THE QUALITY OF RABBIT MEAT FRANKFURTERS WITH MODIFIED FATTY ACID COMPOSITION

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Background

Various studies suggest that rabbit meat has less fat and calories than beef, chicken, lamb and pork and also a lower cholesterol content (Lukefahr *et al.,* 1989; Youssef *et al.,* 1994). This characteristics, together with genetic factors and the possibility of manipulating the composition of the fatty acids through diet to better unsaturated:saturated ratio (P/S) means that rabbit meat could be valuable in human nutrition (Oliver *et al.,* 1997; Hernandez *et al.,* 2000; Piles *et al.,* 2000). Some studies have shown that rabbit meat can be successfully used in production of frankfurters, sausages and patties, alone or in combination with chicken, pork and lamb meat (Baker *et al.,* 1972; Kumar *et al.,* 1998). There is no information about possibilities of application mechanically recovered rabbit meat (MRM) produced from lower valued parts of rabbit carcass in producing of emulsion-type sausages with nutritionally better fatty acids composition (higher P/S) by using vegetable oils.

Objectives

The objective of this study was to asses the effect of various quality of rabbit MRM and substitution of pork fat with rape-oil on the sensory and instrumental quality parameters and fatty acids composition of frankfurters.

Methods

The experiment was conducted on four kinds of model rabbit frankfurters, each group prepared in four repetitions after following recipes: besides commercially prepared additives and spices frankfurters containing (i) 51,3% of mechanically recovered meat (MRM) from whole rabbit carcasses (W-MRM), 20% pork fat (PF) and 26% water; (ii) 51,3% W-MRM, 27% rape-oil (O) and 29% water; (iii) 51,3% MRM from front part of rabbit carcasses (F-MRM), 20% PF and 26% water; (iv) 51,3% F-MRM, 17% O and 29% water. MRM and O were commercially prepared. Frankfurters were prepared by Stephan UMC 5 electronic cutter, at 80% vacuum and till 14°C. Meat emulsion was stuffed in natural sheep's thin bowels and thermal treated by combined Fessmann Turbomat oven (T_{core}= 72 °C, t=120 min.). The chemical composition (water, fat, ash) of MRM and frankfurters was carried out. The sensory analysis of frankfurters was performed by a panel of four qualified assessors. The assessment was based on analytical descriptive tests whereas sensory attributes were evaluated on a scale made on the basis of a preliminary test. The attributes are scored on a scale from 1 to 7 where 1 point means that the attribute is either not sufficiently expressed or it is completely unacceptable, whereas 7 points means that the attribute is strongly expressed or it is regarded as excellent. Some attributes were scored by system 1 - 4 - 7 where 1 point means too low expressed attribute, 4 points mean an optimally expressed attribute and 7 points are given to too much expressed attribute. Sensory traits of frankfurters are listed in Table 1. Instrumental analysis of frankfurter's texture (compression and cutting value, elasticity II and I) was carried out by apparatus INSTRON, type 1111. Compression value (N) was measured as resistance of cylindrical sample (d= 10 mm, h=15 mm) to compression of 2/3 of high (10 mm) by compression cell. Cutting value (N) was measured as resistance of sample (1 cm thick slices) to cutting strength of blade shape cell (l= 10 mm). Elasticity I and II (mm) were measured as return of sample deformation (initial high 1.5 cm) after twice compression on 33% of high. The fatty acid (FA) composition of 16 frankfurters was determined by the method *in situ* transesterification modified after Park and Goins (1994) and by the capillary Gas-Liquid Chromatography. The data were analyzed by the method of the least squares using the GLM procedure (SAS, 1990). The statistical model for data acquired by physico-chemical and sensory analyses of rabbit meat and frankfurters included the effects of added fat (F_i; i = PF, O), type of mechanically recovered meat (MRM_j; j = W-MRM, F-MRM) and repetition (R_k; k = 1 – 4): $y_{ijk} = \mu + F_i + MRM_j + R_k + e_{ijk}$.

Results and discussion

Effect of MRM

Frankfurters prepared from different rabbit MRM (W vs. F) did not differ mostly in the all measured quality parameters, with exception of significantly higher fat and lower ash content in samples from whole carcass W-MRM (Table 1). Fatty acid composition of F-MRM frankfurters shows significantly higher share of SFA , PUFA, n-3 FA and n-6/n-3 ratio; higher P/S an lower atherogenic index (IA) express nutritionally favourable composition of frankfurters prepared from front part of rabbit carcass (Table 2).

Effect of fat

Rabbit frankfurters prepared with pork fat (PF) were scored significantly higher then rape-oil (RO) samples for majority of sensory traits, but the last were sensory highly acceptable too (Table 1). Rape-oil frankfurters (RO) show significantly paler colour (colour hue and intensity) and harder texture, but better emulsion stability and higher elasticity and fat content than PF samples. Substitution of pork fat with rape oil influences significantly the fatty acid composition of rabbit frankfurters (Table 2). RO samples contain significantly lower percent of SFA, higher percent of MUFA, PUFA, n-3 and n-6 fatty acids. Significantly higher P/S index (3.37 vs. 0.58) and lower IA (0.10 vs. 0.28) express better nutritional value of RO rabbit frankfurters.

We can conclude that rabbit mechanically recovered meat could be good raw material for producing emulsion-type sausages of acceptable sensory quality. Substitution pork fat with rape oil is technologically **unproblematic** and could be opportunity of preparing good emulsion-type sausages with favourable nutritional quality.

Pertinent literature

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Table 1.Quality parameters of frankfurters prepared from two types of fats and two types of rabbit mechanically recovered meat (MRM)

parameter	Fat			MRM		
	PF	RO	sig.	W	F	sig.
Chemical composition						
Rabbit meat						
Water (%)	69.01	69.57	**	69.45	69.14	ns
Fat (%)	11.37	10.70	**	10.75	11.31	*
Ash (%)	1.17	1.22	ns	1.04	1.35	***
Rabbit meat frankfurters						
Water (%)	61.43	60.99	ns	60.95	61.47	ns
Fat (%)	23.12	24.16	**	24.03	23.25	*
Ash (%)	2.44	2.39	ns	2.31	2.53	***
Sensory traits (points)						
Surface colour:						
Hue (1-7)	5.75	5.13	***	5.38	5.50	ns
Intensity (1-7)	5.48	5.10	***	5.21	5.38	ns
Uniformity (1-7)	5.56	5.27	*	5.52	5.31	ns
Cross-section colour:						
Hue (1-7)	5.96	5.13	***	5.46	5.63	ns
Intensity (1-7)	5.65	5.06	***	5.31	5.40	ns
Uniformity (1-7)	5.56	5.85	**	5.83	5.58	
Other traits:						
Touch feeling (1-7)	5.33	5.52	ns	5.58	5.27	
Emulsion stability (1-7)	5.90	5.94	ns	5.92	5.92	ns
Texture (1-4-7)	3.71	3.77	ns	3.81	3.67	ns
Smell (1-7)	5.85	5.66	*	5.83	5.69	ns
Flavour (1-7)	6.03	5.63	***	5.81	5.83	ns
After tastes (1-7)	1.13	1.27	ns	1.17	1.23	ns
Saltiness (1-4-7)	4.06	3.75	***	3.88	3.94	ns
Hardness (1-7)	3.98	3.81	ns	3.98	3.81	ns
Mouth feeling (1-7)	5.77	5.98	ns	5.94	5.81	ns
Sandiness (1-7)	1.29	1.54	*	1.38	1.46	ns
Juiciness (1-7)	5.90	5.75	ns	5.81	5.83	ns
Fattiness (1-7)	2.21	1.75	**	2.02	1.94	ns
Overall acceptability (1-7)	5.81	5.52	**	5.71	5.63	ns
Instrumental texture parameters						
Compression value (N)	22.92	23.14	ns	23.85	22.22	ns
Cutting value (N)	1.48	1.52	ns	1.55	1.45	ns
Elasticity I (mm)	3.72	3.90	*	3.81	3.80	ns
Elasticity II (mm)	3.35	3.70	***	3.57	3.64	ns

Levels of significance: ns, P>0.05; * P<0.05; ** P<0.01; *** P<0.001; MDM mechanically recovered meat; PF pork fat; RO rapes seed oil; W whole carcasses; F front parts of carcasses.

Table 2. Fatty acids composition of frankfurters produced from two types fat and two types rabbit MRM (as percents of total fatty acids)

	Fat			MRM		
Fatty acids	PF	RO	sig.	W	F	sig.
12:0	0.23	0.47	ns	0.55	0.14	**
14:0	1.30	0.72	***	0.90	1.13	*
14:1 n-5	0.40	0.40	ns	0.35	0.45	*
15:0	0.18	0.18	ns	0.17	0.19	ns
15:1 n-5	0.10	0.10	-	0.10	0.10	-
16:0 (aiso)	0.63	0.63	ns	0.60	0.65	ns
16:0	17.58	6.60	***	6.90	17.28	**
16:1 n-7	2.09	1.09	**	1.27	1.91	*
17:0	0.39	0.21	***	0.29	0.31	***
17:1 n-7	0.27	0.19	***	0.22	0.23	*
18:0	13.27	3.29	***	8.31	8.25	*
18:1 n-9	35.89	45.00	***	40.71	40.18	ns
18:2 n-6	14.72	25.96	***	18.84	21.85	***
18:3 n-6	0.28	0.23	ns	0.23	0.28	ns
18:3 n-3	1.83	6.88	***	4.32	4.40	ns
18:4 n-3	0.12	0.23	***	0.16	0.19	*
20:0	0.25	0.43	***	0.34	0.34	ns
20:1 n-9	1.16	1.64	***	1.40	1.40	ns
20:2 n-6	0.73	0.16	***	0.44	0.46	ns
20:3 n-6	0.13	0.40	***	0.21	0.31	**
20:4 n-6	0.49	0.26	***	0.37	0.38	*
20:3 n-3	0.12	0.23	***	0.16	0.19	*
20:5 n-3	0.85	0.15	***	0.45	0.55	*
22:0	0.25	0.28	ns	0.29	0.24	ns
22:1 n-9	0.23	2.32	***	1.39	1.16	ns
22:2 n-6	0.40	0.33	ns	0.38	0.35	ns
22:5 n-3	0.29	0.60	***	0.52	0.37	**
22:6 n-3	0.23	0.26	ns	0.32	0.18	ns
SFA	34.07	12.78	***	18.32	28.53	**
MUFA	39.87	50.54	***	45.21	45.2	Ns
PUFA	20.17	35.67	***	26.22	29.64	**
n-3	3.44	8.35	***	5.76	6.02	*
n-6	16.64	27.61	***	20.44	23.79	***
n-6/n-3	4.73	3.31	***	3.59	4.46	***
P/S[a]	0.58	3.37	***	2.65	1.59	***
IA[b]	0.28	0.10	***	0.14	0.24	**

[a] P/S = PUFA/SFA;
[b] IA = atherogenic index = (C12 + 4 C14 + C16 + Trans FA) / (PUFA + C18:1 + other MUFA) (Ulbricht *et all.*, 1991);
levels of significance: ns, P>0.05; * P<0.05; ** P<0.01; *** P<0.001; MRM mechanically recovered meat; PF pork fat; RO oil; W whole carcasses; F front parts of carcasses.