

# 1. INTRODUCTION

Food is a topic on which everybody has his own experience and views. These experiences and views pass through cultural filters and, hence, differ among themselves. Nature has given man the ability and opportunity to select his food from a wide range. However, in reality, these abilities and tastes are greatly restricted by the culture. Traditional foods are, thus, based on culture, custom and natural environment of a region of the world, and concerned by the people for a long time. They are intervened, modified and repetitively processed by human communities. The essential objectives of developing traditional technology were to carry over supplies from the place or time of plenty to those of want. It transpires an essence of knowledge and wisdom, gained by experience and based on trial and error. People might not be able to explain what is going on during storage and processing in terms of scientific language, but they certainly know what they have to do to get the desired product (Dietz 1984). The traditional techniques pass as a trade from older to younger generations in the families; and in some regions of India, the hereditary nature of the profession preparing traditional foods is not only encouraged but also protected by tradition or secular means (Batra and Millner 1976). These methods were based on interdependent factors, such as available raw materials, climate, available energy source, topography, culture and religion.

India is rich in traditional food products and the technologies have achieved a synthesis of Dravidian, Aryan, Moslem and European cultures. Dudh churpi is such a popular traditional food of several countries of the Indian Subcontinent. It is prepared by the combined action of acid-and-heat treatment of milk and curd. The palatability of the product is enhanced by treating the partially dried product (prechurpi) in concentrated milk-sugar solution. The product is sold as rectangular pieces with creamy to chalky white surface. It is moderately sweet and smoky with hard and compact body. Dudh churpi is consumed by biting or chewing, like betel nut and chewing gum. Chewing of this protein-rich product induces profound salivary

secretion during mastication. It is believed to be a great source of energy and is popularly known as 'energy tablet' by the hilly people. The historical documentation on dudh churpi is not available. Although a distinct domination of the Dukpa community is observed in Bhutan, in Sikkim and Darjeeling, village milk producers, irrespective of caste and creed, control the production of dudh churpi, while yak milk is used in Bhutan, milk of dzno (a crossbreed of male yak and indigenous cow) in Sikkim and cow in Darjeeling hills are used in the preparation of dudh churpi.

The sensory quality of food can be depicted in the form of a sensory circle. By the major senses, perimeter of the circle is divided into three zones: appearance, flavour and kinaesthesia (Birch *et al.* 1977). Food product development is generally understood as an empirical method of standardization and product formulation, with respect to sensory appeal and acceptability.

An important fundamental property of all foods is texture which can be regarded as manifestation of the rheological properties of a food. Food texture is defined as the way in which various constituents and structural elements are arranged and combined into a micro- and macro-structure, and the external manifestation of this structure in terms of flow and deformation (de Man 1980). The structural organization of food is, thus, influenced by chemical composition and various physical forces. The external manifestation of food structure is related to the mechanical (rheological) and sensory textural properties of the food. Texture affects processing and handling as it is an important quality attribute, and influences shelf-life, consumer acceptance and food habit (Charm 1962; Matz 1962). It may even be more important than flavour in certain foods (Szczesniak and Kleyn 1963). The knowledge of some of the rheological properties of food may give important clues to its acceptability and may be of utmost importance in determining the nature and design of processing methods and equipment, and for predicting the product quality under certain manufacturing conditions (de Man 1980).

Sensory evaluation of texture in foods belongs to the domain of psychology known as psychophysics that directly concerns the correlation of sensory experience with physical measures (Moskowitz *et al.* 1973). Successfully established psychophysical models could be of considerable significance to the development of new or imitation products and process modifications for existing products (Patil *et al.* 1990).

Quality and convenience, are the two major characteristics that dictate consumers' preference for a food product today. Though freshness, purity and safety are often perceived as indices of food quality, extended shelf-life is now considered as an essential convenience because of the change in traditional family structure and hurried life-style which have changed the existing patterns and food choices of modern consumers (Rao 1993).

The hurdle effect is an illustration of the fact that in most foods several factors (hurdles) contribute to stability and safety. This hurdle effect is of fundamental importance for the preservation of food, since the hurdles in a stable product control microbial spoilage and food poisoning as well as the desirable fermentation (Leistner 1992). There are many processes used for making foods stable and safe, e.g. heating, chilling, freezing, freeze-drying, drying, curing, salting, sugar addition, acidification, fermentation, smoking or oxygen removal. However, these many processes are based on relatively few parameters or hurdles, i.e. high temperature, low temperature, water activity ( $a_w$ ), pH, redox potential (Eh), preservatives and competitive microflora. In some of the preservation methods mentioned, these parameters are of major importance, while in others they are only secondary hurdles (Leistner *et al.* 1981). Hurdle technology is now widely used especially in food design, for making new products or modifications of the existing products. Energy consuming hurdles, such as refrigeration, are replaced by hurdles ( $a_w$ , pH or Eh) which do not demand energy and still ensure a stable and safe food.

The term, 'shelf stable product (SSP)', was introduced by Leistner

and Rödel (1979) for high moisture meats ( $a_w > 0.90$ ), which may be stored after mild heating for weeks or months, but without refrigeration. Stability without refrigeration is an important feature for food since it saves costs by saving energy during distribution and storage. Furthermore, mild heat treatment (70-110°C) is beneficial because it fosters the sensory and nutritional properties of the products (Leistner 1992).

Hurdle concept is now widely used especially in food design for making new products and modification of the existing products. According to this concept, many foods cannot be preserved by a single hurdle alone without affecting their sensory and nutritional properties. With the introduction of two or three more hurdles, the reduction in height and intensity of hurdles could be substantial. By using three or more hurdles together not only the damage to sensory properties is kept to the minimum, but their synergistic action is also exploited for food preservation.

In India, the consumers of traditional milk products are subjected to varied tastes and textures. But little is known about sensory and chemical properties and the different hurdles which greatly influence the acceptability of the product. The production of dudh churpi has remained a traditional family art practised in homes in a crude manner. Consequently, the production has not increased substantially, the quality is not consistent and the shelf-life is short. In order to scale-up its productivity, it is necessary to modernise the production style and optimize the process conditions. In order to know how the preparation could be modernized, it is necessary to know the scientific basis of its production. This will shorten the production time, guarantee improved and consistent texture, flavour and nutritional value, increased shelf life, and these, in turn, will increase their general acceptability.

In the light of the scope indicated above, the present study was undertaken with the following objectives:

- (a) to obtain information in as much details as possible on the methods used by the local people to prepare dudh churpi;

- (b) to assess the physico-chemical qualities and sensory attributes of market samples of dudh churpi prepared in Darjeeling hills, Sikkim and Bhutan;
- (c) to elucidate the rheological and sensory textural properties of market samples of dudh churpi;
- (d) to correlate sensory attributes with some intrinsic parameters of dudh churpi;
- (e) to study the influence of composition on the Instron texture profile of dudh churpi;
- (f) to correlate objective (instrumental) data with subjective (sensory) data on texture of dudh churpi so as to enable prediction of the latter from the former;
- (g) to optimize different process parameters in the preparation of dudh churpi;
- (h) to study the effect of accelerated drying on quality of dudh churpi;
- (i) to study the effect of sorbate and different packaging materials on storability of dudh churpi;
- (j) to establish water sorption isotherms of dudh churpi and determine the monolayer moisture content and multilayer constants; and
- (k) to study the consumer acceptability of the product and the cost of production.