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**STUDIES ON THE UTILIZATION OF WHEY AND
BUTTERMILK SOLIDS IN MAKING ICE CREAM**

By

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Thesis

**Submitted in Partial Fulfilment of The
Requirements for the Degree of**

of

MASTER OF SCIENCE



5859

To



Food Science Department

Faculty of Agriculture

Suez Canal University

Suez, Egypt

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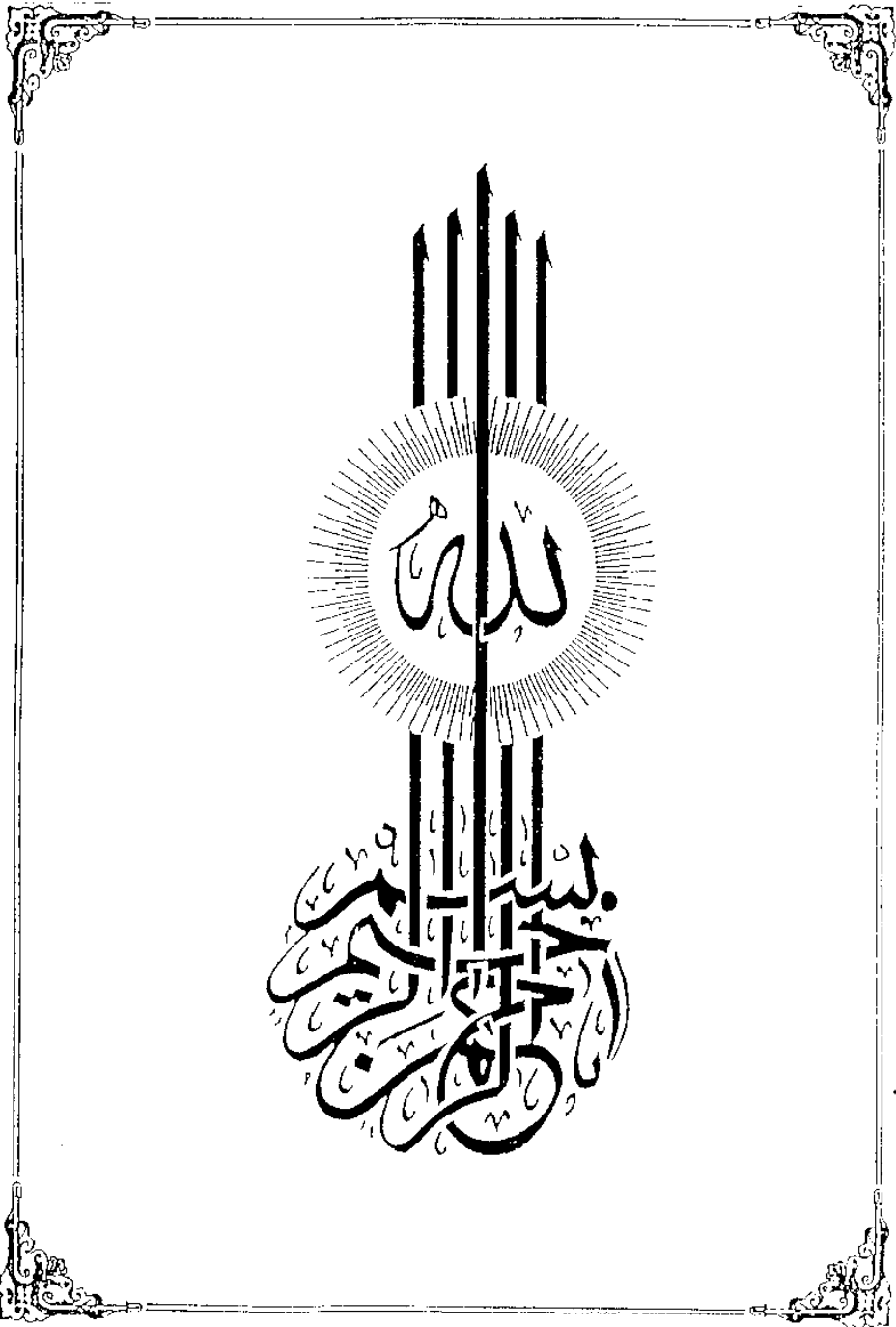
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ACKNOWLEDGMENT

I wish to express my sincere gratitude to professor Dr. G. M. El-Sadek, professor of Dairying and Chairman of the Food Science Department, Faculty of Agriculture, Ain Shams University, Cairo, for his interest, constructive guidance, encouragement throughout the course of this work, advice and revision of the thesis.

I am grateful to Dr. S. M. Khalafalla, Assistant professor of Dairying in the same Department, for his valuable advice, moral support during the course of the work and guidance offered throughout the preparation of the thesis.

To Dr. G. A. Mahron, Lecturer of Dairying in the same Department I owe my gratitude for his guidance throughout the course of this work.

My thanks are also due to all the staff members of the Dairy Department for their useful help.

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INTRODUCTION

Ice cream is a delicious, wholesome, nutritious frozen dairy food. The food value of ice cream obviously depends upon the food value of the products from which it is made. The milk products which go into the mix contain the same constituents as does the whole milk, but in different amounts. In addition it may contain other food products such as sugar which enhance its nutritive value. In ice cream making, the effects of serum solids on the whipping ability and body & texture of the ice cream is a matter of interest. Serum solids, in general with other solids, contribute to the body and texture of ice cream. The proteins improve the body & texture and tend to prevent the formation of a weak body and coarse texture. The milk solids-not-fat have also a more indirect effect on flavour. The milk sugar adds to the sweet taste largely produced by the added sugars, and the milk salts tend to carry slightly salty taste which rounds out the flavour of the finished ice cream.

Whey solids and buttermilk solids are two of the many sources of solids-not-fat which can be used in the ice cream industry.

Spray dried sweet whey is taking an increasingly

important place along with non fat dry milk as the most successfully used source of concentrated milk solids-not-fat in ice cream. Whey is accepted and used by many successful ice cream makers. Expanded utilization has been made possible by recent technological advances both in the production of whey and in the freezing and storage of ice cream. The principal advantages of whey solids as a source of milk solids-not-fat in ice cream are, cheapness as compared to other dairy products, possible improvement in the whipping ability of the mix, smoother body & texture and uniform high quality. Whey powder can be produced and handled in the same manner as non-fat-dried milk.

Sweet buttermilk powder, also, is a desirable ingredient for the ice cream especially in ice cream of low fat content or in ice cream made with the butter or butteroil as the major source of butterfat in the mix. Buttermilk solids impart a rich flavour to the ice cream not ordinarily obtained with milk solids-not-fat from usual sources. Other advantages of buttermilk solids are, the beneficial effects on the whipping quality of the mix and the smoother body & texture.

With this in view, this study was planned to investigate the effect of replacing serum solids of the mix

by whey solids or sweet cream buttermilk solids on some properties of the ice cream mix and the resultant ice cream. Data obtained may give a tool for economic utilization of these solids in the production of ice cream on an industrial scale.

This work was thus covered in two parts :

Part I: The effect of using whey solids in ice cream.

Part II: The effect of using buttermilk solids in ice cream.

REVIEW OF LITERATURE

The use of whey solids in ice cream :

As early as 1944, Leighton found that the addition of cheddar cheese whey solids in replacement up to approximately one-fourth of the milk solids-not-fat in a mix containing 12 per cent fat and 9.6 per cent milk solids-not-fat resulted in an improved body without deleterious effect upon flavour. He attributed the improved body to the action of the rennet left in the whey.

Reid and Shaffer (1947) found that the ice cream of different flavours made from mixes containing 1 - 10 per cent of dried whey were generally of good body, texture and flavour after storage under commercial conditions for periods of 50 days or longer. Sandiness (due to lactose crystals) occurred in some of the mixes containing 7 or 10 per cent of dried whey after storage for 20 - 30 days. They observed a slight heat flavour throughout the observation period in batches of vanilla ice cream containing 7 to 10 per cent of dried whey. They added that the addition of whey solids to ice creams produced a melt down typical of ice creams of high quality.

Turnbow et al. (1947) reported that the whey solids can be used in the low (6.4 - 9.6 per cent) milk solids-not-fat mixes. Also, they showed that the whey solids improved the whipping qualities of the mix.

Lando and Dahle (1950) stated that the shrinkage in ice cream was accompanied by a breakdown of albumin and globulin. They found that the addition of concentrated whey to the mix before pasteurisation increased albumin-globulin content and prevent this form of shrinkage.

Tarassuk and Hutton (1950) showed that the major cause of shrinkage in ice cream mix might be due to the denaturation of whey proteins, especially lactoglobulin by heat or an aging. Although, high overrun and high emulsifier content increased the shrinkage, the addition of 0.05 per cent of undenaturated lactoglobulin to a mix markedly decreased shrinkage.

Rosenberger and Nielsen (1955) cited the advantages of using spray process dry whey in ice cream, being the lower cost of this source of serum solids, possible improvement in whipping ability of the mix, easy incorporation in the mix by going into solution almost instantly,

smoother body and texture, and slower melting quality, bland flavour of whey that does not mask the flavour of fruit used in ice cream or sherbet, and a drier product drawn from the freezer. Also, they cited some disadvantages of using dry whey, being the danger of sandiness if the whey powder is used in too high a percentage, and the possibility of a slightly inferior flavour.

Nielsen (1957) found that the dried whey is commonly used at 20 % of the serum solids of ice cream mix. Whey at this level gives smoother body & texture with no change in flavour. Also, he showed that the dried whey could be used at 30 - 40 % of the serum solids in soft serve mix. Whey gives a drier body at the freezer and increases melt resistance while giving low-fat products a richer flavour. Nielsen stated that the sandiness was not the limiting factor in the use of whey, but rather that the salty flavour characteristic of high serum solids ice cream or ice milk. He showed that 50/50 blend of whey and non fat milk solids may be used to furnish all the added serum solids, if a maximum amount of solids-not-fat is being obtained from fluid milk and cream.

Warburton (1957) discussed the advantages and disadvantages of the various serum solids concentrates

that prepared with water. He added also that there was no difference between the type powder used. No significant differences caused by partial replacement of dried skim milk with whey powder were observed.

EXPERIMENTAL

This part includes two sections, the first deals with the effect of whey solids at different levels on some properties of ice cream. The second section deals with the effect of whey solids acidity on some properties of ice cream.

Section I:

All mixes used in this study were standardized to contain 6 % fat, 11 % milk solids-not-fat, 16 % sugar (sucrose) and 0.6 % gelatin.

The effect of whey solids in ice cream mixes was investigated in five treatments each of five replicates as follows :

Treatment (a): contained 11 % milk solids-not-fat without whey solids (as a control).

Treatment (b): contained 11 % M.S.n.F. of which 1 % was substituted by 1 % whey solids.

Treatment (c): contained 11 % M.S.n.F. of which 2 %

were substituted by 2 % whey solids.

Treatment (d): contained 11 % M.S.n.F. of which
were substituted by 3 % whey solids.

Treatment (e): contained 11 % M.S.n.F. of which 4 %
were substituted by 4 % whey solids.

The amount of dehydrated whey solids used represents percentages of the total mix and not the percentages of the solids-not-fat.

Section 2:

The aim of this section was to study the effect of whey solids acidity on some properties of the resultant ice cream. Three treatments each of five replicates were planned.

The mix in the first treatment contained 2 % whey solids with acidity of 0.11 %.

The mix in the second treatment contained the same percentage of whey solids but with acidity of 0.19 %.

The mix in the third treatment contained also 2 % whey solids but with acidity of 0.27 %.

Acidity of the whey was obtained by the addition of a starter (1 %) containing Streptococcus lactis to fresh whey and incubation at 30°C until the required was reached.