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Utilization of minor millets for tempeh production

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An experiment was carried out for the utilization of minor millets (little foxtail and finger millet) with the soybean and horse gram for millet tempeh production. *Rhizopus microsporus* var *oligosporus* was grown satisfactorily on the substrates. At 35^{0}C fermentation was completed within 39.50 hours compared to 30^{0}C (53.14 hours). The pH, which was adjusted at about 5.2-5.5 with acetic acid in the substrates and during fermentation, raises progressively upto 48 hrs of incubation period to above 7.1-7.3, which was maintained constantly. The Acid protease activity was found to be increased with increase in time intervals upto 36 hrs beyond which, it decreased significantly. But, Acid protease activity was significantly highest at 35^{0}C as compared to 30^{0}C.

Key words : Tempeh, Acid protease, *Rhizopus microsporus* var. *oligosporus*, Fermentation, Soybean, Horsegram, Minor millets.

INTRODUCTION

India attained self-sufficiency in food production to meet the required quantity. However, malnutrition is one of the nutritional constraints mainly due to protein deficiency in the country and in other developing countries like India. In order to solve the problem of malnutrition (protein hunger), possible sources of protein production shall have to be exploited to meet the challenge. Exploitation of traditional food resources can make substantial break through to meet protein deficiency. Small millets as a group include several coarse cereals namely finger millet, little millet, foxtail millet, kodo millet, proso millet and barnyard millet grown throughout the length and breadth of the country in diverse soils and climatic conditions *i.e.*, in wide range of climates and are cheap in cost. The area under small millet in India is around 4.0 million hectares with the production of 3.6 million tones. In Karnataka, annually these crops are grown over an area of 1.3 million hectares with the production of 1.6 million tones. Small millets have remained as the food for the people of lower socioeconomic strata and traditional consumers. Grains are rich in minerals and fiber content. Recent studies indicate that minor millets are nutritionally superior to conventional food grains and exhibit hypoglycemic effect due to presence of higher proportion of unfavorable complex carbohydrate, resistant starch and release sugars slowly (Malleshi, 1993 and Mani *et al.*, 1993). The flavour and difficulty in processing of millets are the limitations for their use in the routine diets. Pulses like soybean and horse gram are not eaten in raw state, but are processed in a number of ways before consumption, which may have an effect on their nutritional quality and digestibility of nutrients (Kalmesh *et al.*, 2002).

MATERIALS AND METHODS

Soybean (*Glycine max*) and horse gram (Dolichos biflorus) were obtained from Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. Minor millets like foxtail millet (*Setaria italica* var HMT-100-1), little millet (*Panicum milearum* var. TNAU-63) and finger millet (*Eleucine coracana* var GPU-34) obtained from the A.R.S, Hanumanamatti. Culture organism (*Rhizopus microsporus* var. *oligosporus* MTCC-556) was obtained from the culture collection center, IMTECH, Chandigarh. Chemicals used for the research were of analytical grade. Soybean and horse gram were dehulled by soaking in the water for over night and rubbing with hand and hulls removed by flotation method. The fungal culture, *Rhizopus microsporus* var. *oligosporus* was maintained on slants of potato dextrose agar at 4^{0}C. Before each experiment, the fungus was transferred to fresh PDA slants and incubated at 25^{0}C for 7 days. Millet tempeh was prepared by using soybean and horse gram at different proportions with millets. The treatments are T1 (100% pulses), T2 (75% pulses + 25% millets), T3 (50% pulses + 50% millets), T4 (25% pulses + 75% millets), T5 (100% millets). Before inoculation of fungal spore suspension, the pH of the substrate was adjusted using acetic acid at 2.4 ml per 100 g of substrate to maintain the pH for the convenient growth of fungi. The pH of each treatment was recorded initially and after incubation of treatments at 30^{0}C, 35^{0}C and 40^{0}c at

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