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BIOCHEMICAL STUDIES ON DEOILED NIGER-SEED CAKE OF OOTAKMOND VARIETY

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Niger Seeds of 'Ootakmond' variety, and its cake have been evaluated for their potentiality as the protein source in human diet. Petroleum ether and hexane, mixture (1:3) was found suitable for deoiling of the seeds, crude protein and carbohydrate in the seeds were 27.8 and 20.9%, respectively. Electrophoretic analysis showed maximum extraction of seed proteins in water. Out of 16 amino acids present in niger seed, 15 were found in its cake and seven of these were essential amino acids.

Keywords: Amino acid profile; Biochemical aspects; Deoiled cake; Heat treated;Niger seeds.

Introduction

In the present context of population exploision and protein crisis[1], seed cake protein has an edge over the conventional proteins as food and feed in developing nations[2]. Niger seed proteins can be used as cheaper protein source. Although the niger seed, particularly the 'Ootakmond' variety, is grown widely in India, little is known about, its Physio-chemical and biochemical properties[3,4].

In the present investigation, various properties of niger seeds of 'Ootakmond' variety and its cake have been studied to evaluate their potential as a protein source in diet.

Materials and Methods

Seed and oil extraction: The niger seeds of 'Ootakmond' variety were obtained from Agriculture Research Farm, Chindwara of Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur (M.P.). The seeds were deoiled by solvent extraction method using petroleum-ether and hexane in different ratios (1:1, 3:1, 1:3). The recovery of oil was measured at different time intervals.

Preparation of deoiled cake: Seeds were ground to a fine powder in an electric grinder and oil was extracted by soxhlet extraction, using petroleum ether (60-80°C). The deoiled sample, thus obtained, served as untreated deoiled niger cake. For preparation of heat treated deoiled niger cake, the deoiled seed powder was incubated at 100°C for 12 hours and then the sample was cooled in a dessicator. Approximately 100 g deoiled cake was autoclaved at 121°C for 15 min to obtain autoclaved deoiled niger cake.

Analytical method: Moisture, oil, protein, fat, total ash and crude fibre contents in niger seed were determined by AOAC methods[5]. Polyphenols were measured by the method[6] using gallic acid as standard. Phytic acid content was determined by the method of Davies and Reid[7] and for analysis

of polypeptides, sodium dodecyl sulphate polyacrylamide gel electrophoresis was done, using 7.5% gel. For amino acid analysis, the protein samples were hydrolysed at 120°C for 17 h in hydrochloric acid fumes, neutralized by 2:2:1 (v/v) mixture of ethanol water and triphenyl amine, before evaporating to dryness. It was then treated with a mixture of ethanol: water: triethylene amine: phenyl isocynate (7:1:1:1(v/v) to make amino acid derivatives and then was evaporated to dryness. To it was added 200 µl of pico tag sample diluent and 50 µl of it was injected in the automatic amino acid analyser.

Results and Discussion

Extraction of oil from niger seed : A combination of petroleum ether and hexane 1:3 resulted in the maximum recovery of oil content (62.3% by weight) after 24 h steeping Nasirullah *et al.*[4] found 30-32.4% oil in many varieties of niger seed upon extraction with hexane. Dunn and Hilditch[8] used petroleum ether for extraction and found 35% oil in niger seeds.

Properties of Niger seeds: Different physical and chemical values of niger seeds of 'Ootakmond' variety were relatively higher than those previously reported values[9]. The mositure content in niger seeds was 3.62% by weight, as comapred to the range of 1.7 to 4.2% reported by other workers[6,10,11]. The crude protein contents in the niger seed was 27.5%, the values similar to the earlier observations[11-13] and Uppal[14] have reported that the protein content in niger seed of 'Ootakmond' variety varied between 22.3 to 40% and Nasirullah *et al*[4] have linked it to the locality.The total ash content was 4.7% Sharma and Mishra[15] also found 4.54% ash in the same variety of niger. The total crude fibre content was 7.9% , which was lower, than the values reported earlier[15,16]. The fat content in the niger seed was 36.12% which was higher than the previously reported value[17]. The carbohydrate content was 20.18%. Niger seed contained 59.2, 8.4 and 5.9% carbon, nitrogen and hydrogen respectively, while there were 44.4, 6.3 and 5.8% carbon, nitrogen and hydrogen respectively in doiled niger cake. The decrease in carbon and hydrogen content in deoiled sample can be attributed to removal of fatty acids from the seeds.

Free polyphenol and phytic acid content of deoiled niger cake was 0.26% and 12.6 mg/g,respectively. These levels are considerably lower than those in chickpea, black gram and other legumes[18,19]. Heat treatment and autoclaving of the cake resulting in negligible decrease 10.24 - 10.25% free polyphenols and12.2 to 12.3 mg/g phytic acid in the quantity of these antinutritional factors, thereby indicating their high resistance to temperature.

Protein pattern in deoiled niger cake: Electrophotic separation of proteins, extracted from autoclaved and heat treated niger seeds by different solvents, revelaed that the maximum of four proteins were extracted by water, followed by three protein in 1 M NaCl and 1 M NaOH extracts. Only one protein band was observed in ethanol fraction. The protein pattern in heat treated and autoclaved niger seed was similar. The poor resolution of protein in the alkali fraction may be due to the denaturation of proteins at high alkaline pH[14]. Water fraction yielded higher proteins.

Table 1. Amino acid composition of protein in Niger seed and its deoiled cake.

Amino Acid	Niger Seed Protein			Deoiled Cake Protein .		
	Amount ng/ml	Relative fraction	Amount %	Amount ng/ml	Relative fraction	Level %
Aspartic Acid	314.9	0.4	8.1	395.2	0.4	7.5
Glutamic Acid	585.5	0.4	15.0	825.3	0.4	15.8
Serine	190.2	0.4	4.8	251.0	0.4	4.8
Glycine	324.6	0.3	8.3	411.1	0.3	7.8
Histidine	94.2	0.4	2.4	119.6	0.4	2.2
Arginine	126.2	0.2	3.2	172.6	0.2	3.3
Threonine	584.4	0.1	15.0	791.4	0.1	15.1
Alanine	233.6	0.4	6.0	348.9	0.4	6.6
Proline	146.0	0.2	3.7	211.0	0.2	4.0
Valine	367.1	0.6	9.4	515.5	0.6	9.8
Methionine	9.1	0.4	0.2	45.2	0.3	0.8
Cystine	6.2	0.7	0.1	-	-	-
Ilanine	254.1	0.5	6.5	321.2	0.5	6.1
Leucin	287.7	0.4	7.4	362.6	0.4	6.9
Phenylalanine	200.8	0.4	5.1	238.9	0.4	4.5
Lysine	126.8	0.2	3.2	190.2	0.2	3.6
Total	3886.8			5222.7		

Table 1 depicts amino acid composition of proteins from niger seed and deoiled niger cake. A total of 16 amino acids were recorded in niger seed, whereas 15 amino acids were found in niger cake. The amount of these amino acids varied between 0.16% to 15.06% in seed and 0.86 to 15.8% in cake. In niger seeds, cystine was found to be present in the lowest amount, whereas it was absent in the niger cake proteins. The niger seed proteins contain seven essential amino acids, five semi dispensable and four dispensable amino acids. The amino acid composition of niger seed has been reported[20]. It is stressed that valine and sulphur containing amino acids are the limiting amino acids. The richness of niger seed cake of 'Ootakmond' variety in essential amino acids could contribute substantially to human diet.

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