STUDIES ON THE USE OF SOME VEGETABLE OILS IN HARD CHEESE MAKING

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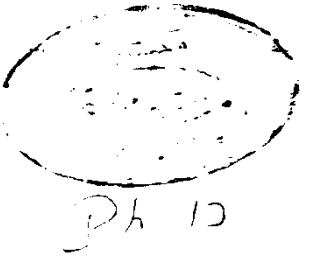

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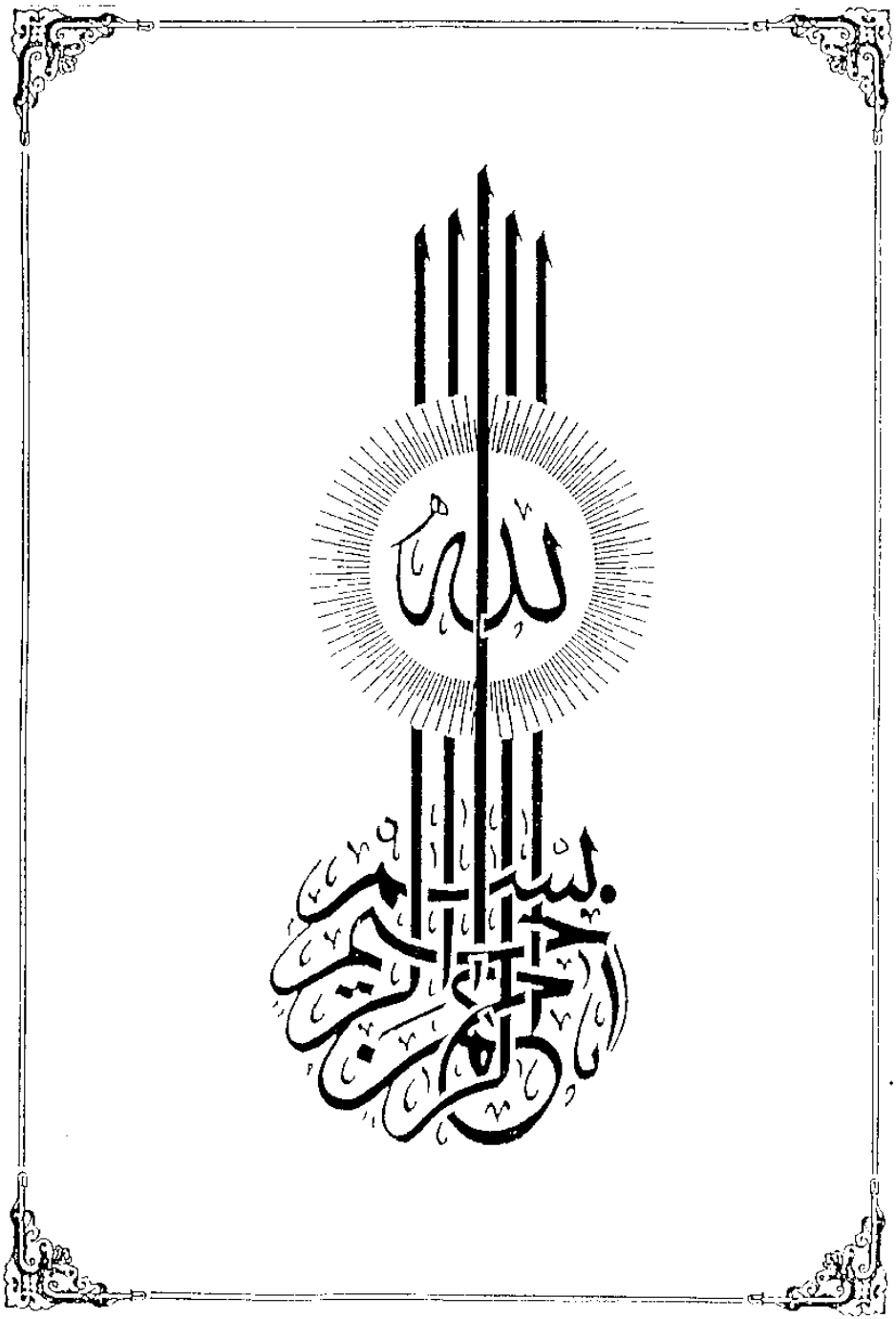

PRAYERFUL THANKS, AT FIRST TO OUR MERCIFUL GOD

WHO GIVES ME EVERY THING I WISH

TO SOUL OF MY

MOTHER AND FATHER

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INTRODUCTION

Recently the use of vegetable fats and oils in dairy industry is one of the most controversial topics. Processors of vegetable fats and oils are now able to process fats that could meet many desired specifications e.g. desired melting point and at any given temperature. Durkee (1968) and Ryberg (1968) reported that, among the major reasons for the growing acceptance of these new foods are: (i) it could be kept for several weeks under normal refrigeration condition, (ii) the vegetable fats and oils are always cheaper than milk fat.

In the last few years milk production has presented some serious problems which is assumed to be to day of much greater importance due to the continuous trend of increase in population in most under developed countries and where milk is unsufficiently produced. Under this current situation substitution of one or more ingredients of cheese constituents became evidently necessary.

The object of this investigation was to produce a filled hard cheese type, using skimmilk powder and vegetable oils. It is hoped that the resultant cheese would be a close type to the national cheese one, actually "Ras" cheese. That might meet with reduced costs and relevant medical slogans, consequently, the welfare of low social income level class of population.

However, the work is presented in the following parts:

PART I - Effect of using skimmilk powder and soyabean or maize oils on the properties of filled hard cheese during ripening.

PART II - Effect of adding sodium citrate to filled milk concentrate on some properties of filled hard cheese.

PART III - Effect of using active and autolyzed starters on the properties of filled hard cheese.

REVIEW OF LITERATURE

I. Utilization of reconstituted skimmilk powder in hard cheese manufacture:

Skimmilk powder may be used in cheese making either to increase the solids of fluid milk or as the sole source of solids as in reconstituted milk. This has been due chiefly to shortage in milk supply in some parts of the world. Skimmilk could be replaced by non fat dry milk, when skimmilk is in shortage supply, as well as its use to increase the yield and as a means of improving the quality of the curd (Remaly, 1958). Thus it is better for countries, including Egypt, importing large amount of dairy products, to import dried milk to produce various dairy products, in order to lower the bulk transport costs, control of the rate of manufacture to meet the demand, provision of local work, increasing the shelf life of materials without freezing or canning, and seasonal variations in milk supply or demand, cause no problems due to the availability of milk powder at any time of the year, often at advantageous prices (Sayce and Park, 1971).

There are several methods for making cheese from dried milk, these methods of manufacture differ mainly in the amount of solids in the reconstituted milk, the amount of rennet added and the recommended acidity of curd at cutting.

Difficulties in stages of curding of cheese formed from reconstituted milk could usually be overcome by the use of

larger amounts of rennet, small additions of calcium chloride, higher cooking temperature, and prolonged processing time (Kemeny, 1959). He also said that the frequent lack of firm curd in the third phase of the coagulation of reconstituted milk was probably caused by casein degradation resulting from heat treatment.

Nichols (1947) and Kemeny (1959), also mentioned that, the most suitable powder-water ratios depended on the powder quality and should be between 1:5 and 1:9, mainly 1:7 to 1:8. In addition different samples of dried milk differed in clotting properties, which were influenced by the bulk density, solubility index and water content of the dry milk.

Babad and Hadass (1959), found that, the most suitable ratios of powder to water depend upon quality of the powder, and should be between 1:7 to 1:8.

Nichols (1947), manufactured Cheddar cheese from reconstituted milk by altering the physical characteristics of the reconstituted milk. Lower acidities, higher renneting temperatures (2°C higher than normal) and twice the normal amount of rennet were needed. The curd was cut finer than the normal practice. It required very gentle handling to prevent a cloudy whey and a flaky crumbly curd. A cooking temperature 1 to 2.5°C above normal was required. He recommended the use of thermoduric starter along with the usual starter. The cooking temperature was raised in 40 to 50 minutes. The whey was drawn at

an acidity of 0.16 percent. There was an appreciable increase in the yield over normal cheese because of higher moisture content (38–40%) and the lower fat loss. The new cheese ripened in 4 to 6 weeks as compared with 4 months for normal Cheddar.

Kemeny (1959), manufactured semi-hard and hard cheese (Cheddar cheese) from reconstituted dry milk. Larger amount of rennet (4 times the normal amount) and small additions of $CaCl_2$. Higher cooking temperatures and prolonged processing time were required. It required very gentle handling to prevent formation of a cloudy whey and a flaky crumbly curd. The cooking temperature was raised gradually within 40 to 50 min. and the whey was drown at an acidity of 0.16%.

Peters (1959), studied the manufacture and ripening of Cheddar cheese made from reconstituted milk. He observed low fat losses in whey (0.02–0.07%). The curd displayed little tendency to mat during cooking. It lacked elasticity. The rind was weak in some of the finished cheese and the ripening was slower than in cheese made from raw or pasteurized, homogenized milk.

Attempts to acidify reconstituted milk to pH 6.4 with lactic, citric or hydrochloric acids prior to the addition of rennet resulted in only minor curd improvement at cutting and milling time with Cheddar type cheese (Peters and William, 1961). The same workers in 1963, stated that, a good quality ripened

Cheddar cheese can be made from reconstituted milk. The rate of ripening of such cheese was accelerated by increasing the amount of rennet added from 113 to 142 gr/450 kg of milk, and possibly by higher rates of inoculation of milk with cultures of lactic bacteria. The retension of a larger percentage of milk solids in the cheese made from reconstituted milk is an advantage from the standpoint of yield, and leaves a smaller percentage of milk solids to be disposed of as lower period whey solids. However, the curd made from reconstituted milk was less elastic at the time of cutting and during matting than were the blends of the two milks (pasteurized homogenized milk and reconstituted milk in ratios of 2 to 1 and 1 to 2) and the pasteurized homogenized milk curd. The same workers reported that a good quality Cheddar cheese was made from reconstituted milk when ripened for 6 months at 10°C. The percentage of total milk solids retained in cheese was higher with reconstituted or blended milk with pasteurized homogenized milk.

Freeman et al. (1970), reported that, no technological difficults were encountered in making or aging Cheddar cheese standardized with dried skimmilk, the curd did not Cheddar normally, but this had no adverse effect on quality of the aged cheese.

Hassan (1970), investigated the possibility of using skimmilk powder in the manufacture of hard cheese (Cheddar cheese). He stated that, the amount of added rennet increased from 4 gr in the control cheese to 7 gr in the reconstituted milk Cheddar

cheese per 100 kg of milk. He also found that, the reconstituted milk curd was soft during cooking and cheddaring even by raising the scalding temperature and by adding more rennet and $CaCl_2$. Also, it lacked elasticity and slow in mating.

Lablee (1970) manufactured mimolett cheese from dried skimmilk, dried butter milk and butter oil, the cheese after curing was of good quality, its flavour resembling that of mimolette cheese. Total solid content was 67.3%, fat in dry matter 50.5% and total protein 27.55% of which 10.37% was soluble. High quality, low-heat milk-powder was used as the initial material.

Lablee (1973), made Dutch-type cheese with 30% fat in DM from dry skimmilk and butter oil using a continuous cheese making process. The resultant cheese was ripened at a temperature higher than the normal.

In a study on the effect of addition of various levels of reconstituted skimmilk (1:9) in a proportional of 10%, 20%, 50% and 75% to the raw fresh mixed milk on Ras cheese making, El-Ashkar, 1979, found that, the clotting time increased with the addition of dried skimmilk, addition of calcium chloride decreased the clotting time, the total solids percentage increased in the whey due to the addition of dried skimmilk, moisture had decreased gradually with aging, and the fat percentage, the salt content, and acidity increased gradually in all treatments during aging. From the organoleptic properties, it is possible to deduce that 50% reconstituted powdered milk cheese

gave best records than 10% reconstituted powdered samples if compared with control and other powdered cheese samples.

Hammad (1981), investigated the possibility of using skimmilk powder in the manufacture of Ras cheese. He produced Ras cheese from recombined milk with 0.02% $CaCl_2$, coagulation temp. at 40°C, 6.25 gr rennet/100 kg milk, and the whey was drained at acidity of 0.16%.

II. Utilization of vegetable oils in cheese manufacture:

The primary risk factor associated with cardiovascular disease is highly consumption of animal fats and/or cholesterol (Saarivirta, 1974). UK department of health and Social Security (1974), in a report on diet in relation to cardiovascular and cerebrovascular diseases. The following dietary changes were recommended for the UK with the aim of diminishing the risk of ischaemic heart disease: reduction of obesity, reduction of the amount of fat in the diet, especially saturated fat from both animal and plant sources, reduction of consumption of sucrose. The panel could not recommended an increase in intake of poly unsaturated fatty acids. In the same year (1974), Hartog, criticizes certain features of the recent report of the committee on Medical Aspects of Food Policy in the UK, dealing with the relationship between nutrition and cardiovascular and cerebrovascular diseases. In particular he points out that the panels' decision not to recommend any increase in use of poly unsaturated fatty acids is contrary to the evidence

provided by certain studies which suggest that such an increase may reduce the risk of atherosclerosis.

Hurt (1972) reported, the association between dietary, fats, cholesterol, and coronary heart disease. He said that, the type and amount of dietary fat consumed will have a significant effect on blood cholesterol concentration. Diets containing a large amount of poly unsaturated fatty acids tend to decrease blood cholesterol concentration, whereas diets high in saturated fatty acids tend to increase blood cholesterol. He also, mentioned that, the American Heart Association in an attempt to reduce the incidence of coronary heart disease, recommended that, an individual should substantially reduce dietary intake of saturated fatty acids to lower blood cholesterol levels. He said that, this can be accomplished by the following:

a - The food industry should make available products which would meet the specification of lower saturated fatty acids and cholesterol content.

b - The dairy industry should develop low-fat, low cholesterol milk and milk products. Also, a switch to cow that produce large amounts of high protein, low-fat-milk should be accomplished.

c - Modified cheese, containing lower saturated fatty acid and cholesterol content, should be developed to aid the reduction of dietary intake to saturated fatty acids and cholesterol.

Vegetable oils have no effect on "atherogenic index" and therefore, can be used to replace animal fat in diet (Gofman et al., 1958). Maize, cotton-seed, sunflower, soya, and similar highly unsaturated oils are used instead of milk fat to produce filled milk products. These all contain a large proportion (e.g. 50%) of poly unsaturated fatty acids and have an iodine value in the range of 120 to 140 (Davis, 1965).

From the above, it could showed that, vegetable oils should be used in mainy dairy products to meet medical and consumer demands.

Peters (1956), obtained a satisfactory curd from pasteurized homogenized filled milk made from natural skimmilk and hydrogenated cotton seed or soya bean oil, or coconut fat without the addition of $Na_3 HpO_4.12H_2O$, but with added $CaCl_2$. The same worker (1956), found that, a satisfactory filled milk for making filled cheese of the Cheddar type was obtained by homogenizing at 35 kg/cm^2. a mixture of natural skimmilk or reconstituted skimmilk and vegetable fat at 55°C before and after pasteurization. Flavour, body and texture characteristics differed somewhat from those of natural milk cheese. Homogenization pressures of 70 kg/cm^2 or less were found superrior to higher pressure in preserving the curd making properties of filled milks. At the same time, the above pressures were found to be sufficient high to properly incorporate the foreign fat into the natural or reconstituted skimmilk. Filled