PE4.63 Use of DAG in Meat Emulsion Products 228.00

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***Abstract*—the technological quality of pork fat is of major importance when meat products are produced. Consistency is one of the main criteria when the quality of pork fat is judged and lack of consistency is a serious problem. A new way to improve the quality of pork fat is enzymatic modification. By enzymatic modification triacylglycerides (TAGs) can be converted to diacylglycerides (DAGs) resulting in changes of the physical and chemical properties of the fat. In this study the texture and jelly and fat separation were investigated in meat emulsions prepared with different levels of DAGs. Emulsions prepared with DAGs were found to have a better fat and water holding in addition with a more firm and solid texture. The effect increased with increasing levels of DAGs but even substitution with only 10 % DAG reduced fat and water separation from the product. The results open for future perspectives for use of enzyme modification as a tool to improve and control the quality of meat products.**

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I. INTRODUCTION

The technological quality of pork fat is a major aspect in the production of meat products. The fat quality considers the rheological and structural properties of meat products and is essential in the formation of a stable emulsion [1]. The technological quality of pork fat is determined by its physical properties depending on fatty acid composition, the position of the fatty acids on the glycerol backbone and the crystallization behavior. The fatty acid composition in monogastric animals like pigs reflects the fatty acid composition in the feed as the fatty acids from the diet pass through the digestive system and are deposited unchanged in the adipose tissue.

Consistency is one of the main criteria by which the quality of pork fat is judged and lack of consistency is a serious problem. Problems associated with the use of soft fat in meat products are found to be: oily appearance, rancidity developments, insufficient drying and separation between muscle and fat on cutting [2]. Consequently the meat industry needs to look into new solutions for controlling these important quality characteristics.

Enzymatic modification of pork triglycerides (TAG) to diglycerides (DAG) opens for new possibilities to improve the functional properties of pork fat. So far enzyme processes have been used for the modification of oils and fats such as for the production of margarine fats [3], butter fats [4], monoglycerides [5], diglycerides [6] and structured lipids [7+8]. The work done so far in non-meat systems suggest a number of physical and chemical changes that could be imagined as beneficial for meat products when TAGs are replaced by DAGs.

In general DAGs have higher melting points compared with their corresponding TAGs, which could serve as a new possibility to overcome problems with lack of consistency. Partial glycerides probably also have stronger interaction with protein and water due to free hydroxyl groups [9]. As the water holding capacity in meat products normally is increased by addition of salt and phosphates, a stronger water binding caused by partial glycerides will reduce the need for salt and addition of phosphates can be avoided in some meat products. Even more interestingly, DAG has been reported to result in a lower fat accumulation in the human body [6].

The aim of this work was to investigate the effect of substitution of TAGs with DAGs in a meat emulsion product for evaluation of the future perspectives of use of DAG in meat products.

II. MATERIALS AND METHODS

A. Preparation of meat

Pork Semimembranosus was purchased from a local meat market. All visible fat and connective tissue was removed before cutting into smaller pieces. The pieces were mixed and minced two times in a mincer with a 3 mm plate. The minced meat was mixed and divided into portions of 480 g, vacuum packed and stored at -

18 °C. When needed the samples were thawed 15 hours at +4 °C.

B. Preparation of fat mixtures

DAG was produced by Danisco from lard supplied by a local slaughterhouse. In the production of emulsions the used lard and DAGs derived from the same batch of lard. For preparation of fat mixtures lard and DAG was melted in a 70 °C water bath until no visible crystals were present. Mixtures containing 10 % and 50 % DAGs were prepared by weight, packed in portions of 250 g and stored at -18 °C. The samples were kept at + 4 °C for 15 hours before use.

C. Preparation of emulsion

The emulsions were prepared in batches of 1 kilo in a food processor. Thawed meat (480 g), potato starch (5 g), curing salt (NaCl with 0.6 % of nitrite) (17 g) and crushed ice (248 g) were comminuted at highest speed for 2 minutes. The temperature at this point was in all batters approximately 1 °C. After addition of 250 g of hand chopped dices of lard or fat mixtures the batter was comminuted for 2 minutes. The temperature was measured (approx. 12 °C) and comminuting was continued for 1 further minute. End temperature was approximately 14 °C. All emulsions were prepared twice at different days.

Four cans were filled with 180 g (+/- 5 g) of emulsion, closed and heated for 35 minutes in a boiling water-bath (Core temperature of about 90 °C). After heat treatment the cans were cooled in running tap water for 5 minutes and then stored at 5 °C for 24 hours.

D. Jelly and fat separation

The jelly and fat separation was measured as described by [10]. After cold storage for 24 hours two cans from each batch were reheated in a water bath at 45 °C for 1 hour. The cans were opened and the fluid from each can was collected in a volumetric cylinder. After clear separation in jelly and fat, the amounts were determined in milliliters and calculated as percentage of the original weight of the batter. Mean values of the two cans were used for each emulsion.

E. Texture

Texture of the 24 hours cold stored canned emulsions was determined using an Instron Universal Material Testing Machine (Instron 5564, England). From each can six cylindrical cores (diameter: 18 mm; height: 20 mm) were prepared. The samples were placed at a platform and each one compressed one time to 10 % of its original height at a cross head speed of 50 mm/s using a 25 kg load cell. Force-time curves were recorded. From each emulsion two cans were used making twelve replicates. Young´s module (elasticity) and maximum hardness were calculated.

III. RESULTS AND DISCUSSION

The results of the jelly and fat separation show that the addition of DAG to a meat emulsion has a considerable effect on both the fat and water holding of the emulsions (Figure 1). The greatest effect was seen on the fat separation where the fat separation was 10.9% in the emulsion with 100% lard and nearly 0% in the emulsion with 50% and 100% DAG. The use of 10 % DAG led to a 50 % reduction in fat separation compared to pure lard.

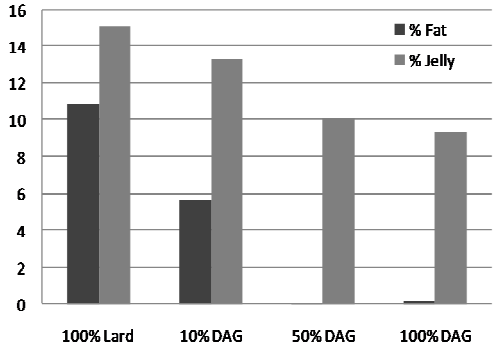

Figure 1 Jelly and fat separation of meat emulsions prepared with pure lard or lard substituted with pork DAG (10%, 50%, 100%).

The separation of jelly was decreased from 15 % in the emulsion prepared with 100% lard to 9,5 % in the emulsion prepared with 100 % DAG. The improved fat and water holding can be speculated as a result of a stronger interaction between fat, water and protein caused by an increased number of free hydroxyl groups in the fat fraction [9].

The texture measurements showed that the use of DAG in meat emulsions also has a major effect on the texture of the emulsion (Figure 2). The emulsions containing DAG were more firm and solid reflected in an increase in young's module and the maximum hardness corresponding to the increase in the content of DAG. This effect can also be explained by a stronger interaction between the macromolecules in the emulsion but also the fact that DAGs have higher melting points than TAGs will influence on the hardness of the product.

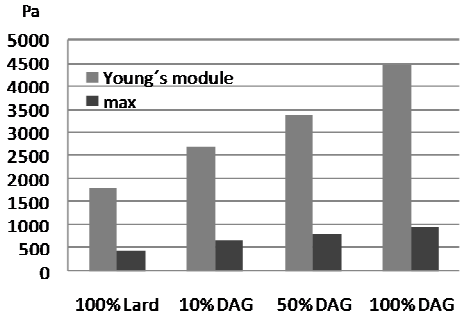

Figure 2 Results of compression test on meat emulsions prepared with different levels of DAG (0 %, 10 %, 50 %, 100 %) shown as Young´s module and maximum hardness (Pa).

In general the results indicate that substitution of TAGs with DAGs has major influence on the physical and chemical properties of the pork fat and that these changes can be beneficial for meat products. Even a 10 % substitution with DAGs showed to affect both texture and emulsion quality.

IV. CONCLUSION

The use of DAG in meat emulsions resulted in a more firm and solid emulsion and the binding of fat and water was improved. These results open for new perspectives for improvement of the technological quality of pork fat by enzyme modification.

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