QUALITY ESTIMATION OF PORK MUSCLES USING THE COMPLEX INDEX

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Reseach and experimental studies as well as the practical work of plants revealed considerable variances in quality of separate cuts received as from different pork carcasses as from one and the same carcass. Analyzing changes of pH values in separate cuts of half-carcasses, those values occurred to be inadequate relating to M. long. dorsi. Other muscles differred to a large degree from M. long. dorsi, if taking into account its food, mechanical, structural and other properties. In the given study, results of quality estimation of pork muscles were summarized. The ultimate aim was to arrange muscles according to the degree of their quality determined by the complex of single indices.

11 muscles were separated from pig half-carcasses of the second grade with PSE, NOR and DFD characteristics. The following cuts were analyzed: fore cut (contained muscles: 1 - infraspinatus, 2 - supraspinatus, 3 - triceps brachii, 4 - cervical), middle cut (contained muscles: 5 - longissimus dorsi, 6 - eye muscle of loin), hind cut (contained muscles: 7 - mid-buttock muscle, 8 - quadriceps femoris, 9 - biceps femoris, 10 - semitendinosus, 11 - semimembranosus). Technological, mechanical and structural properties as well as consumer and nutritive value appeared to be the essential properties of the raw meat, therefore 16 single indices were used for the analysis, because they related to mentioned properties and were received by means of well-known and tested methods.

However some of 16 single indices received in the experiment duplicated the showing, therefore 10 single indices were chosen similar to those used by estimating beef muscles (1). They characterized the chemical content (total protein - Y1, connective tissue - Y2 and fat - Y4), colour (light - Y5, pink - Y6 and yellow -Y7), mechanical and structural properties (modulus of elasticity - Y12, tension by axial compression - Y13, ratio of maximum shear force to cross-sectional area of the sample). All mentioned indices were taken into account, while estimating complex index of quality by methods of rating.

Harrington functions with one- and two-side limitations were used for plotting single indices of quality on the scale of rating. Initial points on the scale of rating, coefficients b0, b1 & n for single indices were summarized in Table 1.

Table 1

Initial points and pattern coefficients for single indices

Indices	Single indices value shown on numerical scale: h = 0.333	h = 0.667	Coefficients: b0	b1	n
For one-side limitations					
Y1	13.0	16.0	-4.414	0.332	-
Y3	4.0	3.0	3.894	-0.997	-
Y4	26.0	12.0	1.757	-0.071	-
Y6	28.0	18.0	2.697	-0.10	-
Y8	49.0	66.0	-3.159	0.062	-
Y12	2200.0	1600.0	3.561	-0.002	-
Y13	370.0	270.0	3.595	-0.010	-
Y16	165.0	115.0	3.196	-0.020	-

For two-side limitations

Indices	Y_{min}	Y_{max}	Y	h	b0	b1	n
Y5	32.0	57.0	48.0	0.995	3.560	-0.080	4.160
Y7	5.0	14.0	9.3	0.999	2.111	-0.222	2.218

It should be noted that initial points for single indices were chosen proceeding from the assumption that ratios of the greatest value of a single index to its least value were to be equal in actual and numerical scales. The complex index was estimated according to following patterns: - additive pattern: IA = h(j)/m ; - multiplicative pattern: IM=h(1)*h(2)*.. ..*h(m), where h(j) is j-th value of the single index characterizing muscle quality, m - number of single indices used by estimating the complex index. Complex indices for various muscles were summarized in Table 2.

Table 2

Values for complex indices

Muscle number	Absolute values for complex indices						Ratio to the least value					
	IM			IA			IM			IA		
	NOR	PSE	DFD	NOR	PSE	DFD	NOR	PSE	DFD	NOR	PSE	DFD
1	0.600	0.593	0.489	0.648	0.637	0.548	1.23	1.21	1.0	1.18	1.16	1.0
2.	0.708	0.681	0.640	0.727	0.697	0.673	1.45	1.39	1.31	1.33	1.27	1.23
3.	0.753	0.716	0.698	0.763	0.727	0.712	1.54	1.46	1.43	1.39	1.33	1.30
4.	0.688	0.706	0.640	0.722	0.751	0.678	1.41	1.44	1.31	1.32	1.37	1.24
5.	0.855	0.846	0.838	0.858	0.849	0.843	1.75	1.73	1.71	1.56	1.55	1.54
6.	0.870	0.855	0.836	0.874	0.858	0.841	1.78	1.75	1.71	1.60	1.56	1.53
7.	0.782	0.727	0.770	0.797	0.744	0.777	1.60	1.49	1.57	1.45	1.38	1.42
8.	0.815	0.763	0.712	0.822	0.773	0.731	1.67	1.56	1.46	1.50	1.41	1.33
9.	0.803	0.808	0.785	0.813	0.818	0.790	1.64	1.65	1.60	1.48	1.49	1.44
10.	0.833	0.839	0.834	0.842	0.846	0.841	1.70	1.71	1.70	1.54	1.54	1.53
11.	0.861	0.859	0.821	0.866	0.865	0.831	1.76	1.76	1.68	1.52	1.58	1.52

Analysis of values for single indices revealed insignificant differences between contents of the total protein and connective tissue protein. Only neck muscle had 4.6% less protein than M. longissimus dorsi. More significant differences were observed in the fat content and mechanical and structural properties of muscles. Ratios of the greatest values for single indices to the least values were correspondingly equal to: Y4-3.84, Y12-3.70, Y13-3.16, Y14-2.06, Y15-1.46, Y16-2.60. Significant differences were revealed among single indices of muscles separated from carcasses having non-identical properties. Thus, water-binding ability of NOR muscles was 6% higher than in PSE muscles, but 6% less than in DFD muscles. The analogical picture was observed relating to mechanical and structural properties. Factually PSE muscles had less values, whereas DFD muscles had greater values in comparison with the same properties of NOR muscles. In particular, corresponding values were 5.8% and 10.3% for long modulus of elasticity, 4.8% and 8.9% for tension by axial compression, 3.7% and 1 (0.9)% for ratio of maximum shear force to cross-sectional area of the sample. As to colour indices, another regularity was observed: DFD muscles had the greatest value (20.9) for colour intensity.(lightness), whereas PSE muscles had the greatest values for pink colour (44.7) and for yellow colour (11.0). Analysis of complex indices showed that the additive index was less sensitive to the variation of single indices (ratio of the greatest value to the less value was equal to 1.60), than the multiplicative one (above ratio was equal to 1.78). As a matter of fact, complex indices analyzed smoothed out differences among muscules in comparison with single indices: Y4, Y12, Y14 and Y16. On the average NOR muscles had higher values IM=0.78 and IA=0.79, than PSE muscles: IM=0.76 and IA=0.78; DFD muscles: IM=0.73 and IA=0.75. Muscles tested were divided into three groups of quality by IM values: 1. value IM$>$0.82 - for muscles 5, 6, 10, 11; 2. value 0.71$<$IM$<$0.82 - for muscles 3, 7, 8, 9; 3. value IM$<$0.71 - for muscles 1, 2, 4. Because of evident differences in muscle quality the necessity appeared to choose as ways of use for any particular muscle as methods of their processing taking into account not only a concrete part of the half-carcass (a cut) but its individual properties (NOR, PSE, DFD) as well. Recommended principles and patterns of estimating complex indices may be used for grounding and optimizing receipts of new products, for improving and optimizing technological parameters for processing muscle tissue and choosing adequate equipment, as well as for grounding and fixing prices for raw material, products etc.

References:

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