STUDIES ON THE USE OF LACTASE IN SOME DAIRY PRODUCTS

BY

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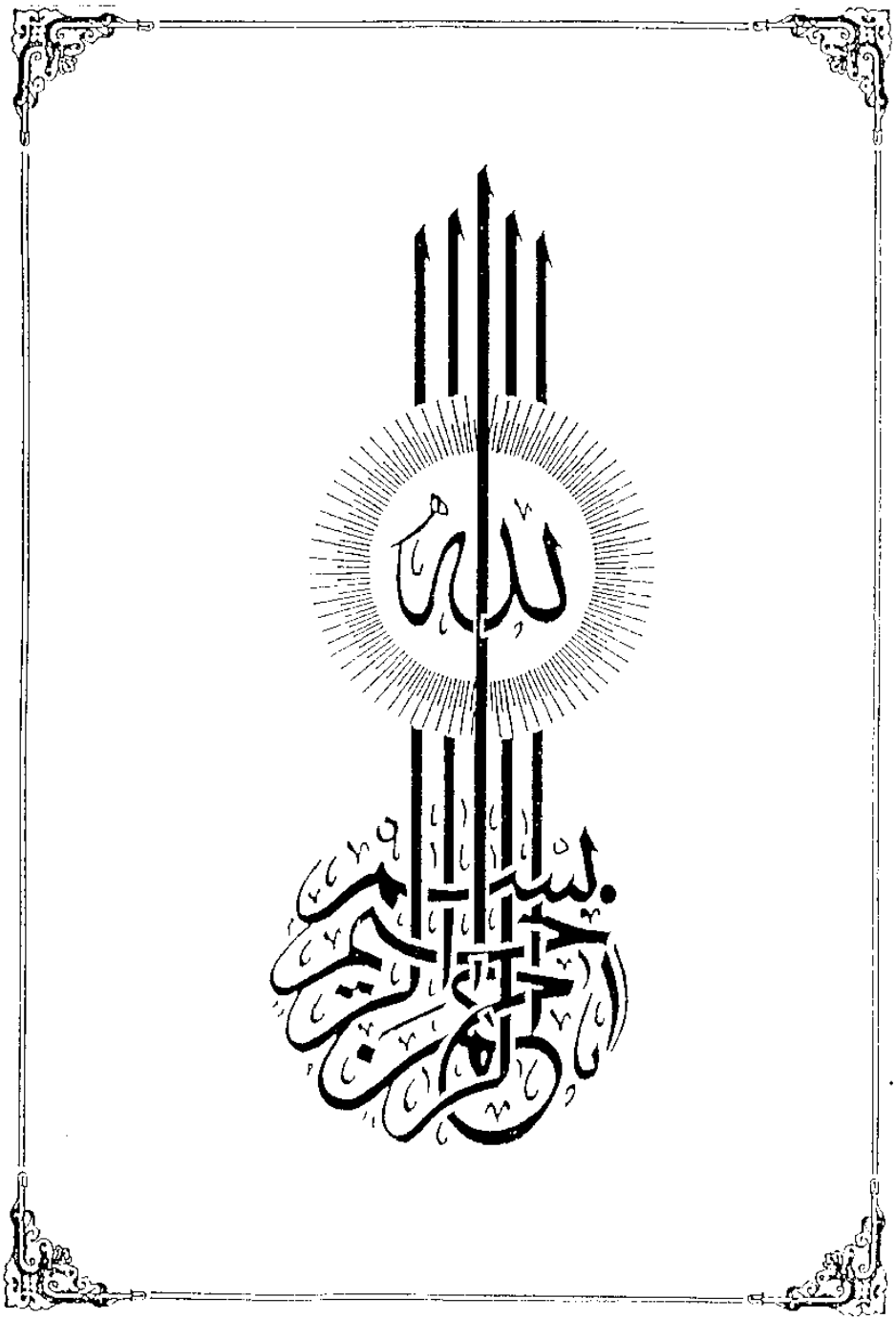

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C O N T E N T S

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INTRODUCTION

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INTRODUCTION

Lactose is the first sugar for humanbeing, it is a disaccharide, normally hydrolysed in the small intestinal lumen to glucose and galactose by lactase (B-D-galactosidase) which is situated in the small intestinal epithelium. Lactase activity is high at birth, but decreases in childhood or adolescence and remain consistently low in adulthood. The prevalence of adult lactose malabsorption varies greatly with different races and populations. In some population it reaches 100%, in others it is less than 1%. Lactose intolerance is a problem when trying to fight malnutrition and famine in developing countries with milk products. Thus, a need exsists for low lactose milk and milk products (Skala et al., 1971 and Jones et al., 1976). However, the valuable milk proteins are important enough to motivate the use of low lactose milk products for people in these countries. One can also consider removing the lactose from the milk by a physical process. The objection is that, together with the lactose, vitamins and minerals also lost. The best solution therefore is to predigest the lactose enzymatically, resulting in a diatary

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milk in which all the nutrients have been retained. Lactose hydrolysis can also be advantageous from the technological point of view (Mustranta et al., 1979 and Hourigan, 1984).

From various studies it appears that the consumption of a few grams of lactose daily is just tolerated by most intolerent persons, with an average consumption of 200 ml of milk a day, this means that the lactose in the milk must be hydrolysed for 50-80% (Nijpels, 1976).

The NOVO's Lactase (Lactozym) is one of the commercially available lactase which produced from Kluyveromyces fragilis. Its major advantages over other commercially available enzymes, its neutral pH optimum (6.0-7.0) and greater temperature range (4-45°C). In Egypt, few technological applications have been done with lactase in different dairy products. Therefore, this work was planned to use the lactozym in some of dairy products which can be manufactured from buffaloe's milk.

The study was carried out under two main parts:

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PART I:- USE OF B-GALACTOSIDASE IN YOGHURT AND FROZEN YOGHURT FROM BUFFALOE'S MILK.

Section A: Lactose hydrolysis as affected by lactozym concentration and incubation temperature.

Section B: Manufacture of plain yoghurt from hydrolysed lactose buffaloe's milk.

Section C: Manufacture of frozen yoghurt from hydrolysed lactose buffaloe's milk.

PART II:- USE OF B-GALACTOSIDASE IN DOMIATI CHEESE.

Section A: Lactose hydrolysis with lactozym as affected by calcium and sodium chloride content.

Section B: Manufacture of Domiati cheese from hydrolysed lactose buffaloe's milk.

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REVIEW OF LITERATURE

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REVIEW OF LITERATURE

Lactose or milk sugar is the main carbohydrate in milk, and its corresponding hydrolase, lactase, have been subject to an extensive research during the past decade. Lactase (B-1,4-D-galactosidase) catalyses the reaction of hydrolysis of lactose towards on isomolecular mixture of glucose and galactose. It is one of the better defined enzyme in the literature today. However, this enzyme is widely distributed in nature and can be found in plants (especially almonds, peache, apricots and apples), animal-organs, yeast, bacteria and fungi. These sources were reviewed by Shukla (1975) and Gekas and lopez leiva (1985). Not all lactase sources are acceptable or generally recognized as safe, when the enzyme is going to be used in food systems. Lactase preparations from Saccharomyces lactis, Saccharomyces fragilis, Aspergillus niger and Aspergillus oryzae are considered safe because those sources have already, a history of safe use and have been subjected to numerous tests (Pariza and Foster, 1983). E.coli lactase, although the species most investigated is not used in milk processing because of its cost and the fact that it gives toxicity problems with crude

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extracts of coliform. Safty considerations also must allow for the eventual appearance of non-desirable by-products production. Mahoney and Whitaker (1978) reported the properties of Kluyveromyces fragilis lactase. It had a molacular weight of 20,000 dalton and 9-10 sub-unit, a pH optimum of 6.0-7.0 and a temperature range from 4-45°C, the activators was potassium and ammonium ions and the inhibitors was sodium and calcium ions.

Lactase applications:

1. Yoghurt:

Kosikowski and Wierzbicki (1971) reported that the microbial lactase free cell preparations were applied to fluid milk basis in the preparation of yoghurt as a possible mechanism to produce a low lactose product of good quality. Lactase preparations from mold,yeast and bacteria at 0.1 to 1.0 % of the lactose in the system were blended with standardized milk (3.0% fat) containing 1% yoghurt starter. Simultaneous lactose hydrolysis and acid development at 43°C during fermentation of yoghurt produced in 4-6 h about 60 to 80% reduction in lactose and almost equally and significantly increased monosaccharides. Taste panel acceptance of the new low lactose yoghurt was high.

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Gilliland et al. (1972) reported that acid production in milk cultures of several strains of Str.cremoris and Str.lactis was stimulated by the addition of B-galactosidase although the growth rate was unaffected. They concluded that lactose catabolism is rate limiting for lactic acid production by lactic streptococci growing in milk and that glucose is utilized preferentially over either galactose or lactose.

Engel (1973) used Maxilact lactase in different concentration in fortified skimmilk and determined the rate of lactose hydrolysis during yoghurt manufacture. He suggested on the basis of limited tests that, plain yoghurt in which 50% of the lactose was hydrolysed before culturing should probably be acceptable.

Thompson and Gyuricsek (1974) found that lactase from Saccharomyces lactis hydrolysed 90 to 95% of the milk sugar in 2 h at 30°C when added to milk at 0.3 g/l. They also mentioned that yoghurt from hydrolysed milk was sweeter than the control and may be a useful product for lactase deficient people. They observed that the rate of acid development by bacterial cultures was reduced.

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Woychik et al. (1974) used soluble and/or immobilized lactase from Saccharomyces lactis in the production of low lactose dairy products. They found that, milk beverage with up to 50% hydrolysed lactose was acceptable to taste panels. Cultured low-lactose dairy products (yoghurt-butter milk) had a decreased acid taste. They observed that the rate of acid development increased with the degree of lactose hydrolysis.

Gyuricsek and Thompson (1976) reported that among yoghurt prepared from lactase treated milk in which more than 90% of the lactose was hydrolysed, the hydrolysed lactose yoghurts set more rapidly than controls did and had good acceptability. Advantages claimed for the application of lactase in yoghurts manufacture include accelerated acid development, which reduces the required set-time, and a reduction of acid flavour by glucose and galactose, which made the plain yoghurt more acceptable to consumers.

O'Leary and Woychik (1976) investigated the properties of yoghurt made from regular commercial skimmilk and from milk which had been treated with lactase enzyme

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