ABSTRACT

STANDARDIZATION OF CEREAL AND PSEUDO-CEREAL PRODUCTS AND THEIR EFFECT ON HYPERLIPIDEMIA IN WISTAR RATS

BY

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Cardio vascular diseases (CVD) are the world’s largest killers, claiming 17.1 million lives a year. Several epidemiological studies have shown the relationship between the incidence of Coronary Heart Disease (CHD) and nutrition. The WHO Expert Committee concluded that there is a well established triangular relationship between habitual diet, blood cholesterol level and CHD. A diet high in whole grains has been reported to have health benefits, such as reduced risk of CVD. Dietary fats play an important role in determining the levels of lipids in serum and liver which are important risk factors responsible for CHD. A large intake of fibre is associated with a lower relative risk of death from coronary heart disease. Polyunsaturated fatty acids, monounsaturated fatty acids and fibre diets have been recommended to lower plasma cholesterol and triglycerides which is a major risk factor for coronary heart disease.

Hence, in the light of the above facts, the work was carried out on standardization of cereal and pseudo-cereal products inorder to study their effect on hyperlipidemia in wistar rats. The results arrived, with respect to the processing and preparation of selected cereals such as raw brown rice, parboiled brown rice, Italian millet and samai are dealt below.
The selected cereal and pseudo-cereals’ milling yield, moisture content, water holding capacity, effects of soaking on the rate of equilibrium moisture content of cereals, chemical characteristics of the cereals were studied. It was found that the parboiled brown rice had higher milling yield of grain weight (76.20 %), water holding capacity (58.20 %) and rate of equilibrium moisture content (62.80 %) of cereals compared to other cereals such as raw brown rice, Italian millet and samai. The Italian millet had higher percentage of protein (10.05 %), fat (5.20 %), crude fiber (7.89 %) and low total carbohydrate (65.23 %) content compared to other cereals.

In the preparation of the cereal and pseudo-cereal products the moisture percentage after washing with respect to parboiled brown rice was comparatively higher moisture percentage of 11.88 % and 11.46 % after shade drying. The shade dried cereals were powdered using plate mill. The mesh size with BSS 30, BSS 60, BSS 85, BSS 100 and above BSS 100 sieve retention flour was calculated. From this the parboiled brown rice had higher percentage of total flour yield (99.83 %) and minimum milling loss (0.17 %) compared to other cereals flour yield such as raw brown rice, control, samai and Italian millet respectively. Italian millet flour had the highest milling loss (4.16 %) compared to other cereals.

The cereal flour obtained from the different mesh sizes was (BSS 30, 60, 85, 100 and >100) used to prepare pittu and porridge was and organoleptically evaluated. The study revealed that the sieve size BSS 30 for porridge and BSS 60 for pittu preparation found to possess the highest overall sensory acceptability score compared to other sieve size.

The parboiled brown rice and black gram had higher soaked grain weight (224.53 gm) compared to other cereals namely; raw brown rice (186.97 gm) and samai (185.50 gm) whereas the Italian millet had the lowest. The parboiled brown rice had the highest batter weight (407.67 gm) compared to the control, cereal and pseudo-cereal similar as soaked grain weight. Among the cereals, the samai had minimum batter weight (277.95 gm).

The raw brown rice and samai had the highest batter volume increase (200 ml) compared to other cereals and control group. The parboiled brown rice batter had lesser batter volume (125 ml) compared to other cereal groups. Standardized fermentation time for cereal and peudo-cereal idli control was10 hrs and 8 hrs for raw brown rice, parboiled brown rice was 12 hrs and 6 hrs for Italian millet and 8 hrs for
samai. The optimum steaming time for control and raw brown rice idli was 20 min, the parboiled brown rice, Italian millet and samai idli was 25 min. The standardized steaming time for cereal and pseudo-cereal pittu control, raw brown rice, parboiled brown rice and samai was 20 minutes. The pittu made from Italian millet was 25 minutes.

The standardization of porridge consistency, texture and cooking time were studied. Raw brown rice and Italian millet porridge cooking time was 10 minutes. Time taken by parboiled brown rice and samai was 12 and 8 minutes respectively.

The moisture content of parboiled brown rice idli preparation was 39.92 % which was comparatively higher than raw brown rice (36.20 %), Italian millet (30.30 %), samai (28.61 %) and control idli (34.00 %). The Italian millet idli sample had higher per cent of protein (12.84 %), fat (4.44 %) and fibre content (4.68 %) when compared to other cereal idli samples. The samai idli sample had a higher carbohydrate (49.89 %) level and ash content (3.28 %) than the other samples.

The moisture content of parboiled brown rice pittu was 19.27 % which was higher than the raw brown rice (17.94 %), Italian millet (17.56 %) and samai (12.02 %). The Italian millet pittu samples had a higher percent of protein (9.05 %), fat (4.68 %) and fibre content (7.10 %) retention when compared to other cereal pittu samples. The samai pittu samples had a higher carbohydrate (70.19 %) level and the ash content (1.44 %) was higher in raw brown rice compared to other pittu samples.

The moisture content of the porridge made of parboiled rice (82.06 %) was higher when compared to raw brown rice, Italian millet and samai porridge. The Italian millet porridge samples had higher percent of protein (2.01 %), fat (1.04 %) and fibre content (1.60 %) retention when compared to other cereal porridge. The samai porridge samples had higher carbohydrate (15.60 %) and the ash content (0.32 %) was higher in raw brown rice compared to other cereal porridge.

Thirty healthy wistar strain male rats have been used for the study. Each rat was weighed and divided in to five groups and fed on the following diets for 45 days: E1 - control, E2 - raw brown rice, E3 - parboiled brown rice, E4 - Italian millet and E5 - samai. At the end of 45 days of feeding, the animals were weighed individually and the gain in weight was recorded.
The rat weight gain was higher in raw brown rice (67.50 gm) when compared to Italian millet (59.16 gm), samai (58.33 gm), control (50.33 gm) and parboiled brown rice (50.00 gm) respectively.

At the end of the 45th day of feeding trial, blood serum analysis revealed the lowest total cholesterol and triglycerides in all the experimental groups when compared to the control group. The raw brown rice had the lowest total cholesterol (58.48 mg/dl) level when compared to parboiled brown rice (64.60 mg/dl), Italian millet (82.51 mg/dl), samai (88.40 mg/dl) and control (91.76 mg/dl). The raw brown rice had the lowest triglycerides (38.65 mg/dl) when compared to Italian millet (40.89 mg/dl), samai (57.35 mg/dl) parboiled brown rice (61.09 mg/dl) and control (75.80 mg/dl). All the experimental groups had higher High Density Lipoproteins (HDL-C) levels when compared to control group. The samai had higher High Density Lipoproteins (HDL-C) level 47.37 mg/dl when compared to raw brown rice (42.38 mg/dl), Italian millet (41.39), parboiled brown rice (42.20 mg/dl) and control (39.39 mg/dl).

The parboiled brown rice had the lowest Low-Density Lipoproteins (LDL-C) level 9.99 mg/dl when compared to raw brown rice (11.10 mg/dl), samai (29.55 mg/dl), Italian millet (32.93 mg/dl) and control (37.20 mg/dl). The raw brown rice had the lowest Very Low-Density Lipoproteins (VLDL-C) level (47.38 mg/dl) when compared to Italian millet (49.57 mg/dl), control (54.55 mg/dl), parboiled brown rice (54.60 mg/dl) and samai (58.84 mg/dl).

The storage study confirmed the moisture content of cereal and pseudo-cereal flour during storage period increased gradually and the final value was reported as 9.32 per cent in samai (T4) which was the minimum and the maximum of 11.31 per cent parboiled brown rice (T2). The reduction in the protein content was observed throughout the storage period of 90 days for the treatments. The final value for the treatments T1 to T4 ranged from minimum of 8.783 per cent in samai (T4) and maximum of 9.846 per cent in Italian millet (T3) and 9.293 per cent in T1 and in T2 9.123 per cent for the treatments. The fat content of cereal and pseudo-cereal flour during storage decreased gradually and the final value was reported to be 1.685 per cent (T4) which was the minimum and the maximum was 4.95 per cent (T3).
At the end of the storage period, the carbohydrate content was found to be maximum in T\textsubscript{1} (75.885 per cent) followed by T\textsubscript{2}, T\textsubscript{4} and T\textsubscript{3}. During the storage period the carbohydrate content level got reduced gradually, the fibre content was found maximum in T\textsubscript{3} (7.850 per cent) followed by T\textsubscript{4} (7.2167 per cent), T\textsubscript{1} (0.9423 per cent) and T\textsubscript{2} (0.570 per cent) and the fibre content got reduced gradually. There was significant reduction in the ash content, during storage period, in the treatment of T\textsubscript{1} initial to 90 days (1.60 per cent to 0.764 per cent). Initial ash content, in T\textsubscript{2}, T\textsubscript{3} and T\textsubscript{4} samples marginally decreased to 1.04 per cent, 0.928 per cent and 1.135 per cent respectively at the end of the 90 days of storage period.