

## Development and optimisation of millet based extruded snack using barnyard and finger millet

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### Abstract

The present study was carried out combination of Barnyard millet (20-30%), Finger millet (10-30%), Corn grits (40-60%), and Green gram dhal (10%) blends for preparation of extruded product using Single screw extrusion cooking. The extruded products were compared with control Corn grits (100%). Physical and sensory qualities of extruded products were investigated. Bulk density was deduced with increasing corn grits content and expansion ratio increased with increasing corn grits composition. The proximate analysis was carried out for all samples. Compare to all samples with control the T1 (Barnyard millet, Finger millet, Corn grits, Green gram dhal were 30,20,40,10 percent respectively) sample showed good attributes and which was combination of cereal and pulse so it may be balance our protein requirement. The selected extruded product T1 studied shelf life studied at room temperature till 45 days the product was good.

**Keywords:** combination, studied, Green, temperature, grits

### Introduction

In today modern life various Ready to eat snacks foods such as fried chips, wafers, flacks, granules, extruded and spiced products, pop corns puffed cereals etc. have become integral part of consumer food habits. Popping or puffing is one of the traditional food processing methods used to prepare RTE light and crisp products. These process involves high temperature short time heat treatment to gains and gelatinized foods (Ushakumari *et. al.*, 2007) <sup>[1]</sup>. Cereals have been popular raw materials extrusion for food uses mainly because of functional properties, low coast, and ready availability. Owing to high protein content, pulses, millets can be utilized for nutritional improvement of cereal based extruded snacks. Extrusion of food is emerging technology for food industries process and market large number of products varying size shapes and texture and taste.

### Corn grits

Corn grits (*Zea mays L.*) are the main raw material for commercial production of extruded snacks. They have high porosity, crunchy texture and are palatable (Ascheri *et. al.* 2003) <sup>[2]</sup>. Food extrusion process from corn is well known because it has crisp texture and easy to make.

### Barnyard millet

Supplementation of cereal based product with millet has increasingly popular due to nutritional and economic advantages. Barnyard millet (*Echinochloa frumentacea L.*) has high utilization potential owing to its excellent capacity to blend with other food grain without importing to any off flavor. Thus the millet can be incorporated in traditional foods and valorize to novel food uses (veena, 2003) <sup>[3]</sup>.

### Finger millet

Finger millet (*Eleusine coracana L.*) or Ragi forms the staple food for a large segment of the population in south Asian and African countries. This millet contains 65 70% starch, 11-12% dietary fibre, and has high levels of calcium (340-360 mg %) (Gopalan *et. al* 2009) <sup>[5]</sup> In resent years ragi is regained importance of its nutritional strength in terms of dietary fiber, starch pattern as well as high calcium and iron contents.

### Green gram dhal

Commonly known as moong or mung bean (*Vigna radiata L.*) is an excellent source of high quality protein. It contents about 25 % protein of high digestibility. Grain legumes are considered to be good for health due to mutual compatibility with cereals and their properties in disease prevention including cardiovascular disease, type -2 diabetic, obesity and possibly colon cancer. (Poonam *et. al.* 2015) <sup>[4]</sup>.

### Materials and methods

Procurement of raw materials: Corn grits, Barnyard millte, Finger millet, Green gram dhal were procured from the local market from Hyderabad. Millet and Green gram dhal were cleaned for extraneous matter. The grains were conditioned to obtain below 15 % Moisture and grounded in mini flour mill.

Preliminary trails conducted to prepare extruded products from mix having proportions of Barnyard millet, Finger millet and Corn grits. The extruded product having Barnyard millet 20-30%, Finger millet (10-30%), and Corn grits (40-60 %) were used to prepare product. Later one more trail is done with use of green gram dhal (10%) to

increase its protein content different formulations of above mixtures were ground in mini flour mill. The composite flours moistened with 18% of water, moistened flour mixture was conditioned in planetary mixer for 30 minutes. The composite flours were extruded by application of single screw extruder (Boolani).the composite flour mixture is fed in to hopper, which is mounted on feed opening of extruder. The extruder consists of pre mixture of 10 kg capacity. The temperature of the extruder at zone-1, zone-2, and zone-3 were adjusted to 120°C, 130°C and 140°C respectively. Screw speed range is adjusted to 200 rpm.3.5 mm die was used to produce extruded product. Extruded was cut into small pieces and dried in tray dryer at 50 °C for one and half hour. To reduce its moisture content and product will get crisp. Best attribute sample were kept for storage studies packed in metallised polyester.

**Table 1:** Different composition of extruded products

	T1	T2	T3	Control
Barnyard millet	30	20	20	-
Finger millet	20	30	10	-
Corn grits	40	50	60	100
Green gram dhal	10	-	-	-
Total (%)	100	100	100	100

**Physical properties**

Expansion ratio was calculated as the cross section of the area of extrudate divided by the cross-section area of the outlet.

Bulk density accounts for expansion of the product in all direction and is measured as mass of product residing specified unit of volume. (Heather maskus *et. al.* 2015) [6].

**Chemical analysis**

The extruded products were analyzed for proximate composition using standard methods of AOAC (1990) [7].

**Sensory analysis**

Extrudate were coated with spice mixture and the coated extrudate evaluated for appearance and color, aroma texture and taste using 9-point Hedonic scale a panel of ten semi trained members. Average of the scores for all sensory characteristic was expressed as overall acceptability score.

**Results and discussion**

**Proximate composition of extrudate**

The composition of extruded product by use of Barnyard millet, Finger millet, Corn grits, Green gram dhal presented in Table: 1. proximate analysis done for the extrudates are Moisture, Ash, Protein, Fat, Crude fiber and Minerals for T1 – T3. And control showed in Table: 2 sample T1-T3 the corn grits were increased from 40-60% increasing the expansion with the increase of corn due its porous structure. In T1 sample Green gram dhal added 10% to increase its protein content and balance with mutual supplementation Lysin and Mithionine with cereals and pulse.

**Table 2:** proximate compositions

Parameters	T1	T2	T3	C
Moisture (%)	5.8	5.6	5.5	5
Total Ash (g/100 g)	2.1	2.0	1.8	0.95
Protein (g/100 g)	8.57	6.9	6.16	7
Fat(g/100 g)	2.3	2.15	1.91	1.41
Crude fiber(g/100 g)	2.8	2.3	2.0	1.8
Carbohydrates (g/100 g)	77.40	80.05	81.63	83.84
Calcium (mg/100 g)	83.65	115.2	42.8	4
Iron (mg/100 g)	3.65	3.78	3.14	2.8

**Bulk density and expansion ratio**

Bulk density of the product measured from weight of standard volume of the product and expansion ratio (mm) measured from die diameter to extruded diameter. Bulk density is decreased with increasing of corn grits proportion and expansion is increased. Presented in Table: 3.

**Table: 3** bulk density and expansion ratio

Sample	Bulk density	Expansion ratio
C (control)	0.058	3.42
T1	0.110	2.6
T2	0.104	2.75
T3	0.098	2.88

**Sensory evaluation**

Sensory evaluation of extruded were coated with spice mix and performed using 9-point hedonic scale. Ten semi trained panelists were selected to discriminate and scale the different attributes different products on broad range. Sample are T1, T2, T3 were compared with the control (C).the sample Appearance was good. Color for the sample T1, T3 good and T2 was somewhat brownish black, control was yellow in color. Taste and texture was good for the sample T1 and T2 then T3. Mouth feel was good for the T1 sample then other remaining samples. Overall acceptability of the product was good sample T1 compare to all sample. Presented in Table: 4.

**Table 4:** Sensory evaluation of the products

Parameter	T1	T2	T3	C
Appearance	8	8	8	8
Color	8	7.8	8	8
Flavor	8	7	7.5	7.5
Taste	8	7.8	7.9	7.8
Texture	8	7.8	7.9	7.8
Mouth feel	8	7.7	7.8	7.8
Overall acceptability	8	7.6	7.8	7.8

**Storage studies**

Extruded sample T1 was selected based on sensory evaluation and protein content. The selected sample was packed in metallised polyester packs and storage at room temperature. Evaluated quality of the product for period of 45 days, the sample was good till 45 days the nutritional

content of the product was not changed much more that is protein content 7.8-8.75g/100g, Fat content 1.8-2.3 g/100g, and mineral content of Calcium 78-83.65 mg/100g, iron 2.8-3.65 mg/100g the moisture 5.8-7% was gained in storage period. And texture, color, and mouth feel was good. And according to 9 point Hedonic scale the overall acceptability was 7.8.

### Conclusion

The extruded samples T1, T2, T3 and compared with control. The sample T1 was showed best attributes and addition of cereal and pulse balances the protein requirement due to Cereals are deficient in Lysine and rich in Methionine and Pulses are rich in Lysine and deficient in Methionine. The sample T1 was good till 45 days.

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