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Development of composite flour mix enriched with fish powders

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A study was conducted to develop a composite flour mix replacing wheat flour with dry powders of three fish species. Enrichment of wheat flour with fish powders would increase the protein, iron and calcium to a greater extent than that possible with wheat flour alone. The three selected fish species are *Amblygaster sirm* (Hurulla), *Sardinella gibbosa* (Salaya) and *Stolephorus indicus* (Handalla) which are under utilized but possess a high nutritive value. Preliminary studies were conducted to select the best ratio of wheat flour to fish powder with a suitable texture. Then the best formula was selected by sensory parameters of taste, appearance, colour, odour, fish flavour and overall acceptability. Sensory evaluations were conducted with 29 panelists and results were analyzed using Minitab statistical software.

The ratio of 60 % wheat flour to 40 % fish powder was rated the best with a significantly higher ($p < 0.05$) number selecting biscuits with this texture. As the best formula, 60 % wheat flour, 13.3 % powder of *Sardinella gibbosa*, 13.3 % *Stolephorus indicus* and 13.3 % *Amblygaster sirm* was rated significantly higher ($p < 0.05$) than the other evaluated formulas. Proximate analysis results revealed that composite flour mix contained 8.13 % moisture, 1.91 % total ash, 0.96 % acid insoluble ash, 22.42 % protein, 4.04 % total fat and 2.36 % crude fiber. The amounts of minerals (mg) in 100 g of composite flour mix were 160.5 Na, 143.4 Ca, 61.47 Mg, 198.0 K, 7.88 Fe, 0.29 Cu, 2.73 Zn and 0.48 Mn. Therefore 100 g of composite flour mix provides more than 1/3 of the recommended daily protein and iron intake of children in the age group of 2 - 14 years and adult men and women including lactating and pregnant women. 100 g of the composite flour mixture also provides 1/5 of the daily calcium requirement of children of the age group 2-14 years and of adult men and women (excluding lactating and pregnant women).

As the best packaging material, a combination of Aluminum/ Polyethylene Terephthalate and Linear Low Density Polyethylene was selected due to the lowest moisture absorption and peroxide value variation within the tested sixteen weeks. At the end of 16 weeks of storage the moisture content, peroxide value, total plate count and yeast and mould counts of the composite flour mix were below the minimum required level for consumption as given in the SLS standards.