



Analysis of Microbial Load in Local Variety Sesame Grown in Chad

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study was carried out to assess the health quality of sesame seeds, a local variety, grown in Chad with a view to contributing to their food and economic valorization. The seeds come from experimental fields in two distinct zones: Kournari in the Sahel and Kélo in the Sudanian zone. The health quality of sesame was assessed by microbiological analyses. The results showed low contamination of the samples analyzed by total coliforms, *Escherichia coli* and yeasts and molds. Analysis of the results showed a total absence of yeasts and molds in the samples from Kournari. Salmonella was absent in all samples analyzed. The health quality of these sesame products is therefore good and can be used for physicochemical analyses. But the contamination of part of the samples confirms the need for good hygiene and good agricultural production techniques. It is therefore necessary to ensure compliance with good agricultural practices and good post-harvest treatment practices for sesame.

Keywords: Sesame; local variety; microbial load; sahelian zone; sudanian zone; Chad.

1. INTRODUCTION

Sesame (*Sesamum indicum* L.) is a legume of the *Pedaliaceae* family. The plant grows on relatively poor soils in climates generally unsuitable for other crops [1]. Its seeds are widely used in human food as well as in the food, pharmaceutical and cosmetic industries. Sesame seeds contain 19-25% protein, 5% ash, 57-63% fat [2]. They are also rich in phosphorus, iron, magnesium, calcium and some potential nutraceutical compounds such as phenolic compounds and tocopherols with antioxidant activity which have a significant effect on human health [3]. Sesame seed is classified among the main tropical oilseeds, capable of constituting commercial sources of edible oils and proteins, after that of cotton and peanut. The oil content is around 35 to 60% depending on the varieties and growing conditions [4]. In Chad, sesame cultivation is of great social, cultural and economic importance. According to FAO statistics, sesame production was estimated at 170,000 tonnes in 2015 [5]. Sesame has seen renewed interest in recent years thanks to the recovery in world prices and increasingly growing demand. Formerly cultivated for self-consumption, sesame has become a cash crop in Chad after cotton and peanuts [6]. The varieties cultivated are local or improved varieties (S42, Pachequeno sel, DLS1) with brown, black or white seeds with a predominance of varieties with white seeds [7]. Sesame is considered a promising sector [8]. Its seed has nutritional importance, and therefore the characterization of its microbiological quality is necessary to ensure the health safety of consumers. Sesame is considered as one of the oldest oil crop known to humanity. This manuscript presents the importance of hygienic sesame production and

its economic valorisation through its production in a scientific manner. It also shows the important factors to be considered while its production which are very much important to prevent various health hazards. The objective of this study is to evaluate the health quality of sesame seeds grown in Chad with a view to contributing to their nutritional value.

2. MATERIALS AND METHODS

2.1 Study Framework

The experiments were carried out in Kélo in the Sudanian zone and in Kournari in the Sahelian zone, in Chad. The microbiological analyzes were carried out in the microbiology laboratory of the Food Microbiological Analysis Department of the Food Quality Control Center (CECOQDA) in N'Djamena, Chad.

2.2 Plant Materials

The plant material consisted of the seeds of the local black-seeded sesame variety (*Sesamum indicum* L.) from experimental sites. It is the same variety that is used in both experimental sites.

2.3 Collection of Samples

The samples were produced in open fields in the natural sites of Kélo in the Sudanian zone and Kournari in the Sahelian zone, in Chad.

A total of 60 sesame samples, or 30 samples per zone of sesame seeds, were taken at maturity, numbered and sent to the CECOQDA laboratories for microbiological analyses.

2.4 Laboratory Analyzes

The microbiological quality of these samples was assessed by determining the prevalence of five putative pathogenic microorganisms: total coliforms, *Escherichia coli*, yeasts and molds and *Salmonella spp.* All microorganisms were searched for and quantified according to the ISO standard (Table 1). To assess the conformity of the sesame samples analyzed, a two-class plan was used for all the parameters sought. Samples of vegetables of unsatisfactory or corrupted microbiological quality were considered samples of non-compliant microbiological quality.

2.5 Statistical Analyzes of Data

The data collected on the various parameters observed and measured were recorded and processed using Excel 2016 software.

3. RESULTS AND DISCUSSION

3.1 Contamination of Sesame by Coliforms at 37°C

The results of the search for coliforms at 37°C in local variety sesame with black seeds are given in Fig. 1. 93.33% of the samples from the Kournari field are satisfied for 6.67% of the

samples are not satisfied. While in Kélo, 83.33% of samples are satisfied for 16.67% of samples not satisfied.

3.2 Contamination of Sesame by *Escherichia Coli*

The enumeration of *Escherichia coli* in sesame is illustrated in Fig. 2 and is as follows:

- 76.67 and 86.67% of the samples are satisfactory (flora $\leq 10^2$ CFU/g);
- 23.33 and 13.33% of the samples are unsatisfactory (flora $> 10^2$ CFU/g).

Analysis of the figure shows that this presumed pathogenic germ is present in both (2) zones. In the sesame samples from Kournari we discovered the most unsatisfactory samples.

3.3 Contamination of Sesame by Yeast and Mold

Fig. 3 gives the contamination levels of sesame produced by yeasts and molds. The analysis of this figure shows a total absence of yeasts and molds in the samples from Kournari. At Kélo, 93.33% of samples are satisfactory. On the other hand, 3.33% of samples were contaminated by yeasts and molds.

Table 1. Microbiological tolerance criteria relating to sesame

Searched parameters	Methods	Microbiological criteria in CFU/g
Coliforms at 37°C	NF ISO 4832 (2006)	$\leq 10^2$
<i>Escherichia coli</i>	NF ISO 16649-2(2001)	$\leq 10^2$
Yeasts - Molds	NF ISO 21527 1 and 2 (2008)	$\leq 10^4$
<i>Salmonella spp.</i>	NF ISO 6579 -1 (2017)	Absence in 25g

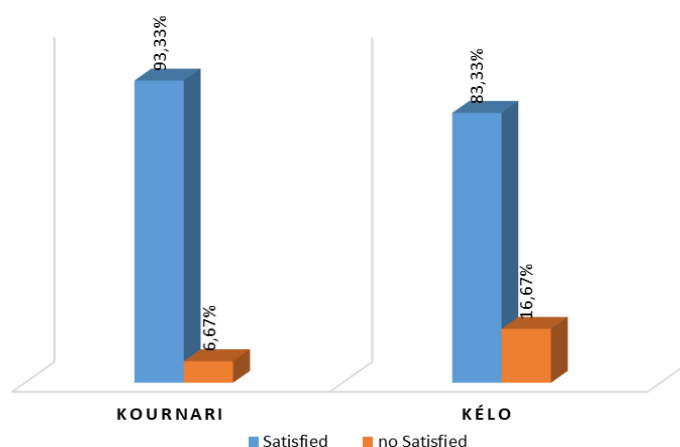


Fig. 1. Percentages of Coliforms present at 37°C in local variety sesame in Chad

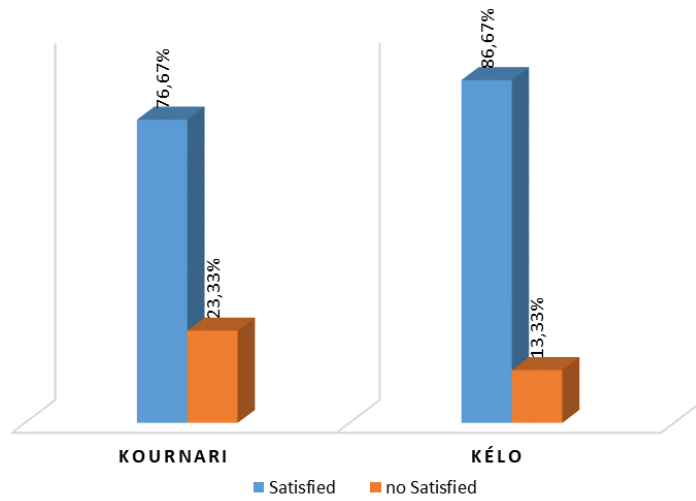


Fig. 2. Percentages of *Escherichia coli* in local variety sesame in Chad

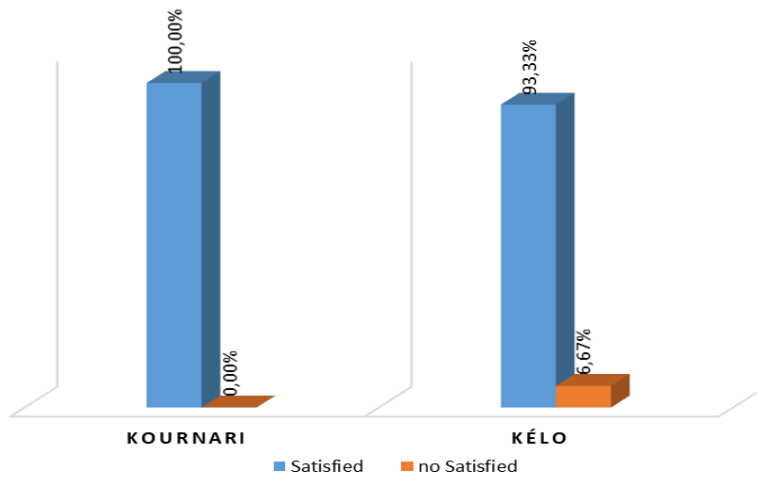


Fig. 3. Percentages of yeast and mold in local variety sesame in Chad

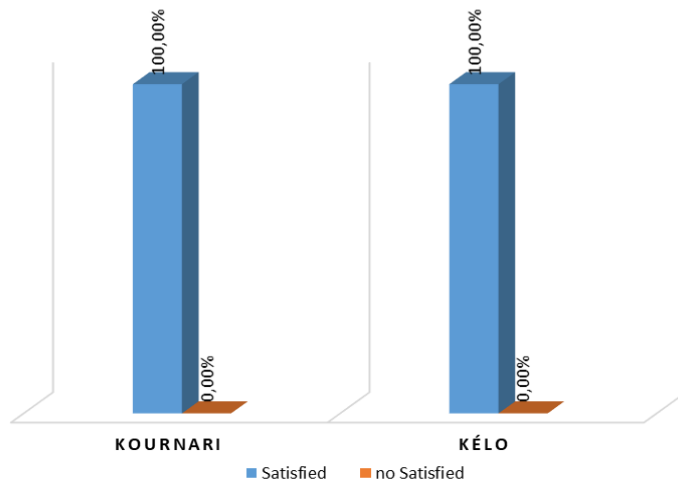


Fig. 4. *Salmonella spp* detection in local variety sesame in Chad

3.4 Contamination of Sesame by *Salmonella spp*

Fig. 4 gives the results of the salmonella count in sesame in the study areas. Generally speaking, all samples from the study areas are satisfied (total absence of salmonella in 25 g).

3.5 Discussion

The enumeration of total coliforms in sesame reveals low contamination of the samples. More than 80% of samples are satisfactory in the study areas. Faecal coliforms are germs that testify to the hygienic quality of food alongside coliforms at 30°C and sulfitereducing anaerobes [9]. *Escherichia coli* was detected in both study areas although at low proportions. The presence of *Escherichia coli* indicates contamination of fecal, human or animal origin. A high load of *Escherichia coli* promotes spoilage of the product and constitutes a risk of the presence of pathogenic germs [10]. *Salmonella* is absent in both sites. *Salmonella* contamination rates of 12.5%, 9.87% and 10.96% were obtained in sesame seeds respectively in Germany by Brockmann et al. [11], in the United States [12] and in Burkina Faso by Douamba et al. [13]. A retrospective study of sesame seeds received for quality control from 2007 to 2017 in a laboratory in Ouagadougou gave a salmonella contamination rate of 26.46% [14]. The results obtained in this study show that the non-compliances noted are due to non-compliance with good hygiene practices and good agricultural practices in a context of higher humidity levels, especially in Kélo. The workforce is the “weakest link” and the most important [15,16]. It is the major source of germs. The analysis of the results confirms the need for good hygiene practice and good agricultural production techniques throughout the production phase. A poorly adapted hygiene policy will result in an increase in biological contamination with the possibility of development of pathogenic microorganisms with a risk of food poisoning [17,18,19].

4. CONCLUSION

Microbiological analyzes showed low microbial contamination of local varieties of sesame produced in Chad. The health quality of these sesame products is therefore good and can be used for physicochemical analyses. But the contamination of part of the samples confirms the need for good hygiene and good agricultural

production techniques. It is therefore necessary to ensure compliance with good agricultural practices and good post-harvest treatment practices for sesame.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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