THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2022; 2(8), 1509-1512

Popular Article

Chemical and Technological application of Protein Based Fat Replacers in Food

Binod Kumar Bharti[1]* and Anamika Das[2]
[1*]Assistant Professor cum Jt. Scientist, Sanjay Gandhi Institute of Dairy Technology (Bihar Animal Sciences University) Patna
[2]Assiatant Professor, Warner College of Dairy Technology (SHUATS) Prayagraj (UP)
https://doi.org/10.5281/zenodo.7038476

Introduction

Fat is an important constitute of food. So, in the food component, it contributes important role in sensory and physiological benefits. Fat contributing various functions like flavour, mouthfeel, taste, and aroma/odour (Lucca and Tepper, 1994; Mistry, 2001; Sampaio, 2004). In addition, fat also contributes to other functions such as creaminess, appearance, palatability, texture and glossiness of foods and increases the feeling of satiety during meals (Romanchik-Cerpovicz, 2002; Sipahioglu, 1999). Fat can carry lipophilic flavour compounds, act as a precursor for flavour development and helping to stabilize the flavour in food (Romeih, 2002; Tamime, 1999).

Fat Replacer

A fat replacer is an ingredient that can be used to provide all the functions of fat and it also contributing fewer calories. Fat replacers are able to replicate some or all of the functional properties of fat in a fat modified food (Schwenk and Guthrie, 1997).

Types of fat replacer

Fat replacer are classified in two groups: fat substitutes and fat mimetic. Fat substitutes are lipid like substance proposed to replace the fat on mass-to-mass basis. Fat mimetics are protein or carbohydrate ingredients which are imitating the various functions such as physical, textural, mouth feel and organoleptic properties of true fats (Owusuapenten, 2005). Fat substitutes are further classified in two types such as emulsion and structural lipids. Similarly, Fat mimetics are also classified in two types such as microparticulate protein and microparticulate carbohydrates.

Protein Based Fat mimetics

The protein in fat replacement is determined by the degree of denaturation, which effects flavour, as well as the protein solubility, gelling properties and temperature stability. Proteins are responsible for whipping agents, emulsion stabilizers, and dough formation. The fat mimetics are derived from a various protein sources like whey, egg, milk, soy, gelatine, wheat gluten and corn zein. Protein-based fat mimetics are commonly used in many forma like butter, cheese, dairy products, salad dressings, sour cream, mayonnaise containing products, soups, sauces, baked goods, and frozen desserts. These protein-based fat mimetics are generally giving a better mouthfeel than carbohydrate-based replacer.

Many protein-based fat mimetics are used in foods and their applications-

Type of fat replacer	Commercial names	Applications
Microparticulated Protein	Simplesse®	Milk and milk products (ice cream, butter, sour cream, yogurt, cheese), Baked goods, salad dressings, frozen desserts, mayonnaise type products, margarine, coffee creamer, soups, sauces
Modified Whey Protein Concentrate	Dairy Lo™	Dairy Products, mayonnaise-type products, baked foods, frostings, salad dressing
Others	K-Blazer®, ULTRA-BAKETM, ULTRA-FREEZETM, Lita®, Trailblazer	Frozen desserts, baked foods, spreads, butter, salad dressing

Microparticulated Protein (Simplesse®) properties

Microparticulated Protein is manufactured from whey protein concentrate by the patented micro-particulation process. In this process, these are undergone heating and blending, egg protein and milk protein are combined and formed into minute particles and their size are 1–1.5 mm. These particles are spherical and smooth, which allows the mouth to perceive them as fat. The product was introduced by the NutraSweet Corporation in 1988. Simplesse® replacer is approved for use as a thickener or texturizer in ice creams and other frozen dessert dairy products by FDA GRAS in the year 1990. This replacer is also suitable for use in many dairy products like yogurt, cheese spreads, cream cheese, and sour cream as well as use for oil-based products such as salad dressings, mayonnaise, and margarine. The caloric value of Simplesse® replacer is 1–2 kcal/g. It used for flavour and fatlike creaminess. It is made from proteins, so it cannot be used in foods that require high-temperature applications like frying or baking. When Simplesse® replacer is heated, then protein gel and texture effects are lost. People who are allergic to milk proteins may have an allergic reaction to this fat replacer.

Modified Whey Protein Concentrate (Dairy Lo™) properties

Modified whey protein concentrate (Dairy-Lo) is manufactured from high-quality whey protein concentrate and it is recognized as generally recognize as safe (GRAS), Dairy Lo™ contributes 4 kcal/g.

Modified whey protein helps in various forma to improve texture, flavour and stability of low-fat foods. It is used in many dairy products like sour cream, frozen dairy desserts, cheese, yogurts and sauces. Its ability is to prevent shrinkage and iciness in frozen dairy foods makes it desirable as a fat replacement ingredient in those products.

Other protein-based fat mimetics

Other than Simplesse® and Dairy Lo™, there are other recently developed fat replacer: It is derived from xanthan gum, egg white, whey protein and LITA from Corn Zein.

Application in dairy foods

In the prepared dairy products such as low-fat cheese using Simplesse® fat replacer, it was found that Simplesse® had improving effect on cheese appearance (Romeiha *et al*., 2002). Yazici and Akgun, (2004) has used Simplesse® and Dairy Lo™ replacer in yoghurt preparation and they it was found good appearance, flavour and colour score to Dairy Lo™ than Simplesse®. The Simplesse® D-100 and Raftilines HP can improve the sensory and texture properties of low-fat fresh kashar cheese (Koca and Metin, 2004). Zoulias *et al*., (2002) has analysed textural properties of low-fat cookies. They have reported that an increase in polydextrose or Dairytrim content resulted in harder cookies, while an increase in C-deLight, Simplesse® or Raftiline content has the opposite effect. So, C deLight, Simplesse® or Raftiline could be used as fat replacers to prepare tenderer lowfat cookies. It was also found that the increase in brittleness of the cookies with increase of all fat mimetics, but a moderate increase was obtained with C-deLight, Simplesse® or Raftiline. The whey protein-based fat replacer on sensory characteristic of low fat and non-fat Ice cream (Prindiville *et al*., 2000). The Simplesse® was more similar to milk fat than Dairy Lo™ in its effect on brown color, cocoa flavor, cocoa character, and textural stability but was less similar in terms of thickness and mouth coating.

Conclusion

A fat replacer is an ingredient can be used in food to provide all the functions of fat. Fat replacers are able to replicate some or all of the functional properties of fat in a fat modified food. It was concluded that the fat replacer is imitating the various functions properties of food such as physical, textural, mouth feel and organoleptic properties of true fats.

References

Koca, N. and Metin, M. (2004). Textural, melting and sensory properties of low-fat fresh kashar cheeses produced by using fat replacers, International Dairy Journal. 14:365–373.

Lucca, P. A. and Tepper, B. J. (1994). Fat replacer and the functionality of fat in foods. Trends in Food Science and Technology. 5:12-19.

Mistry, V. V. (2001). Low fat cheese technology. International Dairy Journal. 11:413-422.

Owusu-apenten, R. (2005). Introduction to Food Chemistry, CRC Press, Washington, D.C

Prindiville, E. A., Marshall, R. T. and Heymann, H. (2000). Effect of Milk Fat, Cocoa Butter, and Whey Protein Fat Replacers on the Sensory Properties of Low fat and Non-fat Chocolate Ice Cream,

Journal of Dairy Science. 83:2216–2223.

Romanchik-Cerpovicz, J. E., Tilmon, R, W and Baldree, K. A. (2002). Moisture retention and Consumer acceptability of chocolate bar cookies prepared with okra gum as a fat Ingredient Substitute, Journal of the American Dietetic Association. 102:1301-1303.

Romeih, E. A., Michaelidou, A., Biliaderis, C. G. and Zerfiridis, G. K. (2002). Low-fat white-brined cheese made from bovine milk and two commercial fat mimetics: chemical, physical and sensory attributes. International Dairy Journal. 12:525-540.

Sampaio, G.R., Castellucci, C. M. N., Silva, M. E. and Torres, E. A. F. S. (2004). Effect of fat replacers on the nutritive value and acceptability of beef frankfurters. Journal of Food Composition and Analysis. 18:469-474.

Schwenk, N. E. and Guthrie, J. F. (1997). Trends in marketing and usage of fat-modified foods implications for dietary status and nutrition promotion. Family economics and nutrition review. 10:16-32.

Sipahioglu, O., Alvarez, V, B. and Solano-Lopez, C. (1999). Structure, physico-chemical and sensory properties of feta cheese made with tapioca starch and lecithin as fat mimetics. International Dairy Journal. 9:783-789.

Tamime, A.Y., Muir, D. D., Shenana, M.E., Kalab, M. and Dawood, A. H. (1999). Processed Cheese Analogues Incorporating Fat-Substitutes 2. Rheology, Sensory Perception of Texture and Microstructure. Lebensmittel-Wissenschsft und Technologies. 32:50-59.

Yazici, F. and Akgun, A. (2004) Effect of some protein based fat replacers on physical, chemical, textural, and sensory properties of strained yoghurt, Journal of Food Engineering. 62: 245–254.

Zoulias, E. I., Oreopoulou, V. and Tzia, C. (2002). Textural properties of low-fat cookies containing carbohydrate- or protein-based fat replacers, Journal of Food Engineering. 55:337–342.