٩٨	٧,٣٢	٣,٨٥
EAAI		٧٥,٤٦		٦٨,٢٤	
B.V. %		٧٠,٥٢		٦٢,٦٥	
PER١		٢,٠٦		١,٨٤	
PER٢		٢,٢٠		١,٩٧	
PER٣		٢,٠٣		١,٦٦	

A.S = amino acid scores. **E.A.A.I.= essential amino acid index.**
B.V. = biological value. **P.E.R ١،٢،٣ = protein efficiency ratios.**

Table ٤: Amino acids content of loofa seeds and its protein concentrate (g /١٠٠ g sample).

Amino acids content	Daily requirement of man in (g)	Loofa seeds		Protein concentrate of loofa seeds	
		g / ١٠٠ g sample	G.D.R.* (g)	g / ١٠٠ g sample	G.D.R (g)
Leucine	١,١٩٧	١,٨٩	٦٣	٤,١٦	٢٩
Isoleucine	٠,٨١٩	١,١٩	٦٩	٢,٨٢	٢٩
Lysine	١,٠٠٨	١,١٢	٩٠	٢,٥٢	٤٠
Methionine		٠,٥٣		١,٢١	
Cystine		٠,٤٢		٠,٩٦	
Phenylalanine		١,٤٣		٣,٣٠	
Tyrosine		٠,٧٨		١,٨٠	
Threonine	٠,٥٦٧	٠,٩٣	٦١	٢,١٠	٢٧
Tryptophan	٠,٣١٥	٠,٤٥	٧٠	١,٠٥	٣٠
Valine	٠,٨١٩	١,٣٤	٦١	٣,١٤	٢٦
Arginine		٥,٥٦		١٣,١٤	
Histidine	١,٠٠٨	٠,٦٩	١٤٦	١,٦٥	٦١
Alanine		١,٣٣		٢,٨١	
Glutamic		٥,٠١		١٠,٧٣	
Glycine		١,٥٨		٣,٧١	
Aspartic		٢,٤٢		٥,٦٧	
Proline		١,٥٩		٣,٥٥	
Hydroxypeoline		٠,١٣		٠,٢٨	
Serine		١,٢٧		٢,٩٩	
Methionine + cystine	١,٠٧١	٠,٩٥	١١٣	٢,١٧	٤٩
Phenylalanine + tyrosine	١,١٩٧	٢,٣٠	٥٢	٥,١٠	٢٣

***G.D.R.: grams consumed to meet the daily requirements of adult man in individual essential amino acids.**

Also, the results showed that the (G.D.R) values were extremely less showing higher nutritional value of protein concentrate compared to that of seeds (Table ٤). From these results , it could be noticed that highest G.D.R. was found for histidine (١٤٦ g) for loofa seeds , while the lowest value was found for phenylalanine + tyrosine (٥٢ g). Also, from the same table , the G.D.R. for loofa seeds protein concentrate were decreased compared with loofa seeds.

Functional properties of protein in loofa seeds protein concentrate

The data of nitrogen solubility index (NSI) of the loofa seeds protein concentrate (L.S.P.C) as a function of pH are presented in Table (٥). When the pH value moved away from the iso-electric point at both sides, nitrogen solubility was increased. Results showed that a minimum solubility at pH ٤,٥ which might be the iso-electric point of protein in the loofa seeds protein concentrate (L.S.P.C). The solubility of protein was increased by rising or decreasing the pH value. The higher solubility of protein was noticed at pH ١,٥ (٢٧,٩٨) and at pH ٩,٠ was (٣٩,٠٩). These results are similar with Hussein (١٩٩٧), who found that at the same pH (٩,٠), fish wastes protein solubility was higher.

Results presented in Table (٥) indicated that, the water absorption (WA), oil absorption (OA) by ١٠٠g of (LSPC) , as well as, the calculated water/oil absorption index (WOAI) for loofa seeds protein concentrate (L.S.P.C). It could be observed that WA, OA and WOAI for (LSPC) were ٢٩٨,٢٣, ٩٠,٥٦ g/١٠٠g dry sample and ٣,٢٩ g water/ml oil , respectively.

The results in Table (٦) show the emulsion capacity (EC) and emulsion stability (ES) of the loofa seeds protein concentrate (L.S.P.C) as function of pH. The emulsion capacity ranged from (٦٥ – ٧٨ ml oil/g protein) at pH ٤,٥ and ٩,٠, respectively. The lowest (EC) was found at pH ٤,٥ ,while , the higher value was recorded at pH (٩,٠). Also, least (ES) was found at pH (٤,٥), while, higher ES value was found at pH (٩.٠).

Foaming capacity (FC) and foaming stability (FS)as function of pH presented in Table (٧). The results indicated that the (FC) value was higher at pH ١,٥, while, it was lower at pH ٤,٥. Also, foam stability (FS) of the loofa seeds protein concentrate (L.S.P.C) was lower at pH ٤,٥ recorded and highest values at pH ٩,٠.

Table ٥: Some physical characteristics of protein concentrate from loofa seeds (L.S.P.C.)

Indices	**pH values**					
	١,٥	**٣,٠**	**٤,٥**	**٦,٠**	**٧,٥**	**٩,٠**
(N.S.I.)*	٢٧,٩٨	٢٦,٢٠	٢٢,٧١	٢٣,٥٩	٢٤,٠٨	٣٩,٠٩
Treatments	**Water absorption (g H٢O/١٠٠ g dry sample)**		**Oil absorption (ml oil /١٠٠ g dry sample)**		**WOAI ** (g water/ml oil)**	
(L.S.P.C.)	٢٩٨,٢٣		٩٠,٥٦		٣,٢٩	

(N.S.I.)*: nitrogen solubility index
****WOAI =water /oil absorption index.**

Table ٦: Emulsion capacity (EC) and emulsion stability (ES) as a function of pH dispersed in ١ % of protein concentrate from loofa seeds (L.S.P.C.)

Values (pH)	**(EC) (ml oil / g protein)**	**(Emulsion stability, ES) Aqueous phase (cm^3) separated at room temperature (١٨°C) after time (hr)**							
		٠	**٠,٢٥**	**٠,٥٠**	**١,٠**	**٢,٠**	**٣,٠**	**٢٤,٠**	**٤٨,٠**
١,٥	٧٥	٠	٠	٠	٠	١٠	١٥	٣٥	٣٠
٣,٠	٧٤	٠	٠	٠	٠	١٠	١٠	٢٥	٢٥
٤,٥	٦٥	٠	٠	٠	٠	٩	٩	١٠	٢٠
٦.٠	٦٧	٠	٠	٠	٠	١٠	١٥	١٥	٢٥
٧,٥	٧٢	٠	٨	٨	١٦	١٨	١٨	٢٣	٦١
٩,٠	٧٨	٠	٨	١٢	١٣	١٨	٢٠	٢٥	٦٥

Table ٧: Foam capacity (FC) and foam stability (FS) as a function of pH dispersed in ١ % of protein concentrate from loofa seeds (L.S.P.C.).

Values (pH)	**(FC) volume inc. %**	**Foam stability (%) at room temperature after time (min.)**										
		٠	**٥**	**١٠**	**٢٠**	**٣٠**	**٤٠**	**٥٠**	**٦٠**	**٧٠**	**٩٠**	**١٢٠**
١,٥	٥٦٨	٧٩	٦٥	٥٢	٤٤	٤٢	٤٢	٣١	٢٥	٢٥	٢٥	٢٥
٣,٠	٢١٣	٦٨	٦٢	٥٣	٥١	٥١	٥٠	٥٠	٤٨	٤٥	٤٥	٤٥
٤,٥	١٢٣	٥٨	٤٧	٣٦	٣٦	٣٦	٢٧	٢١	١٩	١٩	١٧	١٧
٦,٠	١٥٣	٦٠	٤٩	٤٧	٤٦	٤٦	٣٨	٣٨	٣٦	٣٦	٣٦	٣٦
٧,٥	٢٤٨	٧٨	٧١	٦٨	٦٥	٦٣	٦٠	٥٦	٥٦	٥٦	٥٦	٥٦
٩,٠	٣٥٨	٩٢	٨٠	٧٥	٧٣	٧٣	٦٩	٦٦	٦٦	٦٥	٦٣	٦٢

These results of functional properties for protein were in agreement with Hussein (١٩٩٤), for tomato seeds protein.

Chemical composition of carrot jam enriched with different levels of protein concentrate from loofa seeds

The chemical composition of carrot jam enriched with different levels of loofa seeds protein concentrate (L.S.P.C) were shown in Table (٨).Results indicated that levels of loofa seeds protein concentrate (L.S.P.C) caused to increase the protein and decreased other constituents.

The moisture content decreased slightly in carrot jam due to the increasing level of loofa seeds protein concentrate (L.S.P.C). The initial protein content in control jam was ٥,٣٧ % (DWB) , which increased to ١٤,٥٣ and ١٦,٠٢ % (DWB) at level of ٢٠ and ٢٥ % loofa seeds protein concentrate (L.S.P.C), respectively.

Results in Table (٨),also showed that the fat content slightly decreased from ٣,١٥ to ٢,٤٦ % (DWB), whereas, energy values (k.cal./١٠٠g) increased from ٢٨٣,٧١ to ٣٠١,٦٩ k.cal./١٠٠g for control and enriched jam with ٢٥ % of loofa seeds protein concentrate , respectively.

Also, from the same Table (٨) ,it could be seen that by increasing the P.S./١٥٠ g for protein , the increment was ٢٩ % at ٢٥٪ loofa seeds protein concentrate (L.S.P.C) comparing with ٩٪ for control sample. On contrary, GDR value for protein decreased from ١٦٤٥ to ٥١٢ g , respectively.

Table ٨: Proximate chemical composition of carrot jam enriched with different levels of protein concentrate from loofa seeds (L.S.P.C.).

Samples (level of L.S.P.C.)		Chemical composition										
		Moisture %	Protein %	Fat %	Ash %	Fibers %	Carbohydrates %	Energy value (k.cal. / ١٠٠ gm)	GDR for protein g	GDR for energy g	P.S./١٥٠ for protein %	P.S./١٥٠ for energy %
Control	WW	٢٨,٦٤	٣,٨٣	٢,٢٥	٢,٦٣	١,١١	٦١,٥٤	٢٨٣,٧١	١٦٤٥	١٠٢٢	٩	١٤,٦٧
	DW	----	٥,٣٧	٣,١٥	٣,٦٩	١,٥٦	٨٦,٢٣	----	----	----	----	----
٥ %	WW	٢٧,٥٧	٥,١٢	٢,١٨	٢,٦٧	١,٠٨	٦١,٣٨	٢٨٥,٦٢	١٢٣٠	١٠١٥	١٢	١٤,٧٧
	DW	----	٧,٠٧	٣,٠١	٣,٦٩	١,٤٩	٨٤,٧٤	----	----	----	----	----
١٠ %	WW	٢٦,٤٨	٧,٤٢	٢,١١	٢,٦٤	١,٠٦	٦٠,٢٩	٢٨٩,٨٣	٨٤٩	١٠٠١	١٨	١٤,٩٩
	DW	----	١٠,٠٩	٢,٨٧	٣,٥٩	١,٤٤	٨٢,٠١	----	----	----	----	----
١٥ %	WW	٢٥,٣٩	٩,٧١	٢,٠٣	٢,٦٩	١,٠٣	٥٩,١٥	٢٩٣,٧١	٦٤٩	٩٨٧	٢٣	١٥,١٩
	DW	----	١٣,٠١	٢,٧٢	٣,٦١	١,٣٨	٧٩,٢٨	----	----	----	----	----
٢٠ %	WW	٢٤,٣٠	١١,٠٠	١,٩٦	٢,٧٢	١,٠١	٥٩,٠١	٢٩٧,٦٨	٥٧٣	٩٧٤	٢٦	١٥,٤٠
	DW	----	١٤,٥٣	٢,٥٩	٣,٥٩	١,٣٣	٧٧,٩٦	----	----	----	----	----
٢٥ %	WW	٢٣,٢١	١٢,٣٠	١,٨٩	٢,٧٥	٠,٩٨	٥٨,٨٧	٣٠١,٦٩	٥١٢	٩٦١	٢٩	١٥,٦٠
	DW	----	١٦,٠٢	٢,٤٦	٣,٥٨	١,٢٨	٧٦,٦٦	----	----	----	----	----

W.W.: Wet weight basis. D.W.: Dry weight basis.

G.D.R.: grams consumed to meet the daily requirement of adult man in protein or energy.

P.S./١٥٠ :percent satisfaction of the daily needs of adult man in protein or energy when consuming ١٥٠ g of the product.

Amino acids content in carrot jam enriched with different levels of protein concentrate from loofa seeds

Table (٩) show that with increasing levels of loofa seeds protein concentrate (L.S.P.C) in jam , amino acids such as, leucine, isoleucine, lysine, phenylalanine, tyrosine, therionine, tryptophane, valine and arginine were increased , while, the sulpher amino acids were low in loofa seeds protein concentrate (L.S.P.C),which caused decrease in some amino acids owing to different levels, such as, alanine, glutamic acid, glycine and aspartic acid. From these results, it could be observed that hydroxyproline was present in protein concentrate carrot jam samples ,while, it was absent in control sample, this because the connective tissue protein (of loofa seeds) is usually contained a little amount in hydroxyproline (and rich in proline), which was also reported by Askar *et al.* (١٩٨٢).

Values of amino acids score(A.S.) were less than two in control jam expressed as histidine and sulpher amino acids, this indicating that the jam less protein content than the amino acids in protein of FAO/WHO/UNU (١٩٨٥), reference. But ,the adding different levels of loofa seeds protein concentrate (L.S.P.C),(A.S) of protein was increased in carrot jam, except for tryptophane. On the other hand, calculated EAAI,BV and PER values were increased progressively with increasing the levels of loofa seeds protein concentrate as seen in Table (٩). Nevertheless, EAAI and BV in jam contained loofa seeds protein concentrate (L.S.P.C) were considerably higher than that in control sample (٥٥,٨٩ and ٤٩,١٩٪), respectively. Thus, our results indicated that the improvement of protein quality was occurred due to adding different levels of loofa seeds protein concentrate (L.S.P.C) ,which caused increasing for both EAAI and BV values.Also, from the results given in Table(١٠) show the amino acids composition of jams as (g/١٠٠g sample), it could be noticed that the percentage of loofa seeds protein concentrate (L.S.P.C) increased the essential amino acids content in prepared jams.

In addition, the results in Table (١٠) indicated that adding loofa seeds protein concentrate (L.S.P.C) increased nutritional value. Results also indicated that the daily requirements of histidine seems to be low in jams contained loofa seeds protein concentrate (L.S.P.C) compared with other essential amino acids. Also, it could be cleared that the P.S./١٥٠ values were low for control jam (١٠ – ٢٧٪), while, it was higher (٤٢ – ٩٩٪) for jams supplemented with ٢٥٪ of loofa seeds protein concentrate (L.S.P.C).

Conclusively, adding different levels of loofa seeds protein concentrate (L.S.P.C) to carrot jam caused to improve the nutritional and biological values of jams.

٩

١٠

Organoleptic evaluation of prepared carrot jam

Data presented in Table (١١) shows the average scores for aroma, taste, color, texture and overall acceptability. It is evident that the jam contained ٢٥٪ (L.S.P.C) recorded the lowest scores of overall acceptability. Also ,the lowest score of color and texture was recorded in jam contained ٢٥٪. On the other hand, a very good score for all characteristics were noticed in jam enriched with ٥،١٠ and ١٥٪ loofa seeds protein concentrate (L.S.P.C).

Therefore, jams enriched with ٥،١٠ and ١٥٪ of loofa seeds protein concentrate(L.S.P.C) added food quality attributes.

Conclusively, enriched carrot jam up to ١٥ % loofa seeds protein concentrate(L.S.P.C) was suitable for production of jams contained high amount of protein.

Table ١١: Organoleptic evaluation of carrot jam enriched with protein concentrate from loofa seeds (L.S.P.C.).

Characteristics	Level of L.S.P.C. (%)					
	Control	٥ %	١٠ %	١٥ %	٢٠ %	٢٥ %
Aroma	٩^{a}	٩^{a}	٩^{a}	٩^{a}	٩^{a}	٩^{a}
Taste	٩^{a}	٩^{a}	٩^{a}	٩^{a}	٩^{a}	٩^{a}
Color	٩^{a}	٩^{a}	٩^{a}	٩^{a}	٨^{ab}	٧^{b}
Texture	٩^{a}	٩^{a}	٩^{a}	٩^{a}	٨^{ab}	٧^{b}
Overall acceptability	٩^{a}	٩^{a}	٩^{a}	٩^{a}	٩^{a}	٨^{a}

Means under the same line bearing different superscript letters are different significantly (P < ٠,٠٥).

REFERENCES

Alsmeyer, H.R. Cunnigham, A.E. and Happich, M.L. (١٩٧٤) . Equation predict PER from amino acids analysis. Food Technology, July, p.٣٤ – ٤٠ .

AOAC (٢٠٠٣). Official Methods of Analysis. Association of official Analytical Chemistry. ١٦ th Ed.,Virginia, USA.

Askar ,A.; El-Dashloty,A.A. and Dessouki, T.M. (١٩٨٢). Proteins from unconventional seeds for use in meat products. Sonderduk aus., FIEISCHWIRTSCHAFT ., ٦٢ jahrgang, August – heft ٨ .

Baker,E.C. ; Mustakaf, G.C. and Warner, K.A.(١٩٧٩). Extraction of defatted soy bean flours and flakes with aqueous alcohols : Evaluation of flavor and selected properties. J. Agric. Food Chem., ٢٧ : ٩٦٩ – ٩٧٣.

Beuchat , L.R. (١٩٧٧) . Functional and electrophoretic characteristics of succinylated peanut flour protein . J. Agric. Food Chem. , ٢٥ : ٢٥٨.

Blauth, O.J. Chareinski , M. and Berlie , H. (١٩٦٣). A new rapid method for determining tryptophan . Anal. Biochem. ٦ : ٦٩ .

Dipak , K.D. and Mukherjee , K.D. (١٩٨٦) . Functional properties of rapeseed protein products with varying phytic acid contents . J. Food Chem., ٣٤: ٧٧٥ .

Duncan's, D.B. (١٩٨٥) . Multiple range and multiple F testes., Biometrics. ١١ : ١-٤٢.

El-Gindy, M.M. (١٩٨٢) . Food industries (part ٣) processing and preservation of foods. Dar El-Maarif, Cairo. (In Arabic) .

FAO/WHO/UNU (١٩٨٥). Energy and protein requirements, Report of joint FAO/WHO/UNU Expert Consultation , World Health Organization, Technical Report , Series ٧٢٤, WHO, Geneva.

Hussein, F.M (١٩٩٤).The utilization of some tomato processing wastes., M. Sc. Thesis, Institute of Environmental Studies and Researches, Ain Shams University.

Hussein ,S.A.(١٩٩٧). Chemical and Technological Studies on the Utilization of Some Fish Wastes. Ph.D. Thesis, Institute of Environmental Studies and Researches, Ain Shams University.

Jaiswal, S. ; Mehta, B.K. and Jain, S. (١٩٨٤). Protein bound amino acids of medicinally important plant seeds. Plants medicinal et phyto Therapie,١٨ (٤) : ٢٤٨ – ٢٥٤.

Kamel, B.S. and Blackman , B. (١٩٨٢). Nutritional and oil characteristics of the angled luffa. Food Chemistry , ٩ (٤), ٢٧٧-٢٨٢.

Marshall, W.H. ; Duston,T.R.; Carpenter, Z.I. and Smith, C. (١٩٧٥). A simple method of emulsion and point determination. J. Food Sci., ٤٠ : ٨٩٦.

Ministry of Agriculture and Land Reclamation (٢٠١٠). Agriculture Statics, vol. ٢, Ministry of Agriculture and Land Reclamation , Economic Sector , Egypt.

Mona, M.A. ;Bekheit,M.A. and Aly,M.H.(١٩٩١). The utilization of chlorogenic acid free sunflower protein isolate in baking short- breads. Egypt J. Food Sci.,vol.١٩, No.١-٢. PP. ٦٩ – ٨٤.

Oser, B.L. (١٩٩٥). An Integrated Essential Amino Acid Index for Predicting the Biological Value of Protein and Amino Acid Nutrition, Ed. A.A. Albanese, Academic Press, New York.

Pellett, P.L. and Young, V.R. (١٩٨٠) . Nutritional Evaluation of Protein Foods. Food and Nutrition Bulletin, Supplemental, Published by the United Nations University .

RDA (١٩٨٩). Recommended Dietary Allowances , Food and Nutrition Board , National Academy of Sciences , National Research Council , USA.

Saad, M.F. El- Din (١٩٩٨). Isolated protein prepared of loofa (*Luffa aegyptiaca*) as used in some meat products . M.Sc. Thesis, Faculty of Home Economics, Minufiya University .

Steel, E.G. and Torrie, J.H. (١٩٨٠). Principles and Procedures of Statistics . ٢nd Ed. , McGraw Hill Book Co. Inc., New York .

Thompson , L.U. , Liu, F.K. and Jones , J.D (١٩٨٢) . Functional properties and applications of rapeseed protein concentrate . J. Food Sci. , ٤٧ : ١١٧٥ .

Watts, B.M , Yamaki, G.L. , Jeffery , L.E. and Elias, L.G. (١٩٨٩) . Basic Sensory Methods for Food Evaluation., ١st Ed. , The International Development Research Center Pub. , Ottawa, Canada .

Whitney,E.N .; Cataldo,C.B. and Rolfes,S.R.(١٩٩٨). Understanding Normal and Clinical Nutrition , ٣ th Ed., West Publishing Company, St. Paul, New York , Loss Anglos, San Francisco.

Yang, Z.H. and Tsao, T.H. (١٩٨١). Physico-chemical properties of pollen wall proteins of loofa cylindrica. Phytomorphology, ١٣ (٣١٤) : ٢٣١ – ٢٣٩.

خصائص الجودة لمربى الجزر المدعمة بمركز بروتين بذور اللوف

فاطمة حسن المصري، سـعد ميخائيل يوسف و محمد الأمين محمد موسى

معهد بحوث تكنولوجيا الأغذية – مركز البحوث الزراعية – الجيزة – مصر

تم تجهيز مركز بروتين من بذور اللوف واستخدامه بنسب ٥ ، ١٠ ، ١٥ ، ٢٠ ، ٢٥ % لتدعيم مربى الجزر المصنعة بهدف إنتاج مربى غنية بالبروتين وعالية القيمة الغذائية.

ولذلك فقد تم دراسة التركيب الكيميائي لبذور اللوف والمركز ألبروتيني منها. وأوضحت النتائج المتحصل عليها أن بذور اللوف والمركز ألبروتيني منها احتوت علي كميات كبيرة من البروتين حيث كانت ٣٢,٠٦ و ٧٤,٨٣ % (علي أساس الوزن الجاف)، علي التوالي.

بالإضافة إلى ذلك تم حساب كل من دليل الأحماض الأمينية الأساسية والقيمة البيولوجية للبروتين وكفاءة الاستفادة من البروتين ومقارنتهما بالاحتياجات الدولية من قبل منظمة الصحة العالمية ومنظمة الأغذية والزراعة (١٩٨٥). كذلك تم تقييم الخواص الوظيفية للبروتين في مركز بروتين بذور اللوف.

وأيضا تم دراسة التركيب الكيميائي لعينات المربى التي تم إعدادها ،حيث أظهرت النتائج انه بزيادة نسبة الإحلال بمركز بروتين بذور اللوف أدى إلى زيادة نسبة البروتين ، بينما انخفضت نسب كل من الدهون والكربوهيدرات ، مع ملاحظة ارتفاع في مقدار الطاقة الحرارية (ك. كالورى /١٠٠ جرام) .

هذا وقد وجد أنه بزيادة نسب إضافة المركز ألبروتيني لبذور اللوف من ٥ – ٢٥ % قد أدى إلى زيادة تركيز الأحماض الأمينية الأساسية وخاصة الأحماض الأمينية الكبريتية.

وأوضحت نتائج التقييم الحسي للمربى المدعمة بمستويات مختلفة من مركز بروتين بذور اللوف حصولها على معدلات عالية للتقييم الحسي من حيث خصائص الجودة ودرجة التفضيل العالية.

قام بتحكيم البحث

أ.د / محمد طه شلبى — **كلية الزراعة – جامعة المنصورة**
أ.د / حسين كمال الدين المنواتى — **مركز البحوث الزراعية**

Table ١٠: Amino acids content of carrot jam (g/١٠٠g sample) enriched with different levels of protein concentrate from loofa seeds (L.S.P.C).

Amino acids content	Daily requirement of man in g	level of L.S.P.C. (%)																		
		Control			٥%			١٠%			١٥%			٢٠%			٢٥%		
		g/١٠٠g sample	GDR	P.S./ ١٥٠	g/١٠٠g sample	GDR	P.S./ ١٥٠	g/١٠٠g sample	GDR	P.S./ ١٥٠	g/١٠٠g sample	GDR	P.S./ ١٥٠	g/١٠٠g sample	GDR	P.S./ ١٥٠	g/١٠٠g sample	GDR	P.S./ ١٥٠
Leucine	١,١٩٧	٠,١٨	٦٦٥	٢٣	٠,٢٨	٤٢٨	٣٥	٠,٤١	٢٩٢	٥١	٠,٥٥	٢١٨	٦٩	٠,٦٣	١٩٠	٧٩	٠,٧٢	١٦٦	٩٠
Isoleucine	٠,٨١٩	٠,١٥	٥٤٦	٢٧	٠,٢٠	٤١٠	٣٧	٠,٣٠	٢٧٣	٥٥	٠,٣٩	٢١٠	٧١	٠,٤٤	١٨٦	٨١	٠,٥٠	١٦٤	٩٢
Lysine	١,٠٠٨	٠,١١	٩١٦	١٦	٠,١٧	٥٩٣	٢٥	٠,٢٥	٤٠٣	٣٧	٠,٣٤	٢٩٦	٥١	٠,٣٨	٢٦٥	٥٧	٠,٤٣	٢٣٤	٦٤
Methionine		٠,٠٦			٠,٠٨			٠,١٢			٠,١٦			٠,١٩			٠,٢١		
Cystine		٠,٠٥			٠,٠٧			٠,١٠			٠,١٣			٠,١٥			٠,١٧		
Phenylalanine		٠,١٤			٠,٢١			٠,٣٢			٠,٤٣			٠,٥٠			٠,٥٦		
Tyrosine		٠,٠٧			٠,١١			٠,١٨			٠,٢٤			٠,٢٧			٠,٣١		
Threonine	٠,٥٦٧	٠,١٠	٥٦٧	٢٦	٠,١٥	٣٧٨	٤٠	٠,٢٢	٢٥٨	٥٨	٠,٢٩	١٩٦	٧٧	٠,٣٣	١٧٢	٨٧	٠,٣٧	١٥٣	٩٨
Tryptophan	٠,٣١٥	٠,٠٤	٧٨٨	١٩	٠,٠٦	٥٢٥	٢٩	٠,١٠	٣١٥	٤٨	٠,١٤	٢٢٥	٦٧	٠,١٦	١٩٧	٧٦	٠,١٨	١٧٥	٨٦
Valine	٠,٨١٩	٠,١٥	٥٤٦	٢٧	٠,٢١	٣٩٠	٣٨	٠,٣٢	٢٥٦	٥٩	٠,٤٢	١٩٥	٧٧	٠,٤٨	١٧١	٨٨	٠,٥٤	١٥٢	٩٩
Arginine		٠,٣٠			٠,٦٨			١,١٣			١,٥٧			١,٨٦			١,٧٦		
Histidine	١,٠٠٨	٠,٠٧	١٤٤٠	١٠	٠,١١	٩١٦	١٦	٠,١٦	٦٣٠	٢٤	٠,٢٢	٤٥٨	٣٣	٠,٢٥	٤٠٣	٣٧	٠,٢٨	٣٦٠	٤٢
Alanine		٠,٢٨			٠.٢٩			٠,٥٣			٠,٤٧			٠,٥١			٠,٥٥		
Glutamic		٠,٩٦			١,٠٤			١,٣٨			١,٧٢			١,٨٨			٢,٠٦		
Glycine		٠,٢٦			٠,٣١			٠,٤٣			٠,٥٥			٠,٦١			٠,٦٨		
Aspartic		٠,٥٨			٠,٦٠			٠,٩٧			٠,٩٥			١,٠٣			١,١٢		
Proline		٠,١٤			٠,٢٢			٠,٣٤			٠,٤٦			٠,٥٣			٠,٦٠		
Hydroxyproline		----			٠,٠٠٢			٠,٠٠٤			٠,٠٠٦			٠,٠٠٩			٠,٠١		
Serine		٠,١٦			٠,٢٢			٠,٣٢			٠,٤١			٠,٤٧			٠,٥٣		
Methionine + cystine	١,٠٧١	٠,١١	٩٧٤	١٥	٠,١٥	٧١٤	٢١	٠,٢٢	٤٨٧	٣١	٠,٢٩	٣٦٩	٤١	٠,٣٤	٣١٥	٤٨	٠,٣٨	٢٨٢	٥٣
Phenylalanine+ tyrosine	١,١٩٧	٠,٢١	٥٧٠	٢٦	٠,٣٣	٣٦٣	٤١	٠,٥٠	٢٣٩	٦٣	٠,٦٧	١٧٩	٨٤	٠,٧٧	١٥٥	٩٦	٠,٨٧	١٣٨	١٠٩

G.D.R.: grams consumed to meet the daily requirement of adult man in individual essential amino acids..

P.S./١٥٠ :percent satisfaction of the daily needs of adult man in individual essential amino acids when consuming ١٥٠ g of the product.

Table ٩ : Amino acids content of carrot jam enriched with different levels of protein concentrate from loofa seeds (L.S.P.C.).

Amino acids content	FAO/WHO/ UNU (١٩٨٥) reference g / ١٦ g N	level of L.S.P.C. (%)											
		Control		٥٪		١٠٪		١٥٪		٢٠٪		٢٥٪	
		g/١٦ g N	A.S.	g/١٦ g N	A.S.	g/١٦ g N	A.S.	g/١٦ g N	A.S.	g/١٦ g N	A.S.	g/١٦ g N	A.S.
Leucine	١,٩	٤,٧٩	٢,٥٢	٥,٣٧	٢,٨٣	٥,٥٨	٢,٩٤	٥,٦٩	٢,٩٩	٥,٧٦	٣,٠٣	٥,٨١	٣,٠٦
Isoleucine	١,٣	٣,٩٣	٣,٠٢	٣,٩٩	٣,٠٧	٤.٠١	٣,٠٨	٤,٠٢	٣.٠٩	٤,٠٣	٣,١٠	٤,٠٣	٣,١٠
Lysine	١,٦	٢,٩٦	١,٨٥	٣,٢٨	٢,٠٥	٣,٤٠	٢,١٣	٣,٤٥	٢,١٦	٣,٤٩	٢,١٨	٣,٥٢	٢,٢٠
Methionine		١,٤٥		١,٥٩		١,٦٤		١,٦٦		١,٦٨		١,٦٩	
Cystine		١,٢٠		١,٢٩		١,٣٢		١,٣٤		١,٣٥		١,٣٦	
Phenylalanine		٣,٥٧		٤,١٤		٤,٣٥		٤,٤٦		٤,٥٣		٤,٥٨	
Tyrosine		١,٩٠		٢,٢٣		٢,٣٦		٢,٤٢		٢,٤٦		٢,٤٩	
Threonine	٠,٩	٢,٧٢	٣,٠٢	٢,٨٧	٣,١٩	٢,٩٢	٣,٢٤	٢,٩٥	٣,٢٨	٢,٩٧	٣,٣٠	٢,٩٨	٣,٣١
Tryptophan	٠,٥	١,٠٣	٢,٠٦	١,٢٦	٢,٥٢	١,٣٥	٢,٧٠	١,٣٩	٢,٧٨	١,٤٢	٢,٨٤	١,٤٣	٢,٨٦
Valine	١,٣	٣,٧٩	٢,٩٢	٤,١٤	٣,١٨	٤,٢٧	٣,٢٨	٤,٣٤	٣,٣٤	٤,٣٨	٣,٣٧	٤,٤١	٣,٣٩
Arginine		٧,٨١		١٣,٢٢		١٥,٢١		١٦,٢٠		١٦,٨٦		١٧,٣٠	
Histidine	١,٦	١,٨٦	١,١٦	٢,١١	١,٣٢	٢,٢٠	١,٣٨	٢,٢٥	١,٤١	٢,٢٨	١,٤٣	٢,٣٠	١,٤٤
Alanine		٧,٢٠		٥,٦٥		٧,٠٨		٤,٧٩		٤,٦٠		٤,٤٧	
Glutamic		٢٥,٠٣		٢٠,٣١		١٨,٥٧		١٧,٧٠		١٧,١٣		١٦,٧٤	
Glycine		٦,٧٢		٦,٠٣		٥,٧٨		٥,٦٦		٥,٥٧		٥,٥٢	
Aspartic		١٥,١٠		١١,٦٨		١٣,١١		٩,٨٠		٩,٣٨		٩,١١	
Proline		٣,٧٢		٤,٣٩		٤,٦٤		٤,٧٦		٤,٨٤		٤,٩٠	
Hydroxproline		----		٠,٠٣		٠,٠٥		٠,٠٦		٠,٠٨		٠,١١	
Serine		٤,١٤		٤,٢١		٤,٢٤		٤,٢٥		٤,٢٦		٤,٢٧	
Methionine + cystine	١,٧	٢,٦٥	١,٥٦	٢,٨٨	١,٦٩	٢,٩٦	١,٧٤	٣,٠٠	١,٧٦	٣,٠٣	١,٧٨	٣,٠٥	١,٧٩
Phenylalanine + tyrosine	١,٩	٥,٤٧	٢,٨٨	٦,٣٨	٣,٣٦	٦,٧١	٣,٥٣	٦,٨٨	٣,٦٢	٦,٩٩	٣,٦٨	٧,٠٦	٣,٧٢
EAAI		٥٥,٨٩		٦٢,٠٤		٦٤,٢٦		٦٥,٣٦		٦٦,١١		٦٦,٥٥	
B.V. %		٤٩,١٩		٥٥,٨٩		٥٨,٣١		٥٩,٥١		٦٠,٣٣		٦٠,٨١	
PER_1		١,٣٦		١,٥٩		١,٦٨		١,٧٢		١,٧٥		١,٧٧	
PER_2		١,٥١		١,٧٤		١,٨٢		١,٨٦		١,٨٩		١,٩١	
PER_3		١,١٥		١,٤٠		١,٤٩		١,٥٣		١,٥٧		١,٥٩	

A.S = amino acid scores. E.A.A.I.= essential amino acid index.
B.V. = biological value. P.E.R ١،٢،٣ = protein efficiency ratios.