PJN
ISSN 1680-5194

# PAKISTAN JOURNAL OF NUTRITION

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Pakistan Journal of Nutrition 4 (5): 345-348, 2005
ISSN 1680-5194


# A Comparison on Microbial Conditions Between Traditional Dairy Products Sold in Karak and Same Products Produced by Modern Dairies

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**Abstract:** Samples of unpasteurized milk, yoghurt, lebnah (concentrated yoghurt) and white soft cheese produced by farmers were collected from special retail trade of milk and milk products in the province of Karak (Located in the south of Jordan) .These samples and samples of sterilized milk treated with ultra-high temperature (UHT) process, yoghurt, lebnah and cheese produced by modern dairies of Jordan were microbiallly examined. The traditional products showed a high viable count of coliform (indicative of unsanitary conditions), yeast and mould, and *staphylococcus aureus*. All above microbes can have a hazardious effect on human body, beside their effect on the organoleptic properties of the final products especially yoghurt and cheese. Unpasteurized milk sold by farmers packed in polyethylene bags showed a very high total viable count which indicates serious faults in production hygiene, unsatisfactory sanitation and unsuitable storage temperature. On contrast, the UHT milk and dairy products produced by modern dairies showed a very high quality of microbial standard with a very delicate flavor.

**Key words:** Traditional dairy products, coliform In dairy product, *Staphylococcus aureus* in cheese

## Introduction

A large portion of Jordan requires the heat treatment of milk, but there are areas in which milk may still be sold without any heat-treatment formerly designated as (Fresh Farm Milk). This milk and other dairy products like soft cheeses, yoghurt and lebnah (concentrated yoghurt) produced by farmer and sold through special retail trade in the province of Karak can have a worrisome on the health of people.

Hobbs and Roberts (1993) reported that in England and Wales there are a yearly outbreak of food poisoning from salmonella and *compylobacter jejuni* in milk not receiving heat treatment or imperfectly pasteurized. *Staphylococcus aureus* can be isolated from most samples of raw milk and may be found in unheated or lightly heated dairy products.

There are many other foods which are only infrequently implicated in food poisoning incident, these include unpasteurized milk and other dairy products, dairy cows commonly carry the *staphylococcus aureus* on the udder and teats, and an infection, a form of bovine mastitis, can be set by the organism. This close association with the udder inevitably means that milk becomes infected, but, *staphylococcus aureus* can also be spread from the infected region to milking equipment, other utensils and the hands of workers. Forsythe and Hayes (1998).

Also Adams *et al.* (1999) has pointed out that milk has long been recognized as an agent in the spread of human disease and within a few years it was appreciated that pasteurization was also providing protection against milk borne disease. Originally the main health concerns associated with milk were Tuberculosis caused by *Mycobacterium bovis* and *M. tuberculosis* and Brucellosis caused by *Brucella* spp. In some parts of the world milk is still a significant source of these infections.

For the years 1973-1992, there were 32 cheeses-associated disease outbreaks in the United States with 1700 cases and 58 deaths - 52 of the later caused by *Listeria monocytogenes* in the 1985 California outbreak. The most common vehicle was soft cheeses and improper pasteurization was common (Jay, 2000).

The aim of this work was to study the microbial condition of milk and milk products which sold through the special retail trade in Karak and try to compare them with the same kind of products which produced by highly sophisticated dairy industry of Jordan.

## Materials and Methods

**Collection of samples:** samples of the following traditional dairy products bought from the special dairy retail trade of Karak and transported directly to the microbial laboratory of Agricultural college of Mutta University for test, the products were:

1. Unpasteurized milk packed in polyethylene bags.
2. Yoghurt packed in plastic bags.
3. Lebnah packed in plastic bags.
4. Soft cheeses in small cubic pieces packed in polyethylene bags.

A high quality of dairy products of the same kind (UHT milk, yoghurt, lebnah and soft cheese) produced by modern dairy of Jordan with a very highly technique of packaging materials were also collected and transported to the same laboratory for test.

**Microbiology tests**

**Aerobic plate count:** The method of aerobic plate count proposed by Andrews (1992) was followed to determine the total colony count of the samples. A series of dilutions of the samples ($10^{-1}$, $10^{-2}$, $10^{-3}$, and $10^{-4}$) was made and 1 ml. dilution mixed with aerobic plate agar in petri dishes. After incubation at 37°C for 48 hours, the colonies were counted.

**Yeast and moulds count:** The yeast and mould count method proposed by Andrews (1992) was used to enumerate the yeast and moulds of the samples. An agar medium was employed, in which organisms other than yeast and mould was inhibited by using acidified media. After incubation at 25°C for 3-5 days, the colonies were counted.

**Total coliform count:** The coliform count method proposed by Collins *et al*. (1995) was used. Make serial tenfold dilution and do plate counts with violet red bile lactone agar. Incubate at 30°C for 24 hours. Counts only red colonies that are 0.5 mm in diameter or larger.
MacConkeys broth and MacConkeys agar are not satisfactory media for the detection and enumrication of coliform organisms in foods (Harrigan and McCance, 1976).

**Staphylococci count:** The method of staphylococcus count proposed by Andrew (1992) was followed to determine the staphylococci count. The normal medium used a Baird Barker Agar with egg yolk. Incubate at 37°C for 48 hours. Dark colonies with clear zone was identified as *Staphylococcus aureus*. The results were plotted in the Tables.

## Results and Discussion

**The Fluid Milk:** The microbial counts for 10 samples of unpasteurized fresh farm milk and for 10 samples of UHT milk produced by modern dairy of Jordan are shown in Table 1.
The result of this work showed a big difference in microbial conditions between the UHT milk and the unpasteurized fresh farm milk and this completely agreed with Lewis (1994) that milk is heated for a variety of reasons. The main reasons are to remove pathogenic organisms and to increase shelf -lift up to period of six mouths.
Selling milk for direct consumption without any heat treatment can have a very hazardous effect on consumers and the result of this work showed the high level of microbial contamination in the unpasteurized fresh farm milk, which was far away from the standard for pasteurized milk, Which read that a sample will satisfy the plate count test, if the plate count is below 30,000 per ml, and the coliform test if the coliform count is less than 1 per ml. (Lewis, 1994).
The third report of (Joint FAO\WHO Expert committee on milk hygiene 1970) confirmed that there can be no assurance as to the safety of fluid milk for human consumption unless pasteurization or some other effective method of heat treatment has been applied. The high level of coliform of the fresh farm milk can indicate the evidence of unhygienic conditions of the product. Collins *et al.* (1995) reported that *Escherichia coli* and coliform bacilli which they are belong the family of *Enterobacteriaceae* may indicate evidence of contamination or pollution especially of fecal nature. *Enterobacteriaceae* include other organisms, like important pathogens such as salmonellas and various non- lactose fermenters that may be present in human and animal faeces.
The bacterial count of milk is used to measure its sanitary quality and most grading of milk is on the basis of some method for estimating numbers (Collins *et al.*, 1995) .
The high viable count of fresh farm milk of this work show a mean value of $5\times10^5$ cfu/ml and this figure can be regarded as a high count even for raw milk as been mentioned by Bramley and Mckinnon (1990) that counts of greater than $10^5$ ml for raw milk are indicative of serious faults in production hygiene. High viable counts often indicate contaminated raw materials, unsatisfactory sanitation and unsuitable storage temperature or a combination of these. Milk can be contaminated with different kind of microorganisms due to direct or indirect contact with any source of external contamination during all the steps of milking, collection, packing and transport. Direct physical contact of milk with unclean surfaces such as those of milking utensils, udders and teats , and the hands of milkers besides environmental factors such as the design and cleanliness of buildings and installations , the adequacy of the water supply , the manner in which manure and other wastes are disposed of , and the amount of dust in the immediate surroundings are important in so far as they may contribute to the microbial contamination of surfaces with which milk comes into contact.

**Yoghurt and Lebnah:** The result of microbial enumerication of yoghurt and lebnah which produced by farmers and sold through the special retail trade in the province of Karak and for samples of the same products produced by modern dairies of Jordan are shown in Table 2.
Yoghurt is fermented dairy product, resulting from the growth of *Lactobacillus bulgaricus* and *Streptococcus thermophillus* bacteria in warm milk, characterized by a smooth, viscous gel with delicate Walnutty flavor. Delicate flavor in plain yoghurt is achieved through a symbiotic bacterial relationship and these flavor components include small amount of acetic acid, diacetyl and acetaldehyde. Plain yoghurt may contain up to one billion live *L. bulgaricus* and *S. thermophillus*

Table 1: Viability of total colony count , total coliform count , *Staphylococcus aureus* and yeast and mould present in unpasteurized fresh farm milk and UHT milk which been collected from retail trade in the province of Karak, all counts as colony-forming units/ ml and the means of 10 determination

| | Total count | Coliform count | *Staph.aureus* count | Yeast and mould count |
|---|---|---|---|---|
| Unpasteurized fresh farm milk | $5\times10^5$ | $60\times10$ | $3\times10^2$ | $15\times10^3$ |
| UHT milk produced by modern dairy | Zero | Zero | Zero | Zero |

Table 2: Viability of total colony count, total coliform count, yeast and mould, and *Staphylococcus aureus* present in yoghurt and lebnah produced by farmers and for the same products produced by modern dairies, all counts as colony forming units /ml and the means of six determination for yoghurt(A),and of four determination for yoghurt (B), and of seven determination for lebnah (A), and for three determination for lebnah (B), and of ten determination for yoghurt and lebnah produced by modern dairies

| | Total count | Coliform count | Staphylococcal count | Yeast and mould count |
|---|---|---|---|---|
| Yoghurt (A) produced by farmers | $3x10^3$ | $5x10^4$ | 4x10 | 15x10 |
| Yoghurt (B) produced by farmers | $2x\ 10^3$ | 4x10 | 2x10 | $7x10^5$ |
| Yoghurt produced by modern dairies | $6x10^6$ | zero | zero | zero |
| Lebnah (A) produced by farmers | $6x10^2$ | $4x10^2$ | Less than 10 | 4x10 |
| Lebnah (B) produced by farmers | $8x10^2$ | 3x10 | Less than 10 | $5x10^5$ |
| Lebnah produced by modern dairies | $8x10^5$ | Zero | Zero | Less than 10 |

Table 3: Viability of total count, total coliform count, yeast and mould, and *Staphylococcus aureus* present in cheeses produced by farmers and for cheeses produced by modern dairies, all counts as colony forming units/ml and the means of 10 determination

| | Total count | Coliform count | *Staph.aureus* count | Yeast and mould count |
|---|---|---|---|---|
| Cheeses produced by farmers | $2x10^4$ | $3x10^2$ | $5x10^3$ | $1x10^3$ |
| Cheese produced by modern dairies | 5x10 | Zero | Zero | 10 |

cells per ml. As the yoghurt stored at 4°C becomes older, these bacteria die and the number will decline to few millions per ml (Kosikowski, 1977).

The result of this work showed an important relation between the flavor of yoghurt and the microbial condition, that we found a very pleasent, delicate flavors in the samples of yoghurt and lebnah been produced by the modern dairies which had no contamination with coliform or yeast and mould with a total viable count of few millions (Table 2).

At the same time we found a harsh unclean flavors with heavy carbon dioxide evolution creating gas slits and holes on the surface of the products which shows a high number of coliform bacteria as in yoghurt (A) and lebnah (A) produced by farmers (Table 2). The reason for the existence of coliform in the above samples is either for not using any kind of heat treatment for milk or due to post-contamination and the presence of poor sanitary packaging and storage conditions at the production area.

On the other hand we found that samples of yoghurt (B) and lebnah (B) been highly contaminated by yeast and mould (Table 2) were have a very distinguish gas production beside an unpleasant taste and flavors and that agreed with the conformation of Robinson and Tamime (1981) that yeasts(e.g. *Saccharomyces cerevisiae*) can be responsible for doming (gas production in yoghurt).

**Cheese:** The result of microbial enumerication of samples of cheeses which produced by farmer and sold through the special retail trade in the province of karak and for samples of cheeses produce by modern dairy are shown in Table 3.

The result of this work showed that samples of cheese which been produced by the modern factories had no staphylococci and that mostly due to the pasteurizations of milk and to the use of starter which reduce the pH to around 5, to achieve specification be required for cheese production.

For the traditional cheese the farmer neither applied the pasteurization (pasteurization could effect the revenue of cheese) nor using the starter to reduce the pH. For these very important two reasons beside all other factors we mentioned about the *Staphylococcus aureus* in milk we can explain the existence of *Staphylococcus aureus* in samples of traditional cheeses been tested in this work. Most literature refers that *Staphylococcus aureus* appears in milk from cows afflicted with mastitis, often treated with antibiotics or they may be transmitted

directly to milk and cheese by the human through nasal and throat discharges. *Staphylococcus aureus* favors a high protein and a high salt environment found in many cheeses, but it is sensitivity to acid and heat has limited the number of outbreaks when heat-treated or pasteurized cheese milk is employed.

Kosikowski (1977) reported that in many cheeses, staphylococci may be found as contaminants although this doesn't automatically mean a production of enterotoxin. The toxin occurs when large numbers of coagulase positive cells are present under a proper set of conditions. Cheese causing the intoxication when analyzed has been found to contain two million per gram or more. This study revealed the presence of *staphylococcus aureus* in all traditional cheeses with mean values of $5x10^3$ CFU/ml (Table 3). These results are worrisome because the value obtained can be raised to the number of bacteria able to produce enough enterotoxines to cause a food borne disease outbreak if conditions been favorite multiplication of this microorganism.

Tando *et al.* (2000) reported that 35.2% of food handlers were asymptomatic carriers of *staphylococcus aureus*, and that 90.4%of raw milk samples among more than 3200 investigated dairy products.

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