FURTHER STUDIES ON DRIED SKIM MILK IN RELATION TO SOFT CHEESE MANUFACTURE

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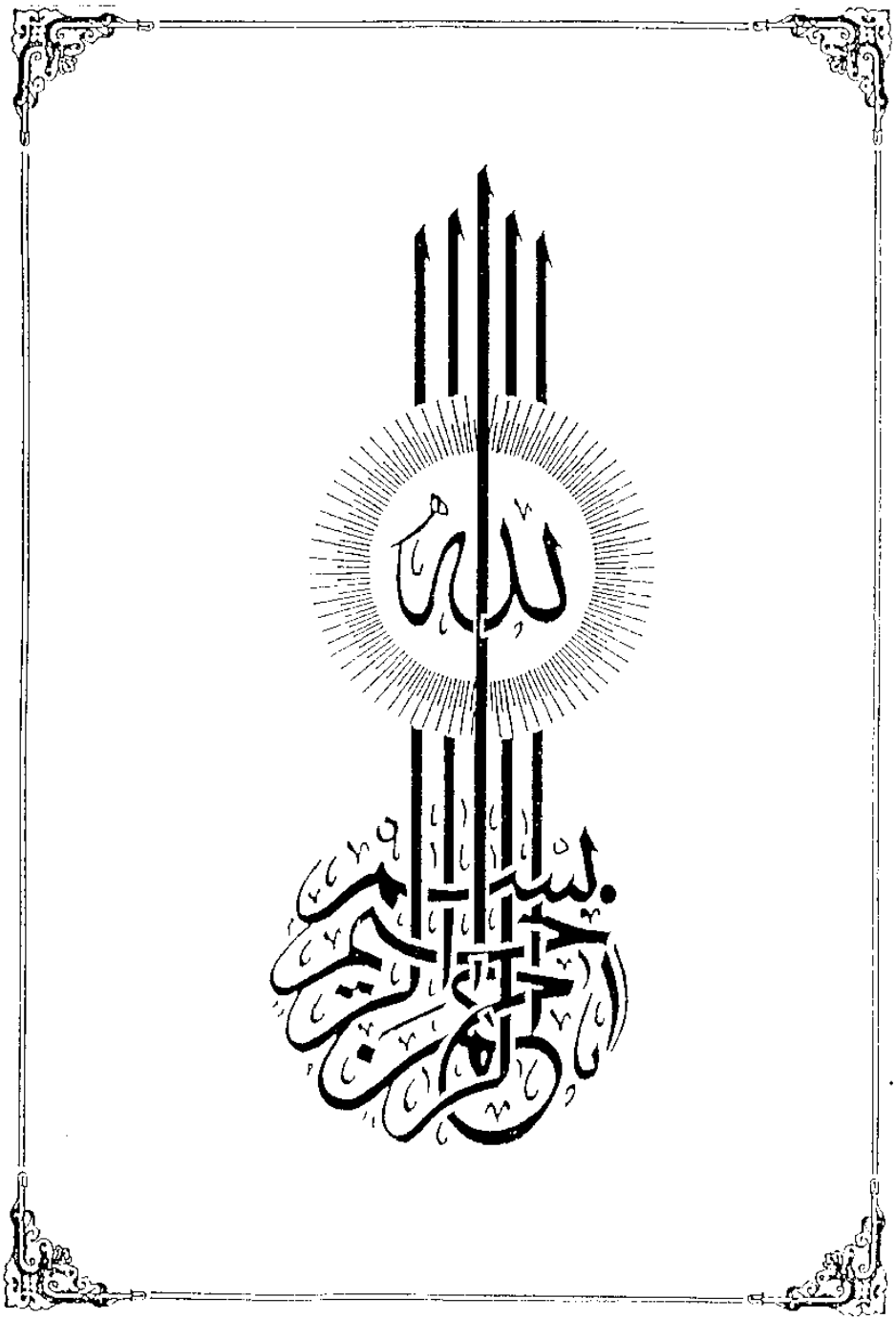

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C O N T E N T S

INTRODUCTION

The structure of the Egyptian dairy industry has been subjected to several changes during the last 25 years. The introduction of milk powder in the manufacture of some dairy products has been one of the major changes in the policy of the national dairy industry. Radical changes started around 1970 when milk production conditions failed to cooperate with the expansion of modern dairy industry.

The physico-chemical properties of milk powder was used, mainly in the form of recombined milk such milk are not identical to raw milk ones and vary according to processing treatments. Adaptation of manufacturing procedures are rather essential especially in soft cheese making. Therefore, some research activities were conducted, locally and abroad for setting up reasonable information which may give enough ground regarding the use of recombined milk. In previous study conducted by the writer, the effect of storage of skimmilk powder ,up to 12 months ,on examined properties as well as the quality of resultant white soft cheese was investigated. However,several areas has not been fully explored in this respect particularly with cheese manufacture. Cheese making from recombined milk is known to be sensitive to the heat treatment received during the manufacture of the skimmilk powder used. Generally,low-heat dried skimmilk powder is recommended for cheese making . However,this type of milk powder is more expensive than the others. Suitability of skimmilk powder of different heat treatments in making a

a specific type of cheese needs thorough investigations. In the literature no cited research dealt with local white soft cheese making from skimmilk powder of different heat treatments .

This study was conducted through some light on this subject. Results are presented in the following four parts:-

PART I : Some chemical and physical properties of dried skimmilk .

PART II : Status of milk proteins in skimmilk powder .

PART III : Gel electrophoretic analysis of whey proteins as a method for detection of dried skimmilk in pasteurized fresh cow's milk.

PART IV : Comparative study on soft cheese making from different heat treated milk powders.

Any results achieved would be of interest to the local industry as well as their scientific merit.

REVIEW OF LITERATURE

Some physical and chemical characteristics of dried skimmilk:

Kannon and Jenness (1956) studied the relation of milk serum proteins to the effects of heat treatments on rennet clotting. They found that, the increase in rennet clotting time induced by heating occurred only when the caseinate and milk serum proteins were heated together. There was no effect when the proteins were heated separately. The heating effect was greater the higher the concentration of the serum proteins.

Merrill (1960), studied the relationship between curd tension and undenatured whey protein content and the heat treatment of skimmilk and non fat dry milk. He found that curd tension and whey protein determinations as heat treatment indicies for milk were comparable. Greater decreases in rennet curd tension and similar decreases in whey protein nitrogen were obtained on heating condensed skimmilk before rather than after reconstitution.

Ionkino and Kugenen (1966) studied the physico-chemical changes in whey proteins of milk on heating. They used three treatments (i) milk was held at 85°C for 5 min., and then heated for 2-3 sec. at 110°C (ii), or 130°C (iii). They found that treatment (i) reduced the content of

undenatured whey protein to 65%, (ii) to 54% and (iii) to 41% of that in the raw milk. The results obtained by paper electrophoresis gave the following values in mg % for different fractions in raw milk was, immunoglobulines 91, α-lactalbumin 100, B-lactoglobulin 311, whey albumines 18; however, after heat treatments (i)- (iii) the contents of the undenatured whey proteins as % of the values in raw milks, were respectively, immunoglobulins 42, 37, 33, α-lactalbumin 107, 119, 119, B-lactoglobulin 59, 37, 17, whey albumins 62, 48, - .

O'Connor et al. (1969), studied the effect of preheating evaporating, concentrate heating and drying stages, used in low heat dried skimmilk manufacture on whey protein denaturation. They found that low heat dried skimmilk contain 6.0 mg/g of whey protein N, when used preheating of 162°F for 30 S.

Voss (1970), studied the effect of the type of heat treatment used for manufacture of dried skimmilk on coagulation time and the time required to attain an intermediate degree of setting using thrombelastograph. He used for identifying the heat treatment received during manufacture the method for estimating of soluble whey protein expressed

as an A.D.M.I. index. He indicated that the samples represented mainly medium or low heat products and the technique of renneting appeared to prove a better guide to suitability of the dried milk for cheesemaking purposes than whey protein index.

Voss (1971) studied the concentration temp., degree of concentration of milk, and temperature of drying air on the undenatured serum protein content, renneting time and curd firmness of the reconstituted spray dried milk. He found that low concentration temperature of 20°C and concentration to 30% T.S. were favourable to renneting conditions and curd firmness. However, high temperature of 60°C and 50% T.S. were unfavourable. He found that best results were obtained with 40°C and 40 T.S. especially if concentration was followed by holding for 2 hrat 40°C or 1 hr at 60°C. Drying air temperature had little effect.

Voss and Schmanke (1973) studied the rennetability of dried skimmilk and estimated whey protein index. They found that whey protein index provided only a limited measurement of the rennetability of the reconstituted milk and curd firmness.

Devilder and Martens (1976), studied the effect of heat treatments on the classification of dried skimmilk based on whey protein N index (W.P.N.I.). In 6 test runs pasteurized milk was heated at 65-90°C for 45 S, prior to evaporation, concn. in 2 steps at 68°C, and 65°C or 75°C and then spray drying. They found that the single most important treatment was heating before pasteurization, low-heat powder (temp. 75°C) had a W.P.N.I. 6.0 mg N/g, whereas heating to 80°C reduced W.P.N.I. to 3.32 and at 90°C it was reduced to 1.65 mg N/g. They also found that globulin and B-lactoglobulin N was slightly decreased in low-heat powder and decreased with W.P.N.I. in medium heat powder. However, albumines (mainly α-lactalbumin) were more slowly denatured, the proteose peptone and non protein N fractions were hardly affected by heating.

Kearney and McGann (1977), used modified electrophoretic techniques for assessment of whey protein denaturation in reconstituted skimmilk powders, which has been subjected to a wide range of heat treatments. They made an electrophoretic separation of casein on (a) urea starch gels at 4°C for 41 hr and (b) in duplicate on cellulose acetate stripe at room temperature for 75 min. A Co-precipitated B-lactoglobulin band resulted from heat denaturation of whey proteins was clearly resolved on both supports. The amount of

coprecipitate was quantified by densitometry, and the results of both electrophoretic methods were in good agreement. They proved that the electrophoresis on cellulose acetate which was a rapid technique offered advantages over starch gel.

Papajova and Krcal (1979), found that bulk density of dried milks ranged from 0.519 to 0.619 g/cm^3 indicating increased proportions of large particles in the products. Also, they found that at 10% significance level, thus was significant correlation between whey protein contents of reconstituted milk, solubility index and rennetability.

Baldwin et al. (1980) investigated the effect of concentrate viscosity on the properties of spray dried skimmilk powder. They found that viscosity of skimmilk concentrate varied independently of total solids content and temperature of concentrate. However, they demonstrated the very large effect of particle size on the solubility index. Further increase in concentration increased the solubility of the casein proteins. Also they indicated that a higher concentrate viscosity produced a greater degree of water bounds by the milk proteins. They showed

that particle size of milk powder was slightly increased with marked increase in concentrate viscosity.

Marschke and Houlihan (1980), investigated a rapid method for estimation of undenatured whey protein nitrogen of skimmilk powder. They found that the rapid P.M.D. (pro-milk difference) technique had useful application in the process control of powder manufacture. They classified the skimmilk powder according to P.M.D. values as, low-heat had not less than 0.52, medium-heat had 0.21-0.52 and high-heat had no more than 0.21.

International Dairy Federation (1982), issued guide-lines for assessment of heat class of skimmilk powder. The method applicable to all types of instant dried milk, was based on determination of the heat number, i.e. the ratio of acid insoluble (pH 4.8) protein N content to total N con-tent, multiplied by 100. It has been stated that heat num-ber of $\leqslant$ 80, 80.1-83, 83.1-88 and $\geqslant$ 88.1 correspond res-pectively to the classes low, medium, medium-high and high heat and to undenatured milk-serum protein N concentrations of $\geqslant$ 6, 5.9-4.5, 4.4-1.5 and $\leqslant$ 1.4 mg/g under the heat classification method of the American Dry Milk Institute.