PE8.23 Heating and storage time effect on lipid fraction of non-fermented sausages 248.00

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I.. Abstract: Two types of sausages (containing Canola and Soybean oil) were investigated at this study to compare their spoilage stability. Samples contained relatively high percentage (80%) of beef. During heating and storage, changes of both batches were analyzed with fatty acid composition experiment using gas chromatography. Statistical data carried out using GLM (repeated measured) and T-Test. Differences were significant at P<0.05. At the end of experiments, fatty acid profile in Canola batch showed lower changes during storage.

II. INTRODUCTION

Sausages classified as emulsified heated meat product that undergo cooking process in producer plant. Lipids are important fractions that characterize functional and sensory properties of emulsified products. Oxidation is a destructive reaction which occurred in products containing lipid and limits the storage life [1]. This reaction can be different in various products that depend on component materials and production parameters such as temperature, pH and process time [2]. Sometimes, for oxidative studies, volatile analysis of headspace has been used in collecting information and aroma properties. [3] studied liver sausages and detected fatty acid profile, proximate composition and volatile compounds derived from product. Finally, they monitored nutritional properties [3]. Since few studies carried out on lipid changes in non-fermented sausages, the aim of this study was investigation of these changes in beef sausages contained high meat percent.

III. MATERIALS AND METHODS:

3.1. Sample preparation: Beef sausages produced in two batches with Canola and Soya oils. Beef meat imported from Brazilian Bertin Company and nitrite and phosphate imported from Germany. Other materials prepared from local markets. Formulation of sausage is shown in Table 1. Sample cooking was performed at 72°C for 120 min, then stored at +3°C until tests performed. 3.2. Fatty acid profile: Lipid content of beef samples was extracted using method of [4]. 20 gr of grinded sample was mixed with 50 ml Methanol and 40 ml of Hexane. Then after mixing, the mixture set at motionless state to separate two phases. The supernatant used for methylation. Methyl esters prepared according [5] using Methanolic KOH. Methyl esters were analyzed using gas chromatography with Flame Ionization Detector and silica capillary column. Injector and detector temperatures were 250 and 260°C, respectively. Carrier gas was selected hydrogen. Programming temperature was: 150°C for 5 min, increasing to 175°C with 5°C/min and after 3 min, up to 190°C with 3°C/min. Temperature stayed at this point for 15 min.

IV. RESULTS AND DISCUSSION:

4.1. Fatty acid changes: As you seen at Table 3, cooking affected on oleic and linoleic acids in CB and linoleic and linolenic acids in SB which except for oleic acid in CB, other fatty acids decreased after cooking. In contrast, in the study of [6], there were no significant differences between the raw and heat treated samples that was due to lower time which they used to cook sausages. In comparison, we used 120 min for heating of samples using water steam. During refrigerated storage, two sausages showed different changes in their fatty acids, but when compared their trends, CB had lower changes and maintained its nutritional properties better, except for palmitic acid which after increase and decrease on days 15 and 30 in SB respectively, decreased at the end of storage in both batches. In CB, significant increases were observed in stearic acid on days 15 and 45 and in oleic acid on days 1, 15 and 45 of storage. Also, linolenic and linoleic acids showed significant decrease on days 1 and 45, respectively. In comparison with SB, after decreasing of stearic acid on day 15, its percentage increased on day 30 and then to begin to decrease at the end of storage. Changes of oleic acid were exactly the same as stearic. Linoleic and linolenic acid values decreased

until day 15, but increased at two last stages (days 30 and 45). All the time did not observed significant differences in trans fatty acids and their values remained at low level during refrigerated storage. [7] reported that no significant differences were found comparing the values obtained for both the total trans isomers and the single unsaturated trans fatty acids in the samples at the end of storage and in those stored for 40 days in vacuum packaging. According to [8], the added walnut to frankfurters caused an increase in percentage of PUFA, as observed significant increase in values of linoleic acid in SB, in comparison of CB, during time.

These results are in agreement to [9] which observed lower value of oleic acid in linseed containing sausages in comparison to control sausages and as expected the higher value of linoleic acid after 2 months of storage. Also similar to our study (Table 2), according to [10] Soybean oil contains higher percentage of PUFA than oleic acid. So in comparison, it is like to walnut and linseed oil. Between different fatty acids, decreasing order was: oleic, palmitic, stearic, linoleic and linolenic acid in both sausages, as observed in fresh meat samples [11]. This order observed in the pork sausages and so, the fatty acids oleic, palmitic and stearic were found in greater amount [6]. In comparison of two batches, Figure 1 shows differences between fatty acid values. At this biplot Figure of Principal Component Analysis, odd and even numbers are represented CB and SB, respectively. Also, numbers 11-15 are represented from palmitic acid-linolenic acids that are explained at Figure 1. On this Figure, PC1 and PC2 explain 80.80% and 13.50% of total variance, respectively. As seen at fig 1, SB set at the positive part of PC1 and has higher percentage of palmitic, stearic and linoleic acid and CB set at the negative part of PC1 and has higher value of oleic and linolenic acid than another one. From nutritional point of view, n-6/n-3 ratio in SB was higher than CB. This situation is due to higher linoleic acid content in Soybean oil because of lecithin [9]. [12] found that the time of aging in meat from 8 to 15 days, improved the ratio of n-6/n-3. They demonstrated that such result may be related to the differential lipolysis of intramuscular fat during refrigerated storage. The same result observed in our study and in SB on day 15. Also, in comparison of PUFA/SFA ratio between two sausages, SB had higher ratio than CB, but as the recommended PUFA/SFA is higher than 0.45 [13], both batches are in borderline limit. Thus this substitution could not improve nutritional properties (PUFA/SFA) of sausages.

V. CONCLUSIONS:

Fatty acid composition in CB had lower changes during heating and time than SB and two batches had PUFA/SFA ratio at borderline limit, but SB had higher n-6/n-3 ratio than another one which was closer to recommended value.

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REFERENCES

[1] James. S. J. JC. Meat refrigeration: Woodhead Publishing Ltd and CRC Press LLC 2002.

[2] Visessanguan W, Benjakul S, Riebroy S, Yarchai M, Tapingkae W. Changes in lipid composition and fatty acid profile of Nham, a Thai fermented pork sausage, during fermentation. Food Chemistry. 2006;94(4):580-8.

[3] Estévez M, Ventanas J, Cava R, Puolanne E. Characterisation of a traditional Finnish liver sausage and different types of Spanish liver pâtés: A comparative study. Elsevier 2005:657-69.

[4] Folch J, Lees M, Stanley GHS. A simple method for the isolation and purification of total lipides from animal tissues. Journal of Biology and Chemistry. 1957;226(1):497-509.

[5] ISO. Animal and vegetable Fats and Oils-Preparation of Methyle Esters of Fatty Acids. Method ISO 5509. International Organization for Standardization 2000.

[6] Baggio SR, Bragagnolo N. Cholesterol oxide, cholesterol, total lipid and fatty acid contents in processed meat products during storage. Elsevier 2006:513-20.

[7] Summo C, Caponio F, Pasqualone A. Effect of vacuum-packaging storage on the quality level of ripened sausages. Elsevier 2006:249-54.

[8] Ayo. J CJ, Serrano. J, Olmedilla-Alonso. B, Ruiz-Capillas. C, Jiménez-Colmenero. F. EVect of total replacement of pork backfat with walnut on the nutritional proWle of frankfurters. Meat Science. 2007(77):173-81.

[9] Valencia. I AD, Astiasara´n. I. Stability of linseed oil and antioxidants containing dry fermented sausages: A study of the lipid fraction during different storage conditions. Meat Science. 2006;73:269-77.

[10] Vaclavik VA, Christian EW. Essentials in food science: Springer Verlag 2007.

[11] Paleari MA, Moretti VM, Beretta G, Caprino F. Chemical parameters, fatty acids and volatile compounds of salted and ripened goat thigh. Elsevier 2008:140-8.

[12] Cifuni GF, Napolitano F, Riviezzi AM, Braghieri A, Girolami A. Fatty acid profile, cholesterol content and tenderness of meat from Podolian young bulls. Elsevier 2004:289-97.

[13] Pereira NR, Tarley CRT, Matsushita M, de Souza NE. Proximate Composition and Fatty Acid Profile in Brazilian Poultry Sausages. Journal of Food Composition and Analysis. 2000;13(6):915-20.

Table 1. Formulation

Ingredients	%
Beef meat	78.04
Water and ice	9.75
Oil	2.93
Salt	1.46
Phosphate	0.29
Nitrite	0.012
Red pepper	0.2
Garlic powder	0.49
Starch	3.9
Protein isolate	2.93
Sum	100

Table 2. Prominent fatty acids (g/100g total free fatty acids) in added meat and oils

Fatty acids	**Beef meat**	**Canola oil**	**Soya oil**
16:0	28.4456	6.1233	9.4625
18:0	1.2973	2.8186	4.0216
18:1	25.1093	63.5424	40.6984
18:2	43.3951	20.3333	37.6695
18:3	1.7528	7.1824	8.1480

Table 3. Prominent fatty acids (g/100g total free fatty acids) in two batches of sausages during storage

	Canola batch					**Soya batch**				
	Before cooking	**Day 1**	**Day 15**	**Day 30**	**Day 45**	**Before cooking**	**Day 1**	**Day 15**	**Day 30**	**Day 45**
16:0	22.9± 0.30	21.2± 0.24	19.98± 0.00	21.7± 0.00	19.94± 0.03	27.55± 0.46	26.52± 0.001	28.85± 0.16	25.88± 0.002	25.69± 0.00
18:0	13.18± 0.41	12.77± 0.06	13.57± 0.00	12.19± 0.00	13.43± 0.006	15.54± 0.31	17.24 0.003	14.06± 0.004	17.51± 0.002	16.73± 0.00
18:1	52.06± 0.1	53.54± 0.002	53.77± 0.00	52.35± 0.00	53.64± 0.04	38.3± 0.25	40.44± 0.002	42.06± 0.002	37.83± 0.003	36.96± 0.00
18:2	7.86± 0.22	9.23± 0.04	9.37± 0.00	9.77± 0.00	9.24± 0.05	16.12± 0.2	13.54± 0.0002	13.4± 0.07	15.89± 0.009	17.32± 0.00
18:3	3.73± 0.04	3.17± 0.02	3.31± 0.00	3.99± 0.00	3.64± 0.1	2.62± 0.003	2.27± 0.0004	1.77± 0.005	2.9± 0.003	3.31± 0.00
n-6/n-3	2.11	2.91	2.83	2.45	2.54	6.15	5.96	7.57	5.48	5.23
PUFA/SFA	0.32	0.36	0.38	0.41	0.39	0.44	0.36	0.35	0.43	0.49

Figure 1. Principal Component Analysis of two types of sausages (11=palmitic acid, 12=stearic acid, 13=oleic acid, 14=linoleic acid, 15=linolenic acid), odd numbers explain Canola batch and even numbers explain Soybean batch