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MICROBIOLOGY OF KISHK : TRADITIONALLY FERMENTED EGYPTIAN FOOD.

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ABSTRACT

During microbiological studies in Seale-Hayne (England) on ten samples of kishk obtained from Southern Egypt, it was found that six of the samples contain *Bacillus cereus*. The mean of *Bacillus cereus* count on BCA was 5.3 (log 10 cfu/g), while there was no *lactic acid bacteria, salmonella* and *staphylococcus aureus*. The thermal resistance of *Bacillus cereus* was relatively medium.

Although the final pH was 3.5-3.9 and the AW was 0.50-0.56, the *coliform* bacteria was found in four samples.

INTRODUCTION

Kishk is one of the most popular fermented food known and consumed in Arab countries of Northern Africa, Middle East and Asia (Wang and Hasseltine, 1981). There are some other fermented milk cereal mixtures similar to Kushuk in Iraq (Alnouri and Duitschaever, 1974).

It is basically made from a combination of parboiled cracked wheat with natural local sour milk, (Laban Khad, Laban Zeer or Laban Rayeb), and salt. The mixture is fermented for (1-4 days) at ambient temperature, then formed in small balls and sun-dried. Before storage kishk is usually heated in an oven to improve its keeping quality (Morcos, *et al.*, 1973).

Trials have been carried to modify its production by using different fermented milk (Muir *et al.*, 1995) and (Toufeili *et al.*, 1999).

It provides basic nutrients to rural communities, preserving proteins effectively in draught seasons due to its shelf life of up to a year resulted from its low moisture, 9.64% and salt content 8.9% (Atia and Khattab, 1985). Kishk is used for feeding children, adults and elderly people (Van Veen and Graham, 1969).

The present study was carried out to investigate the microbiological quality of this food.

MATERIALS AND METHODS

Samples :

Kishk samples from 10 different households in the faiyum, Giza and Dairot, in Southern Egypt were collected in April 1999 with information on the preparation procedure. The samples, sealed in polyethylene bags were transported at ambient temperature for chemical and microbiological analysis to Seale-Hayne (England).

Microbiological analysis :

Ten composite samples were formed for microbiological analysis as indicated, Aerobic plate count agar (PCA) for aerobic mesophiles, 35°C/48 h; violet red bile agar (VRBA) for Enterobacteriaceae, overlaid, 37°C/ 24h; De Man Rogosa Sharp agar (MRS) for lactic acid bacteria, Gas-pack, 30°C/ 48h; Baird-parker (BP) for *staphylococcus aureus*,37°C/24h; Rose Bengal chloramphenicol agar (RBCA) for yeast and moulds, 22°C/ 5 days and *Bacillus cereus* selective agar (BCA) for *Bacillus cereus*, 37°C/24h. To detect *Salmonella* (10g sample) in 100 ml Tetrathionate broth with the addition of 2ml of Iodine-Iodide solution added on the day of use. Incubate at 37°C for 24-48h. A loopful of the growth was streaked on at least 2 plates of xylose lysine decarboxilase agar (XLD agar) and Brilliant green agar (media by Oxoid, 1982). Characteristic colonies were identifies and microbial counts were obtained. Suspect colonies were confirmed by additional tests as described by Kramer, *et al.*, (1982) and Bergey's Manual, (1984).

The efficiency of cooking temperature on the spores of *Bacillus cereus* :

A strain of *Bacillus cereus* isolated strain from kishk (5m) and standard strain (2 b) obtained from microbiological laboratory in Seale-Hayne Campus, Department of Agriculture and Food, were pushed sporulation according to the method reported by (Gaillard *et al.*, 1998).

The stability of the spores during cooking was investigated by adding 0.1ml of the spore suspension to 10ml of sterilized cooking kishk then the tubes were submitted to a thermal in a thermostated oil bath at different temperature (98°C/10 min, 98°C/15 min) then cooled to 30°C in a water/ice bath. The viable spores were counted by duplicate plating in nutritive agar (10g tryptone, 5g meat extract, 5g sodium chloride, 15g agar for 1000 ml distilled water) and incubation at 30°C for 48h.

Chemical analysis :

Moisture and Ash were determined in triplicate according to the methods described in A.O.A.C. (1990). The total fat content of the sample was determined by the soxhlet method using a soxtec HT system (Tecator, Sweden), with petroleum ether being the solvent.Water activity was determined by (AW,Novacina).The pH was measured by using (5gm of sample)blended using a laboratory blender with 100ml of distilled water for 3 min,and the solution was filtered through whatman 30 filter paper. The pH of the solution was then measured using adigital pH meter (Senol Ibanoglu *et al.*,1995).Acidity was determined by titration, using 0.1M NaoH and expressed as percent lactic acid (Kirk and Sawyer, 1991). The salt content was determined by the Mohr method (Kirk and Sawyer, 1991), while the percentage of nitrogen and carbon were determined by (Leco FP-2000).

RESULTS AND DISCUSSION

As shown in Table (1) the average of moisture content and pH value, were 10.21 and 3.76 which relatively close to the result of (Atia and Khattab, 1985). The low moisture and pH may affect on the viablety of the microbial content which mainly compered of the high resistant microorganism.

The values of ash content was ranged between 5.01-9.63% with an average 6.43%, while the values of salt content ranged between 3.04-6.89% with an average 4.46%.

The crude protein content of the kishk sample was 12.13 - 21.06% with an average 18.62% and the crude fat was an average 1.97%, while the carbohydrates was ranged between 54.3-65.2%.

Table (1): Factors influencing microbial growth and survival in kishk, results of triplicate analyses on 10 composite samples.

Composition		Rank	Mean
Moisture	%	9.2 – 11.4	10.21
AW		0.50 – 0.56	0.53
pH		3.5 – 3.9	3.76
Acidity	%	0.30 – 0.55	0.47
Salt	%	3.04 – 6.89	4.46
Ash	%	5.01 – 9.63	6.43
Crude protein	% (N X 6.25)	12.13 – 21.06	18.62
Crude fat	%	0.94 – 3.43	1.97
Carbohydrates	%	54.3 – 65.2	55.4

On the other hand, the mean numbers of certain microbial group presented in Table (2)revealed that the mean of total bacterial count, Enterobacteriaceae, yeasts and mould and *Bacillus cereus* were 6.5 (log10 cfu/g), 4 (log 10 cfu/g), 6.1 (log 10 cfu/g) and 5.3 (log 10 cfu/g) respectively.

Absence of growth on M.R.S. medium may be resulted from drying. Although the cfu/gm on BP medium was ranged from 2.7×10^3 - 2.1×10^7 with an average 3.4×10^5 (5.5 log 10 cfu/g), the microscopical examination of colonies and the coagulase test of plasma showed the absence of typical *staphylococcal cells*. On other hand the *salmonella* sp. did not found in the tested samples.

Table (2): Microbial counts (log 10 cfu/g) in 10 composite kishk samples (duplicates).

Microbial group	Mean	Standard deviation	Samples
Mesophilic aerobes	6.5	0.96	10 / 10
Enterobacteriaceae	4.0	0.75	4 / 10
Yeasts and moulds	6.1	0.34	10 / 10
Bacillus cereus	5.3	1.29	6 / 10
Lactic acid bacteria	(—)	(—)	(—)
Staphylococcus aureus	(—)	(—)	(—)
Salmonella	(—)	(—)	(—)

(—) Not detected.

The effect of cooking temperature on *Bacillus cereus* spores using two strain i.e. 5m and 2b as shown in table (3), revealed that, the count of *Bacillus cereus* at zero time was 6.34, 6.49 (log 10 cfu/ml) of strain 2b, 5m respectively, decreased to 4.01, 4.04 (log 10 cfu/ml) when the spore former were subjected to 98°C/15 min.

Table (3): The effect of cooking temperature of kishk on *Bacillus cereus* spores.

Temperature	(log 10 cfu / ml)	
	Strain 2 b (standared strain)	Strain 5 m (isolated strain)
Zero time	6.73	6.49
98°C	6.20	5.98
98°C / 10 min	4.30	5.65
98°C / 15 min	4.01	4.04
30°C / h	4.74	4.90

It is clear that the cooking temperature of kishk is not efficient to kill the spore former of *Bacillus cereus*. Keeping the spore former at 30°C resulted in an increasement of the cfu / ml, therefore, the kishk must be keeped in the refregirator as soon as it cooked.

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التحليل الميكروبيولوجي للكشك " غذاء مصرى تقليدى متخمر "

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تم تحليل ١٠ عينات من الكشك المتحصل عليه من جنوب مصر (الجيزة – الفيوم – ديروط) فى ألـ Seale-Hayne بإنجلترا ميكروبيولوجيا لمعرفة محتواها من كل من البكتيريا المتجرثمة *Bacillus cereus* ، وبكتيريا حمض اللاكتيك – الخمائر والفطريات – البكتيريا العنقودية المسببة للتسمم الغذائى – الكوليفورم – السلمونيللا ، هذا بالإضافة إلى العد الكلى للبكتيريا الهوائية المحبة للحرارة المتوسطة .

وجد أن ٦ عينات تحتوى على البكتيريا *Bacillus cereus* وكان متوسط لوغاريتم ١٠ للعد البكتيرى ٥,٣ بينما لم يوجد كل من بكتيريا حمض اللاكتيك ، بكتيريا *Staphylococcus aureus* وبكتيريا السلمونيلا. ونظرا لأن البكتيريا المتجرثمة *Bacillus cereus* معروفة بإنتاجها للسموم وقد وجدت فى ٦ عينات من العينات المدروسة ، فقد تم دراسة تأثير درجات الحرارة المستخدمة فى عملية الطهى على الجراثيم ، وذلك بتلقيح عدد معين من الجراثيم فى كشك معقم وتعريضه لدرجات حرارة ٩٨ °م لمدة ١٠ دقائق ، ٩٨ °م لمدة ١٥ دقيقة وجد أن تأثير درجات حرارة الطهى غير كافى لإبادة هذه الجراثيم . وعلى الرغم من أن pH الكشك كان ٣,٥ – ٣,٩ ، AW (Water activity) كانت ٠,٥٠ – ٠,٥٦ وجدت بكتيريا الكوليفورم فى ٤ عينات من العينات المدروسة.