Chapter 1
INTRODUCTION

1.1 Introduction and background

Meat, a highly nutritious and multi-use food, consisting of high quality proteins, B-complex vitamins and minerals especially iron and zinc with a high level of bioavailability. But, the image of meat has recently diminished to some extent because of its high saturated fatty acid and cholesterol contents, which have often been linked to some health issues (Fernandez-Gines et al., 2005) such as colon cancer, obesity, cardiovascular disease etc. Therefore, the image of the meat industry can be boosted up by designing healthier & nutritious meat products. This can be done either by adding ingredients considered beneficial to health or by reducing or eliminating harmful components.

Additives of natural origin are considered safe and healthy. Several studies have been carried out on various such additives. The most studied natural additive is lycopene, a carotenoid, extensively found in nature in various fruits and vegetables especially tomatoes, watermelon, red grapefruit and red pepper. The characteristic red colour of these fruits is due to the presence of lycopene (Goula & Adamopoulos, 2005). Tomatoes are considered the major source of lycopene; however, other carotenoids like β-carotene, lutein, phytofluene, and phytoene are also present. Mascio et al., (1989) demonstrated that lycopene has much more antioxidant activity as compared to α-carotene, β-carotene, and α-tocopherol. Tomatoes are consumed worldwide and are an integral part in the diet of humans. Since tomatoes are eaten as fresh, most of them (80%) are processed in the form of various products like juice, paste, puree, ketchup and sauce (Gould, 1992). Tomatoes are actually fruits, not vegetables which are very beneficial to the human body. Tomatoes can be consumed in many forms and because of their versatile preparation alternatives, it is better to make tomatoes as a part of healthy diet.

There is increasing evidence showing that tomatoes and tomato products may decrease the risks of cardiovascular disease and many kinds of cancers (Baghurst et al., 1991), such as breast (Dorgan et al., 1998); gastric (Liu and Russell 2008), prostate and ovarian cancer (Etminan et al., 2004; Helzlsouer et al., 1996). Lycopene, a highly unsaturated hydrocarbon, is the red tomato natural pigment which has been thought to be important in preventing oxidation (Clinton, 1998; Rao and Agarwal, 1999).
The application of natural pigments as a colorant is a growing interest due to the safety concerns of synthetic dyes. The consumers have become very health conscious and as a result, these synthetic colorants are closely assessed by users. Betalains, as colorants, are considered suitable for low acid foods as they are stable between pH 3 and 7; however, these pigments are not used as commonly in food processing than anthocyanins and carotenoids. Red beetroot (*Beta vulgaris subsp. vulgaris*) is conceived as the most significant source of betanin. It is a root vegetable grown all over the world. It is not consumed frequently; however, beets can be eaten raw or roasted, frequently served in soups or on salads. Beets are composed of 87.57% water, 9.56% carbohydrates (29.3% fiber and 70.7% sugar), 1.61% protein, and 0.17% lipids in addition to being a source of potassium, choline, vitamin C, and niacin (USDA, 2011). They also contain betalains, nitrogen-containing pigments, which are commonly added to foods as a source of red-purple natural color. Betalains are also great antioxidants, inhibiting cancer cell proliferation and increasing the resistance of low-density lipoproteins from oxidation (Wu *et al.*, 2006; Kapadia *et al.*, 1996; Gentile *et al.*, 2004; Tesoriere *et al.*, 2004). Ice-cream, yogurt, processed meat, baked goods, and candies are some of the foods in which betalains have been employed as natural colourants (Delgado-Wargas *et al.*, 2000 and Vereltzis *et al.*, 1984). The two most common and important sources of betalains that are used in colouring food stuffs include beetroot juice and powder. Beet juice contains approximately 1% betalain content and powders contain 0.4 to 0.7% betalain content (Jackman, 1996). Powders derived from beets can be used in various food products as value-added ingredients and as a strong colouring agent. The risk of microbial deterioration is very less because of its low moisture content, thus can be stored for longer periods.

Nowadays consumers have become health conscious and demand healthy products. Therefore, food industries are continuously making efforts and try to provide healthy foods to the consumers. Meat products prepared by traditional methods demonstrate some health issues because they contain high animal fat levels. Animal fat contains high levels of cholesterol and low levels of polyunsaturated to saturated (PUFA/SFA) fatty acid ratios which is responsible for the occurrence of diseases like coronary heart disease (Department of Health, 1994; Enser *et al.*, 1996).

Diets that are rich in animal fats have been linked to various types of diseases such as hypertension, obesity, cardiovascular diseases and coronary heart diseases (Ozvural & Vural, 2008; Serrano *et al.*, 2007; Vural & Javidipour, 2002). Consequently, the development of meat products with reduced amounts of animal fat could overcome these health issues. The
substitution or replacement of animal fat with oils of vegetable origin must give a product which is healthier. Oils of vegetable origin are believed cholesterol free and possess unsaturated to saturated fatty acid ratio in higher levels as compared to animal fats (Liu et al., 1991).

Olive oil has highest amount of monounsaturated fatty acids, hence this vegetable oil is likely to substitute fat of animal origin in meat products. It contains 56.3-86.5% MUFA, 8-25% saturated and 3.6-21.5% PUFA (IOOC, 1984). In foods, 92% of the monounsaturated fatty acids are oleic acids, and olive oil provides 60-80% oleic acids (Pérez-Jiménez et al., 2007). The high biological value of olive oil is due to the combination of monounsaturated fatty acids and naturally present antioxidants such as vitamin E, vitamin K, carotenoids, and polyphenols, for example, hydroxytyrosol, tyrosol, and oleuropein. Olive oil contains an optimum concentration of antioxidants and has a lower ratio of saturated to monounsaturated fatty acids as compared to other oils of vegetable origin (Christakis et al., 1980).

The application of olive oil as animal fat replacer has a positive impact on nutritional value and oxidation stability of meat products. Various studies have been carried out to investigate the beneficial effect of olive oil as an animal fat replacement in many meat products like liver pâté (Martín et al., 2008); frankfurters (Choi et al., 2010a; López-López et al., 2009), and dry-cured sausages (Muguerza et al., 2001). Therefore, the purpose of this study was to assess the effects of olive oil, freeze-dried tomato and beetroot powder incorporation on quality characteristics and storage stability of meat patties.

1.2 Objectives of the study

1. Preparation of freeze-dried tomato and beetroot powder and their analysis.

2. Optimization of freeze-dried tomato powder (FTP) and olive oil for chicken meat patties by different cooking methods namely, oven and microwave.

3. Optimization of freeze-dried beetroot powder (FBP) and olive oil for chicken meat patties by different cooking methods namely, oven and microwave.

4. Effect of different cooking methods on physicochemical, textural, nutritional, physical and sensory quality characteristics of optimized freeze-dried tomato powder (FTP) enriched chicken meat patties.
5. Effect of different cooking methods on physicochemical, textural, nutritional, physical and sensory quality characteristics of optimized freeze dried beetroot powder (FBP) enriched chicken meat patties.

6. Shelf life stability studies of the optimized chicken meat patties.