

Research Article

## Assessment of Microbial Aspects of Fermented fish (Faseikh) at Khartoum State

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### Abstract

This study was conducted to evaluate the microbial aspects of Sudanese fermented fish (Faseikh) at Khartoum state (Khartoum, Khartoum north and Omdurman one) such as Total Viable Bacterial Count (TVBC), *E. coli* and Yeast and moulds and chemical compositions such as Moisture, protein, fat and pH. The findings revealed that there were significant differences ( $P < 0.05$ ) detected among Faseikh samples from different locations at Khartoum state. The highest moisture content of 64.66% was recorded for samples collected from Khartoum, whereas the lowest one (61.34%) was recorded for samples collected from Khartoum north. Protein content of same sample ranged between 19.62% and 22.16%. The highest fat content (7.37%) was recorded for samples collected from Khartoum, whereas, the lowest one (6.36%) was reported for faseikh samples collected from Khartoum north. TVBC of faseikh samples of Khartoum state ranged from 4.84 to 7.80 log<sub>10</sub> cfu/g. It was concluded that all samples under investigation were free from *E. coli* and yeasts and moulds.

**Keywords:** Sudanese fermented fish, Faseikh, Khartoum state, Total viable bacterial count, *E. coli*.

### Introduction

Fish resources are considered important for food security and socio-economic development in Sudan (FAO, 2008). Fish is generally considered as high in nutritional value due to its high quality protein. Fish contains considerable amounts of omega-3 PUFAs, particularly eicosapentaenoic acid and docosahexaenoic acid (Basheer, 2017). Fish consumption reduces the risk of coronary heart disease and overall cardiovascular mortality, especially in high-risk populations. Fish can decrease blood triglycerides concentrations, lower blood pressure and increase HDL cholesterol levels (Dural et al., 2007). Fish processing is very common through canning, salting, drying, fermenting and smoking (FAO, 1992). Dirar (1993) described that the most significant fermented fish items in Sudan are faseikh (wet salted fish), which was introduced into Sudan from Egypt during the 19<sup>th</sup> century. Agap and Shafi (1989) stated that, faseikh is considered the most popular fermented fish in Sudan. This study was conducted to evaluate the microbial aspects of Sudanese fermented fish (Faseikh) at Khartoum state (Khartoum, Khartoum north and Omdurman one) such as Total Viable Bacterial Count (TVBC), *E. coli* and Yeast and moulds and chemical compositions such as Moisture, protein, fat and pH.

### Materials and methods

**Sample collection:** Seventy five of Sudanese fermented fish (Faseikh) samples were collected randomly from the different locations at Khartoum state (Khartoum, Khartoum north and Omdurman) localities namely 25 samples for each locality and transferred immediately to the labs of National Food Research Center (NFRC) for chemical composition and to the Microbiology lab, University of Sudan for microbial aspects.

**Analytical methods:** Moisture content, crude protein, fat and pH values were determined according to the AOAC (2005). Microbial analysis (TVBC, *E. coli*, *Salmonella* and Yeast and Molds) were determined according to Harrigan and McCance (1976).

**Total viable bacterial count (TVBC):** One milliliter aliquot from suitable dilution was transferred aseptically into a sterile Petri dish. To each dilution 10-15 mL melted and cooled sterile plate count agar were added. The inoculums were mixed thoroughly with the medium and allowed to solidify. The plates were then incubated at 37°C for 24-72 h and examined daily for growth (Harrigan and McCone, 1976). Counting was recorded as colony forming units per gram (CFU/g).

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**Coliform bacteria (*E. coli*):** The coliform test was done by plating one mL sample onto MacConkey agar media. The plates were incubated at 37°C for 48 h and the counts were presented as cfu/g. Plates showing positive coliform were subjected to the confirmatory test using Brilliant green blue lactose broth in test tubes with inverted Durham tubes and incubated at 44°C for 48 h. Each positive tube was subcultured into EC broth medium and then incubated at 44.5°C for 24 h. Tubes showing gas productions were considered *E. coli* positive. For the isolation and identification of *E. coli*, the enriched sample was cultured on selective medium Eosin Methylene Blue (EMB) Agar and incubated at 37°C for 24 h (Harrigan and MacCance, 1976).

**Salmonella sp. detection:** Twenty five gram of the sample was aseptically weighed and mixed well with 250 mL sterile nutrient broth. The mixture was incubated at 37°C for 24 h. Ten mL were aseptically drawn from the mixture and added to 100 mL selenite broth and incubated at 37°C for 24 h. A loopful from the broth was streaked onto dried bismuth sulphite agar plates and incubated at 37°C for 24 h (Harrigan and MacCance, 1976).

**Yeast and moulds count:** Yeast and moulds were cultured on Malt Extract Agar (MEA) containing 0.1 g chloramphenicol per liter of medium to inhibit bacterial growth. From suitable dilutions of the sample, 0.1 mL was aseptically transferred onto the surface of readily prepared and solidified malt extracts agar plates. The sample was spread using a sterile bent glass rod. Plates were allowed to dry and incubated at 25 °C for 72 h (Harrigan and McCance, 1976).

#### Statistical analysis:

Data collected were subjected to the analysis of variance and Duncan's Multiple Range Test was used to separate means (Steel and Torrie, 1980).

## Results and discussion

### Chemical composition of Sudanese fermented fish (Fasiekh):

Table 1 illustrated that there were significant ( $P \leq 0.5$ ) differences in moisture content among the Sudanese fermented (fasiekh) samples collected from the different locations at Khartoum state. The highest moisture content 64.66%, was recorded for samples collected from Khartoum, whereas, the lowest one 61.34% was recorded for samples collected from Khartoum north. Lower moisture content 53.30%, of the (fasiekh) samples was reported by Mostafa and Salim (2015). Osman *et al.* (2012) reported that, fasiekh samples had moisture content of 51.17%. Hassan (2010) reported that, fermented fish (Tarkeen) had a moisture content of 40.08%.

FDA (2011) recommended that the moisture content of fermented fish should not exceed 44%. Table 1 showed that there were significant ( $P \leq 0.5$ ) differences of protein content among the fasiekh samples collected from the Khartoum state. The highest protein content 22.16% was recorded for samples collected from Khartoum north, whereas, the lowest one 19.62% was recorded for samples collected from Khartoum. The findings were supported by Eltom (1989) who stated that, fish contains a considerable amount of protein. Lower protein content 18.48% was reported by Osman *et al.* (2012). Higher results were reported by Mostafa and Salim (2015) who found that, fasiekh samples had protein content ranged between 18.12-28.52%. The findings of this study were in agreement with those obtained by Ahmed (2006) who reported that, protein content of fresh and salted fish ranged between 16.54-20.5%. These variations in protein contents could be attributed to, fish species, feeding design, breeding system, genetic factors, type of fermentation and storage conditions as stated by Ahmed (2006).

Table 1 demonstrated that there were significant ( $P \leq 0.5$ ) differences in the fat content among the fasiekh samples collected from Khartoum state. The highest fat content 7.37% was recorded for samples collected from Khartoum, whereas, the lowest one 6.36% was reported for fasiekh samples collected from Khartoum north. The findings were lower than the values reported by Mostafa and Salim (2015) who found that, fasiekh samples had fat content of 9.67%. Osman *et al.* (2012) found that, fasiekh samples at Khartoum state had fat content of 8.09%. Hassan (2010) reported that, fermented fish (Terkeen) had fat content of 5.70%. In addition Hassan (2010) mentioned that the fish composition may differ owing to differences in water quality, feeding conditions, sex, state of maturity and capture conditions. Furthermore Ahmed (2006) stated that lipids are an important component in fish products and human diet.

Data in Table 1 showed that there is a significant ( $P \leq 0.5$ ) difference in pH values of fasiekh samples collected from Khartoum state. The highest pH value of fasiekh samples was 5.96 reported for samples collected from Khartoum, while, the lowest 5.72 was reported for samples collected from Khartoum north. The findings reported lower value compared to Mostafa and Rabab (2015) who found that, fasiekh samples had pH value with an average of 6.34. Similar observation was reported by Sangcharoen (2009) who found that, pH value of Thailand fermented fish was 6.3. The current results were lower than that reported by Hassan (2010) who found that, fermented fish (Terkeen) had pH value of 6.15.

Table 1. Chemical composition of Sudanese fermented fish (Faseikh) at Khartoum state.

Sample code	Moisture %	Protein %	Fat %	pH
A	64.66 <sup>a</sup> (±0.01)	19.62 <sup>c</sup> (±0.02)	7.37 <sup>a</sup> (±0.01)	5.96 <sup>a</sup> (±0.02)
B	61.34 <sup>b</sup> (±0.04)	22.16 <sup>a</sup> (±0.22)	6.36 <sup>c</sup> (±0.05)	5.72 <sup>c</sup> (±0.06)
C	63.26 <sup>c</sup> (±0.05)	20.75 <sup>b</sup> (±0.04)	6.96 <sup>b</sup> (±0.04)	5.81 <sup>b</sup> (±0.05)
Lsd <sub>0.05</sub>	0.0006214*	0.0006216*	0.0006217*	0.0006216*
SE±	0.0001436	0.0001426	0.0001926	0.0001927

Values are means ± SD. \*Means in the same column bearing the same superscript small letters are not significantly different ( $P \geq 0.05$ ). Where A: Samples collected from Khartoum, B: Sample collected from Khartoum north, C: Sample collected from Omdurman.

Table 2. Microbial aspects of Sudanese fermented fish (Faseikh) at Khartoum state.

Sample code	TVBC	<i>E. coli</i>	Yeast and Moulds
A	4.84 <sup>a</sup> (±0.06)	Nil	Nil
B	7.80 <sup>b</sup> (±0.07)	Nil	Nil
C	5.24 (±0.08)	Nil	Nil
Lsd <sub>0.05</sub>	0.0006214*		
SE±	0.0001436		

Ahmed (2006) mentioned that, the production of volatile basic components such as ammonia, trimethylamine and total volatile nitrogen produced by fish spoiling bacteria significantly affect pH value. Furthermore, Mostafa and Salim (2015) stated that the pH value is considered as an important intrinsic factor related to post-mortem changes of fish flesh.

#### Microbial aspects of Sudanese fermented fish (Faseikh):

Table 2 shows that there is a significant ( $P \leq 0.05$ ) difference detected in the Total Viable Bacterial Count (TVBC) of Sudanese fermented fish (faseikh) collected from Khartoum state. TVBC ranged between 4.84 and 7.80  $\log_{10}$ cfu/g. Khartoum north had recorded the highest TVBC 7.80  $\log_{10}$ cfu/g. Osman *et al.* (2012) found that the faseikh samples collected from Khartoum state had TVBC of 6.8  $\log_{10}$ cfu/g. The findings were lower than that reported by Algab and Shafi (1998) who found that, TVBC of faseikh samples of Khartoum state had TVBC of 8.89  $\log_{10}$ cfu/g. FAO (1992) stated that, TVBC of meat products indicates contamination from skin, mouth and nose of employees. All samples collected from Khartoum state were *E. coli* free. SSMO (2008) recommended that meat products suitable for human consumption must be *E. coli* free.

Similar results were observed by Osman *et al.* (2012) who found that faseikh samples collected from different locations at Khartoum state were *E. coli* free. Harris and Savill (2005) mentioned that *E. coli* is the best indicator of fecal contamination. FAO (1992) stated that, the natural habitat for *E. coli* is the intestines of human and vertebrate animals. Table 2 faseikh samples collected from Khartoum state was yeast and moulds free. These results were in accordance with SSMO (2008) which recommended that meat products suitable for human consumption must be mould and yeast free. The results of the current study were in agreement with those reported by Osman *et al.* (2012) who reported that there was no growth of yeast and mould in faseikh samples collected from Khartoum state.

#### Conclusion

The study concluded that the investigated faseikh fish samples in Khartoum state were high in TVBC. However the investigated faseikh samples were *E. coli*, yeast and mould free.

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