

## MIRCROBIAL QUALITY OF READY TO EAT PRODUCTS OF SESAME

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The ready-to-eat products of sesame seeds prepared with sugar or jaggery namely *gajak*, *revadi* and *tilpatti* were analysed for their microbiological quality. The samples were procured from departmental stores, big shops, small shops and *thelewalas* (vendors) located in various areas of Jaipur city. The mean standard plate counts (SPC) ( $1.32 \times 10^5/g$  to  $3.17 \times 10^5/g$ ), coliform counts ( $0.17 \times 10^5/g$  to  $1.57 \times 10^5/g$ ) and total fungal counts ( $0.10 \times 10^5/g$  to  $0.70 \times 10^5/g$ ) were recorded in 80 samples studied. The products sold at *thelewalas* scored more microbial counts followed by small shops, big shops and departmental stores. The fungi isolated from the samples were *Alternaria alternata*, *Aspergillus candidus*, *A. flavus*, *A. fumigatus*, *A. niger*, *Cladosporium oxysporum*, *Curvularia lunata*, *Macrophomina phaseolina*, *Penicillium citrinum* and *Rhizopus nigricans*. The general condition of hygiene and cleanliness was very poor at the sites of preparation and storage of the products and that itself provides the chances of microbial contamination.

**Keywords :** *Gajak*; Microbial quality; *Revadi*; Sesame seeds; *Tilpatti*; Ready-to-eat preparations.

### Introduction

Quality of food is the ultimate criterion of the desirability of any food product and refers to the degree to which a commodity satisfies the wants of the consumer. Sesame also known as gingelly seeds and *til* is an important oil seed crop. It is rich in energy, fat, protein, calcium and iron. It is used in making of many food preparations like *revadi*, *gajak*, *laddu*, *tilpatti* etc., mainly by adding jaggery or sugar. Many ready-to-eat preparations of sesame both savory and sweet are available in market and consumed in a large amount by almost all population groups.

Food is a potential source of infection and liable to contamination by microorganisms at any point during its journey from the producers to the consumers<sup>1</sup>. The microbial quality of food is very important as contaminated food may be a risk factor for public health problems<sup>2</sup>. Microorganisms infecting food are mainly bacteria and fungi including yeast. The microorganisms associated with sesame seeds may alone alter the nutritional composition of the products<sup>3-7</sup>. Sulochana and Balkrishnan<sup>8</sup> reported *Rhizopus nigricans*, *Aspergillus flavus*, *A. niger*, *Mucor haemalis*, *Penicillium chrysogenum* and *Alternaria sesami* on seeds of various varieties of sesame.

Thus, only a few studies have been carried out to assess the microbial quality of the ready-to-eat products of sesame hence, the present study has been carried.

### Material and Methods

The methods of preparation of ready-to-eat products of

sesame were studied at the sites of manufacturing. A total of 80 samples, comprising of 16 samples each of *gajak* of jaggery, *gajak* of sugar, *revadi* of jaggery, *revadi* of sugar and *tilpatti* of jaggery from various shops viz. departmental stores, big shops, small shops and *thelewalas* (vendors) from various parts of Jaipur city were collected. All the samples were assessed for microbial quality using standard plate counts (SPC) on nutrient agar (NA), coliform counts (CC) on MacConkey agar (MCA) and total fungal counts (TFC) on potato dextrose agar (PDA) media<sup>9</sup>. Fungi associated with the products were isolated by using standard blotter method<sup>10</sup>.

### Results and Discussion

**Methods of preparation and storage conditions:** The methods of preparation of ready-to-eat products of sesame were observed. During the preparation of *gajak* with jaggery, melted jaggery is folded on a wooden pole and then mixed with sesame seeds and beaten on floor with wooden hammer. Similarly, during the preparation of *tilpatti* melted jaggery is folded on a wooden pole and sesame seeds are mixed and flattened on surface and cut into long pieces. In case of *revadi* small and flat drops are prepared and dried. During the preparation of *gajak* and *revadi* of sugar, sesame seeds are mixed with sugar syrup and processed in similar manner.

The general condition of hygiene and cleanliness was very poor at the site of preparation of the products. It was revealed that the preparation methods of the sesame

Table 1. Microbial counts of ready-to-eat products of sesame in various types of shops.

Ready-to-eat product (16 samples each)	Mean microbial counts (per g of sample)											
	Departmental Stores			Big Shops			Small Shops			The Lawalas		
	SPC	CC	TFC	SPC	CC	TFC	SPC	CC	TFC	SPC	CC	TFC
<i>Gajak Jaggery</i>	1.36x10 <sup>5</sup>	0.56x10 <sup>5</sup>	0.2x10 <sup>5</sup>	2.1x10 <sup>5</sup>	0.67x10 <sup>5</sup>	2.5x10 <sup>5</sup>	2.84x10 <sup>5</sup>	0.84x10 <sup>5</sup>	0.4x10 <sup>5</sup>	3.12x10 <sup>5</sup>	1.12x10 <sup>5</sup>	0.36x10 <sup>5</sup>
<i>Gajak Sugar</i>	1.77x10 <sup>5</sup>	0.40x10 <sup>5</sup>	0.1x10 <sup>5</sup>	1.9x10 <sup>5</sup>	0.56x10 <sup>5</sup>	0.3x10 <sup>5</sup>	2.53x10 <sup>5</sup>	0.82x10 <sup>5</sup>	0.5x10 <sup>5</sup>	3.06x10 <sup>5</sup>	1.09x10 <sup>5</sup>	0.32x10 <sup>5</sup>
<i>Revadi jaggery</i>	1.32x10 <sup>5</sup>	0.32x10 <sup>5</sup>	0.1x10 <sup>5</sup>	2.49x10 <sup>5</sup>	0.3x10 <sup>5</sup>	0.3x10 <sup>5</sup>	2.85x10 <sup>5</sup>	0.62x10 <sup>5</sup>	0.7x10 <sup>5</sup>	3.01x10 <sup>5</sup>	1.57x10 <sup>5</sup>	0.37x10 <sup>5</sup>
<i>Revadi Sugar</i>	1.80x10 <sup>5</sup>	0.26x10 <sup>5</sup>	0.2x10 <sup>5</sup>	2.10x10 <sup>5</sup>	0.46x10 <sup>5</sup>	0.66x10 <sup>5</sup>	2.96x10 <sup>5</sup>	1.07x10 <sup>5</sup>	0.4x10 <sup>5</sup>	3.17x10 <sup>5</sup>	1.30x10 <sup>5</sup>	0.14x10 <sup>5</sup>
<i>Tilpati Jaggery</i>	1.36x10 <sup>5</sup>	0.17x10 <sup>5</sup>	0.1x10 <sup>5</sup>	1.87x10 <sup>5</sup>	0.26x10 <sup>5</sup>	0.2x10 <sup>5</sup>	2.07x10 <sup>5</sup>	0.55x10 <sup>5</sup>	0.7x10 <sup>5</sup>	2.81x10 <sup>5</sup>	0.80x10 <sup>5</sup>	0.38x10 <sup>5</sup>

SPC= Standard plate counts; CC= Coliform counts; TFC= Total fungal counts

products itself may provide the chances of microbial contamination. Most of the manufactures stored the products in open trays. *Thelewalas* also stored such products in open trays or in glass boxes, small shopkeepers also did not pack these products but kept them in covered boxes while the big shopkeepers and departmental stores packed them in polythene bags.

**Microbial quality:** The ready-to-eat products of sesame viz. *gajak*, *revadi* and *tilpatti* prepared with jaggery or sugar collected from different shops showed high microbial counts (Table 1).

**Gajak:** In the samples of *gajak* prepared with jaggery, the standard plate counts (SPC) ranged between  $1.36 \times 10^5/g$  to  $3.12 \times 10^5/g$  (Table 1). The average microbial counts of samples of *gajak* prepared with sugar ranged from  $1.77 \times 10^5/g$  to  $3.06 \times 10^5/g$ . Most of the samples exhibited the presence of coliform group of bacteria indicating fecal contamination. The average coliform counts (CC) ranged from  $0.56 \times 10^5/g$  to  $1.12 \times 10^5/g$  in samples of *gajak* of jaggery and  $0.40 \times 10^5/g$  to  $1.09 \times 10^5/g$  in samples of *gajak* of sugar. The maximum coliform counts were found in samples collected from *thelewalas* and samples prepared with jaggery. The total fungal counts (TFC) ranged from  $0.2 \times 10^5/g$  to  $0.40 \times 10^5/g$  in samples of *gajak* prepared with jaggery while these counts ranged from  $0.10 \times 10^5/g$  to  $0.50 \times 10^5/g$  in samples of *gajak* prepared with sugar.

**Revadi:** The mean standard plate counts (SPC) and coliform counts were found maximum in samples of *revadi* collected from *thelewalas* being  $3.01 \times 10^5/g$  and  $1.30 \times 10^5/g$ , respectively (Table 1). In samples of *revadi* prepared with jaggery, the maximum SPC ( $3.01 \times 10^5/g$ ) were in samples collected from *thelewalas* while maximum total fungal counts were in samples collected from small shops. Similarly, samples of *revadi* prepared with sugar revealed the maximum SPC ( $3.01 \times 10^5/g$ ) and maximum coliform counts ( $1.30 \times 10^5/g$ ) in samples collected from thelawala while maximum total fungal counts ( $0.66 \times 10^5/g$ ) were observed in samples collected from big shops.

**Tilpatti:** The average SPC in samples of *tilpatti* ranged from  $1.36 \times 10^5/g$  to  $2.81 \times 10^5/g$ . The maximum coliform counts ( $0.80 \times 10^5/g$ ) were in samples collected from *thelewalas* whereas total fungal counts ( $0.7 \times 10^5/g$ ) in samples collected from small shops (Table 1).

The results revealed a significant difference between the mean total scores for total microbial load in samples collected from departmental stores, big shops, small shops and *thelewalas*. In general, the higher microbial counts were shown by samples from *thelewalas* followed by the samples from small shops, big shops and departmental stores (Table 1).

**Fungi associated:** A total of 10 fungal species belonging to 7 genera namely *Alternaria alternate*, *Aspergillus candidus*, *A. flavus*, *A. niger*, *A. tamrii*, *Cladosporium oxysporum*, *Curvularia lunata*, *Macrophonia phaseolina* and *Rhizopus nigricans* were isolated from the above mentioned ready-to-eat products of sesame on incubation using standard blotter method.

During the preparation of various ready-to-eat products of sesame namely *gajak*, *revadi* and *tilpatti*, seeds do not go under any cooking processing and thus are consumed raw. Ten fungal species of 7 genera have been found associated with the products in the present study, of which *Aspergillus flavus* is very important due to production of aflatoxin in food. Earlier Mishra and Saxena<sup>6</sup> have reported 7 fungi from edible preparations of sesame seeds (*revadi*, *gajak* and *tilsakri*). At small scale, these products are prepared in open areas and gain moisture due to the hygroscopic nature of jaggery and become soft and rancid. As a result of improper processing and unhygienic storage conditions, sesame seeds and its products may be contaminated with microorganisms which may be the cause of deterioration of the products. It increases the chances of fungal contamination among which *Aspergillus flavus*, *A. niger*, *A. fumigatus* and *A. candidus* are most common.

Hence, consumption of such contaminated food may prove hazardous for human beings. The various fungi harbouring sesame in storage may cause increase in fatty acid content, saponification value and peroxidase value and reduction in oil, protein as well as amino acids and carbohydrate contents as reviewed by Agrawal *et al*<sup>7</sup>. Among various samples collected, the samples from *thelewalas* from different areas revealed the maximum contamination. In such a way the unhygienic, method of preparation and storage of ready-to-eat products of sesame make the products contaminated at every step of preparation. The extent of fungal contamination is affected by various storage conditions and its duration<sup>11</sup>.

An overview of all the calculated data revealed that the samples collected from *thelewalas* were heavily contaminated which may be due to poor storage conditions as compared to samples from departmental stores and big shops. High microbial counts in the products made with jaggery may be attributed to the unhygienic manufacturing conditions and its hygroscopic nature.

The study suggests to the producers to have proper quality standards for manufacturing, packing and storage to maintain the quality and safety of these products. Further, the retailers should store such products in clean and covered containers to avoid chances of contamination

and growth of microorganisms during storage.

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