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Microbiological Analysis of Solar and Freeze-Dried Jameed Produced from Cow and Sheep Milk with the Addition of Carrageenan Mix to the Jameed Paste

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Abstract: Jameed is a fermented dried dairy product in the form of stone hard balls or other shapes produced by straining the heated buttermilk on cloth mesh bags, salting the formed paste by kneading, shaping and drying in the sun. This product is reconstituted after disintegration to be used in the preparation of Mansaf, the national dish in Jordan, which is basically lamb meat cooked in Jameed sauce (Sharab, Mareece) and served on cooked rice. The addition of Carrageenan (0.15%), to the Jameed paste resulted in improvement of solar dried Jameed with significant result for Carrageenan treatment as evaluated by wettability and syneresis test. Whipping of the paste to which carrageenan was used, added an additional improvement to the solubility of Jameed and stability of its dispersion. The standard plate, yeast and mould counts in goat Jameed were higher than their levels in sheep Jameed. Also the count of the freeze-dried samples are general higher than solar dried ones.

Key words: Jameed, solar, freeze-dried, microbiological analysis, cow milk, protein, fermented milk

Introduction

Fermentation is one of the oldest methods for preservation, which contributes to the flavor, appearance and texture of food. Fermented foods are in general more attractive to the consumer than non fermented products. They play an important role in the diets of many people in Asia, Near East, parts of Africa and rest of the world (Van Veen and Steinkraus, 1970). The main goals for producing or manufacturing dried fermented milk are to improve storage life of the product, to reduce bulk so as to save storage space and to reduce packaging and transportation cost (Yamani, 1994; Khanfar, 1995). Jameed is a dried fermented milk product that is wildly used in Jordan, Syria, Egypt, Northern Saudia Arabia and the western part of Iraq (Abu-Lehia, 1987) . Jameed plays an important role in the nutritional well-being of Bedouins where it forms a major component of their diets (Sawaya *et al*., 1984). Jameed is basically a hard cheese-like product considered a very stable and safe dried fermented milk product. It is mainly produced by Bedouins during the spring season when milk is produced in surplus amounts (El-Erian, 1979; Al-Mohizea *et al*., 1988). It is preferably made from sheep and goat milk but it can be made from cow and camel milk (Abu-Lehia, 1987; Al-Ruqaie and El-Nakhal, 1986). The traditional method for producing Jameed in Badia is a unique system derived from available resources. A bag made of goat hide (Korga, ah) serves as a vat for milk collection and fermentation while another smaller bag called Su, on (Shira, a or Shakwah) is used for the churning of the fermented milk (Yamani, 1994; Khanfar, 1995). Production begins by filling the Korga, ah with the fresh milk which undergoes spontaneous and mixed fermentation process within few hours. This fermentation is due to the active micro flora found in the korga, ah which is used throughout the season without washing. Churning of yoghurt is done in the early morning, since the temperature of the fermented milk is most suitable for the churning process. The fermented milk is usually mixed with variable amount of relatively cold water to facilitate butter separation. The churning is done by rolling the bag back and forth on the floor or by pushing the hung Su, on in the air by tying it to Al-Markabah (which is a wooden pyramidal tripod made of three legs) and pushed by the hand back and forth in sudden and strong jerks perdolier movement. There are two ways for Jameed production from buttermilk, the first involves straining the buttermilk through a fine mesh cloth without heat treatment and the second involves heating buttermilk before straining. Heat results in speeding separation of the whey and settling of the curd in the bottom of the heating pan. The whey is decanted and the curd is finally filled in the mesh cloth. The next step in the production of Jameed is to separate most of the whey to obtain a thick paste which resemble Labaneh. This is accomplished by two different ways, the first by hanging the straining bag freely, the second by tying the bag on a flat surface and squeezing it putting aboard weighted with stones on top. When the curd become a thick paste the cloth bag is emptied and salt is added by kneading (Basson, 1981; Tawalbeh, 1992). The salted paste is shaped into balls covered with salt. The balls are first dried in the shade for 24 hour and

then in direct sun for 10-15 days. The final product should contain a moisture of < 20 % according to Jordanian standard (Anonymous Jondanian Standards, 1986). Time of drying depend on size, shape and weather conditions. The stability and safety of Jameed balls are a result of several factors: the low water activity due to low moisture content and high salt concentration, low pH < 4.0 and the specific effect of table salt and lactic acid that suppress the growth of pathogens and most spoilage microorganisms. Jameed is reconstituted by soaking in water after crushing and is consumed mainly as a sauce in the preparation of Mansaf, a traditional Jordanian dish composed of lamb meat cooked in Jameed sauce (Sharab, Mareece) served on top of rice. Jameed when fully dried is a compact stony hard product, which is difficult to grind. The ground Jameed is difficult to suspend in water and the suspension is likely to settle. This results some times in loss of proteins during preparation and consumption of the sauce since the insoluble the residues are discarded. Another draw back of the traditional Jameed is the contamination of the product especially during drying.

Materials and Methods

Processing steps for jameed production followed in the study as follow

Yoghurt production: Thirty liters of cow milk were heated at 85-90°C for 2-5 minutes, then cooled to 45°C, mixed with 3 % starter culture, (*Lactobacillus delbruekii*) at 42°C until curd was formed (pH, 4.4-4.5). The yoghurt was immediately cooled in the refrigerator (5-6°C) and was kept overnight before churning (Khanfar, 1995).

Churning of yoghurt: Table salt 2 % (w/v) was added under stirring to the yoghurt. Washing machine with single basin was used as a churner (Model 3003, Hydo washing machine, Eisa Zedan company, Jordan), it has a round cross section with 30 liters working capacity. An amount of 30 liters of the cooled salted yoghurt was churned for three hours. The butter grains were scooped a mesh wire strainer (Khanfar, 1995).

Heat treatment of buttermilk: Amounts of the obtained buttermilk were subjected to (55°C /3 minutes) heat treatment and then cooled in the refrigerator (5-6°C) for 24h.

Straining of buttermilk: The cooled buttermilk was filled into cloth mesh and hung freely at room temperature for 48h.

Shaping: The obtained Jameed paste which had a thick consistency was emptied from bags, mixed with 5% (w/w) table salt (Tawalbeh, 1992) and shaped manually into balls, 400 g each.

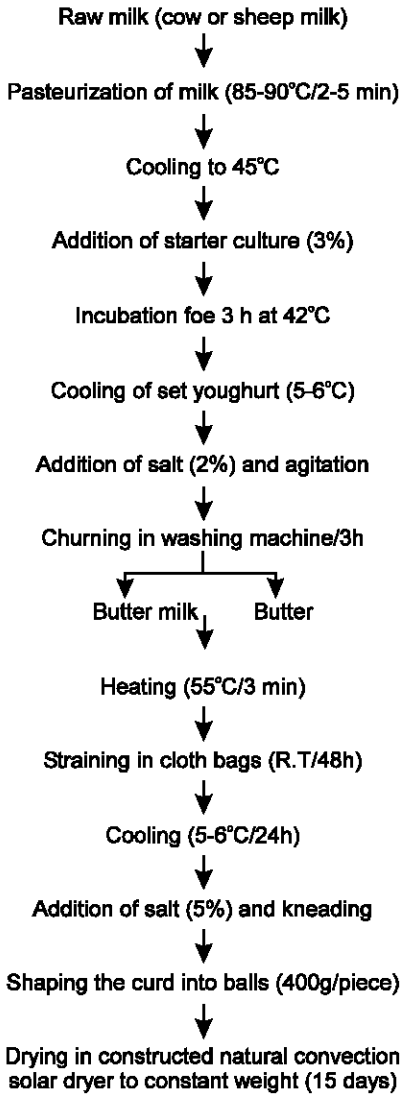

Fig 1: The processing steps for the production of experimental Jameed

Drying (constructed natural convection solar dryer): A solar dryer was constructed to be used for drying Jameed balls instead of sun drying. The dryer is basically a wooden structure consisting of two parts, the collector and the drying chamber. The collector is an inclined body with a light glass plate on the top. The internal surface of the body is coated with a black matt for an optimum absorbance of radiation. The bottom of the collector has slots to allow a free entrance of air. The back of the collector is in the form of a box constituting a base for the cover of the drying chamber. The cover is a box with openings in the upper sides and on the top for exhaustion of the warm air. A frame work is fixed on the base of the drying chamber to adapt the drying shelves. Each shelf is made of wooden frame fixed to galvanized wire mesh. For drying Jameed the shelves are mantled

Table 1: Tests used in the microbiological examination of Jameed samples

Test	Medium	Incubation conditions
Standard plate Count (SPC)	Plate Count Agar (PCA) (Oxoid)	32°C/48 h
Coliform count	Violet Red Bile Agar (Oxoid)	32°C/24 h
Lactic acid Bacteria Count (LAB)	MRS Agar (oxoid)	32°C/48-72 h
Yeast and mold Count	PCA plus 500mg each of Chorotetracycline. HCl and chloramphenicol/L	25°C/5 d

Table 2: Some Chemical analysis of solar and freeze-dried Jameed produced from cow and sheep milk with the addition of Carrageenan mix to the Jameed paste

Percent	Jameed from cow milk[a]	Jameed from sheep milk[b]	Jameed from cow milk[a]	Jameed from sheep milk[b]
Moisture	12.65	13.61	12.7	12.4
Salt	10.52	10.28	9.23	9.46
pH	3.5	3.56	3.5	3.59
Acidity (as lactic acid)	5.3	5.4	4.5	4.2[a]

[a]Solar dried Jameed, [b]Freeze-dried Jameed.

Table 3 : Microbiological analysis of solar and freeze-dried Jameed produced from cow and sheep milk with the addition of carrageenan mix to the Jameed paste

No.	Treatment	Coliform count (a)	LAB count	SPC count	Yeast and Mold count
1.	Jameed from cow milk (b)	<10	$4.2x10^2$	$5x10^2$	<10
2.	Jameed from sheep milk (b)	<10	$2.7x10^2$	$7x10^2$	<10
3.	Jameed from cow milk ©	<10	$5.6x10^3$	$2.0x10^4$	<10
4.	Jameed from sheep milk ©	<10	$1.0x10^4$	$2.2x10^4$	<10

(a) CFU/g, (b) Solar dried Jameed, (c) Freeze-dried Jameed.

with cheesecloth as a porous layer, which protect the product from metal contamination.

Sources of milk: Cow milk from Jordan University farm was used; only cow milk was used in all steps of this experiment.

Addition of carrageenan mix: Carrageenan mix (Genugel type MB-716, Copenhagen Pectin Company, Denmark) a mixture of carrageenan and locust bean gum standardized with sugar and potassium chloride, was added in concentration of 0.15 % (w/w) as follows (Norman, 1990): 0.9 g was dissolved in 10 ml tap water, heated to 42-45°C. The formed gel was added to 600 g Jameed paste and mixed well.

Sun drying: The shaped salted Jameed paste balls were placed on the surface of perforated trays and dried in the shade for 24 h then direct sun for 15 days (until moisture content was < 20 %) (Anonymous Jondanian Standards, 1986).

Freeze drying: Jameed balls dried in freeze-dryer (Freeze-dry-12, Labconco) for 7h.

Chemical Analysis:

pH: A well homogenized 10 grams of the Jameed sample, were diluted with 70 ml distilled water, to determine the pH of Jameed by immersing the pH meter electrode of (Hana Instruments, Limena, Italy Model HI 8416) in the homogenized mix.

Titratable acidity: Acidity of Jameed was determined, according to the standard methods for examination of dairy products (Messer *et al.*, 1985).

Moisture and total solids: A sample was ground using amorter and the atmospheric oven method was used to determine moisture and total solids in Jameed (Messer *et al.*, 1985).

Sodium chloride (salt): Sodium chloride was determined according to the standard methods for the examination of dairy products (Messer *et al.*, 1985).

Microbiological examination: Jameed samples from sheep and cow milk were examined according to the Methods described in the Standard Methods for the Examination of Dairy products (Messer *et al.*, 1985). Pour plate technique was used in all tests. The first dilution was prepared by blending 25 g of each sample with 225 ml sterile peptone water (0.1%). Further dilutions were made according to the need, and duplicate plates were used for each dilution. Table 1 shows the tests, media and the incubation conditions used.

Results and Discussion

Table 2 shows the analysis of salt, pH and acidity of solar dried and freeze dried Jameed from both cow and sheep milk.

Microbiological analysis of solar and freeze-dried Jameed produced from cow and sheep milk with the addition of carrageenan mix to the jameed paste: Table 3 shows the standard plate counts and the counts of coliform, lactic acid bacteria, yeast and molds in solar and freeze-dried Jameed from both cow and sheep milk. These counts prove that Jameed samples were of good microbiological quality. The standard plate counts were 5×10^2 , $7 \times 1\ 0^2$ CFU/g for solar dried Jameed from cow and sheep milk respectively and 2.04×10^4 ,2.2×10^4 CFU/g for freeze-dried Jameed from cow and sheep milk respectively. Lactic acid bacteria count were 4.2×10^2, 2.65×10^2 and 5.625×10^3, 1.01×10^4 CFU/g for solar dried and freeze-dried Jameed from both cow and sheep milk respectively. The count of the freeze-dried samples are generally higher than solar dried ones. This may demonstrate the lethal effect of the prolonged heat (50°C) on certain lactic acid bacteria in solar drying of this product. This also means that the dominant microorganisms in Jameed are lactic acid bacteria. The colonies after counting were microscopically examined and it was found that most of cells were micrococci. These results are similar to those obtained by Tawalbeh (Tawalbeh, 1992) in Jameed samples from Jordan market. Tawallbeh results, were standard plate and the yeast and mold counts in sheep Jameed were (5.5×10^5-7×10^5), (2.2×10^2-8.8×10^2) cell/g, respectively, compared to (8.5×10^5-9.9×10^5), (1.6×10^3-1×10^4) cell/g, respectively, in goat Jameed. The standard plate, yeast and mould counts in goat Jameed were higher than their levels in sheep Jameed. The result of the coliform count (< 10) and yeast and mold count (< 10) indicate that Jameed is a safe foods, from the microbiological point of view even if its produced under relatively uncontrolled condition as done by the Bedouins and farmers. Several preserving factors contributes to this safety, namely low water activity (aw), high salt content, high acidity and the specific metabolite excreted by lactic acid bacteria (Pederson, 1979).

Conclusions and Recommendations:

1. The standard plate, yeast and mould counts in goat Jameed were higher than their levels in sheep Jameed Also the count of the freeze-dried samples are general higher.
2. The use of solar drying of Jameed should be encouraged or even enforced since this would result in an improvement of quality and protection of Jameed from contamination through dust, insects and other animals.
3. The storability of the new products with their porosity has to be investigated, since the porosity means more exposure to oxygen compared to the traditional compact Jameed. However, such products need a suitable packaging system.
4. The result of the study can not be extended on Jameed when made from goat milk or goat milk mixture a further study is needed to evaluate.

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