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## The Benefit of Traditional Recipes - Boiled Legumes

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### Introduction

For many years, chickpeas (*Vigna sinensis*) and various types of bean (*Phaseolus vulgaris*) have been staple foods for peoples around the Arabian Gulf. Generally, these legumes are washed to remove any field debris, and then soaked overnight in cold water. Next day, the peas and/or beans - often these dishes are a mixture of a number of types of legume - are boiled in salted water and, according to Musaiger (1993), sodium bicarbonate may be added to the boiling water to help soften them. The cooked legumes are then cooled, partly drained, and blended with olive oil, lemon juice and mixed spices before serving. The composition of the mixed spices - known locally as lbzar - varies from family to family, but usually contains finely-ground black pepper, cumin, coriander and ginger as the important ingredients.

The final item is known in some regions as Foul Medammas and, while the moisture content is in the region of 70%, a typical portion (100 g) of the dish provides around 15 - 16 g carbohydrate, 6.0 g protein, 1.0 g fat and 0.75 g minerals, including 65 - 70 mg of calcium (Musaiger, 1993). As it is widely consumed across the Gulf Countries for breakfast or supper, it is an important dietary component, but also one that should present no microbial hazard to the consumer. Thus, boiling of the legumes eliminates any vegetative cells of pathogens that might be present and, as the dish is usually consumed shortly after cooking, spore-forming pathogens like *Bacillus cereus* will have no opportunity to grow and produce toxins.

However, times are changing. Younger members of a family may no longer join their parents for supper, but simply 'grab a bite' of something later in the evening. Such a 'snack' could well include a plate of Foul Medammas left over from an earlier meal. If the time between the cooking and consumption of the dish is short, or the Foul Medammas has been rapidly cooled and placed in a refrigerator, then the risk from spore-formers remains low but, if these conditions do not apply, then a traditionally safe food could become a hazard. Just as important as new eating patterns may be changes in the formulation of the dish, for Foul Medammas is now available in cans. This convenience no doubt has its advantages for students or single people living alone, and it is easy to imagine that such a person could warm the product in a microwave oven, eat a portion and leave the remainder for breakfast next morning. However, this proposed scenario leaves one question unanswered - is the microbiological security of

the canned Foul Medammas the same as that of the traditional home-made product ?

In order to answer this question, the two types of Foul Medammas were 'challenged' with a mild pathogen that is widespread in kitchens, *Pseudomonas aeruginosa*. It is a typical Gram-negative, non-spore-forming, rod-shaped member of the *Pseudomonadaceae* and, if ingested in food or water at levels above  $1.0 \times 10^6$  colony-forming units (cfu) g (or ml)<sup>-1</sup>, it can colonise the intestine of even healthy individuals and cause diarrhoea (Rusin *et al.*, 1997); for immunocompromised adults, the impact can be much more severe (Artenstein and Cross, 1993). As the pathogen can occur naturally in kitchen sinks and similar habitats, it could easily be 'splashed' into a bowl of food left standing nearby.

Consequently the aim of this project was to:

1. obtain samples of canned and fresh Foul Medammas
2. inoculate each type of product with *Ps. aeruginosa*
3. determine whether or not the pathogen would grow in either sample.

Table 1: Analyses of the canned and fresh samples of Foul Medammas (see text for details); figures for total solids as g 100<sup>-1</sup>

Sample	pH	Total Solids	Water Activity
Fresh	5.0	32.1	0.99
Canned	5.9	21.0	1.0

### Materials and Methods

The culture of *Ps. aeruginosa* was grown on slopes of Brain Heart Infusion Agar (Oxoid Code No. CM375, Unipath Ltd., Basingstoke, Hampshire, UK), and loopfuls were added to a tube of sterile saline solution until the optical density indicated a cell count of  $1.5 \times 10^9$  cfu ml<sup>-1</sup> (Anon., 2001). This suspension was further diluted to give a solution containing  $1.5 \times 10^6$  cfu ml<sup>-1</sup>.

The canned samples of Foul Medammas were purchased from a local shop, while the fresh product came from a restaurant specializing in Arabic food; the fresh samples were used with 24 h of preparation. Sub-samples (10 g) of the two types of Foul Medammas were taken for analysis for total solids, pH (Kirk and Sawyer, 1991) and water activity (Novatron Meter, Horsham, Sussex, UK). Two bulk samples (200 g) of each type of product were transferred to stomacher bags, and 1 ml of the dilute culture was added to each bag to give an initial cell count of approximately 7,500 cfu g<sup>-1</sup>.

Table 2: Total colony counts of *Ps. aeruginosa* in the canned and fresh samples of Foul Medammas stored at 4 or 25 °C for the times shown; all figures as mean cfu g<sup>-1</sup> of product as consumed, and the trial was repeated on two occasions

Time (hours)	Temperature			
	4 °C		25 °C	
	Fresh	Canned	Fresh	Canned
0	7.0 x 10 <sup>3</sup>	2.0 x 10 <sup>3</sup>	7.0 x 10 <sup>3</sup>	2.0 x 10 <sup>3</sup>
4	6.2 x 10 <sup>3</sup>	2.2 x 10 <sup>3</sup>	6.0 x 10 <sup>3</sup>	3.7 x 10 <sup>3</sup>
8	6.0 x 10 <sup>3</sup>	2.2 x 10 <sup>3</sup>	6.0 x 10 <sup>3</sup>	1.6 x 10 <sup>6</sup>
12	6.0 x 10 <sup>3</sup>	2.3 x 10 <sup>3</sup>	6.0 x 10 <sup>3</sup>	1.7 x 10 <sup>6</sup>

After blending in the Stomacher (Unilever, Sharnbrook, Bedfordshire, UK), one bag of each type was placed at room temperature (~ 25 °C) and one at 4 °C. Each bag was sampled at 4, 8 and 12 hours by removing a sub-sample (1 g), creating a dilution series in quarter-strength Ringer's Solution (Oxoid Code No. BR52) down to 10<sup>-7</sup>, and spreading 0.1 ml samples onto pre-poured plates of *Pseudomonas* Agar selective for *Ps. aeruginosa* (Oxoid Code No. CM559/SR102). Counts were taken after 48 h and recorded as cfu g<sup>-1</sup> of product; the entire trial was repeated twice.

### Results and Discussion

The basic analyses shown in Table 1 confirm that the restaurant-made product has a solids content close to that proposed by Musaiger (1993), but the canned Foul Medammas had a solids content more than 10% lower. The high moisture contents were reflected also in the water activities, and the canned product gave a quite exceptional value for a food (pure water has an A<sub>w</sub> of 1.0). Bearing in mind that values of available water above 0.93 in a food are conducive to bacterial activity (Corry, 1979), it is not surprising that Foul Medammas could be susceptible to bacterial spoilage. Acidity is another factor that can control microbial growth, and it is notable that the canned product has a pH of 5.9 compared with 5.0 for the fresh Foul Medammas. As *Ps. aeruginosa*, as well as other Gram-negative pathogens like *Salmonella* spp., usually grow best at pH 6 - 7 and are inhibited around pH 4.5, it is evident that the fresh product will be less likely to support extensive microbial growth.

This view was borne out by the results shown in Table 2, and contrast between the growth of *Ps. aeruginosa* in the fresh and canned products was quite remarkable. At 4 °C, the low temperature controlled the growth of the pathogen in both products but, when this restraint was removed at 25 °C, the organism grew extremely rapidly in the canned product. Indeed, after 12 h, the cell count of *Ps. aeruginosa* had exceeded the minimum infective dose, even though neither the appearance nor smell of the material revealed the extent of the microbial activity that had occurred. By contrast, the fresh product did not

support the growth of the pathogen at all at 25 °C.

A further comparison of the two types of product revealed some possible reason(s) for the differences in the behaviour of *Ps. aeruginosa*, for while both materials contained salt (~2.0 g 100g<sup>-1</sup>), only the fresh Foul Medammas contained olive oil (~ 3 g 100 g<sup>-1</sup>) and lemon juice (~ 8 g 100 g<sup>-1</sup>). The presence of lemon juice explains the lower and more inhibitory pH of the traditional product, but equally important may be the antimicrobial activity of the olive oil (Raina, 1993; Keceli and Robinson, 2002). Thus, a number of the phenolic compounds found in virgin olive oil are inhibitory to species of bacteria and yeasts, especially at low pH, and it may be that the antimicrobial effects of reduced pH, salt and phenolic agents combined to prevent the growth of *Ps. aeruginosa*. In the canned product, the absence of the 'traditional' ingredients allowed the organism to grow without restraint.

Obviously it can be argued that dishes like Foul Medammas should not be left at ambient temperature anyway, but what is really relevant is the contrast between the traditional and 'modern' products with respect to their ability to support undesirable microbial growth. Thus, many traditional foods have 'evolved' rather than been formulated by a chef working in a modern kitchen and, as a result, ingredients have been incorporated to give both pleasant characteristics to the dish and, albeit by chance perhaps, an element of 'safety' for the consumer. This inherent stability of traditional recipes is not uncommon (Campbell-Platt, 1987) and to forget this lesson could well put consumers at risk.

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