NUTRITIONAL AND BIOLOGICAL STUDIES ON MOULD CHEESE

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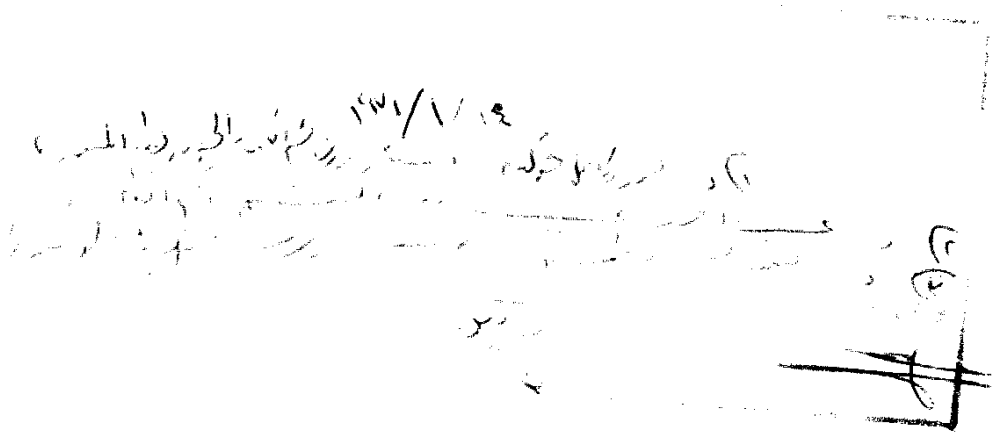

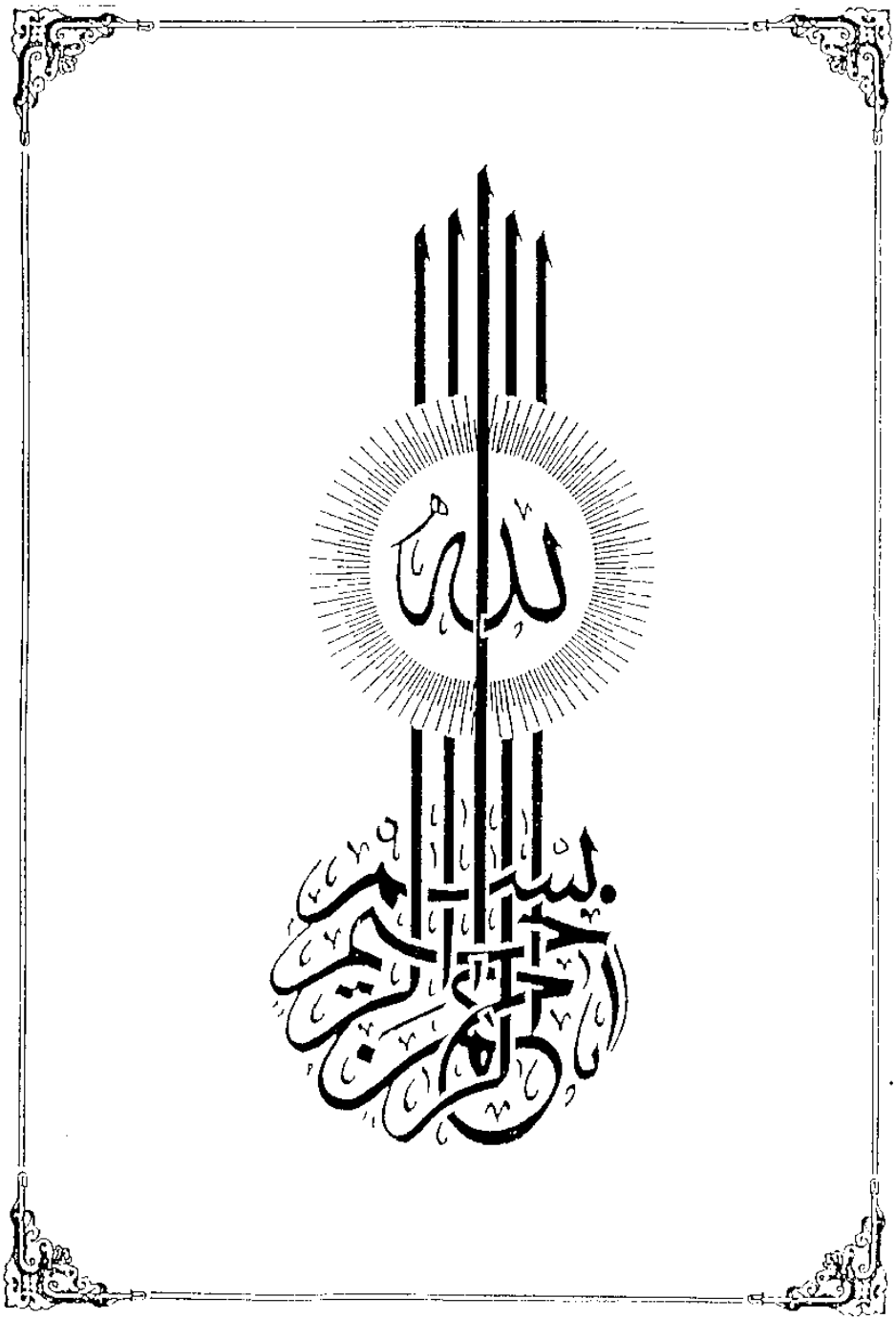

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PART 1

INTRODUCTION AND REVIEW

INTRODUCTION AND REVIEW

Roquefort cheese is an important type of cheese characterized by a sharp peppery flavour and a semisoft consistency. It has a typical mottled appearance when cut due to mould growth. Original roquefort cheese was first made in France from ewe's milk. It has been shown by Alais, C. (1950) that lactic acid cultures isolated from roquefort cheese exhibited distinctly different characteristics when cultured on sheep's milk as compared with cow's milk. Strength of cultures when carried on sheeps milk remained for protracted periods, in cow's milk the organism rapidly lost capacities to produce and to prevent contaminations. He then concluded that these cultures carried in sheep's milk always yield excellent results when used in the manufacture of roquefort cheese.

Other types of blue Veined cheese resembling the original roquefort are made elsewhere in the world.

They possess more or less similar characteristics though having different names. The name of such cheese differs according to place of manufacture. For instance in Czechoslovakia, it is given the name Niva Froma in Danish there are two distinct types of blue cheeses, Danablu and Mycella.

Various types of starters have been used in the manufacture and ripening of blue veined cheese. Streptococcus lactis and Streptococcus cremoris have been used and compared by Clark and Golding (1949). They found that cheeses made with streptococcus cremoris as starter were difinitely poorer in mould growth and of inferior flavour to those made with Streptococcus lactis or commercial starter.

Furthermore, studies were carried out to apply some asporogenous yeasts in the manufacture of roquefort cheese. Maxa and Jicinsky (1956) when using five strains of yeasts isolated from French Roquefort cheese, they found that their addition to milk improve the quality of Niva cheese manufacture.

Penicillium roqueforti is the type of mould responsible for ripening of blue veined cheese. The products of its lypolytic and proteolytic activity are believed to give this cheese its characteristic flavour. (Funder et al (1939), Block (1953), and Foster et al (1958).

Bogdanov and Yefimchenke (1939) examined the source of twelve strains of roquefort cheese mould obtained from Swiss, French, American and Czechoslovakia cheese and

their suitability in cheese making. They found no great difference in their morphology. The properties of penicillium roqueforti particularly lipase activity have received considerable attention. Bogdanov and Yefimchenke (1939), isolated twelve strains which were found to be strongly proteolytic and lypolytic. However the degree of proteolysis and lypolysis varied in experimental cheese inoculated with these strains.

Thibodeau and Macy (1942) found that the addition of pulverised mycelium of penicillium roqueforti instead of spores shortened the time of ripening of cheese from normally ten months to five months, accordingly they concluded that penicillium roqueforti appeared to possess both extracellular and intracellular lipases.

Shipe (1951), studied the influence of penicillium roqueforti on a mixture of tributyrin and tricaprylin, and found the ratio of free butyric to free caprylic acid to be 3:1. The same thing was found by Wilson et al and Imamura et al (1955).

Sjostron and Malm (1952), observed that in culture media penicillium roqueforti consumed the fatty acids up to myristic acid with the production of roquefort flavour.

Using Harper's method, Willart, S. (1956) was able to detect butyric and caproic acids when studying the fat hydrolysis in blue cheese.

It is not only the fat splitting properties of penicillium roqueforti that are of interest, but also the secondary reaction of the fatty acids, especially the formation of B-oxidation products.

Lane, C.B. and Hammer, B.W. (1938) indicated that penicillium changes greatly the amount of volatile fatty acids and the acid value of cheese fat when it was used in manufacture.

Morgan and Anderson (1956) showed the presence of carbonyle compounds in blue mould type cheese.

It has been shown by Girolami, R.L. and Knight, S.G. (1955) that mycillial suspension of penicillium roqueforti, can produce methyl ketones from fatty acids with 4-12 carbon atoms.

Larger fatty acids have never found to be active substrate in this fungi.

This was also confirmed by the work of Haidle,C.W. et al (1960).

The fatty acid oxidation by spores of penicillium roqueforti was studied by Gehris and Knigt (1963).

The importance of methyl ketones as flavour constituents of cheese in which penicillium roqueforti is the ripening agent was investigated by Starkle (1924), Hammer and Bryant (1937), and Patten (1950).

The mould cheese was analysed for methyl ketones by Schwartz (1963); and the results indicated that heptane was the major ketone of all cheeses investigated.

On a study of the biochemical activities of nine strains of penicillium roqueforti isolated from niva cheese, Proks et al (1956), found that the lypolytic and proteolytic activity of these strains are qualitatively and quantitatively variable in producing and developing the characteristic roquefort flavour.

In the same year Kuramote (1956), found a selective splitting of butyric acid from solid butter fat and of stearic acid from liquid butter fat by penicillium roqueforti.

In trials to introduce the optimum conditions for blue cheese manufacture, raw milk was firstly used by Thom and Matheson (1914), Matheson K.J.(1921), and Goss et al (1935).

Lane and Hammer (1936) modified the procedure with homogenizing the raw milk. This modification resulted in faster ripening of the cheese as well as more luxurious mould growth.

Another trial was done using pasteurized milk, the product obtained did not show the full and the typical flavour during ripening, this has been attributed primarly to the inactivation of milk lipase by pasteurization resulting in less hydrolysis of the butter fat.

In (1938) Lane and Hammer reported that blue cheese made from pasteurized homogenized milk was a more satisfactory product than that made from raw nonhomogenized milk, but less satisfactory than if raw homogenized milk was used. They concluded that milk lipase definitely aided in the ripening of blue cheese.

Adding a commercial lipase preparation (steapsin), Irvine (1938), found that, it accelerated fat hydrolysis and hastened the ripening of cheese. It however induced a bitter flavour in the cheese resulted. Similar results were obtained by Coulter, and Combs (1939).

Fabricius and Nelsen (1944), were able to produce a satisfactory blue cheese from raw nonhomogenized milk

by using a combination of heat and vacuum treatment of milk, namely (165-175°F and 19 inches of vacuum). This treatment of milk distroyed most of the undesirable microorganisms present in the raw milk without inactivating the milk lipase.

Parmelee (1947) added pure cultures of Alealigenes lipolyticas, Achromobacter lipolyticum, Pseudomonus fragi, and Mycotorula lipolytica separately to lots of pasteurised homogenized milk made into blue cheese and found that in the cheese microorganism only certain of Mycotorula lipolytica improved the flavour.

Further studies were carried out by Peters I.I., and Nelson, F.E. (1948), to show the possibility of substituting the cell free lipase produced by mycotorula lipolytica for normal milk lipase in the manufacture of blue cheese from pasteurized homogenized milk.

It has been shown by Brunner and Mallmann (1950) that dehydroacetic acid is a mould inhibitor on butter and cheese, and that the acid and its sodium salt inhibited the growth of penicillium roqueforti.

Iron is an important factor in blue cheese manufacture. Knight, S.G. et al (1950) indicated during

their studies on white mutant of penicillium roqueforti that the high iron requirement for good growth and sporulation of penicillium roqueforti might be very significant in the manufacture of mould ripened cheese and that all samples of milk that were obtained directly from the caw and never were in metal container, were iron deficient for green mould, but not for white mutant.

Knight S.G. (1957), showed that the addition of various iron salts to milk improves the growth of penicillium roqueforti during cheese making.

Mayr,G., and Kaemmerer, H. (1959) tried to affect the ripening of roquefort cheese by treatment with ethylene oxide, but they found that ethylene oxide inhibits the development of mould organisms.

Carrere,L. et al (1960) indicated that roquefort cheese can be made from ewe and goat milk naturally infected with Brucella. The presence of this Bacterium, was proven by culturing and Guinea pig inoculation.

Peters and Nelson (1961) demonstrated that the addition of lipade extracted from candida lypolytica in sufficient quantities, improved the quality of blue veined cheese during manufacture.

Schwartz, Parks and Boyd (1963), showed that, removal of methyle ketone from fat portion of the cheese during manufacture still left the fat milk Roquefort type odour.