

EVALUATION OF THE POSSIBILITY OF APPLICATION OF PORK HAMS WITH PSE SYNDROME TO PRODUCTION OF DRY CURED HAMS

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Introduction

It is the common view that the production of dry cured hams, which mature (ripen) in the raw state, needs specific raw material, without PSE syndrome, with a high level of marbling (fat content > 3.5% and fat acid components with high resistance to oxidation, available mainly in the Mediterranean region from traditional, extensive breeding). In Poland, conditions exist to produce such raw material using traditional breeds like pulawska, wielka biala, zlotnicka and their cross-breeding with the duroc race, but the most widely available is the raw material from no race (race-less) breeding, often with PSE syndrome, which results in its lower processing possibilities, not to mention hams, which mature (ripen) in the raw state. In our institute an attempt has been made to evaluate if such raw material is suitable for the production of hams, which mature (ripen) in the raw state.

Materials and Methods

In the trial, the model production of hams, which mature (ripen) in the raw state, made of meat from fatteners (baconers) of three groups has been carried out: 1 – with deep PSE syndrome (pH₄₅ – av. 5.6) code PSEM, 2 – with mild PSE syndrome (pH₄₅ – av. 5.9) code PSES, 3 – of good quality (pH₄₅ – av. 6.5) code NORM. The number of hams in each group was 10. The production of smoked hams, which mature (ripen) in the raw state, has been carried out by the traditional “dry” method consisting of rubbing raw hams with a mix of salt with nitrite and nitrate curing mix, with the additions of starter cultures and a mix of sugar and spices. The production process lasted about 52 days and the finished product was obtained in about 75% yield. In the finished product the following elements were tested: weight after the production process (yield), pH, colour parameters (L, a*, b*), chemical composition (water content, proteins, fat, NaCl, NaNO₂, sum of NaNO₂ and NaNO₃), rheological characteristics using the CASRA method (plasticity – P, elasticity – E, fluidity – F, minimum deformation – D_{min} and plastic deformation – D_{plast}) as well as the sensorial profile analysis were carried out and the internal concentration of brine and the Feder number have been calculated. The obtained results were subjected to statistical tests, including analysis of variance.

Results and Discussion

It has been stated that the samples of the PSEM hams had substantially higher finished product weights, a substantially lower pH measured in the semimembranosus muscle and a substantially higher clearness parameter “L”, compared to the PSES and NORM hams (Table 1). The majority of chemical parameters did not show substantial differentiation (variety) for the tested trial variants (P<0.05).

Table 1: Physical and colour parameters of dry cured hams.

Variant	Mass [kg]	pH 1	pH 2	pH 3	L	a*	b*
PSEM	3.22 ^b	5.47 ^a	5.57	5.50 ^a	44.28 ^b	7.84	8.74
PSES	2.90 ^a	5.59 ^b	5.66	5.56 ^{ab}	41.76 ^a	7.66	8.06
NORM	2.77 ^a	5.62 ^b	5.66	5.64 ^b	42.64 ^{ab}	7.03	8.75
LSD	0.29	0.10	0.15	0.12	2.38	1.39	0.70

P<0.05, PSEM – hams with deep PSE syndrome (mean pH₄₅ - 5.6), PSES – hams with mild PSE syndrome (mean pH₄₅ - 5.9), NORM – hams of good quality (mean pH₄₅ - 6.5), pH 1 – *m.semimembranosus*, pH 2 – *m.semitendinosus*, pH 3 – *m.biceps femoris*

Only the concentration of NaCl and – consequently – brine concentration were substantially lower for the samples of the PSEM hams with very high PSE (Table 2). The rheological parameters of the tested samples due to the type of raw material were on the same level as well, except for the substantially lower D_{plast} of the PSES variant. However, rheological parameters of the tested samples differed according to the muscle type used. The semitendinosus muscle (*m.semitendinosus*), in all the tested variants of hams, was characterised by substantially lower plasticity and substantially higher elasticity, liquidity, minimum deformation D_{min} and plastic deformation D_{plast} compared to the semimembranosus muscle (*m.semimembranosus*) and biceps (*m.biceps femoris*) (Table 3). All the above testifies to the fact that the semitendinosus muscle is more delicate which, most probably, is connected with the higher degree of marble-like structure evaluated visually (higher fat and collagen contents).

Table 2: Chemical characteristics of tested dry cured hams.

Variant	Water content [%]	Protein content [%]	Fat content [%]	Feder's number	NaCl content [%]	Brine Conc. [%]	NaNO ₂ [g/kg]	NaNO ₂ +NaNO ₃ [g/kg]
PSEM	61.48	28.84	5.54	2.13	4.07 ^a	6.23 ^a	27.88	108.66
PSES	60.08	27.90	6.62	2.16	4.76 ^b	7.35 ^b	35.74	105.36
NORM	59.78	28.56	6.18	2.10	4.45 ^{ab}	6.93 ^{ab}	12.16	118.30
LSD	1.84	2.01	3.47	0.13	0.64	1.05	47.70	24.26

$P \leq 0.05$, PSEM – hams with deep PSE syndrome (mean pH₄₅ -5.6), PSES – hams with mild PSE syndrome (mean pH₄₅ - 5.9), NORM – hams of good quality (mean pH₄₅ - 6.5).

Table 3: Rheological characteristics of dry cured hams.

Factor	Variant	Plasticity [x10 ⁵ Nm ⁻²]	Elasticity [x10 ⁻⁶ m ² N ⁻¹]	Fluidity [x10 ⁻⁸ m ² N ⁻¹ s ⁻¹]	D _{min} [%]	D _{plus} [%]
Type of hams	PSEM	17.10	1.11	3.16	11.36	85.90 ^b
	PSES	17.73	1.16	3.08	10.83	83.37 ^a
	NORM	16.07	1.21	3.38	11.15	87.43 ^b
	LSD	1.45	0.13	0.28	1.56	2.45
Type of musculus	<i>m. semimembranosus</i>	17.01 ^b	1.13 ^b	2.97 ^b	9.44 ^a	83.41 ^a
	<i>m. semitendinosus</i>	13.00 ^a	1.44 ^c	4.26 ^c	13.72 ^b	90.61 ^b
	<i>m. biceps femoris</i>	20.89 ^c	0.91 ^a	2.40 ^a	10.17 ^a	82.68 ^a
	LSD	1.45	0.13	0.28	1.56	2.45

$P \leq 0.05$, PSEM – hams with deep PSE syndrome (mean pH₄₅ -5.6), PSES – hams with mild PSE syndrome (mean pH₄₅ - 5.9), NORM – hams of good quality (mean pH₄₅ - 6.5)

The results need to be confirmed in future research work. The sensorial evaluation has shown that the majority of the evaluated features for all the variants were on the same level. The only substantial differences have been stated in colour intensity and in the desirability of taste (hedonic rating). The PSEM hams were characterised by a substantially higher colour intensity and substantially lower desirability of taste (hedonic rating) compared to other variants. The overall hedonic rating > 6.5 confirms the high quality of tested trial variants of dry cured hams. The highest overall hedonic rating was that of the PSES variant with mild PSE syndrome (Table 4).

Table 4: Sensory analysis of tested dry cured hams.

Variant	marble-like structure [c.u.]	Odour intensity [c.u.]	Odour desirability [c.u.]	Colour intensity [c.u.]	Colour desirability [c.u.]	Taste intensity [c.u.]	Saltiness [c.u.]	Acidity [c.u.]	Consistency intensity [c.u.]	Consistency desirability [c.u.]	Overall hedonic rating [c.u.]
PSEM	2.38	6.81	6.41	6.38 ^b	6.53	6.08 ^a	4.71	3.77	4.57	6.42	6.67
PSES	2.59	6.86	6.57	6.08 ^{ab}	6.63	6.53 ^b	4.93	3.85	4.73	6.60	6.93
NORM	2.63	6.88	6.16	5.77 ^a	6.26	6.33 ^{ab}	4.96	3.92	4.52	6.45	6.69
LSD	0.57	0.36	0.51	0.48	0.44	0.34	0.62	0.62	0.65	0.35	0.38

$P \leq 0.05$, PSEM – hams with deep PSE syndrome (mean pH₄₅ -5.6), PSES – hams with mild PSE syndrome (mean pH₄₅ - 5.9), NORM – hams of good quality (mean pH₄₅ - 6.5)

Conclusions

From the presented test results we may conclude that, contrary to common opinion, hams, of sufficient consistency and good sensorial quality, which mature (ripen) in the raw state, may be produced from raw material with PSE present. The above observation should be confirmed in future research work and better documented. Confirmation of the obtained results may provide a valuable guideline for the industry.