The Major Chemical Constituents and the Amino Acid Make-up of Protein in Naked Pumpkin Seed Cake (*Cucurbita pepo*).

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ABSTRACT

The dried meal obtained from the solvent extraction of roasted, ground naked pumpkin seeds was chemically analysed for the major constituents. The meal was rich in protein (55.60%), poor in lipids (0.24%) and relatively low in moisture and crude fiber (8.01% and 7.02%, respectively). Determination of the amino acid composition of the meal protein hydrolyzate indicated the predominance of both amino acids, Arginine and Glutamic acid. Nutritionally, the meal is deficient in both Lysine and Threonine while it contained a reasonable sum of Methionine plus Cystine. However, Tryptophane was presented in an amount exceeding that required in a balanced protein.

INTRODUCTION

The naked pumpkin seeds (*Cucurbita pepo*) i.e., fruit seeds naturally occuring without testae, obtained from ripe pumpkins grown in Libya on experimental basis were tested for their oil content and its fatty acids composition (11). Results obtained also showed that the seeds were rich in proteins (11) like many of the other industrial oil seeds such as soybean, cottonseed and peanuts. No doubt that the extraction of the oil from such seeds results in meals containing high percentages of protein. Today, several oil seed meals are in use as protein supplements in animal and poultry rations (1,3,4, 7,15). Meanwhile, many attempts are in progress in several countries to evaluate the incorporation of some oil seed meals rich in proteins of high biological value for human consumption (8,10,14,19). In addition, the use of such meals in mixes with other protein sources may save and reduce the amount of valuable animal protein which is becoming in short supply, (2,23).

Samples of the naked pumpkin seed meal obtained from the earlier study (11) were analyzed to determine their major constituents and their amino acid profile for possible utilization as a protein supplement.

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MATERIALS AND METHODS

Pumpkin seed meal

The 'Cucurbita pepo' seeds without testae used in this investigation were obtained from the Vegetable Crops Division, Secretariat of Agriculture, Tripoli. The seeds were partially roasted, finely ground and the oil was extracted using Folch *et al.* method (12), as described earlier (11). The oil-extracted residue was air-dried and will be referred to, in this study, as the 'meal'. The meal was stored in an air-tight glass container and held in a freezer until analyzed.

Moisture determination

The moisture content of the meal samples was determined using a vacuum-drying oven at 75°C according to AOAC. (5).

Crude fiber

The total crude fiber content of the meal was determined after digestion with 0.255 *N* H_2SO_4 followed by digestion with 0.313 *N*NaOH according to the procedure outlined in the AOAC. (5).

Total ash

Ashing was carried out at 525°C till constant weight was obtained according to the method described in the AOAC. (5).

Residual oil content

Any remaining lipids in the meal previously extracted with a cold solvent mixture were extracted with diethyl ether using Soxhlet extraction units for four hours.

Crude protein

Total nitrogen in the meal samples was determined by micro-Kjeldahl method as described by Hawk *et al.* (13). Results were reported as crude protein using 6.25 as a factor for calculation.

Amino acid composition of meal protein

Several techniques were used for the preparation of protein hydrolyzate (17,20,21,22). Amino acids were determined in the hydrolyzates by an automatic amino acid analyzer. Correction factors were used in the case of isoleucine, valine, threonine and serine to compensate for either incomplete hydrolysis or partial destruction during acid hydrolysis (20,21). Results obtained for threonine and serine from samples hydrolyzed for 22 hours using 6 *N* HCL were corrected using 1.05 and 1.10, respectively as correction factors. The quantities of isoleucine and valine in the protein were approximated by multiplying results obtained by 1.07 in both cases.

RESULTS AND DISCUSSION

The meal samples of the naked pumpkin seeds used in this investigation were the residue of the partially roasted, ground seeds cold extracted with chloroform-methanol mixture and air-dried. The meal had a light gray colour and an acceptable natural odor.

Data presented in Table 1, show the average values of the major chemical constituents in the tested meal. The low values of 8.01% for moisture and 0.24% for lipids may increase the storage period of such a meal as a high quality feed. The crude fiber content of the meal which averaged 7.42% was comparatively lower than that found in other oil seed meals such as linseed, cottonseed and peanuts (18). Such a meal with low fiber content may be considered a more desirable feed for non-rumenants and poultry. The average quantities of ash and N.F.E. were 8.63% and 20.10%, respectively.

The protein content of the meal which averaged 55.60% is significantly higher than most oil-seed meals including those mentioned earlier (9,18). Such a meal with a high content of protein and a relatively small quantity of fibers should be considered in the preparation of special diets and protein rich foods other than from animal sources such as in the case of the development of meat analogues made from soybean protein (19).

The amino acid composition of the solvent extracted, roasted naked pumpkin seed meal was determined qualitatively and quantitatively using an amino acid analyzer (Table 2). The most predominant amino acids present in the tested meal samples were glutamic acid (18.3%), and arginine (14.9%). In this respect the pumpkin seed meal showed great similarity with both corn and soybean oil meals (18). On the other hand, the quantities of both lysine and threonine present in the pumpkin seed meal were below the minimum nutritional requirements being similar in that respect to peanut meal which exhibits deficiency in lysine, threonine in addition to methionine (7). Since cystine can partially replace methionine in foods the combined quantities in the pumpkin seed meal (3.7%) provide a reasonable amount of sulfur-containing amino acids. Compared with other oil seed meals, the meal under investigation showed a higher content of the essential amino acid, tryptophane (Table 2). As any other plant protein, and because of the essential amino acid make-up of the tested meal protein, in addition to the need for a balanced ratio among essential amino acids to provide a protein of high biological value, such a meal must be mixed with other plant proteins or supplemented with necessary amino acids.

From the favourable results obtained from this investigation with respect to both the chemical composition and the nutritional value of the naked pumpkin seed meal it is suggested that further studies should be carried out to evaluate the economical aspects of seed and meal production. In addition, the safety of the meal with respect to the presence of any toxic substances in the final product should also be investigated both in vivo and in vitro before considering its use as a feed supplement or for the production of protein isolates for human consumption. Although there are several oil seed meals available in the market today, their future use for livestock and humans will depend on

Table 1 Major chemical constituents of naked pumpkin seeds (Cucurbita pepo) meal.

Constituent	Amount, %[a]
Moisture	8.01
Protein	55.60
Lipids	0.24
N. F. E.	20.10[b]
Crude fiber	7.42
Ash	8.63

[a]Average of three replicates
[b]Estimated by difference

Table 2 Amino acid composition of the protein content of naked pumpkin seed meal.

Amino acid	Amount, %[a]
Leucine	6.9
Isoleucine	4.0
Lysine	4.4
Methionine	2.2
Cystine	1.5
Phenylalanine	4.9
Tyrosine	3.5
Threonine	3.0
Tryptophan	1.6
Valine	5.1
Arginine	14.9
Histidine	2.6
Alanine	4.6
Aspartic acid	8.5
Glutamic acid	18.3
Glycine	5.3
Proline	3.5
Serine	5.2

[a]Average of three replicates.

the development of reliable procedures for detoxification (7). The naked pumpkin seed meal may be added to the other meals which are as yet almost untapped for human consumption.

ACKNOWLEDGEMENT

The author is grateful to Dr. M. Monir, Department of Vegetable Crops, Ministry of Agriculture, Tripoli for providing the naked pumpkin seed samples used in this study.

Thanks are also due to Professor C. Angel, Director of the Central Institute for Nutritional and Food Research, TNO, Holland and his colleagues for their valuable assistance.

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المكونات الكيماوية الأساسية والأحماض الأمينية فى البروتين الموجود فى مخلفات استخلاص الزيت من بذور القرع العسلى الخالية من الغلاف الخارجى

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المستخلص

ان مخلفات بذور القرع العسلى (كسب) المعدة من أجل هذه الدراسة قد تم الحصول عليها من البذور الخالية من الغلاف الخارجى كنوع جديد لثمار القرع العسلى التامة النضج وذلك بعد تحميصها وسحقها واستخلاص الزيت منها بالمذيبات العضوية على درجة حرارة الغرفة ٠

حللت عينات الكسب كيمائيا لتقدير المكونات الاساسية من بروتين ومواد كربوهيدراتية ودهون ورماد وألياف بالاضافة الى محتوياتها من الرطوبة ٠ كذلك قدرت الأحماض الأمينية فى بروتين الكسب وصفيا وكميا ودلت النتائج المتحصل عليها من هذه الدراسة أن هذه العينات من الكسب تحتوى كمية ضئيلة جدا من الزيت ونسبة منخفضة نوعا من الماء مما قد يجعله صالحا للتخزين لفترة طويلة من الزمن دون تلف بالاضافة الى ارتفاع نسبة ما به من مواد بروتينية تصل نسبتها الى حوالى ٥٦ ٪ ٠ ومن مزايا هذا الكسب أيضا اذا قورن بمخلفات الكثير من البذور الزيتية بانخفاض محتوياته من الالياف الخام مما يجعله غذاء ملائما للحيوانات وخاصة ذات المعدة الواحدة والدواجن ٠

يحتوى بروتين هذا الكسب على نسبة عالية من كل من الحمضين الأمينيين « أرجنين » ، « جلوتاميك » واذا قيم هذا البروتين آخذين فى الاعتبار نسب مكوناته من الأحماض الأمينية المختلفة لوجدنا أن به كمية وفيرة من « التربتوفان » وكميات كافية من كل من « المثايونين » ، « السستين » معا ولكنه يفتقر فى كل من « الليسين » ، « الثريونين » ٠

يمكن خلط هذا الكسب مع أنواع أخرى من مواد العلف النباتية لتكوين عليقة متزنة بالنسبه للمحتوى البروتينى لها وبالنسبه للمكونات الأخرى فيه أو يمكن أن يقوى هذا الكسب على حدة ببعض الأحماض الأمينية لتعويض ما ينقصه منها ٠ بالاضافة الى أن انخفاض نسبه الألياف لهذا الكسب وارتفاع نسبة البروتين به قد تجعله مادة خام صالحة للدراسة واستخدامه فى تحضير بعض الأغذية البروتينية الصالحة للاستهلاك الآدمى ٠