ANALYSIS OF NUTRITIVE VALUE OF PEANUT PRESS CAKE, FERMENTED BY N. sitophila NCIM 899 and R. oligosporus NCIM 1215..

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Abstract:

Oncom is a popular traditional Indonesian food prepared by the fermentation of Peanut press cake. It is semisolid cake, like tempeh, consumed as native dish and most commonly served deep fat fried as a meat analogue. Peanut press cake (PPC) is the common traditional substrate (raw material) used for oncom preparation in Indonesia. The residue that remains after oil extraction by expeller from Peanut (Groundnut= Arachis hypogea) is known as Peanut press cake or Groundnut cake. Traditionally Oncom is prepared b¬y fermenting overnight soaked peanut press cake with the mold cultures of Neurospora intermedia, Neurospora sitophila or Rhizopus oligosporus at room temperature for 48 hours. The inoculated molds modify physical, biochemical and nutritive characteristics of the peanut press cake substrate during fermentation. The molds produce amylase, protease and lipase enzymes which bring about physico-chemical changes in PPC constituents such as carbohydrates, proteins and lipids and enhance its digestibility, flavor and nutritive value. The present study was carried out to analyze nutritive value of laboratory scale fermented peanut press cake under standardized conditions to determine, total carbohydrate, protein and lipid content; using the mold cultures N.sitophila NCIM 899 and R. oligosporus NCIM 1215. The analyzed nutritive value of fermented PPC by N.sitophilaa NCIM 899 show, total carbohydrate (25.5 %); protein (55.2 %) and lipid (2.0 %) whereas that fermented by R. oligosporus NCIM 1215 show, total carbohydrate (27 %), protein (54.4 %) and lipid (1.6 %).

Keywords:

Oncom, Peanut press cake, Neurospora intermedia, Rhizopus oligosporus, Nutritive value

Introduction:

Oncom is a traditional fungal fermented Indonesian food very much popular in West Java. It is also known as Ontjom, Lontjom, or Onchom and closely resemble to tempeh (van Veen and Graham, 1968). Like tempeh oncom is a thick homogenous semisolid cake commonly served deep fat fried or cooked with other native dishes. It may also be roasted and cut into pieces (chunks)

and covered with ginger sauce (van Veen and Steinkraus, 1970). Oncom has pleasant fruity odor. When fried it takes on a minced-meat flavor. It is consumed as a low-cost protein-rich meat analog in Indonesia. Oncom apparently makes a significant quantitative as well as a qualitative contribution to enrich protein in the diet in area where it is produced and consumed (Winarno, 1979). Peanut Press Cake (PPC) is the common traditional substrate (raw material) used for oncom preparation. In most of the country Peanut press cake is used as animal feed or as organic manure. Its higher fiber content and indigestible components make it undesirable as a human food. However, centuries ago the Indonesians demonstrated a way to convert this animal feed to human quality protein rich food through a traditional fungal fermentation process. Peanut press cake fermented by the molds Neurospora sitophila/intermedia or Rhizopus oligosporus for 48 hours at room temperature makes a traditional food known as Oncom, which is consumed as a daily diet of about 30 million people in Indonesia. N.sitophila / intermedia produce orange-red oncom whereas; R. oligosporus produce ash-gray oncom (Beuchat, 1987; Bigelis, 1992, Kumbhare et al., 2003). The inoculated molds bring about physico-chemical and nutritional quality changes in Peanut press cake substrate. The molds produce flavor metabolites, vitamins and extracellular amylase, protease, enzymes which modify the Peanut press cake constituents such as carbohydrates, protein, lipids and enhance its flavor, digestibility and nutritive value (Quinn et al., 1975; Beuchat, 1995). The present investigation was carried out to analyze nutritive value with reference to total carbohydrate, protein and lipid content of laboratory scale fermented Peanut Press Cake under standardized conditions using the mold cultures, N. intermedia NCIM 899 and R. oligosporus NCIM 1215.

Material and Method:

g/ml) as a standard and Follin-Ciocalteau reagent and reported as protein percent (gm. /100gm). c) Determination of lipid Content: Total lipid content was determined by ethyl ether and ethanol extraction method (Jayaraman,

1981). The lipid was extracted from a 10 gm of fermented dry flours (test samples) using ethyl- ether and ethanol mixture (3:1 v/v) with the help of Sox-let lipid Extractor (Asgi-2445) for 8 hr. Extracted lipid was kept in a vacuum drier at 60oC to remove the solvents. The weight of the solvent free extracted lipid was determined in a dried and pre-weighed Silica Crucible (110oC for 1 hour, thrice). The difference in weight of the crucible with extracted lipid minus the weight of empty dried crucible was the amount of total lipid in the test sample and reported in terms of gm. % (gm. / 100gm).µg/ml) as a standard and reported as carbohydrate percent (gm. /100 gm.). (b) Determination of Protein Content: One gram of dry flour was first defatted by treating with the mixture of 10 ml of ethyl-ether and ethanol (3:1 v/v). The sediment obtained was washed with ether and air dried to remove the solvent. The dry solid was dissolved in 10 ml of ice-cold 10% tri-chloro acetic acid to precipitate out the protein. The precipitate was centrifuged at 10000 rpm for 10 min and filtered through the filter paper Whatman No.1. The filtrates were used as test samples to analyze total protein. Total protein content in the test sample was determined by a method of Lowry et al. (1951), using bovine serum albumin (100 µSubstrate: The common traditional substrate (raw material) used for the preparation of oncom is Peanut Press Cake (PPC), (Beuchat, 1976). The residue that remains after oil extraction by Expeller from Peanut (Groundnut = Arachis hypogea) is known as Peanut press cake or Groundnut cake. It was procured from a local oil mill in Ballarpur. Mold Cultures: The mold cultures, N. sitophila NCIM 899 and R.oligosporus NCIM 1215 were used for laboratory scale fermentation of peanut press cake to determine its nutritive value. The mold cultures were obtained from Microbial Type Culture Collection (MTCC), Chandigarh (India) and maintained by growing on Potato Dextrose Agar (PDA, Himedia M096). Mold culture inoculum: Mold culture inoculum for the fermentation of peanut press cake was prepared from seven day old sporulated culture of molds grown on PDA slants at 28O C. Ten ml of sterile distilled was added to prepare spore suspension and 1 ml of this spore suspension was used

as inoculum to inoculate 25 gm. of overnight soaked Peanut press cake substrate for fermentation. Laboratory scale fermentation of Peanut Press Cake: The peanut press cake was fermented on laboratory scale under optimized process conditions. A 25 gm. of overnight soaked and autoclaved Peanut press cake in a 250 ml Erlenmeyer flask was inoculated separately with 1 ml spore suspension of N. sitophila NCIM 899 and R.oligosporus NCIM 1215. One flask containing 25 gm. of overnight soaked and autoclaved Peanut press cake without inoculation (unfermented) was kept as a Control. Extract for Analysis: The Peanut press cake fermented for 48 hours at 28o C by the molds, N. sitophila NCIM 899 and R.oligosporus NCIM 1215, also the Control was dried in oven at 60oC for 8 hours and ground to smooth flour. The dried and ground floor of fermented peanut press cake was analyzed for its nutritive value i.e. total carbohydrate, protein and lipid content. ANALYTICAL METHODS: (a) Determination of Carbohydrate Content: One gram of respective dry flour of fermented peanut press cake was homogenized with 5ml of sterile distilled water and 5 ml of ethyl alcohol. Samples were extracted for 30 minutes with occasional stirring. Suspension was centrifuged at 10000 rpm for 10 min and filtered through the filter paper Whatman No.1. Filtrates were used as test sample to analyze total carbohydrate. Total carbohydrate content was determined by Anthrone method (Plummer, 1993). Total carbohydrate content in test samples was calculated from a curve using glucose (100

Result and Discussion:

galactosidase activity which hydrolyze peanut press cake carbohydrate and utilize more sucrose, stachyose and raffinose than R. oligosporus ATCC 22959. Beuchat et al. (1974) reported reduction in protein content by R. oligosporus during peanut press cake fermentation due to the production of acid protease which hydrolyze peanut press cake protein (i.e. Arachin and Con-arachin) and liberate amino acids particularly, glutamic acid and aspartic acid responsible for enhancement of flavor. They further noted that, about 2.7% of amino acids are liberated from peanut protein within 48 hour of fermentation.αThe

laboratory scale fermented peanut press cake by N.sitophila NCIM 899 and Rhizopus oligosporus NCIM 1215 has homogenous cake like consistency and pleasant fruity odor and meaty flavor. N.sitophila NCIM 899 produce orange spores and resulted in to orange colored fermented peanut press cake whereas Rhizopus oligosporus NCIM 1215 produce ash-gray spores and resulted in to ash-gray colored fermented peanut press cake (Kumbhare et al. 2003) (Fig.1B, 1C) The data of nutritional analysis shown in Table 1 for i) Control (Fig.1A), total carbohydrate (28.6%), protein (58.8%) and lipid (2.8%). ii) laboratory scale fermented peanut press cake by N. sitophila NCIM 899 (Fig.1B), total carbohydrate (25.2 %), protein (55.2 %), lipid (2.0 %) and iii) That fermented by R.oligosprus NCIM 1215 (Fig.1C), total carbohydrate (27.0 %), protein (54.4 %), lipid (1.6 %), indicate reduction in total carbohydrate, protein and lipid content (Kumbhare et al., 2000, 2003). These findings coincided with those by Beuchat et al., (1974) and Quinn et al., (1975), who reported that reduction in carbohydrate and protein content of peanut press cake during fermentation was due to their utilization and enzymatic hydrolysis to simple sugar, amino acids and free fatty acids. The peanut press cake fermented by N.sitophila NCIM 899 show comparatively more reduction in total carbohydrate (3.1%) than that fermented by R.oligosporus NCIM 1215 (1.6%) whereas, peanut press cake fermented by R.oligosporus NCIM 1215 show more reduction in total protein (4.4%) and lipid (1.2%) than that fermented by N.sitophila NCIM 899 (protein 3.6%, lipid 0.8%). This indicated that N.sitophila NCIM 899 utilizes more carbohydrate than R.oligosporus NCIM 1215 whereas; R.oligosporus NCIM 1215 utilizes more protein and lipid than N.sitophila NCIM 899 during fermentation. Van Veen and Steinkraus (1970) reported that N. intermedia produce cellulase which hydrolyzes fiber content of peanut press cake making it more digestible. Quinn et al., (1975) reported that, utilization of flatulence causing sugars like stachyose and raffinose in peanut press cake by N. intermedia during fermentation causes increased digestibility. Fardiaz and Markakis (1981) reported that N. intermedia ATCC 14151 exhibited strong

The nutritional analysis shown in Table-1 for fermented Peanut press cake by N. sitophila NCIM 899 show, total carbohydrate (25.5%); protein (55.2%) and lipid (2.0%) whereas that fermented by R. oligosporus NCIM 1215 show, total carbohydrate (27%), protei

Table 1: Analysis of Nutritive Value of Laboratory Scale Fermented Peanut Press Cake.

Mold cultures used for fermentation	**Nutritional Analysis of Fermented Peanut Press Cake**		
	Carbohydrate % (gm. /100gm)	**Protein % (gm. /100gm)**	**Lipid % (gm. /100gm)**
Control (Un-fermented PPC)	28.6	58.8	2.8
N.sitophila NCIM 899	25.5	55.2	2.0
R.oligosporus NCIM 1215	27.0	54.4	1.6

Fig.1. Laboratory Scale Fermented Peanut Press Cake

Fig.1A.
Control
(Un-fermented PPC)

Fig.1B.
PPC fermented by
N.sitophila NCIM 899

Fig.1C
PPC fermented by
R.oligosporus NCIM 1215

Conclusion:

Conclusion: The present investigation conclude that the fermentation of peanut press cake by the molds, N. sitophila NCIM 899 and R. oligosporus NCIM 1215 causes reduction in the initial carbohydrate, protein and lipid content due to

their utilization. However, liberated simple sugars, amino acids and fatty acids by enzymatic hydrolysis by mold cultures enhance, flavor, digestibility and nutritive value in peanut press cake. Further studies on the analysis of liberated simple sugars, amino acids and fatty acids due to enzymatic hydrolysis are needed to fully characterize, valuable functional and nutritional properties in fermented peanut press cake.

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