MALAYSIAN PALM FAT AS ANIMAL FAT ANALOGUE IN PROCESSED MEAT PRODUCTS

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BACKGROUND

The growth of the processed meat industry is indicated by the wide range of value-added-meat-products available in the chilled and frozen sector of the food industry. More primary products such as poultry, beef and pork are being utilized by the producers to add value and increase the variety of meat products. Export of primal cuts and boneless, skinless breast meat and thigh has resulted in fat and skin being utilized in the processed meats. Animal fat and skin are excellent raw materials for emulsion-type products but they are also high in cholesterol and contaminating microorganisms. With the increase in production of processed meats, animal fats and skin have become essential items in the formulation of meat products. With consumers demanding healthy foods, the meat manufacturers have focussed their production toward processed meats that are lean,low fat and high in protein content. These products are low in salt, calories and cholesterol. Palm fat is seen by the researchers as a potential raw material to replace unhealthful animal fats and skin in the processed meat industry. Palm fats are stable and resistant to oxidation, containing vitamin E as antioxidant, has sufficient saturated fat to provide the body thus do not require the hydrogenation process, associated with the unwanted trans fatty acid. Palm fats are readily available in the tropics and is priced competitively with animal fats. When compared to animal fats, palm fats offer a wider range of choice for meat manufacturers to meet product requirement. For instance, meat manufacturers can use various palm oil fractions to produce a variety of meat products. Research on the utilization of palm fats in meat products were first investigated as alternative to animal fats in beef burgers and chicken nuggets (Babji, et al. 1998 and Alina et al, 2000).

Key words: Palm fat, animal fat analogue, processed meat

OBJECTIVE

This paper reviews the potential of palm fats as analogue to animal fats in processed meat products, the research and development aspects related to meat quality characteristics, nutritional considerations and the significance of the palm oil industry in Malaysia and the rest of the world.

ANIMAL FAT SUBSTITUTION

Fat substitution technology is of considerable interest to food formulators as more consumers are now concerned about health. Many are now moving away from the conventional foods which are high in fats and oils. As more evidence concerning the risks and benefits of dietary nutrients are emerging in both the scientific field and the mass media, todays' consumers are more informed of the link between health and diet. Development of healthful new meat products must emphasize on three important features: the nutritional property, quality and sensory acceptance. The competitiveness in price when subsituting animal fats with palm fats is also a determining factor on the success of the new palm fat analogue. Saturated and mono unsaturated fatty acids are predominant in meat fats. Animal fat, an important source of food energy and fat soluble vitamins, is added to meat products for economic, flavour and texture reasons. Due to cholesterol and saturated fatty acid content of meat products, their inclusion in a healthful diet is controversial. The American Heart Association and other groups have recommended to the American public, a reduction in the consumption of cholesterol and saturated fatty acid and an increase in the consumption of polyunsaturated fatty acid as a step towards helping to reduce serum cholesterol levels. Meats of all kinds contain cholesterol in the lean muscles in adipose tissue. Chicken fat and skin, the by-products of poultry processing operations, are commonly used in value-added poultry products. As a contributor of fat, chicken flavour and meat, these components help reduce production costs. However, increasing demands by local consumers on VAP which is priced lower than premium cuts from animal meats have caused an increase in price, subsequently affecting the price of VAP. From the consumers' nutritional standpoint, chicken fat and skin are unhealthful; high in fat, cholesterol and monounsaturated fatty acids.With the purpose of generating products with reduced fat and calories while retaining traditional full - fat flavour and texture, a substantial amount of animal fat could be modified, changed and substituted with other sources of fat containing unsaturated fatty acids such as vegetable oils for some of the animal fats during processing. Vegetable oils, high in monounsaturated and polyunsaturated fatty acids, do not contain cholesterol. Consumers perceived such vegetable fats as less health-risk than animal fats. Palm fats seem promising as a fat replacer of skin, due to its product enhancing qualities : i.e. stability and resistance to oxidation with inherent high antioxidant vitamin E content, therefore a better shelf life for tropical climate; a naturally saturated fat which do not need to be stabilized by hydrogenation, thus eliminating the risk of creating unwanted trans fatty acid (O'Holohan, 1997). Palm fat, being cheaper and readily available locally is studied as another alternative of providing more nutritionally acceptable and cost effective processed meat products.

RESEARCH ON FAT ANALOGUES

A variety of fat replacers have been utilized or suggested in meat emulsion products. Direct incorporation of the vegetable oils in meat products have been reported by Paneras and Bloukas (1994) using the oils of olive, corn, sunflower and soybean in frankfurters. Preliminary studies by Babji et al., (1998) replaced beef tallow with palm stearin and specialty fats from partially hydrogenated palm oil in beef burgers. Solid fat content and slip melting point of palm oil fractions need to resemble or simulate animal fat in order to prevent undesirable greasy and waxy mouth feel which affects consumers acceptance. Trials on animal fat substitution on chicken burger, frankfurters and effects of palm fats in chicken nuggets were reported by Babji et al.(2000) and Alina et al.(2000). Various types of commercially available fat replacers used in meat products are usually starch and protein based. Efforts should be made to produce palm fat as analogue to replace animal fats. On going R&D on the utilization of palm fat includes studies on the characteristics of chicken fat/ skin and substituted palm fat/ fractions in specific restructured/comminuted meat systems.

PHYSICAL AND NUTRITIONAL PROPERTIES

Issues of dietary fat in humans have gained tremendous attention recently. A reduction of saturated fatty acids and an increased intake of monounsaturated and polyunsaturated fatty acids have been advocated. Animal fats have been targeted, and a reduction in dietary animal fat intake recommended. The blending of specific fatty acids in palm fats by defining the fatty acid composition of animal skin and fat were used as a baseline towards developing an animal fat analogue. Solid fat content which are determined by the fatty acid composition of palm fat affects the acceptability of the end products. Percentage of fat at the melting point of 30-40°C must not be higher than necessary to avoid a poor mouthfeel due to the 'tailing effect', which is an undesirable waxy after taste from incomplete melting of fat in the mouth. Successful animal fat must be technically superior than existing animal fats and offer more versatility when used in different types of meat products. Palm fat offers an advantage over other commercial plant oil such as soya oil without the process of hydrogenation that will increase the trans fatty acid in saturated fats. Wide ranges of functionality and plasticity can be obtained by varying the content of stearin and olein blends. For instance, beef fat requires higher melting palm fats with a slip melting point of 39 – 41°C which is closer to palm stearins (Babji et al 1998) while poultry fats with lower slip melting point of 22- 25°C, similiar to palm olein (Alina 2000). Various types of meat products:- coarse comminution i.e. burgers, semi-coarse comminuted i.e, meat balls and fine comminution type such as frankfurters require cohesion between the fat and protein matrix in the meat products. Based on the specific solid fat content profiles of each products, palm fats, oleins and stearins blended together

were successfully incorporated in processed meats. Replacing chicken fat with palm fat reduced up to 35 – 45% of cholesterol in chicken nuggets, and 40% of cholesterol in chicken burgers (**Table 1**). Wan Sulaiman et al. (2000) reported high content of vitamin E in chicken sausages where the chicken fat and skin were replaced with red palm as well as regular palm fats. Red palm fat treated franks also had high content of carotene.

Table 1: Cholesterol content of chicken burgers and chicken nuggets

Cholesterol content (mg/100 g of sample)	
[1]burger(control)	64.6 a
60:40 (PO:PS)	38.4 b
70:30 (PO:PS)	37.9 b
[2]Nugget(control)	53.3 a
30:70(POo:PS)	30.6 c
50:50(POo:PS)	28.8 c
70:30(POo:PS)	34.9 b

[1]Wan Sulaiman (2000) at 20% substitution of chicken skin fat with palm fat blends.
[2]Alina (2000) at 10% substitution of chicken skin fat with palm fat blends.
Means within a column with different letters were significantly different at ($P<0.05$)
POo-palm olein, PO-palm oil, PS-palm stearin

PRODUCT QUALITY

The advantage of incorporating palm fats in meat products is the stabilizing effect towards the product. Palm oil is naturally stable due to its rich vitamin E content, compared with oils which have to be protected against oxidation by the addition of artificial antioxidants. Chicken fat had tocopherol amounting to 2.7 mg, compared to palm fat which had 38.4 mg per 100g of fat (Marmer 1995). Animal fats and skins are good raw fat materials for emulsion-type products but they are also high in contaminating microorganisms, unlike palm fats. Animal fats may also accumulate antibiotic and hormone residues which are healthwise undesirable. Significant reduction in microorganisms were observed during frozen storage in beef burgers and chicken balls replaced with palm fat (Babji et al., 1998 and Babji et al, 1999a). The physical aspects when designing a palm fat analogue to be used in meat products must meet the consumers expectations in terms of juiciness, flavour, aroma, tenderness, colour, appearance and taste. Sensory tests measuring undesirable waxy taste indicated acceptable scores by consumers who were unable to differentiate between palm fat treated meat products and animal fat incorporated meat products. Lipids are the components chiefly responsible for the flavour of fresh meat. Lipid oxidation, although present during frozen storage of meat products, did not affect the consumers' perception from off-flavours commonly associated with oxidative rancidity (Babji et al, 1998), Wan Sulaiman (2000), Babji et al. (1999b) and Alina (2000).

CONCLUSIONS

Global consumption of edible oils and fats is expected to increase due to the growing demand for vegetable oils. Demands for animal oils and fats is decreasing as reflected in the world market share which fell from 28.6 % in 1985 to 23.4% in 1995. The increase in income and population in China and India and demands in the vegetable oils market in the EU and the USA in view of growing health concerns is also expected to increase. With a growing acceptance of consumers on downstream products such as emulsifiers, food ingredients and modified oils and fats with fortified vitamins, developing palm based animal fat analogues represent a significant step towards the development of healthful and nutritional foods. Palm fat blends may have to be altered with changing market prices, as the aim is to obtain the desired formulation at minimum cost. In Asian countries, palm fat is cheaper and readily available. As more meat manufacturers turned towards further processing, coupled with increasing cost of animal fats, importation beef fat and a reduced availability of chicken skin/fat, will result in producers looking seriously into the substitute available, i.e. palm fats.

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