PROTEIN, AMINO ACIDS AND CARBOHYDRATE CONTENTS OF SOME EGYPTIAN CUCURBITACEAE SEEDS

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المحتوى البروتينى والأحماض الأمينية والكربوهيدرات لبعض أصناف العائلة القرعية المصرية

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ملخص البحث

وجد أن بذور البطيخ والشمام والقرع واللوف تحتوى على ٢٨,٢ و ٢٧,١ و ٢٢,٥ و ٣٣,٩٪ بروتين على التوالى ٠

وقد وجد أن البروتين المستخلص من كسب بذور البطيخ والقرع واللوف تحتوى على ١٦ حامض أمينى بينما يحتوى البروتين المستخلص من كسب بذور الشمام على ١٥ حامض أمينى فيما عدا البروتين ، ووجد أن نسبة الأحماض الأمينية الأساسية فى بذور البطيخ والشمام والقرع واللوف كانت ٣٣,٣٦ و ٣٩,٥٧ و ٣٦,٣٥ و ٣٩,٣٤ (جرام حامض أمينى لكل ١٦ جرام نتروجين) على التوالى ٠

ولقد درس المحتوى من السكريات المختزلة ووجد أن أعلى نسبة كانت فى بذور البطيخ حيث كانت ٥,٥٤٪ بينما كانت أقلها فى بذور القرع حيث كانت ٠,٣٩٪ كما وجد أن بذور القرع تحتوى على أقل محتوى من الكربوهيدرات الكلية ٠

ABSTRACT

Watermelon, Sweetmelon, fluted Pumpkin and Luffa cylindrica seed meals were found to contain 28.2, 27.1, 22.5 and 33.9% protein respectively. The protein hydrolyzate of the defated meals of the above seeds showed the presence of sixteen amino acids with the exception of sweetmelon meal hydrolyzate, whereas proline was not detected in such protein hydrolyzate. The total essential amino acids (gm/16 gm nitrogen) were 33.36, 39.57, 36.35 and 39.34% in the protein hydrolyzate of watermelon, sweetmelon, fluted Pumpkin and Luffa cylindrica respectively.

The electrophoretic patterns of protein from the above cultivars were studied.

The reducing sugars were 5.54%, 3.56%, 0.80% and 0.39% in watermelon, sweetmelon, luffa cylindrica and fluted pumpkin respectively, the non reducing sugars were 1.26%, 1.97%, 4.15% and 3.99% at the same order. Fluted pumpkin contained the lowest content of total carbohydrates 11.66%.

INTRODUCTION

The acute shortage of protein, especially in the developing countries, necisitate the investigation for other possible sources of such vital diet. Van Etten et al. (1967) reported that seed protein from a number of species have a better pattern of essential amino acids than many crop seed sources.

Since several plants of ground family Cucurbitaceae i.e. watermelon, sweetmelon, luffa cylindrica and fluted pumpkin are widely cultivated in Egypt, yet, considerable quantities of seeds could be produced as wastes during consumption and manufacturing as reported by Khalafalla (1971). Oyenuga and Fetuga (1975) reported that the residual protein produced from defated meal of watermelon seeds fried into protein rich cake known locally in Nigeria as Igbolo. Stafford and Oke (1977) and Stafford et al. (1978) mentioned that the defated meal of watermelon contained 21% protein, the seed cake showed high

digestability and gave high protein efficiency ratio (2.40) almost similar to casien (2.50). In this connection O'Kennedy et al. (1979) indicated that the defated meals of the seeds of watermelon, sweetmelon, fluted pumpkin and luffa cylindrica showed that the protein contents were 27%, 28%, 23% and 32% respectively. Also Nwokolo and Sim (1987) stated that fluted pumpkin seed meal contained 23.28% protein and it has excellent nutritional qualities.

Joshi and Shrivastava (1978) stated that luffa cylindrica seeds contained 19 amino acids with high level of essential amino acids except tryptophan was as a traces.

Bhatangar et al. (1981) indicated that watermelon and weetmelon seeds contained all of the essential amino acids except tryptophan, they added that such seeds can be suggested to be as cheap and good source of protein.

Kamel and Dawson (1985) showed the presence of 17 amino acids in watermelon seeds including nine of the essential amino acids of which arginine was the major.

Joshi and Shrivastava (1978) stated that n-hexane extracted meal of luffa cylindrica seed contained 4.2% carbohydrates.

Boratov (1981) reported that watermelon seed contained total sugars ranged from 7.60-9.06% depending on the kind.

In the present work concerning four plants of the family cucurbitaceae which are widely cultivated in Egypt were investigated as a new cheap source of protein.

MATERIALS AND METHODS

The seeds of watermelon (citrullus vulgaris), sweetmelon (cucumus melo), pumpkin (cucurbita maxima) and luffa (luffa cylindrica) were

obtained from Gharbia Governorate.

The whole seeds were ground to pass through 60 mesh sieve. Such ground seeds were defated by soaking in n-hexane at room-temperature for 72 hrs. The defated meals were air dried to get ride of the solvent, whereas the moisture and ash contents were determined according to A.O.A.C. (1980). The total protein contents was determined according to the modified micro-Kjeldahl method as described by A.O.A.C. (1980).

Amino acids profiles were determined using LKB amino aicd analyzer (AAA) as one gram amino acids/16 gram nitrogen.

Polyacrylamide gel electrophoresis was carried out addopting the procedure of Ogita and Markert (1979) using 8% gel. The experiments were done in 0.0125 M tris-glycine buffer of pH 8.3 at constant current rate of 2.5 mA per tube for 3.5 hrs. The gels were stained with 0.5% amido black in 7.5% acetic acid for 1 hr. and destained in 10% acetic acid.

Total soluble sugars were determined colorimeterically according to Dubis et al. (1956). Reducing sugars were determined as outlined by A.O.A.C. (1980). Non reducing sugars were calculated by the difference. The total carbohydrates were determined after complete hydrolysis according to Dubis et al. (1956).

RESULTS AND DISCUSSION

The composition of watermelon, sweetmelon, fluted pumpkin and luffa cylindrica seeds are presented in Table (1). It can be deduced that the seeds of luffa cylindrica showed the highest ash contents (3.85%) comparable with the other cultivars under investigation. Whereas sweetmelon and watermelon revealed the lowest ash 2.27% and 2.50% respectively. It is worthy to indicate that Kamel and Dawson (1985) stated that ash content of watermelon seed was 2.6%.

Table (1): Ash, protein and total carbohydrates of the investigated seed meals.

Sample	Ash %	Protein %	Total carbohydrates %
Watermelon	2.50	28.2	25.30
Sweetmelon	2.27	27.1	24.26
Fluted pumpkin	2.86	22.5	11.66
Luffa cylindrica	3.85	33.9	20.64

The protein contents of the defated meals of watermelon, sweetmelon, fluted pumpkin and luffa cylindrica were 28.2, 27.1, 22.5 and 33.9% respectively. It is note worhtly to mention that O'Kennedy et al. (1979) stated that the defated meals of watermelon, sweetmelon, fluted pumpkin and luff cylindrica revealed the presence of 27%, 28%, 23% and 32% protein respectively. Whereas Nwokolo and Sim (1987) indicated that fluted pumpkin contained 23.28% protein. It could be noticed that such slight variations may be due to varietal and other environmental conditions.

The total carbohydrates of watermelon, sweetmelon, fluted pumpkin and luffa cylindrica were 23.30%, 24.26%, 11.66% and 20.64% respectively. Watermelon meal showed the highest contents of total carbohydrates 25.30% whereas fluted pumpkin represented the lowest content 11.66%.

The quantitative analysis of the protein hydrolyzates of the above meals revelaed the presence of sixteen amino acids of which nine essential amino acids were detected Table (2). Bhatnagar et al. (1981) indicated that the meals of watermelon and sweetmelon contained all the essential amino acids except tryptophan. Joshi

Table (2): Amino acids composition of the protein hydrolyzates of the investigated samples. (gram/16 gram nitrogen).

Amino acid		water-melon	sweet-melon	fluted pumpking	luffa cylindrica	soybean Braddock, R.J. & Kesterson, J.W. (1972)
Aspartic		11.34	10.17	10.75	11.09	11.70
Thereonine	*	3.08	3.19	3.61	7.55	3.86
Serine		6.13	6.62	5.72	8.56	5.12
Glutamic		15.99	16.41	18.81	10.69	18.17
Proline		6.79	---	4.44	1.92	5.49
Glycine		7.93	6.60	6.31	6.57	4.18
Alamine		6.62	8.22	4.63	7.63	4.26
Valine	*	3.09	3.32	3.09	5.40	4.80
Methionine	*	0.52	1.18	0.41	3.64	1.27
Isoleucine	*	2.44	5.35	3.85	3.75	4.55
Leucine	*	4.27	5.15	5.24	5.10	7.78
Tyrosine		2.25	2.96	3.46	4.51	3.14
Phenylalanine	*	3.53	3.33	3.73	3.31	4.95
Histidine	*	2.42	3.29	2.45	2.45	2.53
Lysine	*	3.21	3.39	3.62	1.58	6.39
Arginine	*	10.80	11.37	10.35	6.53	7.32
Total essential amino acid(EAA)		33.36	39.57	36.35	39.34	43.45
Total non essen. amino acid(NEAA)		57.05	50.98	54.12	50.97	52.06
EAA/NEAA ratios		0.58	0.78	0.67	0.77	0.83

* = essential amino acid.

and Shrivastava (1978) added that luffa cylindrica and luffa acutangula seed contained high level of the essential amino acids.

Aspartic, glutamic and arginine constituted the major amino acids in protein hydrolyzates of watermelon, sweetmelon and fluted pumpkin. Whereas luffa showed the lowest content of arginine. The protein hydrolyzates of sweetmelon and luffa represented the highest contents of EAA 39.57 gm and 39.34 gm respectively. While the lowest content was noticed in the watermelon protein, however the watermelon showed the highest contents of NEAA. The protein hydrolyzates of the investigated cultivars could be arranged descendingly according to their contents of EAA as follows: sweetmelon > luffa cylindrica > fluted pumpkin > watermelon. Similar trend was also acheived when EAA/NEAA ratios were considered.

It is of interest to mention that the amino acid methionine in luffa protein hydrolyzate was seven fold that of watermelon and three fold that of sweetmelon, while it was about nine fold that of fluted pumpkin.

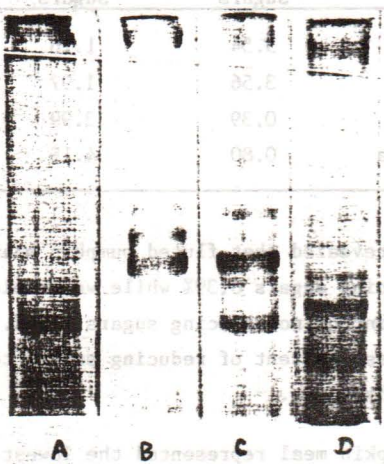

Fig. (1): Electrophoretic patterns of proteins produced from:
(A) Luffa seed. (B) Sweetmelon seed.
(C) Pumpkin seed (D) Watermelon seed.

The electrophoretic patterns of proteins produced from the formentioned cultivars are presented in Fig. (1) from which it could be observed that watermelon and fluted pumpkin showed 6 bands with different relative mobilities, while sweetmelon and luffa showed 4 bands with different relative mobilities. Such results were in agreement with results reported by O'Kennedy et al. (1979).

The carbohydrate contents of the investigated seeds are shown in Table (3).

Table (3): The percentages of the carbohydrate fractions of the seed meals produced from the cultivars under investigation (dry weight).

Seed samples	carbohydrates %			
	soluble sugars %			Total carbohydrates
	reducing sugars	non reducing sugars	total soluble sugars	
Watermelon	5.54	1.26	6.90	25.30
Sweetmelon	3.56	1.97	5.53	24.26
Fluted pumpkin	0.39	3.99	4.38	11.66
Luffa cylindrica	0.80	4.15	4.95	20.64

Such data revealed that fluted pumpkin meal contained the lowest content of reducing sugars 0.39% while watermelon meal respresented the lowest content of nonreducing sugars 1.26%. However, such meal showed the highest content of reducing sugar, total soluble sugars and total carbohydrates.

Fluted pumpkin meal represented the lowest contents of both total soluble sugars and total carbohydrates.

REFERENCES

A.O.A.C. (1980). Official methods of analysis. Association of official Agriculture chemists. Washington, D.C. USA.

Bhatnagar, R.; M.R. Chowdhary and S.P. Garg (1981). Protein and amino acid composition of certain plants of cucurbetaceae. J. Ind. Chem. Soc. Vol. VIII, 932-933.

Boratov, K.B. (1981). Chemical composition of melon crops. Gig sanit (1), 75-76. C.F. Chem. Abst. Vol. 94: 101612 x.

Braddock, R.J. and J.W. Kesterson (1972). Amino acid of citrus seed meal. J.A.O.C.S. 49, 671.

Dubis, M.; A. Gilles; J.K. Hamilton; P.A. Rebers and T. Smith (1956). A colorimetric method for determination of sugar and related substances. Anal. Chem. 28. 350.

Joshi, S.S. and R.K. Shrivastava (1978). Amino acid composition of luffa cylindrica and luffa acutangula seeds. J. Inst. Chem. (India). 50(2): 73-74.

Kamel, B.S. and H. Dawson (1985). Characteristics and composition of melon and grape seed oil and cakes. J.A.O.C.S. Vol. 62, No. 5: 881-883.

Khalafalla,A.M. (1971). Microbial and Chemical studies on watermelon. M.Sc. Thesis, Fac. of Agric.,Cairo Univ., Egypt.

Nwokolo, E. and J.S. Sim (1987). Nutritional assessment of defatted oil meal of melo colocynthis citrullus and fluted pumpkin by chick assay. J. Sci. Food Agric. Soc. of Chem. Indus. 237-246.

Ogita, Z.I. and C.L. Markert (1979). A miniaturized system for electrophoresis on polyacrylamide gels. Analytical Biochemistry. 99: 233-241.

O'Kennedy, B.T.; C.C. Reilly; G.S. Titus and W.E. Splittstoesser (1979). A comparison of the storage protein of eight species of cucurbitaceae. Cand. J. Bot. 57: 2044-2049.

Oyenuga, O.G. and B.L. Fetuga (1975). Some aspects of the biochemistry and nutritive value of the watermelon citrullus vulgaris Schard. J. Soc. Food Agric. 26: 843-844.

Staffoard, W.L. and O.L. Oke (1977). Protein isolate from lesser known oil seeds. Nutr. Rep. Int. 16(6): 813-820.

Staffoard, W.L.; I.B. Umoh; E.O. Ayelogen and O.L. Oke (1978). Lesser known seeds nutritive value of protein isolates. Nutr. Rep. Int. 18(1): 69-78.

Van Etten, C.H.; W.F. Kwolek; J.E. Peters and A.S. Barchay (1967). Seeds as protein sources for food and feed. Evaluation bases on amino acid composition of 379 species. J. Agric. Food Chem. Vol. 15, No. 6: 1077-1089.