CHAPTER 1  

INTRODUCTION AND OBJECTIVES

1.1 Introduction

Wheat is the one of the most widely cultivated food grain used for human consumption among other cereals. India is the second largest producer of wheat in the world with 86.87 million tonnes in the year 2010-11 contributing to about 12 per cent of world wheat production. Being the second largest populous country, it is also the second largest wheat consumer after China (USDA 2012). Wheat and its products play an increasingly important role in India’s food economy. The major wheat producing states in India represents the northern part of the country with Uttar Pradesh, Punjab and Haryana contributing to nearly 80% of the total wheat production (Singh 2010).

Wheat is the important staple food crop for more than one third of the world population and contributes more calories and proteins to the world diet than any other cereal crop (Kumar et al. 2011; Bushuk 1998). It is nutritious, easy to store and transport and can be processed into various types of food. Wheat flour is a complex mixture of starch (70-80%), protein (8-18%), lipids (~2%), pentosans (~2%), enzymes and enzyme inhibitor and minor components (MacRitchie 1984; Pomeranz 1988). Wheat flour is used to prepare chapatti, bread, biscuits, confectionary products and noodles. Wheat based foods are very good source of carbohydrates, fibers, proteins, vitamin B and important trace minerals (Pena 2004). Wheat is also used as animal feed, for ethanol production, brewing of wheat beer, wheat based raw material for cosmetics and wheat protein in meat substitutes (Kumar et al. 2011). It is undoubtful that the adaptability and high yields of wheat have contributed to its success, but these alone are not sufficient to account for its current dominance. The key characteristic, which has given it an advantage over other temperate crops, is the unique viscoelastic properties of dough formed from wheat flours as a result of gluten proteins, which allow it to be processed into a range of products (Shewry et al. 2002; Khatkar and Schofield 1997).

Sheeted wheat-based (*Triticum aestivum*) oriental noodles have been consumed for thousands of years throughout the world and are especially popular in Asian countries such as China, Korea, and Japan (Hou 2001; Fu 2008; Huang 1996). Quality and type of noodles are diverse, depending on the raw materials and methods of manufacturing. Wheat flour is the
main ingredient for making Asian noodles however, noodles are also prepared from rice, buckwheat, and starches derived from the mung bean or potato. Wheat flour noodles are an important part in the diet of Asians and around 40% of the total wheat flour used in Asian countries is dedicated to production of noodles (Shin and Kim 2003). With technological improvements several other variations such as frozen, chilled and long life noodles have been introduced and accepted by the market as products of convenience. However, the raw material requirements, methodology and production procedures for the newer products is still the subject of considerable research in the food industry (Wu et al. 1998).

Texture and colour are generally considered as the most important quality parameters of noodles, though there are wide ranges of Asian noodles, and each type of noodles has its own unique quality requirements. Japanese white salted noodles, Chinese white salted noodles, yellow alkaline noodles have received considerable attention and their quality criteria are well established. The various types of noodles have their own flour specifications as their quality and textural attributes are significantly correlated with flour quality. Noodles have regional preferences for colour, shape, texture, and flavour, which depends on flour characteristics, specific processes used for their manufacture and the inclusion of other raw materials or additives. In case of white salted noodles and yellow alkaline noodles, variations in gluten properties have significant effect on noodle firmness, elasticity, and smoothness. On the other hand, variations in starch properties have a major role in conferring noodle softness and viscoelastic properties (Crosbie 1991; Crosbie et al. 1999; Konik et al. 1994; Zhang et al. 2005a). Flour ash content (Oh et al. 1985c; Lee et al. 1987; Miskelly 1984; Ye et al. 2009; Kruger et al. 1994a) and polyphenol oxidase (PPO) activity (Fuerst et al. 2006; Zhao and Seib 2005) are the key factors influencing noodle whiteness. However, protein content, water absorption, and addition of alkaline salts also govern the colour of noodles (Asenstorfer et al. 2006; Hatcher et al. 1999; Wang et al. 2004). Japanese white salted noodles (Udon) with soft and elastic texture are typically made from the soft wheats with lower protein content of 8-10%, whereas Chinese yellow alkaline noodles which require a firm, smooth and springy texture are prepared from hard wheat with a flour protein content ranging from 11-12%. Quality characteristics of flour protein and starch have a significant influence on the eating quality and consumer preference of the noodles. The preferred texture of Japanese WSN, Udon, is obtained by using a high proportion of ‘partial waxy’ wheat flour, which provides a soft and elastic eating texture because of its low amylose content, high peak paste viscosity, and high gelatinization temperature and enthalpy (Baik and Lee 2003; Konik et al. 1992;
Introduction and objectives

Toyokowa et al. 1989; Zhao et al. 1998). While, in case of Chinese WSN, consumers prefer a firmer texture than Japanese Udon so that the greater swelling associated with partial waxy wheat is undesirable (Yun et al. 1997; Jun et al. 1998; Noda et al. 2001).

Instant noodles are consumed globally due to their ease of preparation, widely acceptable taste, preferred texture and affordable prices. Instant noodles contain wheat flour and water as the main ingredients. Other ingredients such as salt or kansui (an alkaline salt mixture of sodium carbonate, potassium carbonate, and sodium phosphate) are also added to improve the texture and flavour of noodles (Shin and Kim 2003; Kim 1996a; Kim 1996b; Hou 2001). Instant noodles are convenient, nutritionally balanced (higher percentage of calories are derived from carbohydrates), have long shelf life and good eating quality. Long shelf life of instant noodles facilitates their large-scale production and distribution. Instant noodles also offers exciting opportunity for new products with health and nutrition benefits i.e. these can be used as potential vehicles for supplementation and fortification of nutrients (Sudha et al. 2011; Jayasena et al. 2010, 2008; Heo et al. 2011; Bui and Small 2007a). A product variation of fried instant noodles is steamed and dried products i.e. instant dried noodles which has some health benefits due to lower oil content but these are less preferred by the consumers due to longer cooking time and absence of the unique flavour imparted by oil in the fried counterparts. Therefore, 80% of instant noodles are steamed-and-fried instant noodles. It is common practice to include dried condiments, soups, seasoning sachets and flavours in noodle packets making it a complete and convenient meal.

The growth in instant noodle consumption has been substantial. Worldwide, China ranks first in the consumption of noodles followed by Indonesia, Japan and USA according to the World Instant Noodle Association (WINA) (WINA 2011). India is undergoing massive urbanization and expected to witness the largest increase in urban population in the next four decades followed by China according to UN reports (Dhar 2012). This rapid growth in urban population is expected to push demand for industrial products such as bread, biscuit, noodles, cake, etc. Therefore high industrial quality of wheat products is an important trait to work on (Joshi et al. 2007). Market estimates put the instant noodles sector in India currently at around 1,500 crore, growing at around 15 to 20% annually. In India, noodles were made popular by Nestle, which introduced instant noodles under the brand name “Maggi” in 1984 and the instant noodles market in India has long been dominated by Nestle since then. New entrants in the instant noodle industry GlaxoSmithKline’s Horlicks Foodles, Hindustan Unilever’s Knorr Soupy Noodles, ITC’s Sunfeast Yippee and others, are out to grab the share
in noodle production stocking the shelves in recently. The instant noodles market is set to grow from 1,500 crore (US$288 million) at present to around at least 3,000-3,500 crore by 2015 and therefore all the big FMCG players have their eyes set on it (Tomar 2012).

Flour quality primarily determines the quality of end product produced from wheat flour. The wheat generally found suitable for bread or biscuit making has been reported to be unsuitable for noodle production. Incompatible use of wheat may cause production losses and inferior quality of the end product. Producing high quality noodles is thus dependent on a consistent supply of flour with the correct specifications. Extensive research has been conducted especially in Japan, China and Korea in relation to the quality of instant noodles and the suitability of varieties for noodle production but this field is still unexplored in India and there is limited scientific research on Indian wheat varieties and their potential use for instant noodle production.

Therefore, this study was undertaken to generate scientific information on the physicochemical, technological and molecular factors affecting the quality of the instant noodles and wheat varieties suitable for the instant noodle production. It will ensure best utilization of wheat flour for the production of instant noodles thereby benefiting both industry and consumers.

1.2 Objectives

The aim of this research project was to study the physicochemical, rheological, biochemical characteristics and functional properties of wheat varieties in relation to instant noodle quality. The main objectives were:

1. Formula and process optimization of instant noodles
2. To study functional properties of wheat flour for instant noodle making quality
3. To investigate the biochemical characteristics of wheat flour constituents for instant noodle quality
4. To establish relationship of the functional and biochemical characteristics with the quality of instant noodle