



Use of mobile phone technology to measure beef steak doneness preference

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Previous evidence indicates that heterocyclic amines (HCAs) are carcinogenic. HCA levels in cooked meat increase in response to (i) cooking time and (ii) high temperature cooking methods. Therefore, well done meat contains higher amounts of HCAs than less well done meat. However, in dietary surveys, information on meat doneness preferences are rarely collected, and therefore human HCA exposure has been difficult to quantify. In order to further our understanding of the relationship between human cancer and HCA exposure, therefore requires more robust tools to assess meat doneness. The use of photographs of meat of different doneness levels has already been validated as a method for measuring meat doneness preference (1). However, photographs taken at the exact point of consumption may prove a more efficient method of collecting meat doneness preference data. Therefore, this study's objective was to validate the use of mobile phone technology as a means of collecting photographs of meat to determine their doneness.

Thirty participants were screened to participate in this study. During screening, participants reported their habitual beef consumption and their usual meat doneness preference. Using their mobile phones, participants took photographs of cooked steak before consumption on three separate eating occasions. Participants were instructed to take one photograph of the outer surface of their steak and one photograph of the inner cross-section of their steak. Participants' photographs were retrieved via secure email and categorised by doneness level as determined by a trained grader who compared them to standardised doneness photographs. Images were graded according to their doneness as one of the following: 1 = rare, 2 = medium rare, 3 = medium, 4 = medium well, 5 = well done, 6 = very well done. Exact agreement between methods of assessing doneness was achieved if both methods yielded the same doneness level.

Data from 20 participants was included in the analysis. Mobile phone doneness scores were compared with both scores collected at screening (A) and at the time of the eating occasion (B) as shown in the table. The data show that mobile phone-assessed scores correlated more highly with (A) than with (B) for both outer and inner photographs, though the correlations were higher for the latter. Furthermore, there was 60 % exact agreement between participants self-reported meat doneness preference (at screening) and their mobile phone steak photographs (inner photographs). The corresponding value for outer photographs was 30 %.

	Mean*	Standard Deviation	Correlation	
			Coefficient (r ²)	p
Outer photographs				
Mobile phone assessed	4.05	1.10		
A. Self-assessed (at eating occasion)	3.95	1.15	0.589	0.006
B. Doneness preference (at screening)	3.80	1.20	0.479	0.032
Inner photographs				
Mobile phone assessed	3.85	1.39		
A. Self-assessed (at eating occasion)	3.98	1.15	0.789	0.000
B. Doneness preference (at screening)	3.80	1.20	0.605	0.005

* Mean data were calculated based upon doneness scores, 1 = rare, 2 = medium rare, 3 = medium, 4 = medium well, 5 = well done, 6 = very well done. Correlations are based upon Spearman analysis.

The results indicate that mobile phone assessment correlated more highly with self reporting at the eating occasion than when compared to screening. Results also indicate that mobile phone photographs (based upon the inner steak surface) could be used to measure meat doneness preferences. This would enable more standardised measurement of HCA exposure in future dietary surveys.

1. Chan S-H, Moss BW, Farmer LJ, *et al.* (2013). Comparison of consumer perception and acceptability for steaks cooked to different endpoints: validation of photographic approach. *Food Chemistry*, **136**: 1597–1602.