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OILS VERSUS MILK FAT

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Sección:

Yogurt

Milk fat in yogurts can be substituted with cheaper, often more accessible oils. But at what cost to consistency, nutrition and flavour? **E Barrantes**, A Y Tamime and A Sword of the Scottish Agricultural College, Auchincruive, investigate

In developing countries, 'filled' dairy products have been produced for more than 30 years. They are manufactured from recombined skimmed milk powder with vegetable fats and oils in place of the milk fat.

Although 'filled' dairy products are not acknowledged by the International Dairy Federation, the availability of these products in the markets of developing countries benefits the consumer. Furthermore, the use of indigenous fats and oils in these countries reduces the expenditure on imported milk fat while maintaining a wide range of dairy products to the consumer. 'Filled' dairy products are not common in most industrialised countries; however, in the USA in the 1960s, a process for the manufacture of yogurt containing unstaturated fat or vegetable oil was patented by Metzger (1).

Also, in the Commonwealth Independent States (CIS), skimmed milk fortified with 2% corn oils has been used for the production of a traditional and dietetic acidophilus milk (2). The limited information available on 'filled' dairy products has been reported by Newstead et al (3) where it was recommended that (a) the addition of vitamins A and D is important to satisfy the nutritional requirements of the consumer, and (b) the stability of oil emulsion can be achieved by adding lecithin or glycerol mono-stearate, or by using different homogenisation pressures from those used for other dairy processes, though no technical specifications were issued. Some information regarding the influence of vegetable fats and oils on the quality of 'filled' dairy products has recently been reported (4).

Current medical opinion in Europe and North America is not unanimous on the benefits of low fat or reduced cholesterol dairy products, or on the replacement of animal fat with vegetable oils in the diet. The use of hydrogenated vegetable oils in the diet may have similar effects to butter on cholesterol levels in blood, but the 'Mediterranean diet' -where olive oil is the main lipid consumed - is thought to be more healthy (5).

It could be argued that, since yogurt is considered a healthy dairy product among consumers in most countries, if the milk fat is replaced with vegetable oil(s), its healthy image could be greatly enhanced. Some aspects of the production, compositional quality, microbiological analysis, rheological properties and organoleptic evaluation of natural 'filled' yogurts made with different types of vegetable oils were reported by **Barrantes** et al (5). The aim of this study was to manufacture strawberry flavoured 'filled' yogurt using one of four types of vegetable oils and to evaluate the quality of these products organoleptically by students and staff at SAC - Auchincruive.

Materials and methods

Production of yogurt. 'Filled' yogurt was produced from recombined skimmed milk powder (approximately 14% total solids plus 1% sugar according to the method described by **Barrantes** and Tamime (6).

A control batch fortified with anhydrous milk fat (AMF), was produced along with four batches fortified with one of four vegetable oils at a rate of 1.5% (w/w). The following vegetable oils were studied: corn (Mazola(TM), CPC (UK), Surrey UK), sunflower (Flora, Flora Food Co, Burgess Hill, UK), groundnut (KTC, Wednesbury UK) and olive (Filippo Berio & Co, di Lucca, Italy). The oils were purchased from a supermarket and had a shelf-life of approximately 15 months. The oils were stored in the dark, at room temperature. The freeze dried starter culture MY-087 (Texel/Rhone-Poulenc Group, Cheshire, UK) was used as direct-to-vat inoculation of the milk at a rate of 16g 100 1^{-1}.

The processed strawberry fruit for yogurt (G R Spinks & Co, Devon, UK) was added at a rate of 15%. The energy value of the fruit was 187.6kcal $100g^{-1}$ and it was calculated by using Adiabatic Bomb Calorimeter - System 3.

The energy value (kcal $100g^{-1}$) of the yogurts was calculated on the basis of conversion factors as follows: protein 4, carbohydrates 4, fat 9 and organic acids 3 plus the calorific content of the added sugar and fruit (7).

Organoleptic evaluation. Eighty consumers of yogurt were (self) selected from students and staff at SAC-Auchincruive to sample five different yogurts and score each for overall acceptability using a nine point Hedonic scale according to the scheme described by Land and Shepherd (8). The yogurts were presented to the consumers in 100g plastic pots fitted with press on lids. Presentation order was fixed, and designed to balance any bias due to order of tasting (9). Four personal characteristics were recorded for each consumer, namely age, sex, weekly consumption of yogurt and permanent address.

Microbiological analysis. The yogurts were examined before conducting the organoleptic survey for the enumeration Of total colony count (ie non-lactic acid bacteria), coliforms, yeasts and moulds according to the methods reported by **Barrantes** and Tamime (6). Statistical analysis. The data were analysed using the Residual Maximum Likelihood (REML) technique available in the Genstat computer program (copyright 1990, Lawes Agricultural Trust, Rothamsted Experimental Station).

Results and discussion

The calculated calorific value in anhydrous milk fat (AMF) and 'filled' yogurts averaged 87kcal $100g^{-1}$ Energy values observed were similar because all the yogurts contained approximately the same amount of fat or oil, protein, lactose and organic acids.

Concerning the microbiological quality of yogurt, the level of total count (TC) of non-lactic acid bacteria in all the yogurts tested was low (ie <100 colony forming unit $(CFU)g^{-1}$). The coliforms, yeast and mould counts of the AMF and 'filled' yogurts were <10 $CFUg^{-1}$.

These results indicate that the yogurts were produced under good sanitary conditions and to a hygienic standard (7, 10, 11). Similar counts were also achieved in different yogurts when other fat substitutes and microparticulated whey protein were studied (5, 12, 13, 14).

For the purposes of the analysis the personal details of each consumer were categorised in terms of gender and then in the following ways. Age was coded as: a) less than 20 years, b) between 20 and 30 years, c) greater than 30 years. Permanent address was classified as: a) living in Strathclyde, b) not living in Strathclyde, but within the UK, c) living outside the UK. Weekly consumption was divided into: a) less than or equal to 3 pots a week, b) 4 or 5 pots a week, c) more than 5 pots a week.

Organoleptic evaluation Overall scores (figure 1) were analysed for the effects of yogurt, order of presentation and personal characteristics by the Residual Maximum Likelihood (REML) technique (15). Yogurt mean scores ranged between 3.2 (sunflower) and 6.6 (AMF) with the standard error of difference (SED) at 0.39. The AMF yogurt was significantly superior (P<O.05) to each of the other yogurts (figure 2). It is most likely that the poor consumer response to sunflower yogurt could be attributed to the association of the flavour of this oil with yellow spreads rather than fermented milk. Yogurts sampled first averaged a score of 4.1. This was significantly lower than yogurts tasted later on in the session where scores ranged between 4.8 and 5.2, with SED at 0.25 (figure 3).

There was no evidence to suggest that either of the categorised personal factors; consumption or permanent address had any influence on yogurt preference. However, there was significant evidence of an interaction between yogurt scores and consumer gender. Yogurts made from groundnut oil or AMF were rated significantly higher by the females than the males.

The age of each consumer also influenced yogurt preference. All three age groups rated the AMF yogurt highest and the sunflower the lowest; however only the 20-30 age group believed there was an appreciable difference between the remaining three yogurts (figure 4).

Conclusion

Filled yogurt made with different vegetable oils at a rate of 1.5% (w/w) could successfully be used for the manufacture of good product. However, in this subset of the UK population, corn, olive and groundnut yogurts were perceived as moderately acceptable When compared with the AMF yogurt. Least acceptable was sunflower yogurt. The microbiological qualities of strawberry flavoured AMF and 'filled' yogurts were excellent. No reduction in the calorific value of yogurt can be achieved by using vegetable oils, but 'filled' yogurts contain a higher proportion of poly and mono unsaturated fatty acids when compared with AMF.

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GRAPH: Figure 1. Cumulative scores of organoleptic acceptability of anhydrous milk fat and 'filled' yogurts
GRAPH: Figure 2. Yogurt means of the consumer panel
GRAPH: Figure 3. Effect of order of presentation of yogurt samples on the consumers' scores
GRAPH: Figure 4. Interaction diagrams illustration the categorised personal factors that influenced the organoleptic acceptability of 'filled' yogurts.
