

## MICROBIAL QUALITY OF READY TO EAT PRODUCTS OF GROUNDNUT

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Microbiological quality of ready to eat products of groundnut (*Arachis hypogaea* L.) namely roasted groundnut, singdana and chikki (70 samples each collected randomly) revealed that all the samples irrespective of the place of collection showed high microbiological contamination. In the samples of roasted groundnut, singhdana and chikki the mean total viable counts were  $1.95 \times 10^5/g$ ,  $3.63 \times 10^5/g$ , and  $1.92 \times 10^5/g$ , respectively, while the mean total microbial counts were  $0.10 \times 10^5/g$ ,  $0.26 \times 10^5$ ,  $0.77 \times 10^5/g$ , respectively. Coliform counts were indicative of the fecal contamination. The fungi which predominated in the ready to eat products of groundnut were *Aspergillus flavus*, *A. niger*, *A. fumigatus*, *A. candidus*, *A. aculeatus* and *Penicillium citrinum*. The mean total fungal count in roasted groundnut, singhdana and chikki was  $0.09 \times 10^5/g$ ,  $0.17 \times 10^5/g$  and  $0.04 \times 10^5/g$ , respectively. The ready to eat products of groundnut viz. Roasted groundnut, singhdana and chikki collected from Jaipur City showed high microbial counts in the present study.

**Keywords:** Groundnut; Microbial quality; Ready to eat products.

### Introduction

Groundnut (*Arachis hypogaea* L.) occupies an important position in the economy of developing nations. In India it is an industrial crop whose major utilization is as a source of oil with very high energy due to its high fat. A variety of sweet and savory ready to eat (RTE) products of groundnut are widely consumed. It is cheap source of energy, fat, protein and other nutrients and thus are eaten by almost all population groups. As a result of improper processing and storage conditions, groundnut and its products may be contaminated with microorganisms. The number and type of microbes present on the produce is important in deterioration and numerous fungi may be involved, but most common are species of *Aspergillus*, *Penicillium* and *Fusarium*<sup>1, 2</sup>. Abalaka and Elegbede<sup>3</sup> isolated species of *Bacillus*, *Salmonella*, *Pseudomonas* and *Escherichia coli* from groundnuts.

Shewfelt and Young<sup>4</sup> stated that fungal growth development on groundnuts before, during or after harvest is hazardous, particularly when *Aspergillus flavus*, which produces aflatoxins, that is carcinogenic, is involved. Satunkhe *et al.*<sup>5</sup> reported that *A. flavus* and *A. parasiticus* grow and produce aflatoxins in groundnut. The major factors which lead to high contamination levels of groundnuts are shell damage and kernel splitting (usually induced by insects), poor harvesting and drought<sup>6</sup>.

As ready to eat products of groundnut are eaten

as such without further processing, though any product of adverse quality will cause health hazards to human beings. This leaves a big question mark on the availability of the nutrients, as the presence of microorganisms, especially fungi, alter the nutritional quality of the ready to eat products<sup>2, 7</sup>. However, very little work has been done on the assessment of quality of the ready to eat products of groundnut. The present study, thus has been carried out to assess the microbiological quality of the ready to eat products of groundnut in markets in Jaipur City.

### Material and Methods

Two hundred and ten samples of ready to eat products of groundnut *i.e.* roasted groundnut (n= 70), singhdana (n= 70; a salted and roasted ready to eat preparation of groundnut) and chikki (n= 70; a preparation of groundnut and jaggery in which jaggery is melted and roasted groundnut kernels are added to make a flat product, about 0.5cm thick) were collected randomly from different areas of Jaipur City, Rajasthan, India sold on 'thelas', small shops, big shops and departmental stores and were assessed by Standard Plate Counts on Nutrient Agar, Coliform Counts on Mac Conkey agar and Total fungal counts on Potato Dextrose Agar while Standard Blotters Method<sup>8</sup> was used to identify the fungi associated with the kernels and ready to eat products.

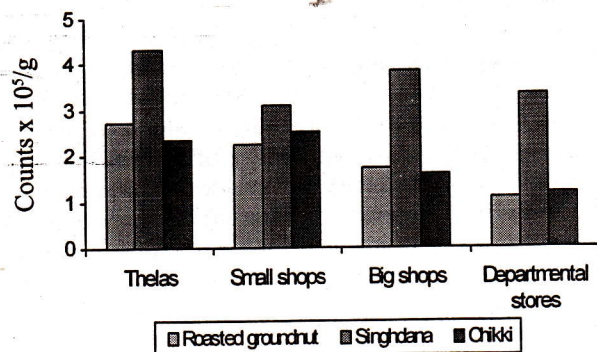
### Results and Discussion

The ready to eat products of groundnut viz. roasted

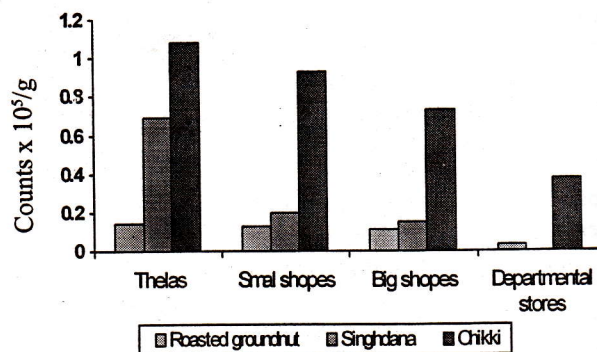
**Table 1.** Mean total microbial counts recorded on different agar media from ready to eat products of groundnut.

Type of Shop	Roasted Groundnut			Singhdana			Chikki		
	Nutrient Agar	Mac Conkey Agar	Potato Dextrose Agar	Nutrient Agar	Mac Conkey Agar	Potato Dextrose Agar	Nutrient Agar	Mac Conkey Agar	Potato Dextrose Agar
Thelas	$2.72 \times 10^5$ $\pm 0.29$	$0.148 \times 10^5$ $\pm 0.13$	$0.101 \times 10^5$ $\pm 0.146$	$4.31 \times 10^5$ $\pm 0.045$	$0.69 \times 10^5$ $\pm 0.042$	$0.535 \times 10^5$ $\pm 0.369$	$2.34 \times 10^5$ $\pm 0.58$	$1.08 \times 10^5$ $\pm 0.115$	$0.045 \times 10^5$ $\pm 0.025$
Small Shops	$2.26 \times 10^5$ $\pm 0.229$	$0.13 \times 10^5$ $\pm 0.18$	$0.206 \times 10^5$ $\pm 0.147$	$3.08 \times 10^5$ $\pm 1.41$	$0.20 \times 10^5$ $\pm 0.29$	$0.126 \times 10^5$ $\pm 0.123$	$2.53 \times 10^5$ $\pm 0.19$	$0.93 \times 10^5$ $\pm .03$	$0.145 \times 10^5$ $\pm 0.025$
Big Shops	$1.72 \times 10^5$ $\pm 0.11$	$0.11 \times 10^5$ $\pm 0.139$	$0.036 \times 10^5$ $\pm 0.038$	$3.86 \times 10^5$ $\pm 0.06$	$0.15 \times 10^5$ $\pm 0.29$	$0.005 \times 10^5$ $\pm 0.05$	$1.59 \times 10^5$ $\pm 0.09$	$0.73 \times 10^5$ $\pm 0.05$	$0.005 \times 10^5$ $\pm 0.05$
Departmental Stores	$1.10 \times 10^5$ $\pm 0.058$	$0.03 \times 10^5$ $\pm 0.001$	$0.02 \times 10^5$ $\pm 0.002$	$3.34 \times 10^5$ $\pm 0.04$	-	$0.025 \times 10^5$ $\pm 0.025$	$1.2 \times 10^5$ $\pm 0.105$	$0.375 \times 10^5$ $\pm 0.015$	-
Mean	$1.95 \times 10^5$	$0.10 \times 10^5$	$0.09 \times 10^5$	$3.63 \times 10^5$	$0.26 \times 10^5$	$0.17 \times 10^5$	$1.92 \times 10^5$	$0.77 \times 10^5$	$0.04 \times 10^5$

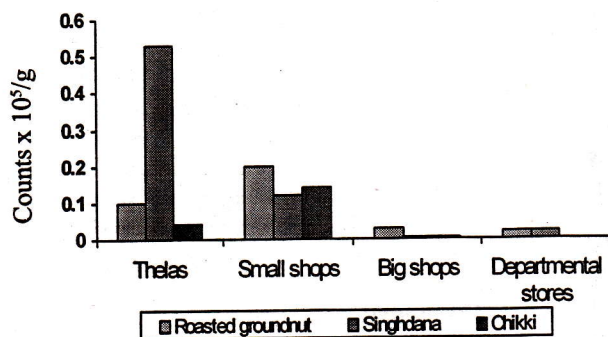
\*All values in counts/g.



**Fig. 1.** Total viable counts of ready to eat products of groundnut.



**Fig. 2.** Total Coliform counts of ready to eat products of groundnut.



**Fig. 3.** Total fungal counts of ready to eat products of groundnut.

groundnut, singhdana and chikki collected from Jaipur City showed high microbial counts. Apart from high viable counts, the samples even exhibited the presence of coliform group of bacteria in almost all the samples indicative of the fecal contamination. The mean total viable count for roasted groundnut, singhdana and chikki was  $1.95 \times 10^5/g$ ,  $3.63 \times 10^5/g$  and  $1.92 \times 10^5/g$ , respectively, while the mean total microbial counts were  $0.10 \times 10^5/g$ ,  $0.26 \times 10^5$ ,  $0.77 \times 10^5/g$ , respectively (Table 1, Figs. 1, 2). The mean total fungal count in roasted groundnut, singhdana and chikki was  $0.09 \times 10^5/g$ ,  $0.17 \times 10^5/g$  and  $0.04 \times 10^5/g$ , respectively (Table 1, Fig. 3).

The observation of the procedure of preparation of various ready to eat products of groundnut revealed that the products are prepared in very unhygienic

conditions, especially chikki. The raw materials used are stored improperly, which reduce the overall quality of the final product. The personnel who were involved in the preparation process followed poor personal hygiene due to ignorance and lack of care in food production. It has been stated that the food handlers are the major source of contamination in processed foods<sup>9</sup>. Apart from this, the use of contaminated utensils and equipments also leads to the deterioration of quality of ready to eat products. The storage of these products is defected as seen in 'thelas', where the products are kept on open trays; the open food products were exposed to environmental pollution, handling, dust and soot from the atmosphere.

The results of the present study revealed an overall quality degradation of ready-to-eat products of groundnut especially those collected from 'thelas' which are located in heavy traffic areas or near open drains and small shops. The total viable counts on the other hand, were low in the samples collected from departmental stores and big shops.

Roasted groundnut is usually exposed with many intending buyers touching with contaminated hands thereby contaminating the product. The major fungi which were isolated from the ready to eat products of groundnut were species of *Aspergillus flavus*, *A. niger*, *A. fumigatus*, *A. candidus*, *A. aculeatus*, *A. terreus*, *A. versicolor* and *Penicillium citrinum*, *Rhizopus nigricans* and *Cladosporium oxysporum*. The samples of chikki were contaminated maximum.

Some of these fungi, especially *Aspergillus* spp. are able to survive in situations where free water is not available<sup>10</sup>. Also the production of spores by these organisms on dried food products makes it possible for them to survive, since their spores are to some extent more resistant to dry conditions than the vegetative mycelia<sup>11</sup>. The presence of these fungi on roasted groundnut, singhdana and chikki may result in production of toxic substances, which could lead to health hazard for the consumers. The fungus *A. flavus* attacks groundnut seeds producing the important metabolite, aflatoxin, which has been shown to be highly toxic to man, all domestic and laboratory animals<sup>12</sup>.

All the three RTE products used in this study were found contaminated with fungi and bacteria, and these microbes might multiply to cause spoilage of these products under favorable condition and render them inedible or could even become vehicles of food poisoning and infection.

Thus, as the ready to eat products of groundnut are widely consumed in India, especially by the lower SES who can only afford to buy the products from 'thelas' and

small shops produced by small-scale food producers, proper packaging is required. The producers should be educated about the proper packaging and storage of these products to avoid the microbial contamination. Also the storage and quality of raw materials should be checked from time to time.

The poor quality of RTE products of groundnut observed in present investigation warrants an urgent need for formulation of a policy by the Government for quality control of RTE products produced by small-scale food producers.

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