International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Microbial Analysis of Commercially Processed Millet Products

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Abstract: ***This study was taken up to assess the quality of commercially available and processed millet products. Millet products were collected from selected shops with sample size of 100 including organic and regular products. The results showed that the average moisture content of 97 products were within standard limit of FSSAI standards (<13%) and remaining three products; one product from RTC and two products from RTE were exceeding standards moisture content. There was no significant difference between RTC and RTE millet products in moisture content and also statistically non- significant difference was found between organic and regular RTC as well as RTE products in moisture content. Microbial analysis results showed that Salmonella sp. And E.coli were absent in all the three products, whereas Coliform was present in all the three products. According to FSSAI regulation, the Coliform should be absent in 0.1 gm of products. However, the Coliform count showed a greater number of colonies when compared with standard limit.***

Keywords: Millet products, ready to cook products, ready to eat products, organic and regular products

1. Introduction

Millets are classified as small-grained cereals that include a large number of different botanical species. Originated by the domestication of wild African grasses in the Nile valley and the Sahel zone, millets were subsequently taken to China and India. These cereals tolerate arid conditions and possess a small, highly nutritious grain that stores well. Millets are used locally, both as a food and as a livestock feed. In all areas where they are cultivated, millets are used in traditional beer brewing. There are also used as a feed for birds (1).

Though regular consumption of millet in general is on gradual decline, it is still consumed as staple food regularly among millet growers and small income families. Rice from decorticated little millet and foxtail millet, roti and mudded from finger millet are most common staple foods consumed regularly. Preparation of few selected millet products during festivals are strictly followed by rural communities and thus have preserved the traditional culture significance of millet used in their regular diet. Rural consumers are more familiar with traditional products of millets only (8).

In recent years there has been increasing recognition for importance of millets and different types of millet processed are available now a day in urban general stores and supermarkets. Exclusive organic shops are also selling processed organic products because people are becoming more and more conscious about their health and prefer to buy healthier processed foods **(**5).

Food influences the health of a population to a great degree; therefore, the control of food quality is an important activity of food industry and is legislatively regulated. FSSAI has laid down the standards for cereals and pulses and their products in section 2.4 of food safety and standards (Food Product Standards and Food Additives) regulations, 2013. These include standards for food grains, their milled products and processed products (3)

Nowadays, different types of processed millet food (branded and without branding) are available in the market. Hence, the present study has been taken up to analyse the quality of the millet processed products available in the market with the objective of study the moisture and microbial content of selected commercially millet products available in the market.

2. Material and Methods

Five to maximum of ten shops based on the availability from each category were selected randomly from the market. Care was taken to collect only fresh samples that are from 0 to 5th days based on the date of manufacture printed on the cover. These collected products were classified in to ready to prepare (RTP) and ready to eat (RTE) products and stored in freezer (- 18 C) for further analysis. Samples were restricted to 100 numbers.

Standards for cereals and pulses and their products are laid down in section 2.4 of food safety and standards (Food Product Standards and Food Additives) regulations. These include standards for food grains, their milled products and processed products (FSSAI, 2013). All the selected millet products were analyzed for moisture and compared with FSSAI standards.That millet products that had moisture content more than standard a cording FSSAI (>13%), those products were subjected to the microbial study. In microbial study, the three microorganisms such as *Salmonella spp*, *E.Coli* and *Coliform* were studied. Bismoth sulphate agar was used for *Salmonella spp*, EMB agar was used for *E.Coli* and *Coliforms*.

All the collected samples were studied for packaging materials used such as LDPE (Low Density Poly Ethylene), HDPE (High Density Poly Ethylene), the cartons, silver foil, metalized silver coating etc.

3. Results and discussion

The results revealed that 52 products were in the form of RTC and 48 products were in the form of RTE. out of 52

RTC millet products; 36 products were in the form of organic products and 16 products were in the form of regular. However, from the 48 RTE millet products; 10 products were organic and 38 products were regular products. Hence, out of a total of one hundred millet products in both RTC and RTE, about 46 products were in organic category and 54 products were regular products. Most of RTC millet products were organic (69.23%) as compared to regular (30.76%). In RTE millet products, most of them were regular (79.16%) as compared to organic category (20.83%). Significant difference at 5 per cent level was found between RTC and RTE millet products that were available in the market (Table 1).

Table 1: Classification of commercially available processed millet products

Type of Products	Organic		Regular		Total
	N	%	N	%	N
Ready - to –cook	36	78.26	16	29.63	52
Ready - to - eat	10	21.74	38	70.37	48
Total	46	100	54	100	100
χ^2	**2.00***				

*Significant at 5% level

Out of hundred collected millet products in both RTC and RTE, most of them were available in super market in compare to local shops and organic shops. Most of the Organic products in both RTC and RTE categories were available in organic shops as well as supermarket. Local shops sold only regular millet products and most of them were RTE products. However, there was significant difference found at 5% (Table 2).

Table 2: Millet products available in different types of shops

Types of shop	Ready - to - cook		Ready - to –eat		Total
	Organic	Regular	Organic	Regular	
Super markets	14	11	2	22	49
Local shops	7	5	-	16	28
Organic shops	15	-	8	-	23
Total	36	16	10	38	100
χ^2	6.00*		6.00*		

*Significant at 5% level

Among ready - to - cook millet products (RTC) in both organic and regular, most of them were in the form of flour (61.11%) as compared to other types of millet products available in market in the form of RTC. There was no malt product available inorganic category but there were infant food and nutria mix which were also malted but named differently (Fig.1). Most of ready – to – eat millet products were in the form of bakery products. Among bakery products cookies were most abundantly available followed by biscuits and rusk in both organic and regular category. It was surprising to note that ready-to - eat finger millet Ambli (type of kanji) was also available in the market under regular category (Fig.2).

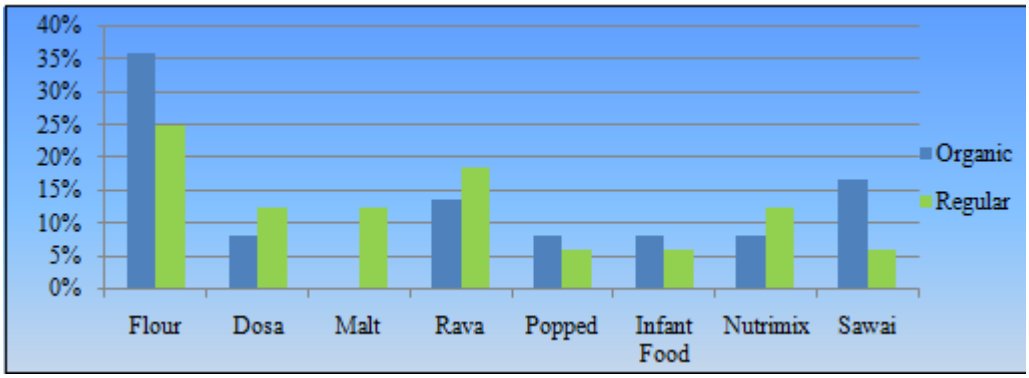

Figure 1: Types of processed ready - to - cook millet products available in market

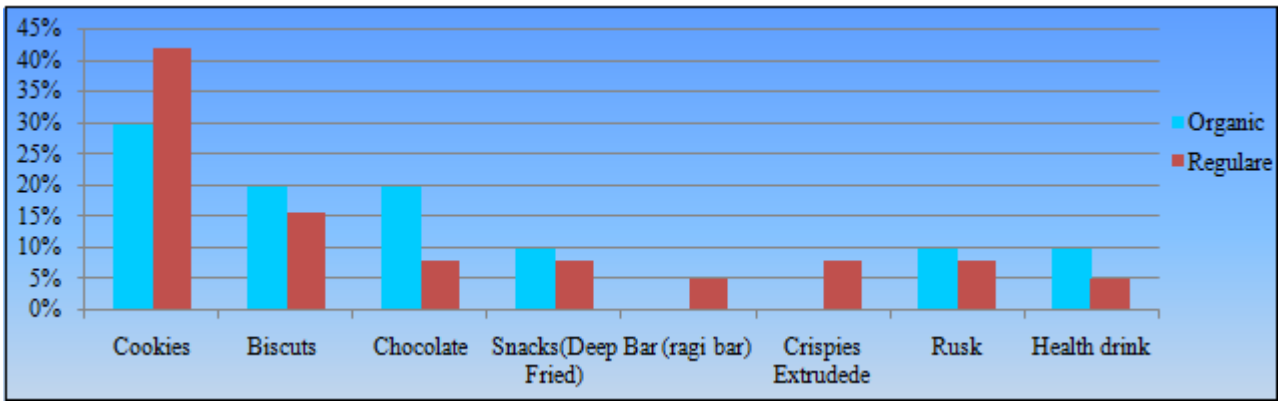

Figure 2: Types of processed ready - to - eat millet products available in market

Details of labeling on the packaging material of millet products were studied and compared with FSSAI standard for packaging (2011). According to table 6 most of the RTC products were packed using polypropylene and silver foil whereas maximum RTE products were packed in plastic boxes. However, there was significant difference found between packaging materials of millet products at 5% level (Table 3). Singh et al. (2012) in his study found that

metalized polyester was found to be the most suitable for the packaging of millet –wheat composite flours as it could be kept up to 55-65 days under accelerated condition without any significant loss of quality.

Table 3: Types of packaging materials used for millet products

Packaging Materials	Ready – to – cook	Ready – to – eat
Poly propylene	15	14
Paper carton	13	3
Silver foils	18	3
Laminated metalined films	6	10
Hard plastic boxes	0	18
Mean±SD	**10.4±6.53**	**9.6±5.95**
χ^2	**15.00***	

*Significant at 5% level

According to the FSSAI standard (2016), moisture content of millet products should not be more than 13%. The results showed (Table 10) all most all the products (N- 97) were within the limit of the FSSAI standard. Seventy five products had <10% of moisture, 20 products had 10 – 12% and 11 products had 12 – 13%. Remaining 3 products; one product from RTC and two from RTE had exceeding moisture content as compared to the standard limit. Statistically there was non- significant difference between RTC and RTE products in moisture content as compared to the standard limit (Fiq. 3).

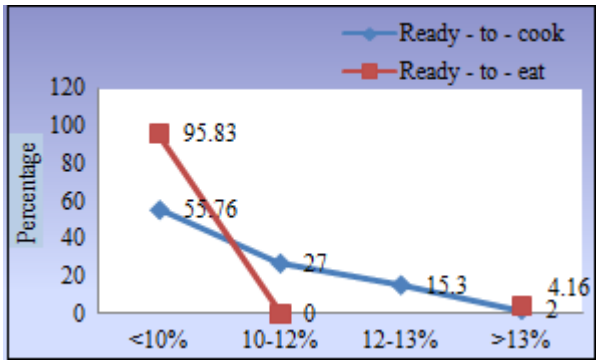

Figure 3: Average moisture contents of millet products available in the market

Among RTC millet products, little millet rava had higher moisture content compared to standard limit, but the moisture content of other types of RTC millet products were within standard limit. The moisture content of RTC millet products from organic category had less moisture when compared to regular products. The average moisture content of different products ranged from 5 to 12.55 percent; least was observed in nutrimix of both organic (4.98%) and regular (5.1%). Moisture content of the infant food was 6.28 in organic whereas 11.39 in regular food. Statistically there was non- significant difference when compared with standard value (Table 4).

Table 4: Average moisture content of different RTC millet products

Type of product	Organic Mean±SD	Regular Mean±SD
Flour	6.38 ± 4.24	11.59 ± 0.38
Rava	9.79 ± 0.01	12.55 ± 0.14
Popped mix	8.20 ± 1.01	9.67 ± 1.81
Infant food	6.28 ± 0.01	11.39 ± 0.01
Nutrimix	4.98 ± 0.33	5.1 ± 0.04
Sawai	11.01 ± 0.67	12.2 ± 0.54
Dosamix	10.17 ± 1.84	10.93 ± 0.01
Malt (ragi malt)	-	7.35 ± 0.01
Mean±SD	8.11 ± 2.29	10.09 ± 2.61

Determination of moisture content of RTE millet products showed that, out of 48 RTE millet products, two regular (non-organic) products; finger millet bar and finger millet ambli had exceeded the standard moisture content limit. However, moisture content of other types of RTE millet products in both organic and regular was within the FSSAI standard limit. Statistically there was non-significant difference between organic and regular on moisture content in RTE millet products when compared with standard valued. However, RTE millet products had less moisture content in both regular and organic as compared to RTC millet products (Table 5). Due to improper packaging and storage of food products few sampled millet had exceeding the moisture content in both TRC and TRE forms.

Table 5: The average moisture content of different RTE millet products

Type of Product	Organic Mean±SD	Regular Mean±SD
Cookies	3.93 ± 0.01	5.27 ± 0.01
Biscuits	3.60 ± 0.01	3.82 ± 0.02
Rusk	5.31 ± 0.42	5.46 ± 0.3
Snacks (Deep Fried)	2.5 ± 0.03	2.92 ± 0.04
Bar (Finger millet bar)	-	13.00 ± 0.12
Chocolate	3.10 ± 0.01	3.80 ± 0.02
Crispy (Extruded)	-	5.04 ± 0.13
Finger millet ambli	-	91.80 ± 0.01
Mean±SD	**2.305 ± 1.05**	**16.39 ± 30.63**

Those millet products which had more than 13% moisture content were referred to a microbial study. The results showed that *Salmonella spp*and *E. coli* were absent but *Coliform* was present in all three products that had exceeding moisture content such as little millet rava, finger millet bar and finger millet ambli. The number of *Coliform* colonies was more than the permitted limit in all three products (Table 6). It was found that those products were not safe for consumption.

Table 6: Population of *Salmonella spp*, *E. coli* and *Coliforms* in selected millet products

S. No	Product Name	*Salmonella spp*	*E.coli*	*Coliforms* (10^2cfu/g)
1	Finger millet bar	Nil	Nil	0.2
2	Finger millet ambli	Nil	Nil	75
3	Little millet rava	Nil	Nil	33.3

*According Microbial Food Safety – Indian Regulations *Coliform* should be absent in 0.1 gm of product (6)

Since regular products had more moisture content (when compared to organic product) and not certified by FSSAI, it is better the consumer to prefer FSSAI certified products because of having safety grantee. Those products that had exceeded moisture content compared to standard limit were contaminated by *Coliforms*, hence are not safe for consumption. Therefore, training might be conducted for

small entrepreneurs regarding the maintenance of hygiene during processing and packing.

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