Low Fat Meat Products - An Overview

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Abstract

Meat is an excellent source of valuable nutrients. Meat fat acts as a reservoir for flavor compounds and contributes to the texture of product. There are diverse possible strategies for developing low fat meat and meat products. Reducing the fat content in products leads to a firmer, rubbery, less juicy product with dark color and more cost. Other technological problems like reduction in particle binding, reduced cook yields, soft and mushy interiors, rubbery skin formation, excessive purge and shortened shelf life are also associated with reduction in fat levels. This paper describes Procedured of reducing fat content, Selection of additives, Protein, Carbohydrat and fat based fat replacer and Super critical fluid extraction.

Keywords: Fat, Meat, Fat replacer, Additives, Protein, Carbohydrate.

Introduction

The increasing concerns for health led the efforts made by the food industries to develop new foods with positive health benefits. Obesity, Cardiovascular disease, stroke, and cancer have been implicated with high fat intake in excess of body needs. The contribution of fat to obesity is due to the well known fact that fat is energy dense providing 2.25 times as much energy per unit as carbohydrate and protein. International medical institutions have been recommending for the last 40 years that dietary fat intake should be controlled both as quantity of calories and type of fatty acids introduced. Nutritional guidelines suggest that dietary fat should provide between 15 and 30 percent of total calories and that saturated fats should be limited between 0 and 10 percent of caloric intake(WHO 1990).

Meat is an excellent source of valuable nutrients. Meat fat acts as a reservoir for flavor compounds and contributes to the texture of product. There are diverse possible strategies for developing low fat meat and meat products. Reducing the fat content in products leads to a firmer, rubbery, less juicy product with dark color and more cost (Trout etal., 1992, Cavestany etal., 1994, Keeton 1994, Paneras etal., 1996, Desmond etal 1998 and kirchan etal., 2000). Other technological problems like reduction in particle binding, reduced cook yields, soft and mushy interiors, rubbery skin formation, excessive purge and shortened shelf life are also associated with reduction in fat levels.

Among the various strategies selection of meat and trimming of excess fat from carcass and cuts, modification of carcass composition, reformulation of meat products with reduced fat content along with modification of the fatty acid profile, reduction of cholesterol and calories provide positive results and can greatly reduce the fat content. Trimming of excess fat from carcass and cuts even though greatly reduces the fat content of over fat carcasses and cuts, this is short term solution for providing low fat products.

Procedures for reducing fat content

Replacement of fat with added water, addition of carbohydrate or protein based fat mimetics and use of synthetic fat substitutes is promising technologies for reducing fat. This is usually accomplished by adding substances that bind water which overcomes the dryness and rubbery ness and improves juiciness. The additives that bind water can be classified as protein additives, non- protein additives and other procedures like super critical fluid extraction.

Selection of additives

There are different types of additives like fat replacers, fat mimetics, fat substitutes and analogs and fat barrier compounds. Fat replacers are the ingredients that contribute fewer or no calories to the formulated foods without altering flavor, mouth feel, viscosity or organoleptic properties (Keeton 1994).Fat mimetics are defined as a partial replacement for fat by mimicking or imitating a particular function, but not all functions of fat in a food. Fat mimetics can replace the mouth feel of fats that can not substitute for fat on an equivalent

weight basis.Fat substitutes and analogs are molecules whose physical and thermal properties resemble fat but have either fewer calories than fat or no calories.Fat barriers are different systems which reduce the fat content of a food by retarding fat absorption into the product during frying.

Protein based fat replacers

These are fat mimetics since they cannot fully replace the functionality of fat in foods. Protein ingredients do not appear to tie up water soluble flavor components and hydrolyzates of these proteins are generally added to meats to achieve a brothy or meaty flavor (Keeton1994). Use of proteins in low fat meat products is an on going area of research and the subject of reviews. Protein based fat replacers were widely accepted while the use of wheat flour and caseinates in chicken nuggets(Rao et al 1997), soy flour in buffalo meat burgers (Modi et al 2003) whey protein concentrates in sausages (Laroia et al 1995, Serdaroglu &Sapanci-Ozsumer2003),Sodium caseinate , milk power and whey powder in turkey rolls(Serdaroglu&Deniz 2003),milk proteins in chicken sausages (Rao et al 1999), milk co-precipitates in the buffalo meat (Sunil kumar et al 2003) and milk co-precipitates in chicken loaf. These protein based fat replacers have been used successfully in the manufacture of comminuted meat products and are reported to have good potential as extenders in several meat products due to their high nutritive value and wide range of functional properties like solubility, viscosity and water binding capacity.

Micro particulated Proteins

Micro particulated proteins can mimic certain properties of fat. The process of micro particulation involves simultaneous application of heat and high shear to proteins. There micro particulated proteins coat the mouth and taste buds with fat mimicking effect. This coating action besides allowing flavors to reach receptors slowly and gradually also masks up some of the off – flavors that seem more pronounced in low fat high water added systems (Lucca&Tepper 1994).Simplesse (NutraSweet Kel Co), Trail blazer (Kraft general foods), Finess (Reach associates), Dairy light (Ault foods) are some of the examples for micro particulated protein based fat replacers.

Carbohydrate based fat replacers

These fat replacers achieve fat mimicking majorly by stabilizing the added water in gel like matrix resulting in lubricity and moisture release similar to high fat products (Glicksman 1991).Pre formed carbohydrate gels such as Konjac flour can also mimic particle definition. Malto dextrins and dextrins are found to contribute significantly to mouth feel, body and viscosity (Lucca&Tepper 1994). Modified starches are found to be of great use for reasonable cost wide availability and conventional handling procedures.

Non protein additives

Carboxy methyl cellulose like water soluble celluloses can be used as bulking agents because of their high water binding capacity(Sester & Racette 1992).Methylated cellulose derivatives have reversible thermal gelation property and even though not true fat mimetics, but are useful as fat barriers in fried foods as they reduce oil absorption into batter.Gums are also hydro colloids that provide viscosity or thickening and in some cases gel formation. These gums contribute no calories and have potential health benefits as dietary fibers. There are a number of gums available to the food industry (Dziezak 1991). Some gums can provide a slippery, creamy, lubricacious mouth feel simultaneously that of fats and can be used like fat replacers (Glicksman 1991).

Carrageenan, a sea weed gum is finding wide spread application in low fat meats. Carrageenan is being used with good results in ground beef patties (Kuo-weilin, Jimmy T.Keeton 1998), Pork nuggets (Berry 1994),Pork sausages (Paula Lyons etal 1999)other gums such as xanthan gum and locust bean are frequently included in reduced fat formulations to help stabilize the system. Alginates and pectin can also be used as fat replacers.Slendid (Hercules) is a non-amidated low methyl pectin derived from citrus peel, which is being promoted as a fat replacer for wide range of products in recents.(Thestrup 1993). Microbiological gums such as xanthan gum from xanthonas, capestris and gellan gum from culturing of *pseudomonas eloda* can also be used as potential partial fat replacers. Konjac gels can also be used to stimulate the sensory poperties and appearance of hardened fat and connective tissue in the mouth (Tye 1991).Konjac gels are being used in low fat bologna (Chin et al 2000),low fat cured lamb sausages(Osburn& Keeton 2004).

Animal proteins like milk proteins including non fat dry milk, calcium –reduced non fat dry milk, dried whey, whey protein concentrate, butter milk proteins, the caseinates and skim milk co precipitates contain appreciable amounts of protein. The dairy products are widely utilized in processed meat and poultry products such as WPC in sausages (Laroia etal 1995, Serdaroglu&Deniz 2003), Milk co-precipitates in pork patties (Manish kumar and sharma 2002), and Whey protein in sausages (Paula lyons etal 1999). Other animal proteins utilized in meat and poultry include mechanically deboned meat and poultry which are both widely used in processed products (Pearson and Gillet 1995).

Fat Based Fat Replacers

Alternative fats and oils: Instead of reducing the fat, they can be modified, so that they are healthier. (Kevin 1995). Fatty acid profiles of meat products can also be altered by substituting fat with various vegetable oils.(Giese 1992,Keeton 1994).Various oils like sunflower oil in low fat sausages (Yilmaz et al 2002),low fat frank furthers (Park et al 1989),Olive oil in low fat frank furters (Bloukas and paneras 1993) were utilized affectively. Emulsifiers are fat or fatty acid derived compounds that have the ability to modify the surface properties of solids or liquids due to their hydrophobic and lipophilic properties (Giese 1996) Emulsifiers are not fat replacers in a traditional sense but can function as part of fat replacer system. Examples include lecithin, mono-and diglycerides, polyglycerol esters, polysorbates and sodium stearolyl lactylate (Glicks man 1991). Emulsifying, lubricating, starch complexing, protein complexing, aeration, freeze/thaw stability properties along with oily or fatty consistency make fat sparing or fat extending effect.

Synthetic fat replacers: Olestra, source polyester is being used widely. It has an appearance,flavor,heat stability, flash point and shelf life similar to those of its constituent fats (Anon 1990 a) Olestra would probably work well as a zero-calorie frying medium for fried or prebrowned meat items (Aylward 1996). It has similar functionality to conventional fats and oils in comminuted meat products. Other experimental synthetic fat substitutes include Trial loxytricarballylate, Frito-lay, Esterified propoxylated glycerols etc.

Super Critical Fluid Extraction

Super critical fluid extraction is based upon altering the proportion of fluid by utilizing elevated pressure and temperatures to produce a super critical phase, which gives the fluid unique extraction properties. The procedure was proved effective for fat extraction from meat products and of lipid and cholesterol from ground beef (Chao et al 1991) and cholesterol from dried egg yolk (froning et al 1990) This finds a niche in the production of low fat foods.

Further research is needed to understand completely the mechanism of sensation of juiciness. Only after full understanding of the factors that contribute to juiciness, the development of low fat products can be exploited. Improving the leanness by breeding and genetics, Gene mapping of meat producing species, transgenic animal production, Altering the leanness by feeding and management techniques, Use of repartitioning agents, Use of protein and non-protein additives and their mechanism of action and super critical fluid extraction.

References

1. Anon (1990a) *Food Technol.* 44(3) 92pp.
2. Anon (1990b) *Prepared Foods*. 159(5): 157.
3. Aylward L (1996) *Meat Market Technology* 4 (4): 48.
4. Dziezak JD (1991). *Food Technol.* 45(3): 116.
5. Chao RR, Mulvaney SJ,Bailey ME and Fernando LN (1991) *J.Food.Sci* 56: 183.
6. Froning GW, Wehling RL, Cuppett SL (1990) *J.Food Sci* 55: 95.
7. Giese J (1992) *Food. Technol.* 46 (4):100.
8. Glicksman M (1991). *Food Technol.* 45(10): 94.
9. Keeton JT(1994) *Meat Science* 36: 26.
10. Lucca PA and Tepper BJ (1994) *Trends in Food Science and Technology* 5:12.
11. Osburn and Keeton (1994). *J.Food.Sci.*59: 484.
12. Sester CS and racette WL (1992) *CRC Critical reviews in foodscience and nutrition* 32: 275.
13. Trout ES, Hunt MC, Johnson DE (1992) *J.Food. Sci.*57: 19.
14. Tye Rj (1991) *Food Technol.*45(3): 87.
15. Kevin K. (1995) *Food Process*.56 (7): 63.
16. Thestrup N (1993) *Food manufactures* 68(9):55.
17. Pearson and Gillet (1995) Processed Meats, 3rd Edition, Chapman & Hall, Newyork.
18. Berry BWJ (1994) *J.of Food Sci.*58(34-37): 48pp.
19. Cavestany M, Jimenez ,Colmenero F, Solas MTR, Carballo J (1994) *Meat Science* 34: 27-37.
20. Desmond EM, Trout DJ, Buckley DJ (1998) *Lebensmittel wiss u technol.* 31:653-657.
21. Laroia S,Magoli EL, Hnasen PMT (1995) in IFT annual meeting pp205.Chicago,IL.
22. Modi VK,Mahendrakar NS, Rao DN and Sachindra NM (2003) *Meat Science* 66:143-149.
23. Serdaroglu M and Deniz E (2005) *J.Food. Technol.* 2: 109-113.
24. Serdaroglu M and Sapanci-ozumer M(2003). *Electronic journal of Polish Agricultural Universities Series: Food.Sci and Technol.* 6: 1-9.
24. Yilmaz I and Daglioglu O (2003) *Meat Science*, 65: 819-823.
25. Kirchner MJ , Beasleyi LC, Harris KB and Savell J.W.(2000) *J.of food composition and Analysis*.3: 253-254.
26. Paneras EO,Boulkas JG and papadina SN (1996). *Lebensmittel Wis-s-u-Technolog.* 29: 507-514.
27. Rao KH, Singh RRB, Anjaneyulu ASR, Rao KVSS and Yadav PL (1997). *J.of Food Science and Technology,* 34:446-449.
28. Rao KH, Anjaneyulu ASR, Singh RRB and Yadav PL (1999) *Ind.j. Poult.Sci.*34(3): 373-377.
29. Sunil kumar, Sharma BD and Biswas AK (2004): *Asian-australian J.Animal Sci.* 17(4):564-568.
30. Bloukas and paneras (1993) : J.Food.Sci . 58 (4)705-708.
31. Kuoweilin and Jimmy T Keeton (1998): *J.Food.Sci.* 63 (4): 571-575.
32. Chin KB, Keeton JT, Miller RK, Long necker MT and Lamkey JW (2000) *J.Food .Sci.* 65(5) : 676.
33. Paula H Lyons,John F. Kewy, Patrick k Monissy , Denis J. Buckley(1999): *Meat Science*: 51:43-52.

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