Physico-chemical, functional and nutritional components of selected under-utilized cereals and their stability during processing for the development of value added product/s

Underutilized cereals are commonly applied to refer to species whose potential has not been fully realized. India is the largest producer of many kind of underutilized grains like millets which are often referred to as coarse cereals. However, their consumption is poor due to lack of ready-to-use products similar to rice and wheat, and also due to the lack of awareness, research based studies on their nutritional quality and health benefits. In the present study Finger millet, Red rice, Kodo millet and Barnyard millet were selected and explored for the functional properties namely dietary fibre, total polyphenols and antioxidant activity. Finger millet was found to contain high amount of calcium (337mg/100g) while barnyard millet was rich in iron content (18.3mg/100g). Kodo millet (38.31%) and finger millet (19.06%) were found to contain appreciable amount of dietary fibre. Red rice contained high %DPPH scavenging activity (61%) and total carotenoid (146 µg/100g). The effect of processing viz. malting, microwave, extrusion cooking, roasting and pressure cooking on physicochemical characteristics, nutritional (ash, moisture, crude protein, crude fat, crude fiber, calcium and iron), antinutritional composition like phytic acid and antioxidant properties present in the selected cereals was studied. The malting and microwave treatments were optimized by response surface methodology, (RSM) while extrusion processing was carried out at different moisture and temperature combinations (M.C%/T °C- 15/90, 15/125, 20/90, 20/125). Among the processing methods, roasting showed highest antioxidant properties followed by extrusion, microwave, pressure cooking and malting treatments respectively. Extruded products mainly prepared from wheat, rice and corn as main ingredient had very good consumer preference mainly due to convenience, attractive appearance and texture; therefore, selected underutilized cereals were utilized for ready to eat (RTE) extruded product. Linear-programming model was applied to meet the RDA (Ca, Fe, Energy, Protein, CHO and crude fibre) of ICMR for sedentary women and preschool children. Finger millet, kodo millet, barnyard millet and red rice composite flour formulations were designed for sedentary women and preschool using a linear programming (LP) model. LP formulated composite flour was extruded through single screw food extruder at different feed moisture (15%, 20% wb), barrel temperature (90°C, 125°C). Effect of process parameters like temperature (90°C, 125°C) and
feed moisture (15%, 20% wb) on physical properties (expansion ratio (ER), bulk density, color value), antinutritional factor (phytic acid) and antioxidant activity (TPC, DPPH, FRAP) of the RTE products was conducted. The developed products were subjected to sensory analysis by the semi trained panelist on 9-point hedonic table for consumer acceptance. The developed products were subjected to sensory analysis by the semi trained panelist for consumer acceptance using 9-point hedonic scale. It was found that the sensory scores of RTE extruded product having temperature 125°C and 20% moisture combination for preschool children and sedentary women had sensory scores between 7.5 to 8.5 for texture, color and flavor and these values were higher than their respective control (semolina). The % DPPH radical scavenging activity and total phenolic content of the RTE product was 75.70%, 77.5% and 284 and 378mg/100g gallic acid equivalent for preschool and sedentary women respectively. The use of linear programming in an RTE snack product could make a great contribution in developing products according to the nutritional requirements of different age group. These underutilized cereals may be further explored for developing gluten free product and managing degenerative diseases.

**Keywords:** Underutilized, millets, processing effect, antioxidant, value addition.