

IN VITRO AND IN VIVO EVALUATION OF PROTEIN DIGESTIBILITY OF DEOILED NIGER CAKE (OOTAKMOND VARIETY) UNDER DIFFERENT HEAT TREATMENTS

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Protein digestibility of deoiled niger seed cake of Ootakmond variety in untreated, heat treated and autoclaved samples was observed *in vitro* and *in vivo*. Casein protein (control) yielded maximum weight gain and maximum digestibility followed by heat treated, autoclaved and untreated seed cake. Whereas, seed cake consumption was maximum in autoclaved sample followed by heat treated, untreated deoiled niger seed cake and casein protein.

Keywords : Protein digestibility; *In Vivo*; *In Vitro*; Untreated; Heat treated; Autoclaved.

Introduction

Among various methods for the evaluation of protein digestibility, *in vitro* method proved very useful, being its rapidity and sensitivity. Specially in the cases where feeds are being processed in large quantities and animal feeding trials to assess the processing effects are tedious, expensive and incapable of detecting small differences¹. However, to assess *in vivo* protein digestibility, the simplest and most convenient method of measuring the nutritive value of proteins is the protein efficiency ratio (gain in weight in g/g protein consumed). Practically none of the animal bioassay method is appropriate for testing protein quality of foods². Before its consumption in human beings, the feeding material is tested with experimental albino rats for this purpose³.

Materials and Methods

Seeds of Ootakmond variety were obtained from Chhindwada outstation research farm of J.N.K.V.V., Jabalpur. To

observe the impact of heat on protein digestibility of seed and cake, 250 g seeds were ground to powder and oil was removed through soxhlet extractor employing petroleum ether between 60-80°C⁴. Thus obtained sample served as untreated cake. Fifty gm of this cake was kept in an oven at 100°C for 12 hours and then cooled and served as heat treated cake. Whereas, 50 g of untreated sample cake was autoclaved at 121°C at 15 lbs/sq inch pressure for 15 minutes, cooled in a desiccator, and served as autoclaved sample cake. These samples were used for studies of protein digestibility *in vitro* and *in vivo*.

The method of Akesson and Stahmann⁵ as modified by Singh and Jamnathan⁶ was employed for evaluation of *in vitro* digestibility of protein. For *in vivo* studies "Protein efficiency ratio" method⁷ based on the growth promoting value of a protein on a diet; containing adequate amounts of other nutrients was

followed. The nutritive value of a protein is expressed as the ratio of gain in body weight (g) to the protein consumed (g) in a given time. The modified P.E.R. method⁸ was employed during investigation.

Results and Discussion

In vitro protein digestibility of niger seed and its cake, with and without heat treatments was recorded and compared with casein protein. The values for the niger seed, untreated deoiled niger cake, heat treated deoiled cake and autoclaved deoiled niger cake and casein were found 61.3%, 69.8%, 74.2%, 73.7% and 94.5%, respectively.

Variation in protein digestibility of niger seed cake may be due to the presence of antinutritional factors. Leaching out of antinutrients, such as polyphenols and phytic acid during defatting by petroleum ether may account for improved protein digestibility value of deoiled niger cake. The protein digestibility of heat treated sample was maximum. The increase in digestibility may be due to denaturation of phytic acid in dry heating. Similar results have also been reported by several workers⁹⁻¹¹ in different legumes. Impact of heat on functional properties of Ootakmond variety of niger has previously been reported¹².

Untreated, heat treated and autoclaved deoiled niger cake samples were incorporated separately in the albino rats rations as a replacement of casein protein at 10% protein level (Table

1). The average body weight of albino rats fed on different diets during the experimental period of 28 days. Their weight gain for casein diet, untreated, heat treated, and autoclaved deoiled niger cake diet was 31.8, 26.2, 20.2 and 18.6 g, respectively. The total feed consumption for casein diet, untreated, heat treated and autoclaved deoiled niger cake diet was 129.2, 155.1, 156.4 and 159.7 g, respectively. The rats fed on autoclaved diet had a maximum feed intake because autoclaving enhanced flavour of cake which ultimately improved palatability of the meal. The P.E.R. of casein diet, untreated, heat treated and autoclaved deoiled niger cake diet was found 2.46, 1.61, 1.27 and 1.20, respectively. Results of the present study are in accordance with earlier workers¹³⁻¹⁵.

It was noticed that in the earlier stage of the experimental period, the rats gained more weight, though in the advanced period increase in body weight was very less in all the experimental diets. This might be because of the age factor as the rats in the early age have better appetite and digestion and thus initially gain more weight, the capacity lowers down with advancement in the age. Throughout the experimental period of 28 days, rats fed on heat treated diets were alert, healthy and cheerful. While in autoclaved diet, the rats had dull appearance and were slightly sluggish, in the case of untreated diet the rats were weak and very sluggish, their diet consumption was

Table 1. Diet composition

Content	I	II	III	IV
	Controlled group	Heat treated deoiled niger cake	Autoclaved deoiled niger cake	Untreated deoiled niger cake
Casein	10.5 g	-	-	-
Untreated deoiled niger cake	-	-	-	27.5 g
Heat treated deoiled niger cake	-	27.5 g	-	-
Autoclaved deoiled niger cake	-	-	27.5 g	-
Groundnut oil	10 ml	10 ml	10 ml	10 ml
Sugar	10 g	10 g	10 g	10 g
Starch	65.5 g	48.5 g	48.5 g	48.5 g
Vitamin Mineral Mix	4 g	4 g	4 g	4 g
Total	100 g	100 g	100 g	100 g

also low throughout the experimental period. Thus it could be concluded that heat processing improves digestibility of proteins in both *in vivo* and *in vitro* system. However, over heating causes vitamin loss and amino acid destruction/binding and nutritional non-availability.

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