



## Microbial Contamination of Commercial and Traditional Doogh Dairy Products in Lorestan Province of Iran

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### HIGHLIGHTS

- *Escherichia coli* and *Staphylococcus aureus* were not detected in doogh dairy samples (n=200).
- Unacceptable levels of mold and yeast counts were found in 90% of traditional samples.
- Attempts have to be made to standardize the processing of Iranian traditional doogh manufacturing.

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#### Acronyms and abbreviations

MPN=Most Probable Number

### ABSTRACT

**Background:** Doogh is a popular dairy beverage in Iran which its main ingredient is yogurt. The aim of this study was evaluation of bacterial and fungal contamination of this product marketed in Lorestan province, West of Iran.

**Methods:** A total of 200 doogh samples consisted of 150 commercial samples, including five different brands and also 50 homemade samples were purchased randomly from markets. Coliforms, *Escherichia coli*, *Staphylococcus aureus*, mold, and yeasts counts were performed according to Iranian national standard protocols.

**Results:** *E. coli* and *S. aureus* counts were negative for all doogh samples. Coliform enumerations of all samples were less than the acceptable range declared from Iranian national standard. Out of 200 samples, 56 (28%) were unacceptable due to mold and yeast counts more than the maximum acceptable level stated by national standard of Iran ( $\leq 100$  CFU/ml). Overall, 45 samples (90%) of traditional as well as 11 samples (7.3%) of commercial doogh were microbiologically unacceptable.

**Conclusion:** Attempts have to be made to standardize the processing of Iranian traditional doogh manufacturing, and public health authorities should control the hygienic quality of both traditional and commercial doogh in Lorestan province, routinely.

### Introduction

Doogh as a drinking yogurt with low viscosity has high consumption among the dairy beverage in Iran (Kiani et al., 2008). Iranian doogh is produced with a mixture of yogurt and water (in the same rate), salt, and plant extracts flavoring agents such as mint, oregano, as well as thyme essence or mixture of them (Azarikia and Abbasi, 2010; ISIRI, 2008a). In the other countries, consumption

of similar dairy beverage products is very common such as Ayran in Turkey; Than in Armenia; Lassi and Dahi in Southern Asia; Viili, Tafil and Filmjolk in Scandinavian countries, and Laban drink in most Arab countries (Kabak and Dobson, 2011; Kiani et al., 2008; Kiani et al., 2010).

Nowadays, doogh is produced in large scales by many

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Iranian dairy companies. Some undesirable spoilage microorganisms, including coliforms, molds, yeasts, as well as various important pathogenic bacteria such as enterotoxigenic strains of *Staphylococcus aureus* and enteropathogenic strains of *Escherichia coli* may be found in them (Jay et al., 2005). Also, fungi have a potential risk for human due to its ability to produce mycotoxin in food especially in appropriate environmental conditions. Mycotoxins could cause carcinogenicity, malformations, growth retardation, as well as immune systems suppression and even mutagenesis (Heshmati, 2010; Heshmati and Milani, 2010; Rahmani et al., 2011). Considering high consumption of doogh in Iran, the aim of this study was to evaluate of microbial contamination of this product marketed in Lorestan province, Iran.

### Materials and methods

This cross sectional study carried out in main cities of Lorestan province, West of Iran from March to December 2013. A total of 200 doogh samples consisted of 150 commercial samples, including five different brands and also 50 homemade samples were purchased randomly from markets. The samples were immediately transferred to the laboratory in a cold box.

Coliform, *E. coli*, *S. aureus*, mold, and yeasts counts were performed using recommended methods in Iranian national standards (ISIRI, 2000; ISIRI, 2002; ISIRI, 2006; ISIRI, 2008b). Samples (100 ml) were diluted decimal serially in peptone water (0.1% w/v), and aliquots (100  $\mu$ l) of the sample dilutions were spread on special agar plates (ISIRI, 2008a). Coliform counts were determined on crystal violet neutral red bile lactose agar (Merck Darmstadt, Germany) at 30 °C for 24 h (ISIRI, 2002). Yeast extract glucose chloramphenicol agar (Merck Darmstadt, Germany) was used for mold and yeast count and incubated at 25 °C for 3–5 days (ISIRI, 2008b). *E. coli* and *S. aureus* were incubated in lauryl sulfate broth (Merck Darmstadt, Germany) and mannitol salt agar (Merck Darmstadt, Germany), respectively and subsequently determined by Most Probable Number (MPN) technique (ISIRI, 2000; ISIRI, 2006).

### Results and discussion

*E. coli* and *S. aureus* counts were negative for all doogh samples supplied in Lorestan province. Coliforms enumerations of all samples were less than the range of acceptable limits according to Iranian national standard ( $\leq 10$  CFU/ml). Out of 200 samples, 56 (28%) were unacceptable due to the mold and yeast contamination counts that were higher than the acceptable level according to national standard of Iran ( $\leq 100$  CFU/ml). Overall, 45

(90%) traditional and 11 (7.3%) commercial doogh samples were microbiologically unacceptable.

Gulmez et al. (2003) studied microbial quality of Ayran dairy product samples distributed in two cities in Turkey. They found that 53.3% of commercial samples were not acceptable due to the presence of viable coliform. Also, mold and yeast enumerations in 63.3% of commercial samples were higher than acceptable limits, according to the Turkish standard. But, all traditional samples were reported unacceptable, microbiologically. The authors concluded that such high contamination rate was probably due to cross contamination by the tap water (Gulmez et al., 2003). In another survey, 94.4% of buttermilk samples collected from manufacturing plants in Atlanta-Athens area, were contaminated to yeast as well as psychrotroph bacteria. *Pseudomonas*, *Enterobacter*, *Acinetobacter*, *Escherichia*, and *Actinobacillus* (Wang and Frank, 1981). Also, Hosseini et al. (2012) have stated that *Bacillus* sp. are the major bacterial contaminants of Iranian dairy products.

In the current survey, we found that the contamination rate of traditional doogh samples was considerably higher than the commercial products which were in agreement with the results of Gulmez et al. (2003). It has been demonstrated that traditional dairy products are often contaminated more than that of industrial ones. However, absence of *S. aureus* and *E. coli* in doogh samples seen in the present survey was not consistent with the results of other studies in Iran (Farajvand and Alimohammadi, 2014; Mehraban Sangatash et al., 2011). It is probably due to differences of chemical compositions, starter culture, added ingredients, and packaging materials that affect hygienic quality of doogh. All the unacceptable samples reported in this study were related only to mold and yeast. It speculated that coliforms might not have the ability of germination possibly due to the high acidity of this product (pH<4.5). Probably, the lack of satisfactory sanitary conditions and quality control during manufacturing or post production handling of the doogh was the cause of samples noncompliance with national standards of Iran. So, in order to production high quality products, the use of suitable raw material and production under hygienic conditions is necessary.

### Conclusion

Attempts have to be made to standardize the processing of Iranian traditional doogh manufacturing, and public health authorities should control the hygienic quality of traditional and commercial doogh in Lorestan province.

### Conflicts of interest

There are no conflicts of interest.

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