The reduction of Na and fat levels in traditional breakfast sausages developed for the elderly and the effects on physiochemical and sensory properties

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Abstract

The aim of this study was to investigate the sensory (Affective and Descriptive) differences between young (18-40 yrs. old), middle aged (41-65 yrs. old) and elderly (65-85 yrs. old) respondents for traditional breakfast sausages with varying NaCl and fat levels. Eight sausages were produced along with one control (triplicate batches) they varied in fat (15-30%) and NaCl levels (0-2.50%). Additionally, colour, moisture, fat, cooking loss and texture profiling analysis were assessed. Assessors evaluated each product in duplicate for colour, texture, tenderness, juiciness, salt taste, meat flavour, off flavour & overall acceptability (hedonic scale).

There are differences between the sensory preferences of various age cohorts when sodium and fat are varied in traditional breakfast sausages. The youngest age group significantly preferred the control group. The middle aged group had a preference for the low fat, but not the low salt sausages. The older assessors (41-65+) preferred lower salt variants. Thus it is possible to further optimise traditional sausages by reducing salt further if required. Additionally the salt replacer Velona was positively perceived by the oldest age cohort (65+).

Key Words – Cardiovascular disease, Sarcopenia, Sensory.

I. INTRODUCTION

According to the Irish Universities Nutrition Alliance – IUNA 39 % of the Irish population aged 18-64 years old consume sausages and 31 % of those aged 65 years old and over consume sausages. Taste (41%) was the most important factor for Irish consumers purchasing a product, followed by health and nutrition (36%) [1]. these findings demonstrate the Irish consumer's reluctance to compromise on taste. Tuorila et al 2001 [2] has demonstrated a lack of willingness to try new food products by the elderly, which is termed 'food neophobia' or reluctance to try new foods.

Additionally, elderly often do not eat meat due to dentures, sensory decline, and lack of hand functioning, medications or cooking ability. This puts them at a great risk of sarcopenia. Sarcopenia is a syndrome characterised by progressive and generalised loss of skeletal muscle mass and strength, with a risk of adverse outcomes such as physical disability, poor quality of life and death [3]. Thus, every effort should be adhered to incorporate protein into their diet.

Meat and meat products are a food source high in nutrients such as protein, vitamin B12, iron, vitamin B6 and magnesium. They are also a source of fat and salt. A high intake of meat, particularly those with a high level of sodium and animal fat like sausages, are not recommended from a health point of view [4] & [5]. The main aim of this study was to identify sensory and nutritionally optimised traditional processed meat products for all cohorts, in particular the elderly.

II. MATERIALS AND METHODS

Sample Preparation

Fresh boneless pork and pork back fat were purchased from local processors (Ballyburden Meats Ltd, Ballincollig, Cork, Ireland.) The meat and fat were cut, weighed and placed into vacuum packs accordingly. They were stored in the freezer (-18 ° C). Prior to use the meat and fat were thawed slightly at refrigerated temperature (4 ° C) before being minced through a 10 mm plate (TALSABELL S. A., Spain).

The ingredients were weighed according to the formulations in table 1. The pork, the seasoning, salt, pea starch, and a third of the required water were fed into a bowel chopper and mixed at high speed for 45 seconds (s). The required fat was then added to the bowel chopper and the mix was

chopped for a further 45 s. at high speed. The remaining water was added for 30 s. at high speed. Finally the pin head rusk was added for 30 s at low speed. The sausage mix was then put into the casing filler and fed into collagen casings. The sausages were the sealed in vacuum pack bags and refrigerated overnight (4° C).

Table 1: % of ingredients for sausage manufacture

Sample	Velona	Fat	Pork	Water	Rusk	NaCl	Starch	Seasoning
F30: S:2.5 V:0	0	30	35	17.5	12.5	2.5	0	2.5
F15: S:0 V:1.13	1.13	15	35	33.37	12.5	0	0.5	2.5
F15: S:1.13 V:0	0	15	35	33.37	12.5	1.13	0.5	2.5
F15: S:0 V:1	1	15	35	33.37	12.5	0	0.5	2.5
F:15 S:1 V:0	0	15	35	33.37	12.5	1	0.5	2.5
F:20 S:0 V:1.13	1.13	20	35	28.37	12.5	0	0.5	2.5
F:20 S:1.13 V:0	0	20	35	28.37	12.5	1.13	0.5	2.5
F:20 S:0.13 V:1	1	20	35	28.37	12.5	0	0.5	2.5
F: 20 S: 1 V:0	0	20	35	28.37	12.5	1	0.5	2.5

F: % of fat, S: % of NaCl, V: % Velona.

Sensory Evaluation

Sensory analysis was carried out on 228 participants. The sample size of the three age cohorts were 18 – 40 yrs. (n = 81), 41-64yrs (n = 104) and 65-85 yrs. (n = 43). Each panellist rated the sensory qualities of the samples (in duplicate on triplicate batches) according to the methodology of the American Meat Science Association [6] & [7]. The attributes are outlined in Table 2.

Protein content

Protein was determined using the Kjeldahl method [8].

Moisture and Fat

A 200 g of sausage sample was homogenised using a Büchi Mixer B-400 (Büchi Labortechnik AG, Meierseggstrasse 40, Postfach, CH-9230 Flawil 1, Switzerland. The moisture content was then determined using the CEM SMART system and the fat was determined using the SMART Trac system [9].

Texture Properties

The texture was measured using texture profile analyses Texture Analyser 16 TA-XT2I (Stable Micro Systems, Surrey, UK) following Bourne M 1978 procedures [10].

Statistical analysis

The data obtained from the sensory, the instrumental and the compositional trials were analysed using ANOVA – Partial Least Squares Regression (APLSR) using Unscrambler software version 10.3. (CAMO ASA, Trondheim, Norway).

III. RESULTS AND DISCUSSION

The results of the consumer sensory evaluation are presented in table 2. This table features the P values of the regression co-efficients.

Table 2: P values of estimated regression coefficients for the relationships of sensory terms and various age groups for each sample.

Age	Sample	Texture	Saltiness	Spiciness	Flavour	Colour	Acceptable	Coarse	Tough	Juicy	Meat	Off
(18-40)	F30: S:2.5 V:0	0.00***	0.01**	0.80	0.12	0.01**	0***	0.03*	0.17	0.77	0.91	0.07
	F15: S:0 V:1.13	0.02*	0.11	0.68	0.68	0.83	0.21	0.85	0.64	0.94	0.93	0.59
	F15: S:1.13 V:0	0.15	0.01**	0.81	0.55	0.99	0.33	0.12	0.72	0.30	0.20	0.77
	F15: S:0 V:1	0.80	0.11	0.13	0.63	0.15	0.96	0***	0.83	0.54	0.44	0.38
	F:15 S:1 V:0	0.24	0.66	0.19	0.31	0.76	0.66	0.07	0.69	0.06	0.15	0.52
	F:20 S:0 V:1.13	0.12	0.68	0.22	0.48	0.00	0.02	0.04*	0.67	0.84	0.80	0.33
	F:20 S:1.13 V:0	0.36	0.15	0.93	0.82	0.87	0.54	0.65	0.78	0.61	0.51	0.80
	F:20 S:0.13 V:1	0.23	0.08	0.11	0.82	0.07	0.86	0.08	0.69	0.86	0.79	0.90
	F: 20 S: 1 V:0	0.07	0.11	0.42	0.32	0.60	0.22	0.53	0.66	0.70	0.82	0.61
(41-65)	F30: S:2.5 V:0	0.67	0.57	0.45	0.47	0.49	0.49	0.24	0.85	0.24	0.31	0.78
	F15: S:0 V:1.13	-0.21	-0.23	-0.10	0.11	-0.11	-0.06	-0.66	-0.91	-0.28	-0.29	-0.84
	F15: S:1.13 V:0	0.76	0.04*	0.41	0.35	0.94	0.47	0.02*	0.94	0.10	0.03*	0.93
	F15: S:0 V:1	-0.49	-0.81	-0.10	-0.83	-0.17	-0.44	-0.09	-0.79	-0.81	-0.74	-0.55
	F:15 S:1 V:0	-0.35	-0.60	-0.06	-0.86	-0.40	-0.55	-0.30	-0.79	-0.65	-0.57	-0.67
	F:20 S:0 V:1.13	-0.25	-0.17	-0.89	-0.49	-0.10	-0.83	-0.08	-0.74	-0.65	-0.68	-0.80
	F:20 S:1.13 V:0	-0.22	-0.25	-0.52	-0.36	-0.22	-0.83	-0.16	-0.71	-0.54	-0.63	-0.72
	F:20 S:0.13 V:1	0.83	0.96	0.02	0.37	0.30	0.70	0.54	0.87	0.29	0.23	0.69
	F: 20 S: 1 V:0	0.70	0.48	0.07	0.34	0.84	0.48	0.94	0.98	0.72	0.79	0.95
(65+)	F30: S:2.5 V:0	0.41	0.61	0.53	0.87	0.89	0.90	0.55	0.27	0.99	0.94	0.16
	F15: S:0 V:1.13	0.82	0.30	0.79	0.84	0.36	0.15	0.11	0.89	0.29	0.46	0.78
	F15: S:1.13 V:0	-0.70	-0.88	-0.01**	-0.02*	-0.64	-0.28	-0.13	-0.79	-0.14	-0.27	-0.73
	F15: S:0 V:1	-0.01**	-0.99	-0***	-0.05*	-0.61	-0.20	-0***	-0.54	-0***	-0***	-0.36
	F:15 S:1 V:0	-0.02*	-0.15	-0***	-0.01**	-0.84	-0.08	-0.17	-0.39	-0.03*	-0.01**	-0.49
	F:20 S:0 V:1.13	-0.60	-0.91	-1.00	-0.89	0.47	-0.55	-0.34	-0.68	-0.48	-0.69	-0.56
	F:20 S:1.13 V:0	-0.03*	-0.01**	-0***	-0.02*	-0.87	-0.04	-0.93	-0.72	-0.18	-0.16	-0.85
	F:20 S:0.13 V:1	-0***	-0***	-0***	-0.01**	-0.65	-0.01	-0.80	-0.35	-0.09	-0.07	-0.48
	F: 20 S: 1 V:0	-0.09	-0.06	-0***	-0.02*	-0.91	-0.15	-0.74	-0.56	-0.16	-0.16	-0.80

Significance of regression coefficients * = P ≤ 0.05, ** = P ≤ 0.01, *** = P ≤ 0.001. $^{-}$ Dictates weather the correlation is negatively correlated.

The 18-40 age group, had a strong preference ($P \leq 0.001$) for the overall acceptability and the texture of the control sample (F: 30, S: 2.5, V: 0). this age group was able to differentiate between the control group and the other samples. This sample was also positively correlated for salt flavour ($P \leq 0.01$), colour ($P \leq 0.01$) and coarseness ($P \leq 0.5$).They had a preference ($P \leq 0.05$) for the texture of samples containing 15% fat, 0% NaCl, 1.13 % Velona. They also had a preference for the salt taste in samples containing 15 % fat, 1.13 % NaCl, and 0 % Velona and a preference for coarseness in the samples containing 15% fat, 0% NaCl, & 1% Velona as well as the sample that contained 20% fat, 0% NaCl & 1.13 % Velona.

The 41-65 year old age group had a preference for samples containing 15 % fat, 1.13 % NaCl & 0 % Velona. This sample was positively correlated ($P \leq 0.05$) for salt flavour, coarseness and meat flavour.
The 65+ age category had many negative significant correlations. This age group disliked the spicy flavour ($P \leq 0.01$) and the overall flavour ($P \leq 0.05$) of the sample containing 15 % fat, 1.13 % NaCl & 0 % Velona. They disliked the texture ($P \leq 0.01$), spiciness ($P \leq 0.001$), the overall flavour ($P \leq 0.05$), coarseness ($P \leq 0.01$), juiciness ($P \leq 0.001$) and the meat flavour ($P \leq 0.001$) of the sample containing 15 % fat, 0 % NaCl & 1 % Velona.

This age group disliked the sample containing 15 % fat, 1% NaCl & 0 % Velona for texture ($P \leq 0.05$), spicy flavour ($P \leq 0.001$), overall flavour ($P \leq 0.01$), juiciness ($P \leq 0.05$) and meat flavour ($P \leq 0.01$). They disliked texture ($P \leq 0.05$), salt flavour ($P \leq 0.01$), spicy flavour ($P \leq 0.001$), and overall flavour ($P \leq 0.05$) of the samples containing 20 % fat, 1.13% NaCl & 0 % Velona. They disliked the sample containing 20 % fat, 0 % NaCl & 1% Velona for texture ($P \leq 0.001$), salt flavour ($P \leq 0.01$), spicy flavour ($P \leq 0.001$) and overall flavour ($P \leq 0.05$). They disliked the sample containing 20 % fat, 1 % NaCl & 0 % Velona for spicy flavour ($P \leq 0.001$) and overall flavour ($P \leq 0.01$).
Results did not differ with varying fat and salt levels.

IV. CONCLUSION

The 18 – 40 age group were able to differentiate between the control and the other samples. This may be due to a better sensory acuity than the older age groups. The 41-65 age groups preferred the samples without Velona. They had a preference for the low salt samples but not for the low fat samples. The elderly category disliked samples where the salt replacer Velona was not used and thus a general trend towards lower salt products containing this salt replacer. Thus it appears that older assessors (41-65+) preferred lower salt variants. This is a positive finding indicating it is possible to further optimise traditional sausages by reducing salt further if required. Additionally the salt replacer Velona was positively perceived by the oldest age cohort (65+).

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