

Using double emulsions to improve quality characteristics of beef sausage (#504)

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Introduction

Although meat cuts have become leaner, products such as ground beef, and various types of sausages have higher levels of fat [1]. Fat reduction in sausage formulations can be easily achievable by reducing fat directly. However, it is difficult to maintain technological and sensorial properties at high level. In recent years, W/O/W double emulsions (DE) are shown to have promising potential in reduced fat meat products because of their role in masking flavor, preventing oxidation and improving sensory properties [2,3,4]. W/O/W emulsions consist of an inner aqueous phase (W1) dispersed inside fat globules (O), which in turn are dispersed in an outer continuous aqueous phase (W2).

Nutrition organizations recommend in modern diets not only a certain limitation of fat intake but also a balance between saturated and unsaturated fatty acids [5]. In modern western diets n6/n3 ratio can be up to 15:1 but according to authorities this ratio should be lower than 10:1 [6]. Linseed oil (LO) is known as an oil which is consisted of n3 fatty acids while peanut oil (PO) is rich in n6 fatty acids [7]. Therefore, using PO/LO mixture in formulation can be good option to decrease n6/n3 ratio.

In this study, we targeted to search effects of fat reduction and fatty acid profile modification in emulsion type sausages by replacing beef fat with PO/LO combination in the form of W/O/W.

Methods

Four different emulsion type sausage formulations were prepared (Table 1). W/O/W emulsion was prepared based on two-stage homogenization method [2]. W1 phase consisted of 0.6% NaCl. W2 phase was prepared by dispersing 0.6% NaCl and 3% egg white powder (EWP) in water. O phase was consisted of 6.4% polyglycerol polyricinoleate and 93.6% PO/LO (10:1). Total expressible fluid (TEF) [8], processing yield (PY), water holding capacity (WHC) [8] and jelly-fat separation (JFS) [9] were analyzed. Sensory properties of sausages were evaluated in terms of appearance, texture, oiliness, taste, rancid taste and general acceptability (1: not like, 9: extremely like). Data was analyzed by ANOVA and Duncan Post-Hoc tests using the SPSS 23 software.

Results

Technological characteristics of samples are given in Table 2. There were no significant difference in relation to WHC ($p>0.05$). Thus, the results obtained in this research indicate that dietary ingredients can improve the yield of the sausages. Process yield was higher in W/O/W added samples than sausages formulated with 10 or 20% beef fat. Choi et al. [10] reported that

the yield depends on temperature, cooking time, ingredients, amount of fat in the products, and dietary fiber. Thus, the results obtained in our research indicate that fat type is also effected process yield. The lowest TEF and JFS values were obtain in sausages that beef fat was substituted with W/O/W in 100%. Similar results were obtained by Öztürk et al. [3] in model system meat emulsions.

Reducing fat can have negative sensory effects in meat products [11] but in our work using W/O/W in formulation showed contrast results (Table 3) and found significantly better than C20 sample in general acceptability ($p<0.05$).

Conclusion

The results of our study showed that use of DE provided advantages in production of fat reduced/modified beef sausages in terms of emulsion stability and sensory properties. Further researches are needed to investigate oxidative changes of DE addition to sausage formulation since oils can be easily oxidized.

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Groups	PY (%)	WHC (%)	TEF (%)	JFS (%)
C20	91.74 ^b ±2.31	97.47 ^a ±0.57	6.27 ^b ±0.16	7.83 ^b ±0.20
C10	91.91 ^b ±0.22	97.56 ^a ±1.22	5.98 ^b ±0.84	7.48 ^b ±1.04
WOW50	94.55 ^a ±0.23	97.84 ^a ±0.16	5.28 ^b ±0.33	6.61 ^b ±0.41
WOW100	95.87 ^a ±0.32	98.81 ^a ±0.17	1.39 ^a ±0.65	1.73 ^a ±0.80

Table 2. Technological characteristics a,b: different letters in the columns with same pattern are significantly different (P<0.05)

Groups	Beef meat (g)	Beef fat (g)	Double Emulsion (g)	Water (g)
C20	3000	1000	-	1000
C10	3000	500	-	1500
WOW50	3000	250	834.7	915.3
WOW100	3000	-	1669.4	330.6

Table 1. Formulation of sausage samples

C20 (Control, 20% beef fat), C10 (Control, 10% beef fat), WOW50 (5% beef fat+ 5% W/O/W) and WOW100 (10% W/O/W) Other ingredients: 1.5% Salt, 0.15% sugar, 0.15% sodium tripolyphosphate, 0.09% ascorbic acid, 150 ppm sodium nitrite, 3% powdered milk, 3% sodium caseinate, 4% starch, 1.5% bread crumbs, spices: 0.9%

Groups	Appearance	Texture	Oiliness	Taste	Rancid Taste	General Acceptability
C20	7.10 ^b ±0.57	6.70 ^a ±0.67	6.60 ^c ±0.51	6.60 ^b ±0.52	1.60 ^a ±0.52	6.50 ^b ±0.53
C10	7.70 ^{ab} ±0.82	6.00 ^a ±0.94	6.80 ^{bc} ±0.63	6.50 ^b ±0.85	1.30 ^a ±0.48	6.90 ^b ±0.57
WOW50	7.10 ^b ±0.99	6.20 ^a ±0.63	7.30 ^{ab} ±0.82	6.90 ^b ±0.88	1.40 ^a ±0.52	7.10 ^{ab} ±0.87
WOW100	8.10 ^a ±0.57	6.40 ^a ±0.69	7.60 ^a ±0.70	7.60 ^a ±0.52	1.60 ^a ±0.52	7.60 ^a ±0.52

Table 3. Sensory properties a,b,c: different letters in the columns are significantly different (P<0.05)

Notes