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Molecular biomarkers to discriminate pork quality classes based on sensory and technological attributes

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INTRODUCTION & OBJECTIVE

Meat quality (MQ) is a complex phenotype assessed by different indicators measured by using costly and/or invasive analyses. Early post-mortem (p.m.) biomarkers of MQ have been identified, however they refer to single MQ indicators but not to the overall quality level of pork samples.

The aim of the present study was to determine sensory and technological pork quality classes and then to determine combinations of early p.m. biomarkers discriminating between quality classes in order to predict MQ level of pork loins in meat industries.

RESULTS

Determination of pork quality classes

Among MQ traits, the 4 most discriminant ones: pH30, pHu, IMF and drip loss were selected to determine 3 quality classes: Low (acid or acid-tendency and PSE or PSE-tendency defected meat), Acceptable, or Extra (low drip and high IMF) that exhibited high sensory and technological qualities.

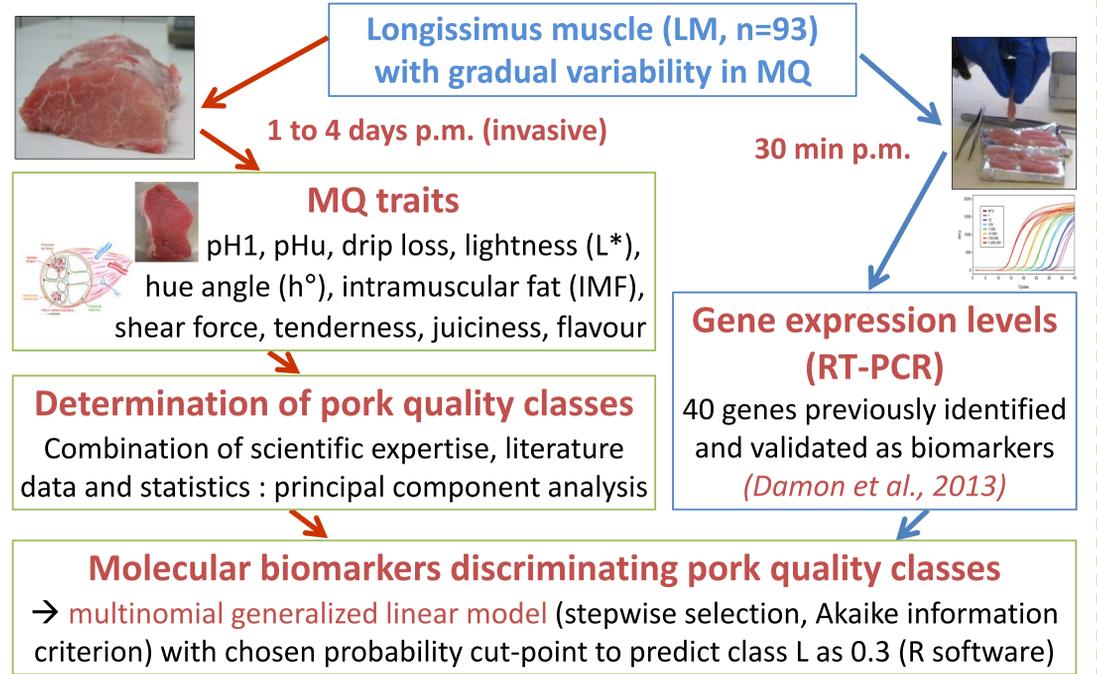
Characteristics of pork quality classes

Quality trait	Low	Acceptable	Extra	Sign ¹ .
n	34	25	34	
pH1 (30 min) ²	6.39 a	6.48 b	6.59 c	***
pHu ²	5.43 a	5.57 b	5.66 c	***
Drip loss 1-3 d, % ²	2.52 c	1.84 b	0.65 a	***
IMF, % ²	2.90 a	2.71 a	3.67 b	**
Lightness	54.3 b	51.3 b	49.5 a	***
Hue angle, °	37.6 b	35.8 b	31.5 a	***
Shear force, N	28.8	29.2	26.2	P=0.11
Tenderness ³	4.07 a	4.40 ab	4.92 b	***
Juiciness ³	2.81 a	3.19 ab	3.36 b	*
Flavour ³	4.24	4.40	4.43	ns

¹ Differences in MQ traits between quality classes were analyzed by Anova. ***: P<0.001; **: P<0.01; *: P<0.05; ns: P>0.05. In a row values with different letters differed (P<0.05). ² Traits used to establish pork quality classes.

³ Scored on a 0 (low) to 10 (high intensity) scale.

MATERIAL & METHODS



Model predicting pork quality classes

The multinomial generalized linear model to predict pork quality classes selected the expression levels of 12 genes: GLOD4, PPARd, GUP1, HSPD1, YDJC, CCDC91, NAP1, FOS, LIPE, SPARC, IGF1, MCAT as best predictive variables. These genes were associated to various biological functions known to play important roles in the determination of quality of fresh pork.

The chosen probability cut-point to predict the class L as 0.3 allowed reducing error of 'over-grading' samples. Accurate classification rate was 82% on the known data (i.e. 18% error rate).

		Predicted		
		Low	Acceptable	Extra
Observed	Low	33	0	1
	Acceptable	7	15	3
	Extra	4	2	28

After cross validation using the "leave-one-out" method, the accurate classification rate was 76%.

		Predicted		
		Low	Acceptable	Extra
Observed	Low	30	2	2
	Acceptable	9	13	3
	Extra	4	2	28

CONCLUSION

- Pork quality classes discriminating both sensory and technological dimensions of fresh meat have been determined.
- A multinomial generalized model to predict quality class of a given pork sample with high accuracy, based on gene expression levels of LM taken early p.m. has been proposed.
- The ability to detect early high quality loins could be useful in meat industries and pork chains of high quality products.