RELATIONSHIP BETWEEN MEAT JUICINESS INTENSITY SCORES DURING CHEWING

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Abstract – The objective was to establish relationships between sensory juiciness intensity scores during chewing. Chicken breast meat was ground, made into 90g patties, and cooked to 78°C. Sensory assessment for juiciness was made by a 7-member, trained descriptive panel using a time-intensity method followed by an overall juiciness evaluation. There were significant differences in intensity scores of juiciness during chewing. Significant linear correlations were consistently found between juiciness scores at evaluating times (seconds) that were close to each other during chewing. Juiciness intensity scores in the first 15 bites of evaluation were highly correlated (P<0.01 and r≥0.79). However, for the intensity scores collected between 20 and 40 bites during chewing, correlation is neither significant (P>0.01) nor as strong as those scored in the first 15 bites. Overall juiciness scores were better correlated (P>0.70) with the scores collected in the first 20 bites of chewing. These results indicate that for cooked chicken breast meat, any measurement of the moisture released in the first 15 bites of chewing provides the results similar to each other and is a good indicator for overall meat juiciness.

I. INTRODUCTION

Juiciness is one of the most important meat sensory quality attributes for consumption. Meat juiciness is exclusively measured by sensory evaluation and its definition varies in study. It can be the overall impression of juice perceived in the mouth during chewing, in which saliva formation could be a factor, or the amount of moisture released from the food after the initial a few chews, in which juiciness more relies on moisture in products and saliva formation is not involved (1, 2). The relationship between these two-evaluation results is not well established in meat and how many initial chews should be used before the juiciness is scored is not consistent in the literature. Sensory time-intensity (IT) study is a technique used to measure temporal changes in sensory perception taking place in the mouth during chewing and should be a proper tool to help to answer these two questions. The objective of the present study was to investigate relationships between juiciness intensity scores during chewing (moisture releases in the initial chews) and between juiciness scores during chewing and overall juiciness (an overall impression of juiciness) using the IT method and cooked chicken breast meat as a model.

II. MATERIALS AND METHODS

Broiler (6 weeks old) carcasses were collected from a local processing plant. Breast fillets were deboned, ground, and made into 90g patties. Meat patties were cooked in a Henny penny combi oven to the end-point temperature of 78°C. TI-juiciness was assessed for 40 seconds on 0-15 point line scales (Compusense C5R48, Guelph, ON) (2, 3). Trained assessors chewed at a rate of one chew/sec and selected zero when samples were ready to swallow. Overall juiciness was scored following TI assessments. For data analysis, Proc GLM of SAS and the Tukey options were used for the mean comparison among juiciness scores. Pearson's correlations between measurements were analyzed using XLSTAT.

III. RESULTS AND DISCUSSION

Table 1 shows that the ranges of sensory juiciness intensity scores were similar (1.5 to 2.5 units) and there were significant differences (P<0.05) among average juiciness intensity scores during chewing. Average juiciness intensity scores of cooked chicken breast meat started at 3.41 unit, increased significantly (P>0.05) as the chewing continued, and reached the maximal value of 4.24 at the 15th bite or 15 sec of chewing. Then they reduced to 1.62 after

40 bite (or sec). The similar TI pattern for juiciness scores was also reported by Zimoch and Findlay (2) in cooked beef. Our results indicate that the average values of juiciness intensity scores for cooked chicken breast meat would differ from the time you evaluate them during chewing.

Table 1. Reference values of observation, minimum, maximum, mean, standard deviation, and significance for sensory juiciness intensity score of broiler breast meat tested during chewing.

Second/Bite	Obs.	Min.	Max.	Mean	Stddev.
one	260	1.99	4.53	3.41[e]	0.63
two	260	2.22	4.73	3.64[d]	0.62
five	260	2.43	4.79	3.95[c]	0.56
ten	260	2.64	4.84	4.09[abc]	0.51
fifteen	260	2.87	4.97	4.24[a]	0.47
twenty	260	3.25	4.74	4.18[ab]	0.33
Twenty five	260	3.38	4.74	4.18[ab]	0.31
thirty	260	2.34	4.49	2.80[f]	0.53
Thirty five	260	2.07	4.03	2.80[f]	0.54
forty	260	0.91	2.62	1.62[g]	0.52
overall	260	2.72	4.78	4.05[bc]	0.44

[a-f] Mean values with no common superscript in the juiciness scores are significantly different from each other (P<0.05).

Table 2 shows that highly significant (P<0.01) and strong (r≥0.79) Pearson's correlation coefficients occurred between the juiciness intensity scores ≤15 bites. Scores given at the 20th bite correlated with those at 2 through 15 bites (P<0.005) but the coefficients were <0.70. Highly significant Pearson's correlations (P<0.005) were found between juiciness scores at bites or seconds that were close to each other. There were no correlations between juiciness scores collected after 20 bites and scores before the 15th bite, with the exception of 15 versus 25 bite. There were significant (P<0.0001) and strong (r>0.70) correlation between juiciness scores collected before 15 sec of chewing and overall juiciness. There were significant (P<0.001) but not strong correlations (r<0.7) between overall juiciness and juiciness scores collected between the 20th and 25th bite; however, no significant correlations were found between juiciness scores >25 bites and overall juiciness. These results indicate that both juiciness definitions would provide the same results for cooked chicken breast meat. For cooked chicken breast meat, the juiciness intensity scores collected from the initial 15 bites during chewing or moisture released in the initial 15 sec of chewing are similar to each other and any one of them can be used for indicating meat juiciness. The initial moisture release (≤15 bites) has more impact on panel's overall juiciness perception than those after the 20th bite. Any of the measurements of moisture releases during the first 15 seconds of chewing or in the first 15 bites can be used to predict meat overall juiciness.

IV. CONCLUSIONS

For cooked chicken breast meat, average values of juiciness intensity of cooked meat would depend upon the time when the juiciness is scored during chewing and they are not always linearly correlated. Either of the two juiciness evaluation methods would provide the same conclusion. As long as the moisture releases are scored during the first 15 bites, the values should be valid indicators for meat juiciness and can be used to predict overall meat juiciness.

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Table 2. Pearson's correlation coefficients between time-intensity juiciness scores at selected intervals and between the time-intensity scores and overall juiciness scores (Values in bold are significantly different from 0 with a significance level alpha=0.01).

SECONDS	ONE	TWO	FIVE	TEN	FIFTEEN	TWENTY	TWNTFIVE	THIRTY	THIRTFV	FORTY
TWO	**0.9797**	**1**								
p-value	**<.0001**									
FIVE	**0.926**	**0.9698**	**1**							
p-value	**<.0001**	**<.0001**								
TEN	**0.8569**	**0.9111**	**0.9535**	**1**						
p-value	**<.0001**	**<.0001**	**<.0001**							
FIFTEEN	**0.7874**	**0.8391**	**0.8896**	**0.9431**	**1**					
p-value	**<.0001**	**<.0001**	**<.0001**	**<.0001**						
TWENTY	0.3991	**0.4248**	**0.4742**	**0.4857**	**0.6738**	**1**				
p-value	0.0159	**0.0098**	**0.0035**	**0.0027**	**<.0001**					
TWNTFIVE	0.2497	0.2545	0.2819	0.2723	**0.4578**	**0.7339**	**1**			
p-value	0.1419	0.1342	0.0957	0.1081	**0.005**	**<.0001**				
THIRTY	-0.052	-0.0278	0.0187	0.0001	0.1363	**0.4319**	**0.5235**	**1**		
p-value	0.7628	0.8723	0.914	0.9995	0.4281	**0.0085**	**0.0011**			
THIRTFV	-0.282	-0.2483	-0.229	-0.2563	-0.267	0.0034	0.1398	**0.5442**	**1**	
p-value	0.0952	0.1443	0.1783	0.1314	0.1159	0.9845	0.4162	**0.0006**		
FORTY	-0.353	-0.3642	-0.336	-0.3434	-0.364	-0.118	0.1686	**0.5069**	**0.7929**	**1**
p-value	0.0349	0.029	0.0449	0.0403	0.0289	0.4923	0.3257	**0.0016**	**<.0001**	
OVERALL JUICINESS	**0.7342**	**0.7853**	**0.8337**	**0.8542**	**0.9249**	**0.6688**	**0.5615**	0.2665	-0.178	-0.2
p-value	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**0.0004**	0.1161	0.2986	0.25