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26 The economic significance of the global Halal meat market is huge, and it is projected to
27 continue to expand (1-3). This has resulted in the scramble for a share of the market by
28 mainstream retail multiples such as Tesco, Sainsbury's, Morrisons, Asda, etc. While some
29 researchers have attributed the rapid growth of this segment of the EU meat industry to the
30 exponential growth in the population of Muslims within the EU, in part due to the exodus of
31 Muslims (the main Halal consumers) from unstable democracies into Europe (4). Additionally,
32 the UK's English Beef and Lamb Executive (EBLEX) (5) noted that Muslims generally
33 consume above average quantities of meat. For example, the EBLEX study reported that
34 although the Muslim population accounts for approximately 5% of the population of England,
35 Muslims account for over 20% of sheep meat consumption. The number of sheep slaughtered
36 in the UK is currently circa 14 million. These findings corroborate the results of the UK's Food
37 Standards Agency's 2015 (6) Animal Welfare Survey which found that Halal slaughter in Great
38 Britain accounted for over 40% of the total of all small ruminants slaughtered and this figure
39 had increased to 70% in 2018, according to recent data published by the FSA (7). In terms of
40 the future prospects of the EU Halal meat market and the Muslim population size, the Pew
41 Research Centre (4), projected that even with zero further migration into Europe, the Muslim
42 population would still grow from the current 4.9% to approximately 7.4% by the year 2050.
43 This projection was made on the basis that it is a younger population (approximately a mean
44 of 13 years younger) with accompanying higher fertility rate, with women having
45 approximately a mean of one additional child greater than the remainder of the population.
46 For meat to be considered Halal, it is stipulated that it must be from animals slaughtered in
47 accordance with rules derived from the Quran and other Islamic scriptures. Generally, the rules
48 require animals to be alive and fit but not necessarily conscious at the point of neck-cutting,
49 although some Muslim authorities do insist the animals be fully conscious (8). In addition to
50 meeting the Halal rules, slaughter practices must, of course, comply with the legislative

51 requirements of the country where the slaughter takes place. For example, the slaughter of
52 animals within the EU is regulated by European Council Regulation EC1099/2009. This
53 regulation requires the stunning of all animals prior to slaughter in order to induce immediate
54 loss of consciousness and loss of sensibility before neck-cutting. This is because slaughter
55 without stunning has been shown to compromise the welfare of animals (9-11) due to the pain
56 and distress caused during and following the neck cut. Gibson and colleagues (9) investigated
57 the perception to pain in halothane anaesthetized calves that were slaughtered by ventral neck
58 incision without stunning. They objectively recorded the perception of pain through
59 electroencephalographic responses to the neck cut and concluded that ventral neck incision
60 without stunning represents a noxious stimulus. In cattle, ballooning of the cut ends of the
61 carotid arteries (false aneurysm) may occur, leading to delayed loss of brain function due to
62 the continued supply of oxygenated blood to the brain through an alternative route of blood
63 supply, through the vertebral arteries (12). In fact, it has been shown that the average time for
64 the start of early arrested blood flow (in the carotid) is 21 s (12). To reduce the incidence of
65 false aneurysm and its effect on delayed loss of consciousness and suffering during slaughter
66 without stunning, Gibson and colleagues (13) demonstrated that using a high neck cut position
67 instead of the conventional low neck cut in cattle reduced the time to collapse. The authors
68 implied that collapse of cattle after neck incision is an indication of the initiation of the start to
69 loss of consciousness. A high neck cut position was defined as a cut that corresponded to the
70 position of the first cervical vertebra (C1), whilst a low neck cut corresponded to the second
71 cerebral vertebra (C2).

72 It is worth noting, however, that despite the controversial nature of slaughter without stunning,
73 EC1099/2009 permits member states to exempt from stunning the slaughter of animals
74 performed according to religious rites. This option is mainly practiced by followers of Judaism
75 and Islam. Despite this exemption from stunning, the majority of Halal meat in Europe is

76 derived from stunned animals (6, 7), to the contrary, the Jewish community unanimously reject
77 all forms of stunning prior to slaughter. According to the UK's FSA, 25% of sheep were
78 slaughtered without stunning in 2018 (7), an increase of 10% from the proportion slaughtered
79 without stunning in 2012, which was reported to be 15% (6). Halal slaughter of broilers
80 accounted for 21% of the throughput with 41% of these slaughtered without any form of
81 stunning. The proportion of cattle slaughtered in accordance with religious rites (i.e. Halal and
82 Kosher) was relatively low, only 3.7% of the 35,343 cattle slaughtered during the study period
83 were killed in accordance with the Halal and Kosher rules, of which 1.1% were not stunned
84 prior to the neck cut (7). Some researchers have suggested that the slaughter of animals without
85 stunning is equally as humane as slaughter with stunning. Grandin and Regenstein (14)
86 observed the slaughter of some 3000 cattle and formula-fed calves in three Kosher abattoirs in
87 the US and concluded that it is possible for animals to show little or no reaction to the cut when
88 very careful, specific handling and restraint is applied and an especially sharp, clean blade is
89 used. They noted further that there was only a slight 'flinch' when the neck was cut, suggesting
90 that the procedure was relatively painless. Contrary to many other authors, Rosen (15)
91 concluded after a review of physiological evidence that Shechita slaughter is a painless method
92 of slaughter, and that the method could be regarded as a 'stun' procedure.

93 A survey of Islamic scholars and Halal consumers in the UK found that the majority of Halal
94 consumers (53%) and scholars (95%) would regard meat from stunned animals as Halal if it
95 could be shown that animals did not die as a consequence of the stun, but died as a consequence
96 of bleeding-out from the neck cut (8). The authors recommended that there should be a dialogue
97 and education of Islamic scholars on the different methods of stunning so that they could make
98 informed decisions in recognising stunning methods that do not result in the instantaneous
99 death of the animals.

100 The objective of this study was to examine the frequency of meat consumption in a
101 representative sample of Halal consumers in England and their preference for meat based on
102 the species of animal. It further considered the preference of Halal consumers for meat based
103 on the method of slaughter (slaughter with and without stunning). As far as the authors are
104 aware, there is no existing study of this topic.

105 **2. Materials and methods**

106 **2.1. Data collection and sampling procedure**

107 A total of 250 Halal consumers were surveyed from 11th March 2017 to 1st January 2018. All
108 respondents fully consented to participate in the survey and were provided with information on
109 the aims and objectives of the study. Two volunteers from Birmingham and London were each
110 given one hundred hard copies of the questionnaire, 46 and 43 fully completed questionnaires
111 were returned from Birmingham and London, respectively. The volunteer from Birmingham
112 was recruited through a mosque (in Birmingham), and was a male teacher of Arabic and the
113 Quran aged 58 at the time of the survey. The second volunteer (from Moredon in the London
114 Borough of Merton) was recruited through word of mouth and was a 37 years old male
115 undergraduate student. The remainder of the respondents were recruited by sharing a
116 SurveyMonkey weblink to Muslim WhatsApp groups (n=90), Facebook (n=67) and email
117 (n=4). Ethical approval was granted for this study by the University of Bristol's Ethical Review
118 Committee (ID49821).

119 **2.2. Data analysis**

120 Responses to questions are reported as percentages of respondents, with the actual numbers
121 contributing in brackets, following. Exact Chi square tests were used to test for associations
122 between categorical variables.

123 **3. Results**

124 The majority of respondents answered all the questions, no respondent was dropped from the
125 overall analysis, however, where there were occasional missed questions, those respondent(s)
126 were not included in the count. For the purpose of the analysis, these were treated as missing
127 at random. Note that the count will decrease where missing values appear within the
128 calculation. Absolute values are used in all calculations, except where data are missing. Exact
129 p values are reported for Chi-Sq. tests. The socio demographic characteristics of respondents
130 included 67.5% [166] male, 32.1% [79] female and 0.41% [1] other, of which 46.4% [115],
131 27.8% [69], 12.5% [31], 7.3% [18], 3.6% [9] and 2.4% [6] fell within the age ranges 31-40,
132 41-50, 20-30, 51-60, Over 60 and less than 20, respectively. The majority of respondents
133 (87.0%) [215] reported being married while 13% [32] were single. Of the male respondents,
134 13.4% [22] were single whilst 86.6% [142] were married whilst 12.7% [10] of female
135 respondents were single and 87.3% [69] married. There was no imbalance between gender and
136 marital status (i.e. whether respondents were single or married and male or female) with
137 approximately 13% of both sexes being single (Chi Sq = 0.178, df = 2, p value = 1.00). The
138 highest academic qualifications of respondents were; postgraduates 37.8% (94), graduate
139 32.9% [82], further education qualification 12.9% [32], GCSE/O-Level 8.4% [21], A-Level
140 5.6% [14] and respondents with no academic qualifications 2.4% [6]. A high proportion of
141 respondents were in employment, with 84.3% [210] reported as employed and 15.7% [39]
142 unemployed.

143 **Table 1: Distributions of responses to various questions regarding Halal meat**
144 **consumption preferences in the UK**

		Frequency	Percent
How often do you eat meat? (Two respondents did not answer this question)	At least once a day	113	45.6
	At least once a week	126	50.8
	At least once a month	8	3.2
	Occasionally (e.g. during special occasions such as Eid)	1	0.4
Which of the following is your preferred meat?	Beef	13	5.5

(Twelve respondents did not answer this question)	Lamb	109	45.8
	Poultry	116	48.7
Animals may be pre-stunned or post-cut stunned during Halal slaughter. Do you understand what these procedures mean? (Four respondents did not answer this question)	No I do not understand what pre-slaughter stunning and post-cut stunning mean	52	21.1
	Yes I understand what pre-slaughter stunning and post-cut stunning mean	194	78.9
Which of the following is your preferred method of Halal slaughter (Assuming the slaughter is performed by a Muslim in all cases)? (Four respondents did not answer this question)	Pre-stunned slaughter on condition that the animal was alive at the point its neck was cut.	35	14.2
	Slaughter without stunning	172	69.9
	Post-cut stunned slaughter (This is where a live animal is slaughtered followed by stunning)	1	0.4
	I do not understand what the above slaughter methods mean	16	6.5
If your preferred method of Halal slaughter is NOT pre-stunned or post-cut stunned (in Q16), please indicate your reason? (Thirty one respondents did not answer this question)	I am unsure about the Halal status of meat from animals pre-stunned/post-cut stunned	100	45.7
	I do sometimes eat meat from pre-stunned/post-cut stunned animals if there is no unstunned alternative	52	23.7
	I regard meat from animals pre-stunned/post-cut stunned as Haram (Prohibited)	46	21
	Not applicable- My preference is meat from stunned animals	21	9.6

145 Note: The percentages for each of the categories do not necessarily sum to 100 due to missing data.

146 Table 1 shows the distribution of responses to the questions on frequency of meat consumption,

147 preference of meat according to species and preference according to the method of slaughter.

148 The majority of respondents (50.8%) [126] indicated that they eat meat at least once a week,

149 45.6% [113] eat meat at least once a day, 3.2% [8] eat meat at least once a month and only

150 0.4% [1] of respondents indicated that they eat meat occasionally, for example during special

151 religious festivals. Two respondents did not answer this question. These figures suggest that

152 the majority of Halal consumers (96.4%) eat meat at least once daily or weekly. On where they

153 usually purchase their meat, the majority of respondents indicated purchasing their meat from

154 local Muslim butchers 85.4% [210]. The rest of the respondents indicated that they usually
155 purchase their meat from; Muslim butchers in mainstream supermarkets (e.g. Tesco,
156 Sainsbury's etc.) 7.3% [18], directly from Halal abattoirs 5.3% [13] and from non-Muslim
157 butchers 2.0% [5]. Four respondents did not indicate where they usually purchase their meat.
158 The preference for meat with relation to the species of animal, that is, beef (from cattle), lamb
159 (from sheep) and poultry meat is reported in table 1. The question was not answered by 12
160 respondents. The results showed 48.7% [116] preferred poultry meat (chicken, turkey etc.),
161 45.8% [109] lamb and 5.5% (13) beef. However, this result hides a gender imbalance; females
162 had a greater preference for chicken meat, and males a slightly greater preference for beef and
163 lamb than females (Chi sq = 10.25, d f= 4, p = 0.066). The preference for meat based on gender
164 were; beef (7.5% male and 1.4% female), lamb (49.4% male and 36.5% female) and poultry
165 meat (43.1% male and 62.2% female). On preference of meat according to the method of
166 slaughter, the results show that the majority of respondents preferred meat from animals
167 slaughtered without stunning 69.9% [172], whilst 14.2% [35] indicated preference for meat
168 from animals stunned prior to slaughter if animals were alive at the point of neck-cutting, 0.4%
169 [1] reported preference for meat from animals stunned after neck-cutting whilst 6.5% [16] of
170 respondents indicated that they did not understand the meaning of the three methods of
171 slaughter described and 8.9% [22] indicated that they had no preference across the three
172 methods of slaughter (animals slaughtered without stunning, those stunned before slaughter
173 and those stunned after neck-cutting). Of the 68.5% of respondents who did not prefer meat
174 from stunned animals, the reasons for the rejection of meat from stunned animals included; i)
175 I am unsure about the Halal status of meat from stunned animals 45.7% [100], ii) I do
176 sometimes consume meat from pre-stunned/post-cut stunned animals if there is no unstunned
177 alternative 23.7% [52] and iii) I regard meat from animals pre-stunned/post-cut stunned as
178 Haram (prohibited) 21.0% [46]. Respondents were also asked whether they understood what

179 the two stunning methods meant (pre-stunned slaughter and post neck-cut slaughter), to which
180 78.9% [194] said they did whilst 21.1% [52] indicated that they did not. Four respondents did
181 not answer this question.

182 The majority of male respondents indicated their preference for meat from animals
183 slaughtered without stunning 70.7% [116] over meat from pre-stunned animals. The
184 preference for method of slaughter by female respondents was approximately similar at
185 67.9% [53] for slaughter without stunning

186 **Discussion**

187 Muslims are enjoined to consume meat from animals slaughtered in accordance with the rules
188 of Halal. The rules stipulate that at the time of exsanguination, animals must be alive and that
189 sufficient time must be allowed for thorough bleeding-out because the consumption of blood
190 is prohibited (16). The results of this study show that the majority of respondents consume
191 meat on a regular basis, indeed 96.4% of respondents indicated that they consume meat at least
192 once a week or daily. This corroborates the results of previous studies where Halal consumers
193 were reported to consume above average amounts of meat, which has contributed, in addition
194 to population growth, to the expansion of the global Halal meat market (6,17,18,19). Culture,
195 religion and gender have been identified as the two main factors influencing meat consumption
196 patterns (19, 20). EBLEX (5) reported that the Muslim community in England, which
197 represents an estimated 5% of the population, consume around 20% of sheep meat produced
198 in England. Halal slaughter of sheep represents an estimated 70% of the over 14 million sheep
199 killed annually in Great Britain, according to data from the UK's FSA (7). In terms of
200 preference for meat based on the species of animals, the results of the present study show that
201 the majority of respondents overall, marginally prefer poultry meat (approximately 48.7%),
202 whilst 45.8% indicated a preference for lamb and 5.5% for beef. This is consistent with the
203 findings of the report published by EBLEX (5) and it also partly explains the throughput figures

204 published by the UK's Food Standards Agency (6) in which the proportion of animals
205 slaughtered according to the Halal rules in Great Britain were; 41%, 21% and 3% for small
206 ruminants (sheep and goats), poultry and cattle, respectively. Poultry meat provides
207 convenience and versatility, which may explain why some consumers prefer this particular
208 source of protein. The results showed greatest female preference was for chicken meat, and
209 male a slightly greater preference for beef and lamb This corroborates the findings of a study
210 by Kubberød and colleagues (21) who reported that the majority of female respondents
211 indicated their preference for white meat over red meat in a study carried out in Norway.
212 Kenyon & Barker (22) reported that young female consumers found red meat repulsive because
213 the reddish colour is associated with blood, and that it is hard to digest and does not help in
214 weight loss. Despite the reported negative impact on the welfare of animals during slaughter
215 without stunning (9-11), the majority of respondents indicated their preference for meat from
216 animals slaughtered using this method. In fact, 69.9% of respondents indicated their preference
217 for meat from animals slaughtered without stunning whilst 14.6% preferred meat from stunned
218 animals (pre-stunned and post-neck-cut stunned). Halal consumer preference for meat from
219 animals slaughtered without stunning has been reported previously (23). Farouk et al. (23)
220 suggested that some Halal consumers regard such meats as having a high spiritual quality
221 because it is the only method which was practiced by the Prophet of Islam some 1,400 years
222 ago. It is worth noting however, that stunning is a relatively new slaughter technology which
223 was discovered many centuries after the *Quran* (Islamic Holy Book which contains the Halal
224 slaughter rules) was revealed. It has been suggested that some Muslims avoid meat from
225 stunned animals because of doubts over the compatibility of stunning with the Halal rules, that
226 is, the possibility of some animals dying as a consequence of the stun or the belief that stunning
227 obstruct blood loss (8, 23, 24, 25, 26).

228 When compared with the general UK population, a number of consumer studies on attitudes
229 towards animal welfare have concluded that there is public concern for animal welfare (27, 28,
230 29). These findings are in contrast to the results of the current study, where the majority of
231 respondents consuming Halal meat preferred meat from animals slaughtered without stunning.
232 The preference for meat slaughtered without stunning appear to be influenced by religion and
233 cultural beliefs. Schroder and McEachern (27) explained that despite showing concern for
234 animal welfare, UK consumers try to disengage with on-farm procedures that may affect
235 animal welfare, or the welfare aspect of transport and slaughter. Tawse (28) on the other hand
236 observed that despite a recent rise in concern for animal welfare in the UK, this did not reflect
237 in a rise in the purchase of meat or other animal products that are perceived to originate from
238 high welfare systems. One may therefore argue that despite having a concern for animal
239 welfare, many UK consumers may not have a good understanding of the slaughter process, this
240 may affect their choice of meat from stunned or non-stunned animals as observed in the Muslim
241 population in the current study. Additionally, cultural and religious factors may have
242 influenced the results in the present study.

243 New Zealand introduced a Halal quality assurance system which permits abattoirs to conduct
244 annual reversibility demonstrations on stunned animals to assure Muslims that some methods
245 of stunning (e.g. electrical head-only) do not result in the death of animals prior to the neck
246 cut, and to highlight the fact that death is caused by blood loss. To increase consumer
247 confidence in stunned products, the UK may need to consider a similar model to the New
248 Zealand system. Fuseini and others (8) carried out a survey of Islamic scholars and Halal
249 consumers in the UK to understand the reasons for the rejection of meat from stunned animals,
250 the majority of scholars (95%) and consumers (53%) indicated that they would accept stunning
251 if it could be shown that animals did not die as a result of the stun, and that the volume of blood
252 loss was not negatively affected. There are, however, a number of studies showing that head-

253 only electrical stunning does not cause instantaneous death of animals, and that, whether
254 animals are stunned or not, does not have any effect on the volume of blood loss (24, 30). In
255 the present study, whilst 78.9% indicated that they understood the meaning of all 3 methods of
256 Halal slaughter (pre-stun, post neck cut stun and slaughter without stunning), 21.1% did not.
257 This collaborates the findings of Fuseini and others (8) who reported that some Islamic scholars
258 did not have a good understanding and perception of the different methods of stunning.
259 Consumer education on the methods of slaughter may be useful in helping consumers make
260 informed decisions about the compatibility of some stunning methods with the Halal rules. The
261 69.9% of respondents who indicated that they did not prefer meat from stunned animals gave
262 the following reasons for their responses; 45.7% avoided meat from stunned animals because
263 they were unsure about the compatibility of such meats with the Halal rules, 23.7% indicated
264 that they would only eat stunned Halal meat if they didn't have a non-stunned option whilst
265 21% regarded meat from stunned animals *Haram* (prohibited). It can be deduced from the
266 above that the 21% who regarded meat from stunned animals as *Haram* will almost always
267 avoid such meats, however the 45.7% who were unsure about the Halal status of stunned meat
268 and the 23.7% who would eat stunned meat if there was no non-stun alternative are more likely
269 to be persuaded to consume meat from stunned animals if they could be given assurance that
270 some forms of stunning (e.g. electrical head-only) were compatible with the Halal rules. In the
271 present study, 37.8% and 32.9% of respondents indicated that they held postgraduate and
272 graduate qualifications respectively, this is higher than the data reported in the UK Islamic
273 Economy Report by Thomson Reuters (31). The report suggested that the proportion of UK
274 Muslim degree holders was 24%, against 27% of UK degree holders. Therefore, one of the
275 limitations of the data in the present study is the high proportion of educated Muslims surveyed,
276 this may have affected how representative the data is of UK Muslims.

277 **4. Conclusion**

278 The Halal meat sector is one of the fastest growing segments of the meat industry. However,
279 there are animal welfare issues associated with the slaughter of animals without stunning. Many
280 Muslims appear to prefer meat from animals slaughtered without stunning, however, the
281 majority of these are either unsure of the Halal status of meat from stunned animals or they are
282 ‘part-time’ stunned meat consumers who will eat meat from stunned animals if there was no
283 non-stun alternative. Education of Halal consumers on the different slaughter methods is
284 important in enabling them make informed choices when purchasing meat. There appear to be
285 a significant effect of gender on the choice of meat based on the method of slaughter. Poultry
286 meat appeared to be the most popular meat followed by lamb and beef, with female respondents
287 indicating a greater preference for white meat over red meat. The results of this study provide
288 an insight into the purchasing patterns of Halal consumers which can be utilised by mainstream
289 supermarkets and independent retailers in formulating future marketing strategies. The findings
290 are also useful to the veterinary profession and the government in formulating future animal
291 welfare legislations regarding religious slaughter.

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