

Evaluation of the Chemical and Sensory Attributes 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 sensory evaluation of the sauce prepared from sheep milk using hedonic scale test had higher mean scores than control market sample which was karaki jameed considered as the best quality in Jordan.

Key words: Jameed, solar, freeze- dried, carrageenan, sensory evaluation

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^[1]. 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^[2].

Jameed is a dried fermented milk product that is widely used in Jordan, Syria, Egypt, Northern Saudi Arabia and the western part of Iraq^[3]. Jameed plays an important role in the nutritional wellbeing of Bedouins where it forms a major component of their diets^[4].

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^[5,6]. It is preferably made from sheep and goat milk but it can be made from cow and camel milk^[3,7].

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^[2]. 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^[8]. The salted paste is shaped into balls covered with salt. The balls are first dried in the shade for 24 h and then in direct sun for 10-15 days.

The final product should contain moisture of <20% according to Jordanian standard^[9]. 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 (Fig. 1):

Yoghurt production: Thirty liters of cow milk were heated at 85-90°C for 2-5 min, then cooled to 45°C, mixed with 3% starter culture, (*Lactobacillus delbruekii*) at 42°C until curd was formed (pH, 4.4-4.5).

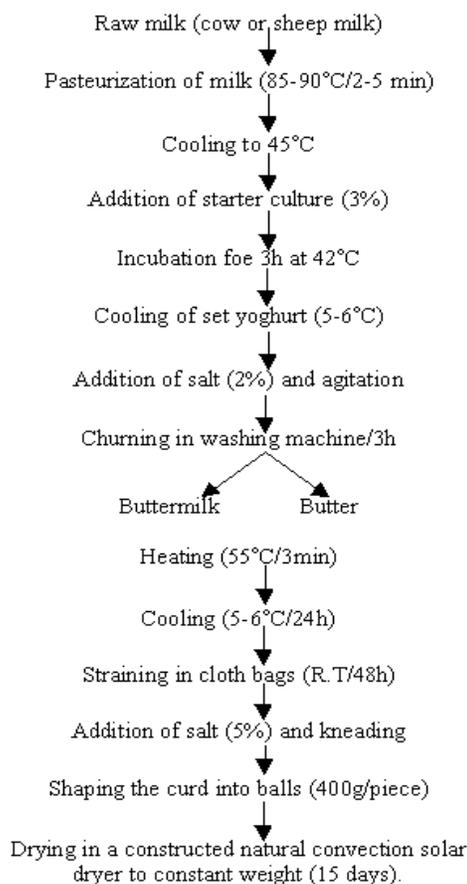


Fig. 1: The processing steps for the production of experimental Jameed

The yoghurt was immediately cooled in the refrigerator (5-6°C) and was kept overnight before churning^[5,8,9].

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 L working capacity. An amount of 30 L of the cooled salted yoghurt was churned for three hours. The butter grains were scooped a mesh wire strainer^[5,8,9].

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

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

Shaping: The obtained Jameed paste which had a thick consistency was emptied from bags, mixed with 5% (w/w) table salt (6) and shaped manually into balls, 400g each.

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 iteration 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 framework 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 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 [11].

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%) [9].

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

Chemical Analysis:

PH: A well homogenized 10 g 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.

Titrateable acidity: Acidity of Jameed was determined, according to the standard methods for examination of dairy products [13].

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 [13].

Sodium chloride (salt): Sodium chloride was determined according to the standard methods for the examination of dairy products [13].

Protein: Total nitrogen content was determined by the macro Kjeldahl method [13].

Fat content: Fat was determined in Jameed according to the AOAC (1990) methods [14].

Ash: Ash was determined in Jameed according to the Pearson's chemical analysis of food [15].

Sensory evaluation: Hedonic scale test was used to investigate the degree of preference to six jameed samples with different treatment. Each panelist expressed his or her degree of preference by filling the following questionnaire [16].

Comments: Thirty semi-trained panelists were selected from the workers and the graduate students at our Departments, to conduct the sensory evaluation.

These panelists were from both sexes and from different age groups.

Representative sample of Jameed was soaked with water in a ratio of (1 Jameed: 7 water) for 24 h in a refrigerator, then blended with an electrical mixer as follows:

- Freeze-dried jameed (from cow and sheep milk) for 30 sec
- Solar dried Jameed (from cow and sheep milk) for 3 min
- Market Jameed (Karaki) for 6 min.

The dispersion was strained through a fine sieve strainer.

One Kg of lamb meat (boned) was boiled with 5 L water with the addition of onion and spices for 30 min. The Jameed disperse and meat broth were mixed in a ratio of 1:1 and cooked for 10-15 min and served hot in glass cup to the panelist.

Sensory test was done in two days the first day, panelist evaluated, two samples of Jameed from cow milk with different treatments (solar and freeze dried) and a Jameed sample from the local market (Jameed Karaki) which is considered the best in our local market. In the second day three samples of Jameed from sheep milk with different treatments (solar and freeze-dried) and a sample from a local marker were evaluated.

The results of the sensory examination were analyzed by analysis of variance.

RESULTS AND DISCUSSION

Table 1 shows the proximate analysis, salt, pH and acidity of solar dried and freeze dried Jameed from both cow and sheep milk. Protein content of Jameed makes up 50% of its weight (4.14). This makes Jameed a good source of high quality protein (casein). Jameed as such was considered to be a better source of protein than several types of cheeses, for example it contains (1.5) times as much protein as cheddar cheese^[17].

Fat contents (8.1-10.9%) of the experimental Jameed of this study are much lower than those found by Tawalbeh^[6] and Abu-Lehieh^[4]. In market samples. In which fat ranged from (91.6 and 31.7%). These high fat contents may demonstrate the inefficiency of churning yoghurt in Jordan following the traditional methods. If these values are confirmed, Jameed should be termed as a half-fatty milk product rather than skimmed milk product.

Jameed has high amount of ash this is due to addition of salt (NaCl) to the Jameed paste before shaping and drying; as seen from Table 1 salt makes about 10% out off 16% of the ash content. Though this salt content seems to be high, it becomes acceptable if we consider the dilution factor of seven times in the preparation of Jameed sauce which would result in a salt content of (1.42); in addition this sauce is usually cooked with lamb meat during the preparation of Mansaf without adding extra salt, so that the resulting concentration of salt may come in the range of 0.5-1% in final dish. The nitrogen free extract found in Jameed of this study represents mainly lactic acid, residual lactose and the added Carrageenan. Since lactic acid makes approximately 5% of this values Table 1, it can be concluded that the lactose content of Jameed is quite low, therefore the product is favored by lactose intolerant patients^[12,17,18].

Sensory evaluation of solar and freeze-dried Jameed compared to market Jameed from cow and sheep milk.

Table 1: 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	Solar dired Jameed		Freeze dired Jameed	
	Cow milk	Sheep milk	Cow milk	Sheep milk
Moisture	12.65	13.61	12.70	12.40
Ash	16.30	17.87	16.34	16.62
Crude protein	53.50	52.70	54.70	54.60
Ether extract fat	8.10	10.60	8.50	10.90
N-Free extract	9.38	5.80	7.80	5.50
Salt	10.52	10.28	9.23	9.46
pH	3.50	3.56	3.50	3.59
Acidity (as lactic acid)	5.30	5.40	4.50	4.20

Table 2: Sensory evaluation of sauce prepared from a solar and freeze-dried Jameed made from cow and sheep milk with the addition of carrageenan mix and whipping

No.	Sample	Treatment		
		1*	2**	3***
1	Jameed from cow milk	5.133b	7.100a	5.533b
2	Jameed from sheep milk	6.833a	6.800a	5.166b

*solar dried Jameed, **Freeze-dried Jameed, ***Sample form the local market (Jameed Karaki) which is considered as the best Jameed in the local market, a,b Means with no common letters within column differ significantly

The freeze-dried Jameed from cow milk was significantly preferred ($p < 0.05$), regarding over all quality than solar dried and market Jameed from cow milk. Solar and freeze-dried Jameed from sheep milk was significantly preferred ($p < 0.05$) regarding over all quality, than market samples. The results of the sensory evaluation of Jameed sauce prepared from the two heat treatments found in this study are summarized in Table 2. As seen from the means of the over all quality both solar and freeze-dried Jameed from cow milk and sheep milk were significantly over the control (Karaki) sample which is generally considered the best quality Jameed in Jordan. Surely one obvious factor for this preference is the better dispensability of the experimental Jameed which would be noticed in a better mouth feel.

The results of the sensory evaluation were unexpected since the flavor of the traditional Jameed was thought to be decisive in the acceptance of such product. The flavor of traditional Jameed is the result of many factors including the use of the natural Korga'ah and Su'on with their microflora and the natural spontaneous mixed fermentation, the sun drying, aging,... etc.

However, the result of sensory evaluation as done in this study is not conclusive and further studies should be carried out on a broader scale such as consumer test which considers a wide spectrum of the population in Jordan.

CONCLUSIONS

- 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.
- The sensory quality of the improved Jameed as evaluated through hedonic scale test was equal or superior to the Karaki Jameed which is considered the best quality in Jordan. However, further sensory evaluation on wide range of consumers is needed to obtain a conclusive Judgment.
- 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.
- 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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