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FAT REPLACERS IN MEAT: A BRIEF REVIEW

Heena Jalal[1], Parveez Ahmad Para[2], Subha Ganguly[3]*, Arpita Padhy[4], Praveen Kumar Praveen[5], Rajesh Wakchaure[6]

[1]PhD Research Scholar, Division of Livestock Products Technology, Faculty of Veterinary Science and Animal Husbandry, Sher-e-Kashmir University of Animal Science and Technology- Kashmir (J&K), India, Pin – 190006.

[2]Assistant Professor, Department of Livestock Products Technology,[3]Associate Professor & Head; [4]Assistant Professor, Department of Veterinary Microbiology, [5]Assistant Professor, Department of Veterinary Public Health & Epidemiology, [6]Associate Professor, Department of Animal Genetics & Breeding, Arawali Veterinary College (Affiliated with Rajasthan University of Veterinary and Animal Sciences, Bikaner), N.H. – 11 Jaipur Road, V.P.O. Bajor, Dist. Sikar, Pin – 332001, Rajasthan, India.

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***Correspondence for Author**
Dr. Subha Ganguly
Associate Professor and Head, Department of Veterinary Microbiology, Arawali Veterinary College, Bajor, Sikar- 332001, Rajasthan, India.
ganguly38@gmail.com

ABSTRACT

Fat replacers in meats are ingredients that contribute a minimum of calories to formulated meats and do not dramatically alter organoleptic and processing properties. Fat replacers or substitutes are ingredients that contribute a minimum of calories to formulated meats and alter flavor, tenderness, mouth feel, viscosity and other sensory and processing properties (Cengiz and Gokoglu, 2007).

KEYWORDS: Fat replacers, Meat.

INTRODUCTION

The increase in consumer interest in reduced fat foods has created a growing need for low fat meat products in the market. Developing a lean or extra lean ground product, while assuring the necessary palatability demanded by consumers, is not as simple as just removing fat (Trout *et al.*, 1992). The active approach to fat replacement is to add fat replacers, which

either replace fat or modify the interactions of the remaining components (Miller *et al.*, 1993). The direct replacement of fat with ingredients is an attractive alternative to fat reduction due to the functional and nutritional properties that the ingredients may impart. Many substitutes are used for partial replacement of the fat and may include the use of leaner meats, added water (Sylvia *et al.*, 1994), protein-based substitutes (Riisom, 1991), carbohydrate substitutes (Giese, 1992), vegetable and plant oils (Paneras and Bloukas, 1994), synthetic compounds (Keeton, 1994) and oat fibre/products (Yang *et al.*, 2007). Fat replacers can be added to meat formulations to improve water and fat binding properties as well as to improve cooking yields, slicing characteristics and flavour (Schmidt, 1988). Several approaches have been proposed to reduce the fat content without substantially affecting the texture; use of leaner raw materials and addition of water or other ingredients as fat substitutes and fat mimetics, water soluble components used to partially replace the sensory and functional characteristics of fat (Drake and Swanson, 1995). Most of the ingredients being promoted as fat substitutes, complete or partial, may be classified into protein-based substitute, synthetic compounds, fat-based and carbohydrate- based ones (Kirkeegard, 1989). Among non-meat additives used as fat replacers are wheat flour in chicken nuggets (Rao *et al.*, 1997), soy-flour in buffalo meat burgers (Modi *et al.*, 2003), common bean flour in beef sausages (Dzudie *et al.*, 2002), liquid egg and soyprotein in goat beef patties (Gujral *et al.*,2002), amaranthus and buck wheat proteins in emulsion type products (Bejesano and Corke,1998), whey protein concentrate in sausages (Laroia *et al.*, 1995), gram flour in low fat duck meat patties (Reddy and Rao, 1997). In cooked meat products, a number of proteins (soy, maize, whey proteins, egg white, wheat and cotton), carbohydrates (starch, pectin, cellulose, gums, maltodextrins) and fat-based substitutes have been studied (Akoh, 1998). The results obtained were satisfactory, mainly with carbohydrates which improve cooking yield, enhance water holding capacity, reduce formulation cost and modify texture (Akoh, 1998). Rapaille (1991) observed that use of maltodextrins as partial fat replacer not only provide functional and sensory properties of fat but also produce low cost product. Berry and Wergin (1993) reported that incorporation of pre-gelatinised potato starch in low-fat beef patty formulations improved tenderness and cooking yield but reduced fat retention during cooking. Tapioca starch also was efficiently utilized as a fat substitute (Hughes *et al.* 1998). Gums are hydrocolloids, dissolve in water and produce gels which resemble fat in mouth feel, texture and sensory attributes. Guar gum, Xanthan gum and Locust bean gum are the common gums used in fat substitution (Pearson and Gillet, 1997). Ahmed *et al.* (1990) reported that added water could also be utilized as a fat substitute. Miller *et al.* (1993)

reported that low-fat ground beef patties with added water, with or without phosphates, were similar to 22% fat patties in sensory attributes, although added water increased thaw and cooking losses.

Lin and Keeton (1998) studied the textural and physico-chemical properties of low-fat, precooked ground beef patties containing carrageenan and sodium alginate. Results suggested that low-fat (5-10%) ground beef patties containing a combination of alginate and carrageenan were similar to regular beef patties (20% fat) regarding yields and textural properties. Desmond and Troy (1998) compared 17 commercially available non-meat adjuncts at 0.5 to 5.0% use levels and observed highest flavour and overall quality scores for low fat beef burgers containing pectin, cellulose, oat fibre and carrageenan.

Kumar and Sharma (2003) showed that incorporation of skimmed milk co-precipitate (as fat replacer) into low-fat (<10%) ground pork patties improved cooking yield, fat and moisture retention and reduced shrinkage and sensory properties were comparable with control (15%) patties. Fat reduction can significantly affect the acceptability of the product (Giese, 1992) and increases the toughness of meat products (Barbut and Mittal, 1996). Young *et al.* (1991) observed that raw patties made from ground chicken thigh meat become lighter and more yellow in colour as fat content increased. The low-fat patties were harder, springier, less cohesive and chewier than high fat patties.

HYDROCOLLOIDS USED IN LOW-FAT MEAT PRODUCT FORMULATIONS

Alginates: Alginates constitute the primary structural polysaccharides of brown seaweeds (*Phaeophyceae*).The major species of seaweeds that produce alginates are *Macrocystis pyrifera.* Other good sources of alginates are *Laminaria hyperborea*, *Laminaria digitata* and *Laminaria japonica*. Alginates are the extracts from class brown seaweed and used in the manufacture of animal foods and salami. Various workers used alginate as thickening agent, binding agent and for enrobing in meat products.

Carrageenan: Carrageenan comes from seaweed and derives its name from a region on the Irish coast “Carragheen”, “Carragahen” or “Carraigin” – where it was originally harvested. Because of this origin, it is also called “Irish moss”. Carrageenan is a water soluble polysaccharide in the group of hydrocolloids. Hydrocolloids are water soluble polymers with the ability to thicken or gel water systems. It is extractable from sea weed. The ability of carrageenan to form a gel in meat products has been proven to give a range of advantages by

increasing yield, consistency, sliceability, spreadability, cohesiveness and decreasing purge, fat content and slicing loss. Carrageenan is approved and widely used as a food additive. There are three types of carrageenans: iota-, kappa- and lambda- carrageenans. Iota- and kappa- carrageenans act as gelling agents. The lambda- type is non-gelling and functions as a thickener.

Oatmeal: There is great interest in increasing the consumption of oat-based products that contain both soluble and insoluble fibers. A number of studies have evaluated the addition of dietary fiber to meat products. Oats are considered an excellent source of soluble fiber that has shown to be effective in reducing dietary cholesterol. In addition, oats are of particular interest as an ingredient since they may help to control obesity, hypertension, diabetes and heart disease. Oat fiber has many characteristics, particularly moisture retention, that are useful to low-fat and fat-free meat systems. Oat and oat constituents have received increased consideration for use in low-fat products due to their functional and nutritional qualities. Oat grains contain 39-55% starch, 20-38% β-glucan and other dietary fiber and 8-16% protein. Oat fibre is one of the most effective ingredients in the cooked low-fat meat products with the ability to mimic fat characteristics.

SUMMARY

Protein-based fat substitutes have technological limitations (resistance to heat treatments, compatibility with other constituents as flavor components which restrict their use (Lucca and Tepper, 1994). A variety of milk proteins including non-fat dried milk, sodium caseinate, milk co-precipitates and skimmed milk protein could be utilized as fat substitutes and texture modifying agents.

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