# EFFECTS OF RAPESEED OIL IN SAUSAGES

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## I. INTRODUCTION

Fat is an important ingredient in the formulation of sausages which has impact on both sensory and functional properties. Animal fat contains a relatively high proportion of saturated fatty acids which are connected to changes in certain risk markers for cardiovascular disease (i.e. total and LDL cholesterol). Despite controversy on health effects associated with saturated fat [1], exchanging some of the animal fat with plant oils could potentially have a positive health effect for consumers of sausages. Rapeseed oil has a high percentage of unsaturated fatty acids and a mild flavor. However, since plant oils have lower melting point than animal fat an exchange could affect texture and sensory perception of the sausage. The purpose of this study was to compare physical, chemical and sensory properties of grill sausages when saturated fat was partly replaced with rapeseed oil.

## II. MATERIALS AND METHODS

A 2x3 factorial design was applied to make grill sausages. All recipes had fixed levels of protein (11%) and fat (18%). Minced meat from pork (23% fat) and beef (14% fat) were used in recipe 1-3, while lean pork (6% fat) and beef (5% fat) were used in recipes 4-6. Pork backfat was the only additional fat-source in recipes 1 and 4, while 50% of the backfat was replaced with rapeseed oil in recipes 2 and 5. All backfat was exchanged with rapeseed oil in recipe 3 and 6. The recipes were equally homogenized and duplicated in randomized order. Alginate (0.2%) was added to all batters to facilitate fat emulsification. The sausages were characterized by several different methods: evaluation by trained sensory assessors, texture profile analysis, fatty acid composition, histology, color measurements, cooking loss and pH. Statistical analyses were performed with the software Minitab (Version 19).

## III. RESULTS AND DISCUSSION

The sausages were evaluated for 22 different attributes by the trained sensory panel. For 6 attributes, small but significant differences were found. As shown in Table 1, “recipe 6 sausages” deviated most from the others. These sausages had the highest ($p<0.05$) content of unsaturated fat, still they were found to have higher ($p<0.05$) sensory hardness and lower sensory fatness ($p<0.05$) than the other sausages made with lean meat ingredients. Juiciness was significantly lower ($p<0.05$) for recipe 6 compared to recipes 1-4, but not different from recipe 5. Textural profile analysis (TPA) indicated that springiness and resilience increased when backfat was replaced with rapeseed oil. No difference in cooking loss (approximately 5.5%) was observed between the different recipes. Histological analyses showed that the rapeseed oil was well emulsified in all sausages. Regular meat, with higher animal fat content, gave emulsions with smaller rapeseed droplets than the lean meat ingredients. Color measurements showed increasing lightness L* ($p<0.05$) and higher redness a* ($p<0.05$) when rapeseed oil content was increased. The present results indicate that some of the animal fat could be replaced with rapeseed oil in grill type sausages without detrimental effects on textural and sensory properties. Our findings are in agreement with the results reported by Youssef

and Barbut [2], who compared sausages with different levels of protein. They found high fat loss from batters when protein level was raised to 14%.

Table 1 – Description of sausages and mean values for some of the obtained results. Results with different letters (a-d) are significantly different, p>0.05.

| Recipe No. | Description | Ratio sat/unsat fat | Sensory fattiness | Sensory hardness | Sensory springiness | TPA springiness | TPA resilience |
|---|---|---|---|---|---|---|---|
| 1 | Regular grill sausage, Control | 0.66$^{a}$ | 4.76$^{a}$ | 3.75$^{abc}$ | 3.62$^{ab}$ | 65.2$^{a}$ | 7.2$^{a}$ |
| 2 | Regular meat, 50% of backfat exchanged with rapeseed oil | 0.51$^{b}$ | 4.68$^{a}$ | 3.98$^{ab}$ | 3.74$^{a}$ | 68.0$^{ab}$ | 7.3$^{ab}$ |
| 3 | Regular meat, 100% of backfat exchanged with rapeseed oil | 0.42$^{c}$ | 4.60$^{a}$ | 3.89$^{ab}$ | 3.79$^{a}$ | 70.8$^{b}$ | 7.5$^{ab}$ |
| 4 | Lean meat and backfat | 0.62$^{a}$ | 4.84$^{a}$ | 3.46$^{bc}$ | 2.99$^{bc}$ | 69.4$^{b}$ | 6.9$^{a}$ |
| 5 | Lean meat, 50% of backfat exchanged with rapeseed oil | 0.38$^{c}$ | 4.41$^{a}$ | 3.16$^{c}$ | 2.96$^{c}$ | 70.5$^{b}$ | 7.5$^{ab}$ |
| 6 | Lean meat, 100% of backfat exchanged with rapeseed oil | 0.17$^{d}$ | 3.86$^{b}$ | 4.22$^{a}$ | 3.88$^{a}$ | 75.0$^{c}$ | 8.6$^{b}$ |

## IV. CONCLUSION

This work has shown that exchanging pork backfat with rapeseed oil in grill sausages will improve the ratio of saturated versus unsaturated fatty acids significantly. The results also indicate that fat replacement may not have large effects on sensory or textural properties.

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## REFERENCES

1. Astrup, A. et. al. (2020) Saturated Fats and Health: A Reassessment and Proposal for Food-Based Recommendations. J. American College of Cardiology 76: 844-857.
2. Youssef. M.K. and Barbut. S. (2010) Physiochemical Effects of the Lipid Phase and Protein Level on Meat Emulsion Stability, Texture and Microstructure. J Food Sci. 75: 108-114.