



Physicochemical aspects of pumpkin seeds cake protein concentrate

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Abstract

The protein concentrate prepared from pumpkin seeds cake was evaluated. Proximate composition, *In vitro*-protein digestibility, tannins content, minerals content, water and fat absorption capacity were determined. The results of protein content, *In vitro*-protein digestibility and tannins content were found to be (45.68%), (81.57%) and (0.35%), respectively. The results obtained revealed that the pumpkin seeds cake protein concentrate was found to be rich in minerals especially Na, K and Fe.

Keywords: pumpkin seeds cake, protein concentrate, *In vitro*-protein digestibility

Introduction

Pumpkin is a member of the *Cucurbitaceae* family and has received considerable attention in recent years because of the nutritional and health protective values such as anti-tumor, anti-bacterial, anti-hypertensive (Caili *et al.*, 2007) [5].

The seeds of pumpkin are generally considered to be agro-industrial wastes. As the conversion of byproducts - especially pumpkin seeds- into value added ingredients is being one of the big challenges, therefore, food technologists and producers alike showing great interest regarding their valuable nutrition content for consumers health and beneficial effects on food industry. The constant fact reflects that the developing countries faces shortage in supply of animal protein to meet the protein needs of the rapidly growing population. The insufficient and continuous demands of animal protein have necessitated contemporary research efforts geared towards the study of the food properties and potential utilization of protein from locally available food crops, especially from underutilized or relatively neglected high protein oilseeds and legumes (Enujiugha, 2000) [9]. Technically, great efforts have been made to promote the utilization of seeds cake protein, for instance, enhancement the use of composite flours in which flour from locally grown high protein oilseeds and legumes replace a portion of wheat flour for production of high protein composite bakery products (UNECA, 1985) [18]. In some parts of the world, the seeds are consumed raw, roasted or cooked, but only at the domestic scale. Value addition to existing foods with such ingredients benefits is a simple and feasible way of enhancing nutritional values of foods and in turn the health. In Sudan, the estimation of fruits and vegetables production in season 2016 was 3593.708 (1000MT). Meanwhile, production of zucchini and pumpkins was 40.621(1000MT) (AOAD, 2016) [3]. Although, Sudanese people have known the cultivation of pumpkin for many decades and they planted different cultivars in assorted areas, a limit numbers of products-based pumpkin, excepting jam were manufactured (Abdelgadir *et al.*, 2019) [1]. Taking into account the limitation of the information regarding to the quality evaluation and deep processing of pumpkin seeds cake protein, thus, this study aims to pave the road for incorporation of pumpkin seeds cake protein concentrate as by product in different food

recipes. Additionally, it shed light on nutritive value and quality aspects of seeds cake protein hopefully assist in mitigate malnutrition and food insecurity, above all supporting public health impact on the whole community.

Materials and Methods

Materials

Seeds of pumpkin were obtained from a local market at *Khartoum Bahri*, Sudan.

Preparation method

Pumpkin seeds were cleaned and freed from foreign materials then; the oil was removed using cold extraction method. The protein concentrate was prepared using distilled water and centrifugation to remove the hells then dried using air drying method and kept in refrigerator for further analysis. Chemicals used in this study were of analytical grade and provided by Food Chemistry and Nutrition Department, National Food Research Center (NFRC).

Analytical Methods

Proximate Composition

Proximate analysis of food is the determination of the major components of food which includes moisture, lipids (fats), ash, protein, fibre, and carbohydrate calculated by deference. These methods are however not in any way perfect but act as guide for empirical estimations. Procedures recommended by (AOAC, 2000) [2] were used for the analyses.

Protein Digestibility

The *in vitro*-protein digestibility of the samples was carried out according to Monjula *et al.*, (1991) [15] method. A known weight of the sample containing 16mg nitrogen was taken in triplicate and digested with 1mg pepsin in 15 ml of 0.1 M HCl at (37°C) for 2 hours. The reaction was stopped by the addition of 15ml of 10% trichloro-acetic acid (TCA). The mixture was then filtered quantitatively through Whatman No. 1 filter paper. The TCA soluble fraction was assayed for nitrogen using the micro-kjeldahl method. Digestibility was calculated using the following equation:

$$\text{Protein digestibility (\%)} = \frac{\text{N in supernatant} - \text{blank N}}{\text{N X100}}$$

N in sample

Tannins Content

Tannic acid was determined by the method described by Ranganna (1986) [16]. Colorimetric estimation of tannic acid is based on the measurement of the blue color formed by the reduction of molybdic acid by tannin like materials in alkaline solution. Standard solutions: - {A} Folin and Dennis Reagent: - Sodium tungstate (100 g) was added to 750 ml distilled water followed by 20g phosphomolybdic acid. Then 50 ml of 85% of acid were added and the mixture was refluxed for 2 hours, cooled to 25° C made up to volume in a 1000 ml volumetric flask. {B} Standard anhydrous sodium bicarbonate: Anhydrous sodium bicarbonate (350g) was dissolved in 750 ml distilled water, heated at 70-80C° and cooled overnight then completed to one liter; the solution was filtered before use. {c} Tannic acid standard solution: Tannic acid (0.1 g) was dissolved in 1L distilled water, prepared freshly for each determination {0.1mg/ml}. Tannic acid standard curve: Standard tannic acid solution (0-10 ml) was pipetted into a series of 100 ml volumetric flasks containing 75 ml distilled water. To each flask was added 5 ml of Folin and Dennis reagent and 10 ml of anhydrous sodium bicarbonate then made up to volume in a 100ml volumetric flask, mixed well and left for 30 minutes then read in, spectrophotometer (JENWAY-6400 spectrophotometer) at 760 nm. Test sample preparation: Sample (1g) was added to 40 ml water boiled for 30 minutes then transferred to a 100 ml volumetric flask, completed to volume, well shaken and filtered.

Calculation Tannic acid = mg tannic acid × dilution

MI Taken for (color development) × W × 1000

W=Weight of Sample

MI = standard tannic acid from curve

Total Minerals Determination

Minerals were extracted from the samples by the dry ashing method as described by Chapman and Pratt (1961) [4] using Atomic Absorption Spectroscopy (Perkin-Elmer 2380).

Water and Fat Absorption Capacity

Water Absorption Capacity (WAC) of the samples was measured by the centrifugation method of Sosulski (1962) [17]. Fat Absorption Capacity (FAC) of the defatted samples was measured using the method described by Lin *et al.*, (1974) [14].

Statistical Analysis

Statistical analysis was performed using Statistical Package for Social Science software version 16.0 (SPSS Inc., Chicago, USA). All experiments were presented in triplicate for mean values with the standard deviation.

Results and Discussion

As shown in Table.1, the results of the proximate composition of pumpkin seeds cake protein concentrate (PSCP) reflect that the (PSCP) has moisture content of 9.06% which is comparatively higher than 5.47% and 6.03% as reported by Hamed (2006) [11] and El- Gharabawi (1977), respectively. Since the ash content of the sample plays as mineral content indicator therefore, pumpkin seeds are

expected to be rich in minerals. Ash content was found to be 8.09% which is close to the findings of seed cake of naked pumpkin seeds 8.63% as reported by El- Gharabawi (1978). On the other hand, oil content was found to be 3.07%. Although the cake was extracted with hexane (cold extraction), oil was not removed completely. Regarding fibre content, it was found to be 3.93% which is very cognate to the result of 3.74% reported by Kamel *et al.*, (1982) [13]. In addition, protein content was found to be 45.68%. The obtained result was inconformity with that of Giami *et al.*, (2005) who reported 45.90% and lower than 65.05% reported by Hamed (2006) [11]. The differences in proximate composition could be attributed to the variation between seeds and growing location of the cultivars. According to the findings illustrated in Table.1, the carbohydrate (%) of pumpkin seeds cake protein (PSCP) was found to be 30.1%.

Table 1: Proximate composition (%) of pumpkin seeds cake protein concentrate

Moisture	Protein	Oil	Fibre	Ash	Carbohydrates
9.06	45.68	3.07	3.93	8.09	30.10
±0.25	±0.02	±0.08	±0.05	±0.02	±0.28

Mean ± standard deviation (n=3)

The results of in vitro protein digestibility and tannins content of pumpkin seeds cake protein (PSCP) were presented in Table.2, the in vitro protein digestibility was found to be 81.57%. The value obtained was lower than 90% reported by El- Adaway and Taha (2001) [6] for pumpkin kernel flour; these differences may be due to (PSCP) preparation method or the variation of the varieties and the content of the anti-nutritional factors in the seeds.

Tannins are phenolics polymers which bind with protein through hydrogen bonding with peptide linkages, precipitate protein and rendering plant protein relatively indigestible and reducing or inhibiting enzymes activity. The tannins content of (PSCP) was found to be 0.35% which is higher than (0.17g/100) reported by El- Adaway and Taha (2001) [6] for pumpkin seed kernel.

Table 2: In vitro-protein digestibility (%) and tannins content (mg/100g) of pumpkin seeds cake protein concentrate

In vitro-protein digestibility	Tannins content
81.57	0.35
±0.02	±0.01

Mean ± standard deviation (n=3)

As presented in Table.3 the potassium (K) content of (PSCP) was found to be 844.86mg/100g which is lower than 982mg/100g stated by El- Adaway and Taha (2001) [6], WHO recommends an increase in potassium intake from food to reduce blood pressure and risk of cardiovascular disease, recommended daily intake of potassium for adults 3510 mg/day (WHO 2009). Moreover, the iron (Fe) content of (PSCP) was found to be (24.431mg/100g) which is high compared with the results of pumpkin seeds flour 23.97mg/100g reported by Hamed (2006) [11] and 10.97mg/100g reported by El- Adaway and Taha (2001) [6]. The recommended daily intake of iron for men (Over 18 years) and women (Between 19 and 50 years) are (8mg) and (18mg), respectively (Joann and Bo Lonnerdal, 2012). This finding strongly supports the utilization of (PSCP) for the supplementation of foods allocated for targeting groups for

instance, babies suffering of iron deficiency. On the other hand, the results of Mg, Ca, K and Cu were found to be (122.22mg/100g), (239.36mg/100g), (844.86 mg/100g) and (19.40 mg/100g), respectively.

Table 3: *Minerals concentration (mg/100g) of pumpkin seeds cake protein concentrate

Mg	Ca	Na	K	Fe	Cu
122.22	239.36	866.70	844.86	24.431	19.40

*Values represent the mean

Based on the data presented in Table.4, Water Absorption Capacity (WAC) of the (PSCP) was found to be 189 ml/100g which is lower than 250ml/100g stated by El- Adaway and Taha (2001) ^[6], while Fat Absorption Capacity (FAC) of (PSCP) was found to be 108ml/100g which is lower than 180.7ml/ 100g reported by Hamed (2006) ^[11].

Table 4: Water Absorption Capacity (WAC) and Fat Absorption Capacity (FAC) of pumpkin seeds cake protein concentrate

Water Absorption Capacity	Fat Absorption Capacity
1.89	1.08
±0.04	±0.17

Mean ± standard deviation (n=3)

Conclusion

In view of the results recorded in this study, production and physico-chemical aspects evaluation of pumpkin seeds cake protein concentrate were achieved successfully. As pumpkin seeds cake protein concentrate revealed promising results in terms of protein content, protein digestibility and minerals content, it could represent the base for upcoming deep research attempts, as well as it could shift the attention towards natural resources in Sudan that shall play effectual role in realizing various food security interventions.

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