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# Load of coliforms and fecal coliforms in dairy desserts in Aswan City

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## Abstract

The dairy desserts are of wide popularity and variety. Also microbiological safety and quality is lack. Seventy five samples of dairy dessert consumed in Aswan City were collected and analyzed for coliforms, fecal coliforms, and E.coli counts. The results revealed that 14 (56%), 9 (36%) and 5(20%) of examined dairy desserts Bellilah, Custard and Om-Ali samples, respectively were contaminated by coliforms in counts exceeding the Egyptian standards. While, 9(36%), 2(8%), 2(8%) of samples exposed fecal coliforms. On the other hand, E.coli was occurred in 7(28%), 2 (8%) and 2 (8%) of examined samples. In conclusion more studies should be applied on dairy desserts to insure its safety and quality. The *E.coli* count should be added as criteria in food examination regulations.

**Keywords:** Dairy desserts; Coliforms; Fecal coliforms; Aswan City

## 1. Introduction

Dairy desserts are conceded as popular food for majority of people. It can meet a wide range of taste for those who do not or cannot consume milk directly (REF). Various dairy desserts are designed, widely distributed and consumed in Egypt like Bellilah (milk and boiled wheat grains), Custard (cornflower dissolved in milk), Om-Ali, (mille-fiuille sheets dipping in milk) and others. Such products with the developed pH and water activity provide a suitable atmosphere for the reproduction of many microorganisms. Consequently, the raw materials, that is very rich in nutrients and water are suitable cause of microbial growth in such products and leading to the appearance of health risks within consumers by especially if hygienic practices are lack [1]. Moreover, such a dairy desserts may subjected to contamination at different points such as: water used in processing, equipment, packaging materials, workers during handling and preserving conditions of storage [2]

Among these contaminates, coliforms are coming in the front with a great concern. Coliforms are group of Enterobacteriacea (gram negative bacilli), can ferment lactose with production of acid and gas causing rapid spoilage of dairy products faster than other food commodities and reducing the shelf-life[3]. Besides some of coliforms are typically pathogens responsible for food borne diseases. Coliforms main habitat is the soil and surface water. The common coliform genera including *Escherichia coli*, *Klebsiella pneumoniae*, *Enterobacter aerogenes*, and Citrobacter [4]. which can originate from different sources in the environment including fecal sources [5]. The fecal coliforms are that bacteria grow at 44.5 ºC and inhabited the intestinal tract of mammals in which its common source are human and animal excreta. [6]

Coliforms are responsible for increasing total bacterial count of a product, so it is classified as indicator organisms for sanitary quality and food safety. [2]

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Many researches show that dairy desserts not satisfy the high quality and could contain pathogenic microorganisms. Moreover, it is necessity to identify the possible risks in dairy desserts in order to reduce public health hazards.

Therefore this paper was planned to investigate the load of coliforms and fecal coliforms in dairy desserts sold in Aswan city (24°05′N 32°53′E), Egypt to evaluate and improve the sanitary conditions of it.

## 2. Material and methods

### 2.1 Collection of samples

A total of 75 samples of three types of dairy desserts Bellilah, Custard and, Om-Ali (n=25) were collected randomly from Aswan city supermarkets and desserts shops. In February and March 2022. All samples were in the first day of production and kept in refrigerator.

### 2.2 Preparation of samples

Each type of desserts samples were thoroughly mixed by sterile homogenizer under aseptic condition, then, Eleven grams of previously prepared sample were transferred into a sterile container, containing 99 mL of sterile dilution buffer peptone water and thoroughly mixed until obtaining a uniform 1:10 solution, from which decimal dilutions were prepared [7].

### 2.3 Enumeration of coliforms [7]

Coliforms count was performed according to APHA 2004 [7] by using Violet Red Bile Agar (VRBA) medium, 1ml from prepared dilution was mixed with hardened (42-45 ºC) VRBA and then 4 mL of VRBA added, left for solidification and incubated at 37 ºC for 24 h and dark red colonies were counted.

### 2.4 Fecal Coliform

Fecal Coliforms count was estimated by inoculation of pure colonies on Escherichia coli broth and incubated at 44.5 ºC for 48 h.

### 2.5 *E. coli* counting

E.coli counting performed on EMB agar incubated at 37 ºC/24 h, and then the olive green colonies were counted. Then biochemically confirmed by Citrate, Indol, and Methyl red tests.

## 3. Results

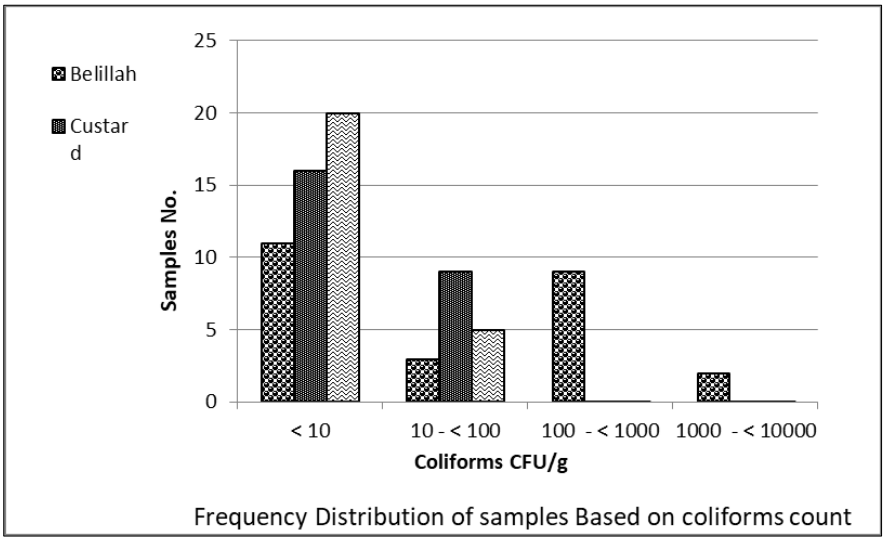


**Figure 1** Frequency distribution of the examined desserts samples based on their total coliforms count CFU/g

**Table 1** Minimum, maximum, means ±SE of total coliforms count (CFU /mL or g) in desserts samples

| | examined samples No. | Positive samples No. & (%) | +ve samples exceeded ES | Min. | Max. | Mean ±SE |
|---|---|---|---|---|---|---|
| Bellilah | 25 | 14 (56) | 14/14 | 3 x 10 | 2 x $10^3$ | 1.97 x $10^2$ ± 0.248 |
| Custard | 25 | 09 (36) | 9/9 | 1 x10 | 4x 10 | 2.5 x10 ±0.300 |
| Om-Ali | 25 | 05 (20) | 5/5 | 1 x10 | 3 x10 | 2 x10 ±0.316 |

*ES= Egyptian standards 2005, coliforms count <10 CFU /g. [8]

**Table 2** Minimum, maximum, means±SE of total fecal coliform count (CFU /mL or g) in desserts samples

| | Examined samples | +ve samples % | No Of +ve samples exceeded ES | Min. | Max. | Mean ±SE |
|---|---|---|---|---|---|---|
| Bellilah | 25 | 9 (36) | 9/9 | 5 x10 | 3 x $10^2$ | 1.65 x $10^2$ ± 0. 29 |
| Custard | 25 | 3 (12) | 3/3 | 1.5 x10 | 2.5 x10 | 2.00 x10 ± 0.2886 |
| Om-Ali | 25 | 3 (12) | 3/3 | 1 x10 | 2 x10 | 1.30 x 10 ±0.577 |

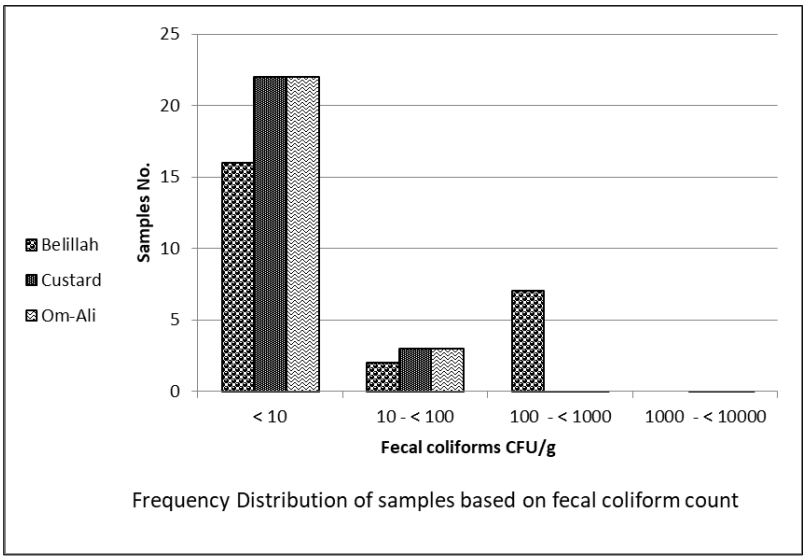


**Figure 2** Frequency distribution of the examined desserts samples based on their total fecal coliform count CFU/g

**Table 3** Minimum, maximum, means ±SE of *E.coli* count (CFU /mL or g) in desserts samples

| | Examined samples | +ve samples % | No Of +ve samples exceeded ES | Min. | Max. | Mean ±SE |
|---|---|---|---|---|---|---|
| Bellilah | 25 | 7 (28) | 7/7 | 1 x10 | 3 x10 | 2.00 x 10 ± 0.645 |
| Custard | 25 | 2 (8) | 2/2 | 1 x10 | 1 x10 | 0.00 |
| Om-Ali | 25 | 2 (8) | 2/2 | 1 x10 | 1 x10 | 0.00 |

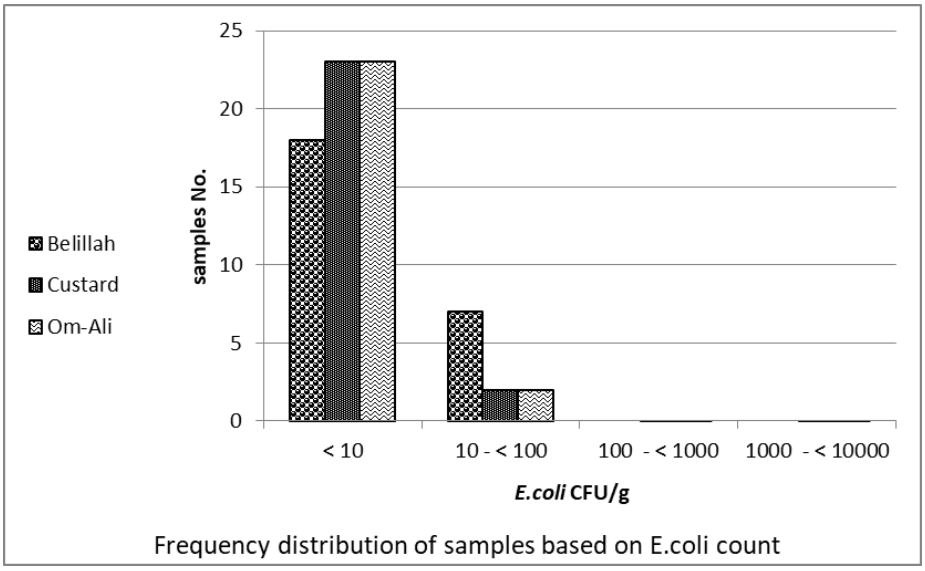


**Figure 3** Frequency distribution of the examined desserts samples based on their total *E.coli* count CFU/g

## 4. Discussion

Even with the colossal popularity of dairy desserts among consumers, the scientific data about the microbiological quality of these products is limited. In Egypt there is a very wide diversity of dairy desserts types. Some of them have a historical origins and ancient customs since ages.

In this work the microbiological quality assessment of three types of dairy desserts (Belillah, Custard, Om-Ali) marked in Aswan City were applied throw investigation of coliforms, fecal coliform, and *E.coli* count.

### 4.1 Coliforms count

Table 1 reflects Coliforms were detected in 56% (14/25) and 36% (9/25) and 20% (5/25) of analyzed Belillah, Custard and Om-Ali samples respectively. The coliforms count ranged between 3 x10 to 2 x $10^3$ CFU/g in Belillah samples which showed the highest counts, followed by Custard (1 x10 : 4 x10) and Om-Ali samples (1 x10 : 3 x10) CFU/g. even though, 100% of positive samples from three types of deserts samples were exceeding the Egyptian standard limits (<10 CFU /g). These findings are nearly parallel to Attala et al., [9] who analyzed different types of ice desserts in Alexandria. On the other hand Sobei, Fathi and Ibrahim [1, 10 and 11] who examined coliforms in dairy products and desserts recorded higher results. Higher results also were reported in ice cream desserts by [12, 13, 6].

The revealed coliforms count were exceeding the Egyptian Standards limits (<10 CFU /g) in all positive samples. This indicates that only 46% (9/25) and 74% (16/25) and 80% (20/25) of Bellilah, Custard and Om-Ali examined samples respectively were complying with the ES2005 for coliform count in dairy desserts.

### 4.2 Fecal coliform count

Table 2 reflects the load of fecal coliforms contaminations were within range of 5 x10 to 3 x $10^2$, 1.5 x10 to 2.5 x10 and, 1 x10 to 2 x10 CFU/g in examined samples of Bellilah, Custared and Om-Ali respectively. Obviously 36, 12 and,12% of samples were contaminated by fecal coliforms. Higher results were obtained by Wafy [14] This indicates poor hygienic practices during manufacturing, handling, and storage of dairy desserts.

### 4.3 *E. coli* count

The incidence of *E. coil* in examined samples were recorded in table 3 in which 68% (7/25), 8% (2/25) and, 8% (2/255) of Bellilah, Custard and, Om-Ali samples respectively were contaminated. The table 3 showed that the *E. Coli* counts were ranged between 10: 30 CFU/ g in examined samples. These findings are lower than those recorded by Morsy, Wafy and El-Zubeir [14, 15, 16].However nearly counts were been reported by El-Kholy [17], who examined indicator organisms in dairy products.

The presence of *E.coli* in dairy desserts is an indicator to fecal contamination and presence of other enteropathogens.

In this work Om-Ali samples showed the lowest level of coliforms and *E. coli* contaminations among other tow desserts. This may be due to it is submitted in oven temperature till complete cooking as well as the raw materials used in its processing (mille-fiuille sheets) was dry and not favorable for microbial growth.

Several sources lead to coliforms contamination of dairy desserts starting from using inferior quality of raw milk, raw materials, processing under unhygienic conditions and uncareful handling and storage [2].

The variation in coliforms, fecal coliforms, and E.coli counts between studies may be of many reasons, such as nature of dairy product (fresh, iced, cooked), quality of raw milk used, methods of processing, probabilities of post-cooking contamination, quality of containers and packaging, efficacy of refrigeration facilities, and environmental hygienic conditions.

## 5. Conclusion

The dairy desserts are a very wide variety of types and kinds, differ completely in nature and additives, each type is considered a special product and should be investigated adequately. In Aswan a subtropical city, the dairy desserts submitted to analysis were moderately contaminated with coliforms; further studies should be applied to insure its safety and quality. The *E.coli* count must be added in Egyptian Standards regulations as a mast.

## Compliance with ethical standards

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### *Disclosure of conflict of interest*

The authors declare that there is no conflict of interest.

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