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Test du système MSA pour prédire la qualité de la viande bovine irlandaise

Prédiction de la qualité sensorielle de la viande bovine (tendreté, jutosité, flaveur, appréciation globale) en république d'Irlande à l'aide du système australien MSA (Meat Standards Australia)

Mots-clés : Tendreté, Flaveur, Jutosité, Appréciation globale de la qualité, Viande bovine

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Un programme de recherche a été mis en place pour tester le système « Meat standards Australia » (MSA) en république irlandaise. Cet article décrit les résultats de ce programme. Il a été préalablement publié en 2013 dans l'ouvrage « Developments in beef meat quality » édité par JD Wood qui résume les travaux qui ont été présentés lors de la « Langford Food Industy Conference » en juin 2012.

Résumé :

La qualité en bouche de la viande bovine, en particulier sa tendreté, est très importante pour les consommateurs. Elle est affectée par de nombreux facteurs de l'élevage jusqu'à la cuisson et peut être très variable au moment de l'achat. Pourtant, le consommateur ne peut pas, au moment de l'achat, évaluer la qualité en bouche de la viande bovine. La couleur est le critère le plus important pour le consommateur quand il achète la viande, mais ce critère est peu corrélé à la qualité en bouche. Pour traiter la question de l'insatisfaction des consommateurs concernant la qualité variable de la viande bovine, le « Meat and Livestock Australia » a développé un modèle permettant de prédire la qualité en bouche de la viande bovine à partir de facteurs avant et après abattage qui sont connus pour affecter la qualité finale de la viande. Le modèle de prédiction MSA (Meat Standards Australia) est basé sur le développement et l'exploitation d'une vaste base de données, comprenant les résultats de dégustations consommateurs des muscles de la carcasse cuisinés de différentes manières. Chaque échantillon a été évalué pour sa tendreté, sa jutosité, sa flaveur et son appréciation globale, chacune sur une échelle de 0 à 100. Ces scores sont combinés en un index global de qualité appelé MQ4 (« Meat Quality 4 », en référence au 4 scores en question). Cette combinaison est effectuée en utilisant des pondérations appropriées pour chaque score. La valeur du MQ4 permet de définir 4 niveaux de qualité de la viande (non satisfaisant, 3* = produit de qualité courante, 4* = bon produit et 5* = produit de qualité supérieure). Le modèle a été testé avec de la viande bovine irlandaise et des consommateurs irlandais. Il a été montré que le système MSA est aussi précis pour prédire la qualité de la viande bovine en Irlande qu'en Australie (avec de la viande australienne et des consommateurs australiens). Des essais expérimentaux ont également été menés pour tester l'influence de facteurs particulièrement pertinents pour filière viande bovine irlandaise. Les résultats ont montré que le modèle MSA permet de bien prendre en compte les effets de facteurs tels que la stimulation électrique, la méthode de suspension des carcasses, la durée de maturation, la race et le sexe des animaux. Le modèle MSA pourrait donc potentiellement être utilisé par les professionnels irlandais de la filière bovine pour trier les pièces de viande en fonction de leur qualité potentielle et ainsi réduire la variabilité de la qualité en bouche de la viande bovine.

Abstract: Testing the MSA palatability grading scheme on Irish beef

The eating quality of beef, particularly tenderness, is very important to consumers. It is affected by many on-farm and post-slaughter factors and can be variable at the point of sale. Yet the consumer cannot assess the eating quality when purchasing beef. Colour is the most important attribute as seen by the consumer but this has little to do with eating quality. To address the issue of consumer dissatisfaction with the variable eating quality of beef, Meat and Livestock Australia developed a model to predict palatability from the on-farm and post-slaughter factors that are known to affect it. The MSA grading model is based on a large database of beef samples from different cuts cooked in a number of ways and tasted by many consumers. Each sample is assessed for tenderness, juiciness, flavour and overall acceptability, each on a scale from 0 to 100. These scores are converted to the Meat Quality Score (MQS) using appropriate weightings for each attribute and given a star rating. The model was tested on Irish beef and Irish consumers and found to be as accurate at predicting consumer scores as when used on Australian beef and Australian consumers. Experiments were also carried out to see how well the model accounted for some of the factors that are particularly relevant to the Irish beef industry. There was generally a good fit for factors such as electrical stimulation, aitch bone hanging, ageing time, breed and sex. The MSA model could be used by the Irish beef industry to sort cuts into eating quality classes and reduce the amount of variation in eating quality.

INTRODUCTION

Beef is an important yet relatively expensive component in the diet of most consumers. The eating quality, or palatability, of beef, particularly tenderness, is therefore important to consumers. The palatability of beef is mainly a function of its flavour, juiciness, and tenderness. The consumer can assess none of these characteristics when purchasing beef. The EUROP beef carcass classification scheme (EC Regulation no. 1249/2008) uses visually assessed conformation and external fat cover as a means of sorting carcasses into classes for price reporting purposes. These are used by the industry to pay producers and for trading carcasses but conformation and fatness mainly affect the saleable yield of the carcass and have little or no relationship with palatability. In the absence of cues about eating quality, consumers select beef according to the redness of the meat (Mannion et *al.*, 2000), which has little correlation with tenderness or juiciness.

There is considerable variation in quality, particularly tenderness at point of sale even for relatively homogeneous groups of animals and consistent post slaughter handling (Maher et *al.*, 2004). A negative experience will affect a consumer's willingness to purchase beef from the same source. The palatability of beef is a function of production, cut, processing, value adding and cooking method used to prepare the meat for consumption (Thompson, 2002). Increasing consumer confidence in the palatability of beef therefore requires all links in the meat production chain to work together to consistently produce beef with good palatability. This can be done by having blueprints for all sections of the industry to follow. In Australia the industry representative body, Meat and Livestock Australia, went a step further and developed a model, the MSA grading model, which predicts palatability of individual cuts from all the live animal and post slaughter factors that are known to affect it.

The voluntary MSA grading has been implemented in Australia for many years and its usage is increasing annually. The model was devised using Australian consumers rating the palatability of Australian beef samples and is based on a very large database covering all the important live animal and post slaughter factors (Polkinghorne et *al.*, 2008). If such a model could be applied to Irish beef and Irish consumers it would offer the Irish industry the possibility of marketing beef of guaranteed eating quality. A project was therefore undertaken to test the model on Irish beef and Irish consumers and to check how well the model accounted for certain factors that are important to the Irish industry, since it is well known that there are differences between the Australian and Irish industries in the breeds and feeding systems used and in some of the post slaughter practices.

To fulfil the objective of thoroughly testing the MSA model in an Irish context, a series of experiments were carried out. Firstly a comparative study of Irish and Australian beef and consumers was completed then experiments were undertaken to test the effect of a range of post slaughter factors on predicted palatability scores.

I. TESTING THE MSA MODEL ON IRISH BEEF AND IRISH CONSUMERS

Samples from five muscles were taken from 18 Irish heifer carcasses and frozen. Samples from the same cuts from Australian animals matched as closely as possible to the Irish heifers for breed type, weight and age were frozen and shipped to Teagasc, Ashtown. The Irish and Australian beef samples were grilled or roasted and tasted by Irish consumers according to the MSA protocols. Consumers scored each sample (0-100) for tenderness, juiciness, flavour and overall acceptability and rated each sample as "unsatisfactory" (2-star), "good everyday eating quality" (3-star), "better than everyday eating quality" (4-star) or "premium eating quality" (5-star). Figure 1 shows the percentage falling into these quality categories for each cut. Not surprisingly, most of the fillet samples were rated as either 4-star or 5-star and most of the round samples were either 2-star or 3-star. The striploin samples were almost equally distributed across the quality categories which is a cause for concern, given that this is one of the most popular steaks with consumers.

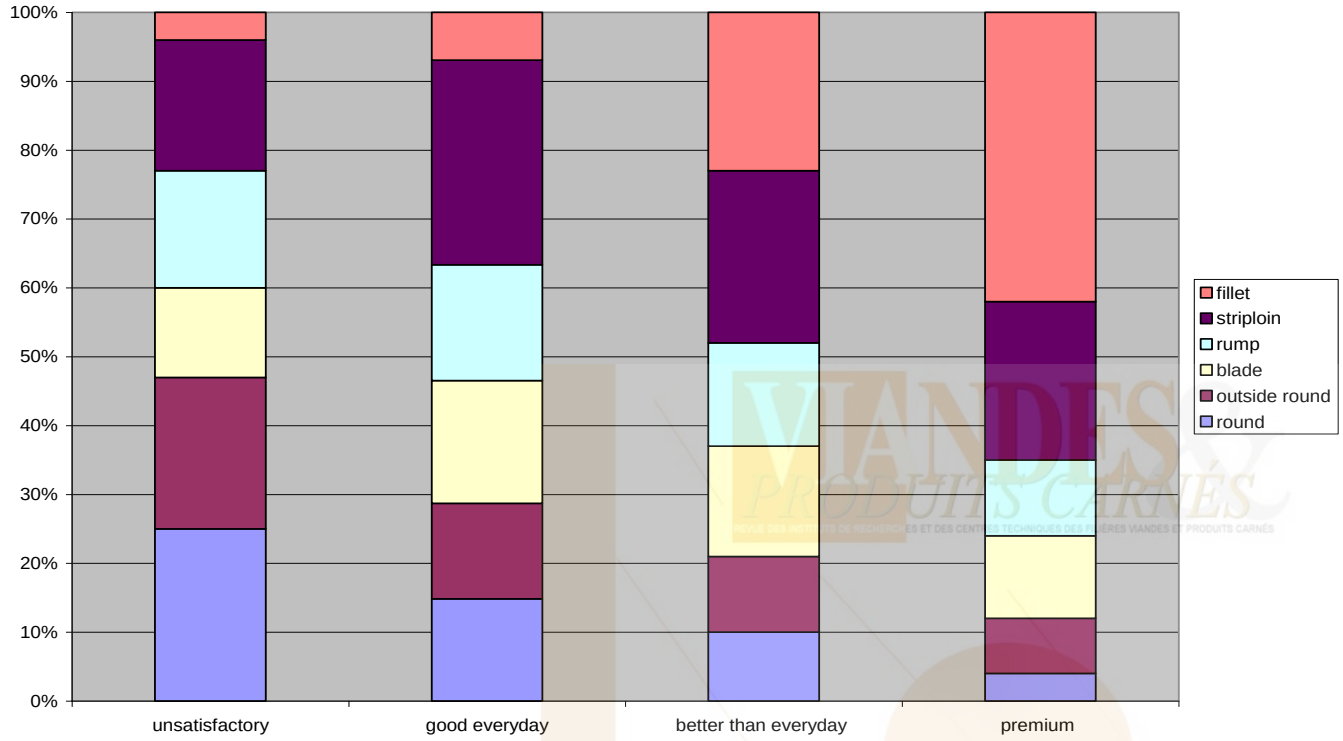
The scores for the individual attributes were converted to overall meat quality scores (MQS, 0-100) using MSA weightings. These were then compared with the scores predicted by the MSA model. The results (Table 1) show how well the model works for Irish beef and Irish consumers.

For all attributes there was a wide range of scores and a mean score between 55 and 59%. The mean deviations of the actual scores from those predicted by the model (MQSDIFF) ranged from -2.1 for roasted rump samples to 12.3 for grilled rump samples. The latter suggests the model has a positive bias for this cut x cooking method combination (i.e. model predicts higher scores than the actual scores), though for all other cut x cooking method combinations and for all samples combined (see Table 1) the mean deviations were not different from zero, suggesting no bias.

Table 1: Summary statistics for meat quality attributes for a homogenous group of heifers (All samples, n=103)

	Tender	Juicy	Flavour	Like	MQS	MQSDIFF
Min	10.3	15.5	21.7	25.0	22.1	-22.02
Max	84.7	84.5	80.2	87.0	82.9	26.7
Mean	58.8	55.9	57.3	58.1	57.4	4.9
SD	18.4	14.3	14.0	14.7	14.5	11.3

Figure 1: Percentage of different cuts falling into each quality category



II. TESTING THE MODEL ON A COMMERCIAL SAMPLE

Three cuts (striploin, rump and topside) were taken from 16 steers varying in breed, weight, conformation and fatness slaughtered under factory conditions and prepared according to MSA guidelines. The samples were grilled and presented to consumers for assessment following the MSA protocols. The actual scores were compared with those predicted by the MSA model. These predicted scores proved to be a more conservative estimate of meat quality than the actual consumer scores for the striploin, rump and topside. For all three muscles the actual score was higher than the predicted score (Table 2). For the striploin the underestimation was greater than for the other two cuts (15% *vs* 11%).

Table 2: Actual and predicted scores for grilled samples of three cuts from commercial steers

	Predicted	Actual	Deviation	% Dev
Striploin	55.9	65.8	9.9	15.1
Rump	50.6	56.6	6.0	10.6
Topside	34.0	38.4	4.3	11.2

III. TESTING FACTORS IN THE MODEL

III.1. Effect of low voltage stimulation (LVES) and ageing on goodness of fit of the model

Low voltage stimulation had no effect on the MQS for any muscle. Ageing improved the MQS for all muscles. Mean deviations of actual Irish consumer scores from those predicted by the model are shown in Table 3 for carcasses that were either simulated or not and aged for 14 or 28 days. Deviations were large (greater than 10 units) for non-stimulated 14 day aged grilled outside round with the model underestimating the consumer scores for non-stimulated samples at both ageing times. This resulted in a significant effect of ageing time on the goodness of fit of the model. The effect of stimulation on the goodness of fit of the model was non-significant.

Table 3: Mean differences between actual and predicted MQS for four grilled cuts at two ageing times and for stimulated (LVES) or non-stimulated carcasses (NON)

Ageing time	14 days		28 days		Significance		
Stimulation	LVES	NON	LVES	NON	Ageing	Stim	A x S
Striploin	-0.30	8.89	-0.25	8.84	0.480	0.484	0.324
Topside	4.46	7.84	6.43	5.87	0.087	0.745	0.792
Outside	3.49	-14.4	-3.38	-7.50	0.003**	0.405	0.346

III.2. Effect of sex, breed and high voltage stimulation (HVES) on goodness of fit of the model

HVES improved the MQS of the striploin but not for other cuts. Sex did not affect MQS of any muscles. The only effect of breed on MQS was a higher score for eye of round samples from Charolais carcasses. This was unaccounted for by the model, resulting in a significant deviation in the MQS of 10.4. There was also a significant deviation for the MQS score of non-stimulated striploin samples, though this was only 4.81. The model accounted quite well for the effects of sex (heifers v steers).

Table 4: Mean differences between actual and predicted MQS for three cuts from two breeds and two sexes

	Sex		Breed		Stimulation	
	Heifers	Steers	Angus	Charolais	HVES	Non
Striploin	0.43	1.11	-2.35	3.89	6.34	-4.81*
Topside	5.17	1.81	0.83	6.25	4.07	3.00
Eye of Round	5.43	7.03	2.04	10.4*	8.27	4.19

III.3. Effect of hanging method and low voltage stimulation (LVES) on goodness of fit of the model

Aitch bone hanging improved the MQS for the striploin but not for the topside or eye of round cuts. LVES improved the MQS only for the eye of round. The largest deviation of the actual consumer scores from those predicted by the model was for the stimulated aitch bone hung samples, although this was not significant. The effect of hanging method was accounted for well by the model for all muscles while the stimulation effect on the goodness of fit of the model was significant only for the eye of round.

Table 5: Mean differences between actual and predicted MQS for three cuts from stimulated and non-stimulated carcasses hung by the Achilles tendon or the aitch bone

Hanging method	Achilles tendon		Aitch bone		Significance		
Stimulation	LVES	NON	LVES	NON	Hang	Stim	H xS
Striploin	-9.69	0.59	-6.54	-2.56	0.111	0.525	0.124
Topside	8.24	6.89	10.5	4.69	0.795	0.277	0.222
Eye of Round	2.36	-0.77	4.30	-2.71	0.307	0.030*	0.099

OVERALL CONCLUSIONS

The MSA palatability model predicted Irish consumer scores of Irish beef at least as well as Australian consumer scores of Australian beef. Irish consumers seem to score beef in a similar way to Australian consumers, though there were some differences in the relative importance of tenderness and juiciness. In general the model accounted for the main factors that are known to affect meat quality and are commonly used by Irish processors but there were some significant deviations which suggest that the model could be optimised for use in the Irish industry. The Irish industry could use the model to sort carcasses and cuts into quality classes thereby reducing the variability within classes and allowing for a quality guarantee to consumers. There is evidence that consumers are willing to pay more for better quality beef (Lyford et al., 2010). The MSA grading model could also be used as a management tool, for instance to identify carcasses or cuts that would benefit from longer ageing times. The model has also been tested in Northern Ireland, France and will soon be tested in Poland, raising the possibility of the databases being combined to generate a European model for predicting palatability.

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