CHAPTER - V

SUMMARY AND CONCLUSION

Investigations were carried out for the standardization of cereal and pseudo-cereal products and their effect on hyperlipidemia in wistar rats. The cereal products such as *idli, pittu and porridge* were prepared by using cereals like raw brown rice, parboiled brown rice, Italian millet and samai. The main aim of this study is to prepare *idli, pittu and porridge* with nutrient content like protein and fibre and reduce the levels of carbohydrate and fat content so as to make it suitable for hyperlipidemia subjects through effectiveness of cereals in reducing hyperlipidemia in wistar rats.

The processing and preparation of cereal and pseudo-cereal such as raw brown rice, parboiled brown rice, Italian millet and samai was done. The selected cereal and pseudo-cereal milling yield, moisture content, water holding capacity, effect of soaking on the rate of equilibrium moisture content (EMC-S) of cereals, chemical characteristics of the cereals were studied.

Processing of cereal and pseudo-cereal flour includes moisture content of the cereals during flour preparation, size reduction characteristics of cereal flour in plate mill, selection of flour for *pittu and porridge*.

The physical characteristics, organoleptic characteristics and the nutrient contents of the cereals, normally used to prepare *idli, pittu and porridge* were studied. The effect of cereals on lipid profile in rats, animal experiment was conducted. In the animal experiment, the weight gain of rats and lipid profile was taken. Chemical analyses of cereal flour during storage were studied.

5.1 PROCESSING OF CEREAL AND PSEUDO-CEREAL

It was found that the parboiled brown rice had a higher grain milling yield, water holding capacity, rate of equilibrium moisture content of cereals compared to other cereals such as raw brown rice, Italian millet and samai. The Italian millet had a higher percentage of protein, fat, fibre and low carbohydrate content compared to other cereals.
5.2 PROCESSING OF CEREAL AND PSEUDO-CEREAL FLOUR

The shade dried cereals was passed through the plate mill for size reduction. The different sieve retention flour was calculated and in this process the parboiled brown rice had a higher percentage of total flour yield and minimum milling loss 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 compared to other cereals.

The cereal flour obtained from the different mesh sizes (BSS 30, 60, 85, 100 and >100) used to prepare pittu and porridge was observed and organoleptically evaluated. From this evaluation, the BSS 30 sieve retention flour used to prepare porridge and BSS 60 sieve retention flour used to prepare pittu had the highest overall acceptability score compared to other sieve retention flour. The BSS 30 sieve retention flour and the BSS 60 sieve retention flour, used in the preparation of porridge and pittu respectively, have been selected for the present study.

5.3 PHYSICAL CHARACTERISTICS OF IDLI

5.3.1 Physical characteristics of idli batter

The parboiled brown rice and black gram had a higher grain weight on soaking compared to other cereals such as control, raw brown rice and samai. The Italian millet had a lower grain weight after soaking. The parboiled brown rice had the highest wet ground batter weight compared to control and other cereals similar as soaked grain weight. Among the cereals, the samai had the minimum wet ground batter weight.

5.3.2 Increase in volume of idli batter and the time of fermentation

The raw brown rice and samai had the highest increase batter volume compared to other cereals and control group. The parboiled brown rice batter had lesser increased batter volume compared to other cereal groups and control. The standardized fermentation time for control idli was 10 hrs and 8 hrs for raw brown rice, 12 hrs for parboiled brown rice and 6 hrs for Italian millet and 8 hrs for samai.
5.3.3 Optimum steaming time and quality of Idli

Optimum steaming time for idli was 20 min for control and raw brown rice idli and 25 min for parboiled brown rice, Italian millet and samai idli with this steaming time, the idli had the normal fermented cereal smell, normal air holes and spongy texture.

5.4 PHYSICAL CHARACTERISTICS OF Pittu IN DIFFERENT STEAMING TIME

Standardized pittu steaming time for control, raw brown rice and parboiled brown rice and samai was 20 min. The Italian millet took 25 min. It showed that the cereal containing high fibre required a longer steaming time.

5.5 STANDARDIZATION OF POrRIDGE CONSISTENCY AND TEXTURE

The porridge prepared with 20 gm of cereal and 200 ml of water was soft having the normal consistency. The raw brown rice and Italian millet porridge took 10 min for cooking. The parboiled brown rice and samai needed 12 and 8 min respectively.

5.6 ORGANOLEPTIC CHARACTERISTICS OF CEREAL AND PSEUDO-CEREAL PRODUCTS

The organoleptic characteristics of idli, pittu and porridge prepared by using raw brown rice, parboiled brown rice, Italian millet and samai were assessed with a panel of judges using the 9-1 scale score card. The appearance, colour, flavour, texture, taste and overall acceptability were judged and statistically analysed.

5.6.1 Idli

Idli prepared with parboiled brown rice had the highest acceptable score when compared to raw brown rice, samai and Italian millet respectively. The statistical analysis revealed that the highly significant differences were observed in flavor and overall acceptability.
5.6.2 Pittu

Raw brown rice used to prepare pittu had a highly acceptable score when compared to control and other cereals. The statistical analysis revealed that the significant difference was observed in the texture among the treatments and organoleptic characteristics.

5.6.3 Porridge

The parboiled brown rice porridge had the highest overall score compared to other cereals porridge. The statistical analysis revealed that the non-significant difference was observed among the treatments and organoleptic characteristics.

5.7 NUTRIENT CONTENT OF CEREAL AND PSEUDO-CEREAL PRODUCTS

5.7.1 Idli

The moisture, protein, fat, carbohydrate, fibre and ash content of idli were analysed. The moisture content was higher in parboiled brown rice idli compared to raw brown rice, Italian millet, samai and control idli. The Italian millet idli sample had a higher percent of protein, fat and fibre content than the other cereal idli samples. The samai idli sample had a higher carbohydrate and ash content than the other samples.

5.7.2 Pittu

The moisture content was higher in control and parboiled brown rice pittu compared to raw brown rice, Italian millet and samai pittu. The Italian millet pittu had a higher percent of protein, fat and fibre content than the other cereal pittu. The samai pittu sample had a higher carbohydrate level and the ash content was higher in parboiled brown rice compared to other cereal pittu.

5.7.3 Porridge

The moisture content was higher in parboiled brown rice porridge compared to raw brown rice, Italian millet and samai porridge. The Italian millet porridge had a higher percent of protein, fat and fibre content than other cereal porridge. The samai porridge sample had higher carbohydrate content. The ash content was higher in raw brown rice than the other cereal porridge.
5.8 ANIMAL EXPERIMENT

5.8.1 Rats weight gain

Thirty healthy wistar strain male rats have been used for the study. Each rat was weighed and divided into five groups and fed on the following diets for 45 days: E\textsubscript{1} - control, E\textsubscript{2} - raw brown rice, E\textsubscript{3} - parboiled brown rice, E\textsubscript{4} - Italian millet and E\textsubscript{5} - samai.

At the end of 45 days of feeding, the animals were weighed individually and the gain in weight was recorded. The weight gain was higher among the rats fed by raw brown rice compared to the rats fed by Italian millet, samai, control and parboiled brown rice respectively. It was found that the weight gain among all the experimental groups was highly significant.

5.8.2 Effect of cereal and pseudo-cereal on lipid profile in rats

At the end of 45 days, the blood serum was analyzed for total cholesterol, triglycerides and High- Density Lipoproteins (HDL-C) by using commercially available kits on blood chemistry analyzer and Low- Density Lipoproteins (LDL-C), Very Low- Density Lipoproteins (VLDL-C) was calculated by using Friede-wald equation.

The total cholesterol and triglycerides was lower among all the experimental groups compared to control group. The lowest total cholesterol level was seen in the rats fed by raw brown rice compared to other experimental groups. The maximum reduction of triglycerides was found in rats fed by raw brown rice and followed by Italian millet, samai and parboiled brown rice. All the experimental groups had a higher High- Density Lipoproteins (HDL-C) level as compared to rats fed by control group.

The Low-Density Lipoproteins (LDL-C) was found higher in control group compared to experimental groups. The decrease of LDL-C was significantly higher in the case of the rats fed on selected cereals compared to control group. In the experimental groups, Very Low- Density Lipoproteins (VLDL-C) reduction was found lesser in rats fed by samai followed by parboiled brown rice compared to the rats fed on control group diet.

5.9 SHELF LIFE STUDY OF CEREAL AND PSEUDO-CEREAL FLOUR
Shelf-life study of cereal and pseudo-cereal flour was done. It showed that during storage the cereal flour moisture, protein, fat, carbohydrate, fibre and ash content got decreased gradually at the end of the storage periods (90 days) among all the treatments of flour, namely raw brown rice, parboiled brown rice, Italian millet and samai.