1. INTRODUCTION

Fats provide energy and carry out a variety of important functions in the body. Dietary fats supply essential fatty acids and are needed for the absorption of vitamins A, D, E and K (called "fat soluble" vitamins). They contain the highest level of energy (9 calories per gram) of any nutrient and are essential for growth and health. Fat is also a necessary component of body tissue. The brain and central nervous system are rich in fat and fat must be sufficient in the diet in times when tissues are developing, as in pregnancy and the first several years of life. The body uses fat to manufacture needed chemicals such as hormones. Fats protect the cells and internal organs and allow us to store calories to protect us from times when food is not available. Fats stay in the stomach longer than other foods, making us feel full. Fats are also important for keeping the body warm and they make food taste better (FAO, 2011).

A major function of fat in baked goods is to improve eating quality. When fat is included in a recipe, it becomes dispersed throughout the mix in the form of irregularly sized droplets and it also coats some of the surfaces of the flour particles. In this way it interrupts the continuity of the gluten chains that form when flour proteins become hydrated, by creating areas of weakness in the structure. The result is that the baked product becomes softer and generally, the more fat there is, the more crumbly the product (Dwyer & Gallagher, 2001).

The excessive dietary fat intake can result in health problems such as obesity and heart-related diseases, resulting in increased consumer demand for reduced fat foods (Jongbin *et al.*, 2010). Obesity has become a public health concern as it has been associated with life-threatening conditions. In the countries of WHO European Region the prevalence of obesity has risen 3-fold since the 1980s (WHO, 2007).

A number of food ingredients with fat-like functions have been developed as fat alternatives in the food industry. Especially, some fat replacers that belong to carbohydrate-based fat replacers, play multi-functional roles in foods beyond the reduction of fat and calories. They can provide beneficial physiological activity and control texture and rheology without quality loss. Also, they can promote the development of environment-friendly and natural products, make health claims on a label, and diversify the type of reduced-fat foods. Therefore the use of multi-functional fat replacers can encourage the food industry to respond to current demand of health-conscious consumers for reduced-fat foods (Jongbin *et al.*, 2010).

A major strategy overlooked at reducing fat intake in the American diet is the use of fat-modified foods. The success of this type of dietary intervention depends on the sensory acceptability of the fat-modified foods included in the diet, and how similar they are to their full-fat counterparts. Most consumers are not ready to trade taste for health; therefore, the reduced fat products need to be at least as acceptable as the regular ones to be seen as full alternatives, even though they may taste differently (Lawhorn, 2013).

A fat replacer is an ingredient that can be used to provide some or all of the functions of fat, yielding fewer calories than fat. Fat replacers need to be able to replicate all or some of the functional properties of fat in a fat-modified food (Jonnalagadda & Jones, 2005). The fat replacers developed to date generally fall into one of three categories: carbohydrate,

protein, and lipid-based fat replacers. Carbohydrates have been used safely for many years as thickeners and stabilizer, and they are used now effectively in many formulated foods. Many of the low-fat products introduced in recent years contain carbohydrate-based fat replacers (e.g. starch, dextrin, gums, and fibers) (CCC, 2006).

In general, carbohydrate-based fat replacers are dispersed/ dissolved in water to form a viscous solution or a gel. The increased viscosity aids in incorporating more air bubbles and stabilizing the structure of a food matrix (Lee *et al.*, 2005). Most of fat replacers derived from carbohydrate-based fat replacers belong to hydrocolloids which are mainly hydrophilic biopolymers with high molecular weight with great water retention capacity. Thus, since carbohydrate-based fat replacers can bind substantial amount of water, their unique functionalities such as thickening, gelling, and emulsifying properties allow them to mimic the mouth-feel and flow properties similar to those of fat in aqueous systems. Hence, it is also critical to characterize the rheological properties of carbohydrate-based fat replacers prior to the food applications (Jongbin *et al.*, 2010).

In cake making, fat has the property of air entrapment, which is of vital importance. The basis of the cake structure is formed during mixing when a myriad of minute air bubbles are incorporated into the batter (Dwyer and Gallagher, 2001). Fat is a very important ingredient of cookies because it contributes texture and pleasing mouth fell and positively impacts flavour intensity and perception. Many cookies and especially soft-type cookies contain large amounts of fat (Drewnowski *et al.*, 1998).

Reducing fat in every-day's diet has become a public health issue and a concern for most consumers. One of the major trends is to reduce the fat content of cake and cookies, which has led to popular "reduced fat", "low fat" or "fat free" versions of these traditional products. It is necessary to use a combination of non fat ingredients with different functional roles to replace the quality attributes lost when fat is removed. Thus to establish the formulation of the low fat products, food technologists have focused their efforts essentially on fat replacers (Liu *et al.*, 2007). Biopolymers, such as gums, starches and proteins are often incorporated into fat-reduced products to provide some of these functional attributes (Mun *et al.*, 2009).

Therefore, the present work was carried out to study the effect of using two type of carbohydrate-based fat replacers (flaxseed and okra gums) in the production of some bakery products (cakes and cookies) which are generally known for their high fat content, with the aim of reducing such fat content while keeping their physical, nutritional, and sensory quality characteristics.

The present research was carried out in order to achieve the following main goals:

1- Proximate chemical composition:
   Moisture content, crude protein, crude fat, total ash, and carbohydrate.
2- Physical measurements:
   The pH, weight, volume, and height.
3- Texture profile analysis:
   Firmness, cohesiveness, gumminess, chewiness, springiness and resilience.
4- Sensory characteristics:
   Colour, flavour, texture and over all acceptance.