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## RESEARCH ARTICLE

# Brits and British Muslims and their perceptions of cultured meat: How big is their willingness to purchase?

Anouk Boereboom<sup>1</sup> | Mustapha Sheikh<sup>2</sup> | Tajul Islam<sup>2</sup> | Elma Achirimbi<sup>1</sup> | Frank Vriesekoop<sup>1</sup> 

<sup>1</sup>Department of Food, Land and Agribusiness Management, Harper Adams University, Newport, United Kingdom

<sup>2</sup>School of Languages, Cultures and Societies, University of Leeds, Leeds, England

## Correspondence

Frank Vriesekoop, Department of Food, Land and Agribusiness Management, Harper Adams University, Newport, United Kingdom.  
Email: [FVriesekoop@harper-adams.ac.uk](mailto:FVriesekoop@harper-adams.ac.uk)

## Abstract

Consumer preferences regarding food in general, livestock meat and cultured meat among Muslim populations remains largely unknown, especially in a United Kingdom context. This is a significant gap in our understanding since foods that meet *halal* requirements have a major economical share of both the British and the global food market. The aim of this study is threefold: (1) gain insight into the perceptions of the broader British community and the Muslim demographic within it regarding food choice determinants, livestock meat, and cultured meat; (2) investigating similarities and differences within and between the two groups; and (3) model the willingness to purchase (WTPu) cultured meat for both populations. The British Muslim and the British non-Muslim population are very similar in their considerations about food in general, livestock meat and cultured meat. With regard to the willingness to purchase cultured meat, further product development and marketing strategies should focus on the same factor for both populations: the healthiness, safety, and nutritional characteristics of cultured meat.

## KEYWORDS

cultured meat, halal, meat consumption, Muslim, United Kingdom

## 1 | INTRODUCTION

The global average per capita consumption of meat and the total amount of meat consumed are rising rapidly, driven by increasing average individual incomes and by population growth (Milford et al., 2019). At present rates, the Food and Agriculture Organization of the United Nations estimates that the demand for meat is going to increase by more than two-thirds in the next 40 years, while current production methods are neither sustainable nor conducive to supplying the anticipated rise in demand (Godfray et al., 2018). Simultaneously, the

consumption of meat and meat products can have various effects on health (Wolk, 2017), while livestock farming and production is seen as having a major negative impact on the environment (IPCC, 2019; Stoll-Kleemann & Schmidt, 2017). Additionally, the production of meat from livestock is associated with depleting fresh water and animal feed, and, significantly, with the increase in greenhouse gases (Bhat & Bhat, 2011). Particular concern to epidemiologists is the fact that use of antibiotics in livestock farming is linked to growing antibiotic resistance (Busch et al., 2020). In this context, cultured meat appears to be the “inescapable future of humanity” (Bhat & Bhat, 2011). Cultured

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meat is produced in-vitro by cultivating animal stem cells in bioreactors (Jairath et al., 2021; Post, 2012), creating muscle cells for human consumption without the need to kill livestock animals.

An important challenge for the success of cultured meat is consumer acceptance. In recent years, extensive research has been done on the predictors, drivers and inhibitors influencing acceptance (Bryant & Barnett, 2020; Liu et al., 2021; Ruzgys & Pickering, 2020; Siegrist & Hartmann, 2020; Wilks et al., 2019). These studies suggest that characteristics of cultured meat compared to conventional meat, and psychographic factors like food neophobia directly influence acceptance (Gómez-Luciano et al., 2019; Siegrist & Hartmann, 2020). Furthermore, demographic factors like gender, age and dietary preferences (e.g., vegan and vegetarian) are also relevant (Bryant & Barnett, 2020).

Cultured meat, like any other new technology, raises numerous ethical, philosophical, but also cultural and religious queries. Given its uncertain status, religious authorities representing all the major faith traditions are still attempting to determine whether cultured meat can be considered religiously acceptable for consumption and serve as a suitable meat alternative, especially as an alternative to sacrificial meat. For the Muslim community, the crucial question is whether cultured meat is *halal* (lit. “permissible”), that is, compliant with the Shari’a, the body of laws derived by Muslim jurists from Islam’s sacred texts, the Qur’an and Hadith. Numerous academic studies have attempted to formulate a normative Islamic position on cultured meat (e.g., Hamdan et al., 2017; Karahaliil, 2020), with varying degrees of success and often questionable assumptions and premises. In reality, the question of the *halal*-ness of cultured meat is less an academic one and more a question of how, ultimately, Muslim jurists, as guides and representatives of the faithful, will determine the status of such meat. The take up among the masses will, to a large extent, remain contingent on such religio-legal determinations.

Previous research that has profiled the general public has already yielded a sense of the potential uptake of cultured meat (e.g., Boereboom et al., 2022; Gómez-Luciano et al., 2019). Meanwhile, consumer preferences among Muslim populations remains largely unknown, especially in the United Kingdom context. This is a significant gap in our understanding since foods that meet *halal* requirements have a major economical share of the global food market. Considering the increase in the population of Muslim communities, which constitute about 25% of the population in the world, the increase in market share is foreseen to continue (Pew Research Center, 2017). In addition, it is also estimated that the size of the global *halal* market, which includes other *halal* products such as pharmaceuticals and personal care products, has reached £1.9 trillion in 2020 (MLC Media, 2021).

Toward improving our understanding of this understudied area, the aim of this study is threefold: (1) gain insight into the perceptions of the British Muslim community with regard to livestock meat, cultured meat, and food choice determinants; (2) to investigate the similarities and differences with the non-Muslim British community; and (3) to model the willingness to purchase (WTPu) cultured meat for both populations, using the method employed by Gómez-Luciano et al. (2019).

The significance of the paper lays in its attempt to understand the drivers behind how Muslims make food choices, and its insights into current attitudes and prospects around acceptance of cultured meat among Muslims. Importantly, it serves as the groundwork for future research that will explore attitudes toward cultured meat among Muslim religious leaders.

## 2 | MATERIALS AND METHODS

### 2.1 | The sample

From the non-Muslim UK population, a valid sample of 391 responses was collected. From the UK Muslim population, a valid sample of 118 responses was collected. Sociodemographic characteristics of the sample are presented in Table 1. To ensure the two populations were independent, respondents ( $n = 2$ ) in the non-Muslim UK population that indicated adhering to the Islam were taken out of the sample. In both cohorts females were overrepresented. Women are more likely to respond to surveys (Curtin et al., 2000; Moore & Tarnai, 2002) and have a bigger affiliation with environmentally friendly behavior (Pearson et al., 2017). Because large parts of the survey were related to environmental issues with regard to food, this may have contributed to the unequal distribution between the genders. The small sample size of the British Muslim population creates the need to be cautious with generalization of the findings. A convenience sampling method was used, which relies on the willingness of a person to respond to the survey. When the survey was distributed, several reminders were sent out encouraging people to participate, which yielded some extra responses.

### 2.2 | Data collection and survey design

The survey used to collect the sample from both populations were identical, with a few adaptations specific to the Muslim population survey, which will be explained below, resulting in two separate surveys. Both surveys were approved by Harper Adams University Ethics committee. Data collection took place between July 2020 and June 2021. Distribution of the survey of the non-Muslim UK population took place in a digital format, using a combination of preexisting contact lists and convenient sampling techniques, such as distribution of the survey via social media platforms such as LinkedIn (Boereboom et al., 2022; de Koning et al., 2020; Gómez-Luciano et al., 2019). Distribution of the survey for the British Muslim population was done using preexisting contact lists within the British Muslim community. All data were stored on the servers of Harper-Adams University in the United Kingdom.

The design of the survey was the same as the design used in Boereboom et al. (2022) and Gómez-Luciano et al. (2019). The demographic section asked respondents about indications of gender, age, religious alignment, and active or intermediate avoidance of meat or animal products. The remainder of the survey consisted of distinct groups of questions regarding a certain topic (Table 2), presented on a

**TABLE 1** Sociodemographic characteristics of the samples in percentages (%), compared to national demographic data about religion distribution in the United Kingdom (Pew Research Center, 2015)

		Muslim (n = 118)	Non-Muslim (n = 391)	United Kingdom*
Gender	Male	32.2	33.2	49.3
	Female	67.8	66.2	50.7
Age	≤24	16.9	55	29.6
	25–39	52.5	20.7	40.8
	40–54	26.3	14.6	11.8
	55+	4.2	9.7	17.8
Cultural alignment	I am not religious	–	38.9	38.4**
	Agnostic/atheist	–	17.6	
	Christianity (any)	–	39.1	51.0
	Muslim	100	–	5.7
	Judaism	–	0.3	<1
	Hinduism	–	0.3	1.7
	Other	–	1.3	<1
	Prefer not to say	–	2.6	–
Meat avoidance	Yes, I avoid meat or animal products	4.7	11.5	16
	I specifically avoid meat or animal products on some days	27.3	19.6	19
	No	68	69	65

\*Source: Office of National Statistics UK (2021); Pew Research Center (2015); Statista (2022).

\*\*No distinction was made between these groups.

5-point Likert Scale, ranging from “Strongly Disagree” to “Strongly Agree” [1–5]. Statements with a negative connotation were reversed (indicated with R in Table 2) (De Koning et al., 2020). One section enquired about sentiments toward new/unknown foods, utilizing the established Food Neophobia Scale (FNS) by Pliner and Hobden (1992), the Food Technology Neophobia Scale (FTNS) inspired by Cox and Evans (2008), and the importance of three food-choice determinants: the healthiness of food choices (De Koning et al., 2020), the love for cooking (De Koning et al., 2020), and the environmental impact of foods (Candel, 2001) (Table 2, Sections 1–5). The survey that was targeted toward the British Muslim community, contained an additional three questions that explicitly explored adherence to halal lifestyle. This was added to gain insight into the “religious strictness” of the Muslim population sample. Furthermore, in the survey that was targeted toward the British Muslim community, the food neophobia scale was included twice: first to measure food neophobia with regard to any food, and second, with regards to foods that were known to be certified Halal. This distinction was made clear to respondents by an introductory statement.

The next section asked respondents about their attitudes toward and perceptions of livestock meat (Table 2, Section 6), their current (“How would you describe your current meat consumption?”) and future intended meat consumption (“Do you intend to change your meat consumption in the coming year?”). In the following section, after giving a brief description, respondents were asked to express their

opinions about cultured meat, with regard to its perceived characteristics (is it healthy, safe, and nutritious), perceived benefits of cultured meat compared to livestock meat (is cultured meat tastier, more sustainable, and cheaper than livestock meat). Finally, respondents were asked about their willingness to try, purchase, and pay more for cultured meat, answering with either “yes,” “maybe,” or “no” (Table 2, Sections 7–9). In the survey targeted at the British Muslim population, respondents were asked to answer these questions, assuming the alternative protein sources were deemed Halal. This was added to reduce the risk the people answering negatively about the alternative proteins because they thought it was not Halal, and not because they actually disagree with the statements. This would have distorted the results.

To avoid repetition, and to ensure clarity, all the above-mentioned scales were taken and sometimes adjusted from the original (Candel, 2001; Cox & Evans, 2008; De Koning et al., 2020; Pliner & Hobden, 1992; Roberts, 1996; Roininen et al., 1999; Verbeke, 2015). For example, some statements originally in the FTNS, regarding health and environment were left out and featured in other parts of the survey (Candel, 2001; Roininen et al., 1999).

### 2.3 | Collapsing statements

To test associations between the broader British and Muslim populations, and to model the WTPu of cultured meat, groups of statements

**TABLE 2** Items in the survey, factor loadings, Cronbach's alpha, and total variance explained (TVE) by the measure in percentages (%)

	KMO*	Cronbach's alpha	TVE (%)
1. Food neophobia	0.896	0.896	60
R I am constantly sampling new and different foods			
I do not trust new foods			
R I like foods from different countries			
If I do not know what is in a food, I will not eat it			
R At dinner parties, I will try a new food			
Some foods look too weird to eat			
I am afraid to eat things I have never had before			
I am very particular about the foods I eat			
R I will eat almost anything			
R I like to try new foods from all over the world			
2. Food technology neophobia	0.770	0.757	51
The benefits of new food technologies are often grossly overstated			
There are plenty of tasty foods around, so we do not need to use new food technologies to produce more			
New food technologies decrease the natural quality of foods			
R New products, using new food technologies, can help people have a balanced diet			
R Innovations in food technology can help us produce foods in a sustainable manner			
3. Importance of healthiness of food	0.670	0.748	67
R The healthiness of food has little impact on my food choices			
I am very particular about the healthiness of the food I eat			
R I eat what I like and I do not worry much about the healthiness of food			
4. Importance of cooking	0.756	0.824	66
R The less I have to do to prepare a meal—the better			
I love cooking, and will spend a lot of time and effort to prepare foods on a daily basis			
R At home, I preferably eat meals that can be prepared quickly			
Even though I live a busy life, whenever possible I love to cook and bake			
5. Importance of the environmental	0.717	0.692	46
When I buy foods, I try to consider how my use of them will affect the environment			

(Continues)

**TABLE 2** (Continued)

	KMO*	Cronbach's alpha	TVE (%)
I am worried about humankind's ability to provide the nutritional needs for all people living on earth now			
Something drastic has to change in order to feed all the people on earth by 2050			
R The world can easily sustain the food demands of a growing population in one or two generations time			
R Humankind is <i>not</i> responsible for global warming			
6. Importance of livestock meat	0.840	0.901	68
Eating meat is necessary for obtaining beneficial nutrients			
R The nutritional benefits of meat can easily be matched by alternative protein sources			
Meat is an important part of a healthy and balanced diet			
The taste of meat is important to me			
The texture of meat is important to me			
The smell of meat is important to me			
7. Cultured meat characteristics	0.747	0.901	84
Cultured meat is healthy			
Cultured meat is safe to eat			
Cultured meat is nutritious			
8. Cultured meat benefits compared to livestock meat	0.669	0.757	68
1. Cultured meat is much more sustainable than traditional meat			
2. Cultured meat is much tastier than traditional meat			
3. Cultured meat is much cheaper than traditional meat			
9. Willingness to engage with cultured meat	0.634	0.843	76
Are you willing to try cultured meat?			
Are you willing to purchase cultured meat?			
Are you willing to pay more for cultured meat?			

\*KMO: the Kaiser–Meyer–Olkin Measure of Sampling Adequacy (created as output of the principal component analysis), indicating proportion of variance explained by the underlying statements.

regarding a same topic were merged into a single variable, representing a respondents' mean score on that measure (De Koning et al., 2020; Gómez-Luciano et al., 2019). The reliability of this was assessed using confirmatory principal component analysis using Varimax as rotation method, and Cronbach's alpha values on the complete dataset (Table 2) (De Koning et al., 2020). Cronbach's alpha values should be above the preferred minimum of 0.7 (Tavakol & Dennick, 2011). Construct validity was assessed by reporting the total variance explained (TVE,

Table 2), and the Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO, Table 2), created as output of the principal component analysis that indicates the proportion of variance explained by the underlying statements, which should be >0.6 (Pallant, 2016).

All Cronbach's alpha scores were above the preferred minimum of 0.7 (Tavakol & Dennick, 2011), except for the variable "the importance of the environmental" (Cronbach's alpha = 0.672). Deleting any of the five items resulted in a lower Cronbach's alpha. Because the score was

not drastically below 0.7, it was chosen to keep the measure in the study. Total variance explained was also relatively low (44.88%), so caution was taken in assessing the results associated with this variable. All KMO-scores were above the preferred 0.6 (Pallant, 2016).

## 2.4 | Data analysis

SPSS, version 26, was used for data analysis. To accomplish the first two aims of this study (gain insight into the perceptions of the British Muslim community with regard to livestock meat, cultured meat, and food choice determinants, and investigating similarities and differences with the non-Muslim UK community), chi-square tests for goodness-of-fit, with adjusted residuals for pairwise comparison were used to test associations between the two populations and the variables meat avoidance, current and future meat consumption. The distribution of the test variables (Table 2, Sections 1–6) was evaluated using Shapiro–Wilks tests for small samples. Based on the nonparametric distribution of the test variables, ordinal nature of the Likert scale, and unequal sample sizes, Mann–Whitney *U* tests were chosen to test for associations with both populations. The Mann–Whitney *U* test is considered to be robust against unequal sample sizes, like the samples in this study (Pallant, 2016).

To accomplish the third aim of this study (model the willingness to purchase (WTPu) cultured meat for both populations), a method was applied, very similar to the method used by Gómez-Luciano et al. (2019). WTPu cultured meat was recoded as a binary choice (Verbeke, 2015): “Yes” = 1, “Maybe,” and “No” = 0. Binary logistic regression was used to model WTPu, after a PCA was performed for each population to reduce the number of variables and avoid multicollinearity by identifying components. Factor coefficients were suppressed below 0.4. From each component, the factor (variable) with the biggest effect loadings was chosen to use in the binary regression model, of which the diagnostics also retrieved regression coefficients and Wald  $\chi^2$  statistics. As such, it revealed the predicted WTPu cultured meat and its most important determinants for each population. The minimum sample size for binary logistic regression is  $50 + 8 \times P$  ( $P$  = number of predictors in the regression model) (Pallant, 2016). For this study that would be 74, a number that both populations exceeded.

## 3 | RESULTS

### 3.1 | Descriptive statistics

Chi-square tests for goodness of fit ( $\chi^2 = 6.520$ ,  $df = 2$ ,  $p = 0.038$ ) revealed that there were significantly more respondents from the non-Muslim population (12%) that indicated they completely avoided meat and/or animal products compared to respondents from the British Muslim population (5%). Furthermore, significantly more Muslim respondents (28%) indicated to purposely avoid meat and/or

**TABLE 3** Responses to the statements regarding eating in accordance to halal requirements among the British Muslim respondents, expressed in percentages (%)

	Agree	Neutral	Disagree
If I don't know whether a new food is halal, I will check first with a religious authority.	59	22	19
Even if I was not sure a new food was halal or haram, I would not try it.	88	5	7
If I believe a new food to be haram (prohibited), I will not try it.	92	2	6

animal products on some days compared to respondents from the non-Muslim British population (20%). Chi-square tests ( $\chi^2 = 14.115$ ,  $df = 2$ ,  $p < 0.001$ ) also showed a higher intend to decrease meat consumption in the future (45%) within the British Muslim population compared to respondents from the non-Muslim British population (27%). Consequently, respondents from the non-Muslim British population indicated more often that they would not change their meat consumption in the future compared to the Muslim population (71% vs. 53%).

Responses to the three statements regarding the extent to which British Muslim respondents adhere to *halal* guidelines, showed most respondents are very strict when it comes to trying foods not known to be *halal* (Table 3). A smaller majority (59%) would consult with a religious authority to find out.

### 3.2 | Acceptance of cultured meat

Mann–Whitney *U* tests revealed no associations between the two populations and the perceived characteristics of cultured meat. All scores found for both populations ranged between 3 (neither agree nor disagree) and 4 (agree) (Table 4). There were associations found between the two populations and the perceived benefits of cultured meat compared to livestock meat. For all three statements, Muslim respondents are less negative about the sustainability, taste, and price of cultured meat compared to livestock meat (Table 4).

Figure 1 shows results for the statements regarding willingness to engage (try, purchase, and pay more) with cultured meat. A chi-square test revealed an association between the populations and their willingness to purchase cultured meat ( $\chi^2 = 7.837$ ,  $df = 2$ ,  $p = 0.020$ ). British Muslim respondents were more willing to purchase cultured meat (38%) compared to respondents from the non-Muslim British population (25%). Furthermore, an association ( $\chi^2 = 11.434$ ,  $df = 2$ ,  $p = 0.003$ ) found was between the populations and the willingness to pay more for cultured meat. British Muslim respondents were more willing to pay extra for cultured meat (15%) compared to respondents from the non-Muslim population (6%), although both populations show low willingness to pay more.



**TABLE 4** Mann–Whitney *U* test results for the characteristics and benefits of cultured meat

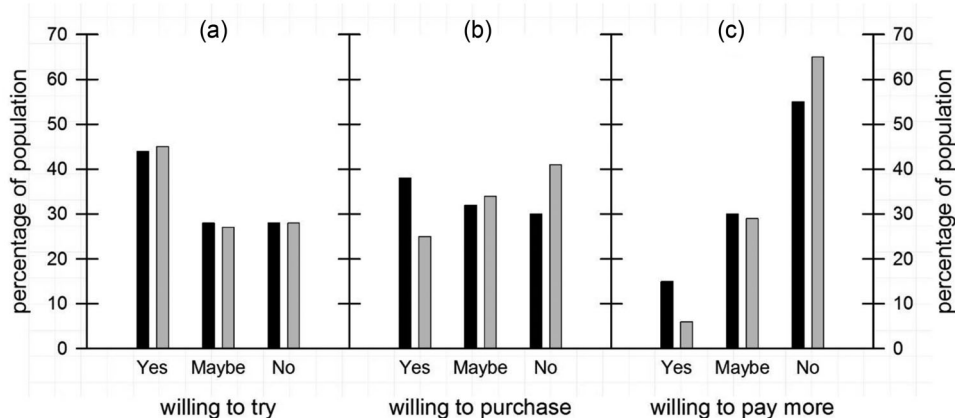
Cultured meat (CM) characteristics	$\mu$ Muslim	$\mu$ Non-Muslim	Z	SE***	p Value
CM is healthy	3.3	3.1	−1.235	1302.24	0.217
CM is safe to eat	3.3	3.1	−1.369	1328.45	0.171
CM is nutritious	3.4	3.3	−0.557	1330.47	0.578
Cultured meat benefits					
CM is more sustainable than livestock meat	3.4	3.1	−2.900	1354.89	0.004**
CM is tastier than livestock meat	2.8	2.5	−2.135	1241.28	0.033*
CM is cheaper than livestock meat	2.8	2.4	−3.904	1317.90	<0.001**

Note: *p* Values are significant for  $p < 0.05$ .

\* $p < 0.05$ .

\*\* $p < 0.01$ .

\*\*\*Standard error.



**FIGURE 1** Variation in the willingness to engage with cultured meat between the non-Muslim British population (gray bars) and the British Muslim population (black bars). (a) Willing to try; (b) willing to purchase; and (c) willing pay more for cultured meat, expressed in percentages (%) of both populations

### 3.3 | Psychographic factors

Mann–Whitney *U* tests revealed British Muslim respondents to have higher levels of food neophobia and food technology neophobia compared to the non-Muslim British population (Table 5). Significant differences were also found between the populations for the variables “the importance of cooking” and “the importance of the environmental” (Table 5). Respondents from the non-Muslim British population scored higher on the variable importance of cooking (3.4 vs. 2.9), and higher on the variable importance of the environmental when making food choices (3.8 vs. 3.7), suggesting that the non-Muslim British population places a greater importance on the notion of engaging in home cooking compared to the British Muslim population. However, no statistical differences were found with regards to aspects of the healthiness of food and similarly the significance of livestock meat is equally important to both populations (Table 5).

### 3.4 | Principal component analysis results

A PCA was carried out for each population separately, in order to reduce the number of variables that will serve as input for the binary logistic regression by identifying components. The PCA created three components for each population (Table 6). For the British Muslim population, they were related to (1) cultured meat characteristics and benefits; (2) food and food technology neophobia; and (3) buying decisions. For the non-Muslim British population, they were related to (1) cultured meat characteristics and benefits; (2) food neophobia and the importance of cooking; and (3) buying decisions.

The variables with the most significant factor loadings were chosen as predictor in the model to predict WTPu cultured meat. For the British Muslim population, these were “cultured meat characteristics,” “food neophobia,” and “importance of livestock meat.” For the



**TABLE 5** Mann-Whitney *U* test results for food neophobia, food technology neophobia, and the importance of healthiness of food, love for cooking, the environmental impact of food, and livestock meat

	$\mu$ Muslim	$\mu$ non-Muslim	Z	SE***	p Value
Food neophobia	2.5	2.3	-2.797	1384.51	0.005**
Food technology neophobia	2.8	2.5	-5.236	1407.51	<0.001**
Importance of health	3.5	3.4	-1.449	1404.14	0.147
Importance of cooking	2.9	3.4	5.606	1409.75	<0.001**
Importance of the environmental	3.7	3.8	2.518	1408.63	0.012*
Importance of livestock meat	3.6	3.6	1.073	1411.65	0.283

Note: *p* Values are significant for  $p < 0.05$ .

\* $p < 0.05$ .

\*\* $p < 0.01$ .

\*\*\*Standard error.

**TABLE 6** Principal component analysis reduction of variables results, using varimax

	Muslim population			Non-Muslim population		
	Component			Component		
	1	2	3	1	2	3
Food neophobia		0.884*			-0.769*	
Food technology neophobia		0.676		-0.652		
Importance of health			0.698			0.788*
Importance of cooking					0.744	
Importance of environment		-0.517	0.550			0.595
Importance of livestock meat			-0.734*			-0.644
Cultured meat characteristics	0.896*			0.843*		
Cultured meat benefits vs. traditional meat	0.795			0.719		

Note: Factor loadings below 0.4 were suppressed. The factor with the highest loading for each component was chosen as input for the binary regression analysis to model the WTPu.

\*Factor chosen as input for the binary regression analysis.

non-Muslim British population, these were “cultured meat characteristics,” “food neophobia,” and “the importance of healthiness of food.”

### 3.5 | Binary logistic regression results

For the British Muslim population, the binary regression model (Table 7) revealed variable “cultured meat characteristics” to be the significant predictor of the WTPu cultured meat. The variable was positively related to the WTPu, meaning a one-unit increase in the predictor increased the intent to purchase cultured meat. This means that

respondents that scored higher for the perceived health, safety, and nutritiousness of cultured meat were more willing to purchase cultured meat.

Because it was a binary model,  $\text{Exp}(\beta_i)$  (Table 7) values represent an odds ratio change, indicating the probability change of a respondent answering 1 (“yes”) to the question if they are willing to purchase cultured meat for a one-unit change of the predictor (and all others remain equal). In a model containing zero predictors (the null-model), the probability ( $p$ ) of answering “yes, I would purchase cultured meat” is 0.5. Consequently, at a certain value of a predictor, the odds of 1 for the WTPu would be:  $O(\text{WTPu}) = p/(1 - p)$  (Gómez-Luciano et al., 2019). The odds ratio ( $\text{Exp}(\beta_i)$ ) for “Cultured meat characteristics” was 7.941

**TABLE 7** The willingness to purchase (WTPu) cultured meat for the Muslim and non-Muslim UK population, using binary logistic regression with coefficient and exponentiated coefficient estimates, Wald statistics, and significant levels (method based on Gómez-Luciano et al., 2019)

Muslim UK population	B	SE	Wald	Sig.	Exp( $\beta_i$ )
Cultured meat characteristics	2.07	0.41	25.16	<0.001	7.941
Food neophobia	-0.47	0.38	1.56	0.212	0.624
Importance of livestock meat	-0.20	0.39	0.26	0.612	0.819
Non-Muslim UK population					
Cultured meat characteristics	2.085	0.278	56.39	<0.001	8.042
Food neophobia	-0.810	0.208	15.24	<0.001	0.445
Importance of health	0.047	0.159	0.09	0.768	1.048

Note: Goodness-of-fit statistics of the model associated with WTPu plant-based proteins in the British Muslim community:  $-2\text{Log likelihood statistic} = 109.54$ . Overall success rate = 81%. Goodness-of-fit statistics of the model associated with WTPu plant-based proteins in the non-Muslim community:  $-2\text{Log likelihood statistic} = 100.49$ . Overall success rate = 82%. B = beta values; SE = standard error; Wald = Wald chi-square value; Sig. = significance; Exp( $\beta_i$ ) = odds ratio change.

(Table 7), which results in a probability of the WTPu ( $p = 7.941/(1 - p) = 0.888$  this is an  $0.888/0.5 = 78\%$  increase in probability of a respondent to be willing to purchase cultured meat.

For the non-Muslim UK population, the model revealed the variables “cultured meat characteristics” and “food neophobia” to be significant predictors of the WTPu cultured meat. The Exp( $\beta_i$ ) for “cultured meat characteristics” was 8.024 (Table 7), resulting in a probability of WTPu = 0.889. This is a 78% increase from the original 0.5 probability. The Exp( $\beta_i$ ) for “food neophobia” was 0.445 (Table 7), resulting in a probability of WTPu = 0.310. This is a 38% decrease ( $1 - (0.310/0.5)$ ) from the original 0.5 probability. The overall success rates of the models: 82% for the British Muslim population and 81% for the non-Muslim population, indicated both models had predictive power (Gómez-Luciano et al., 2019).

## 4 | DISCUSSION

This study aimed to gain insight into the British Muslim community, investigating their perceptions toward food choice determinants, livestock meat, and cultured meat. This attempt to gain an extensive, holistic picture of food lifestyles of this large community within the United Kingdom is something that has not been adequately investigated in the literature to date. Therefore, the findings from this study are novel, and the implications of our findings will be discussed here.

Our results suggest that the British Muslim community and the non-Muslim British community are virtually aligned when making considerations for the importance of livestock meat and the healthiness of food in their diet. Furthermore, our findings show that both pop-

ulations slightly different but essentially the same level of inclination toward novel food and food technologies. There is a slightly greater food and food technology neophobia among the British Muslim population that can be explained in terms of the halal principle, which makes Muslims somewhat more cautious with regards to foods they are not familiar with. Finding some similarities between the populations was consistent throughout all aspects of this study (when testing for associations, in the components created by the PCA, and in identifying factors influencing the WTPu). Finding many similarities between both populations might come as a surprise, given the general assumptions made of Muslims and their framing as a community supposedly at odds with or unintegrated into the United Kingdom (Jackson, 2018; Peucker & Ceylan, 2017). In fact, the similarities suggest an alternative picture, which makes sense when we consider that Muslims in the United Kingdom experience the same socialization processes as their non-Muslim counterparts (schooling, Abrahamic values, media influence, etc.). Moreover, the religious ethic of Muslims is very similar to their Christian and Jewish counterparts, the Qur’an affirming the scriptures of Prophets such as Moses and Jesus and reflecting content that is mostly aligned to the Judeo-Christian tradition (De Sondy et al., 2020). For the authors, this finding therefore is perfectly in line with our expectations.

However, there were some differences between the two populations that require interpretation. There were significantly fewer people in the British Muslim sample that completely avoided meat ( $p = 0.035$ ). Although this study found an equal level of importance of livestock meat for both populations, slaughtering animals and the consumption of their meat is intrinsically linked with Islamic celebrations, mainly the birth of a child or the Festival of Sacrifice (Hamdan et al., 2021), which may contribute to less people considering themselves vegetarian or vegan. However, they show a significantly higher willingness to reduce their meat consumption than people from the non-Muslim British population. This may be linked with the religious ethos of moderation. In Islamic belief, moderation is required in all facets of life, including food and drink. The Qur’an commands Muslims not to pursue an ostentatious and luxurious lifestyle (Sandıkcı, 2018), which may underpin the indication to decrease their meat consumption in the future. Furthermore, it could also be linked with the finding that Muslim respondents attributed a higher score to the importance of the environmental when making food choices, compared to respondents from the non-Muslim British population. This could indicate a higher level of awareness about the impacts of livestock meat production, which increases the willingness to reduce meat consumption (Hartmann & Siegrist, 2017). However, the higher importance of the environmental score attained for the British Muslim population could also stem from a religious ethic rooted in scripture and Islamic theology. The Qur’an describes the human being as a “viceregent on Earth” (*khalifa*) (Qur’an 2: 30) and is replete with references to the ontological significance of the environment both in itself, as a sustainer of life, and for its importance to ritual practices (Dien, 2000). It is perhaps of no surprise then that Muslims attribute high scores to the importance of the environmental.

Respondents from the non-Muslim British population attributed a significantly higher score to the importance of cooking than respondents from the British Muslim community. Cooking and food are at the center of Muslim family life, with the primary responsibility usually placed on women (Joseph, 2006, p. 105), so spending a lot of time on cooking may be perceived as more natural, and therefore Muslim respondents are less likely to attribute high scores. Contrastingly, there is evidence that cooking skills are diminishing in Western societies (Lyon et al., 2011), people in the United Kingdom are cooking less at home (Mills et al., 2017), and consuming more convenience foods (Kellershohn et al., 2018). Therefore, respondents from the non-Muslim population could have perceived “basic” cooking as a big effort, attributing higher scores to those statements.

Acceptance rates of cultured meat were relatively low for both populations. Both populations showed “neutrality” in regard to the statements regarding cultured meat characteristics (healthy, safe, nutritious, etc.) with scores ranging between 3 and 3.5 (the maximum score was 5). These findings are consistent with Gómez-Luciano et al. (2019), who investigated the British population as a whole.

The WTPu cultured meat for both populations (Muslim population = 38%, non-Muslim population = 25%) was higher than the WTPu reported by Gómez-Luciano et al. (2019) (20%). Because data collection for this study took place more recently, people may be more aware about the concept, which may explain the higher acceptance (Rolland et al., 2020). The willingness to try cultured meat was nearly identical at 44% and 45% for the Muslim population and non-Muslim British population respectively. Respondents from the British Muslim population attributed significantly higher scores to the perceived benefits of cultured meat, it being more sustainable, tasty, and cheaper than livestock meat. However, scores for both populations were low, ranging between 2.4 and 3.4. At this point, due to a lack of existing literature on this topic, it would be speculation why these differences were found. Further research is necessary to confirm our findings and explore underpinning factors.

Something that needs to be considered when interpreting the differences between the British Muslim population and the British non-Muslim population is the small sample size of the British Muslim population ( $n = 118$ ), which creates difficulties for the generalizing of the findings. A convenience sampling method was used, which relies on the willingness of a person to respond to the survey (Etikan et al., 2016). When the survey was distributed, several reminders were sent out encouraging people to participate, which yielded some extra responses. Furthermore, we collaborated with people within the British Muslim community themselves to distribute the survey among the community, in an attempt to increase comfort and familiarity with potential respondents. Unfortunately, for this study, the British Muslim community seemed not very willing to participate, possibly due to reticence about sharing personal information (Muslims communities are already over-surveyed, and there may have been an issue with survey fatigue among some respondents). These difficulties were not experienced when distributing the survey for the non-Muslim British population ( $n = 391$ ). A different sampling method may improve this for future studies. However, the current sample size was deemed appropriate for the statistical

tests chosen (the Mann–Whitney  $U$  test and binary logistic regression), described in Section 2.4 of this article.

Eighty-eight percent of British Muslims would not try new food because they were not sure of to be *halal*, while 92% of British Muslims would not try a food they thought was *haram* (prohibited), showing a high willingness to adhere to religious dietary guidelines. Our findings highlight the importance of cultured meat considered to be Halal, if it is to be accepted as a dietary option by Muslims. Previous studies have explored the conditions under which this might be the case (Hamdan et al., 2017; 2021). Two main conditions were identified: stem cells should be derived from animals that are slaughtered according to Halal customs (note: slaughtering the source animal is not always necessary), and the use of serum (derived from blood) containing important nutrients for the growing of cells (Jochems et al., 2002) should be avoided since the consumption of blood is explicitly haram. It should be noted that Hamdan et al. (2017, 2021) represent the arguments put forward by Muslim jurists (i.e., Shari’a experts), while our results come from the non-Muslim Muslim population (i.e., followers of the faith). Most Muslims will respect the informed guidance of Shari’a experts; however, individual Muslims develop their own interpretations during their engagement with the day-to-day consumer culture they live in (Jafari & Süerdem, 2012). This means that the actions of everyday Muslims do not always align with the ideal principles and tenets.

The perceived characteristics of cultured meat were the most important variable influencing the WTPu for both populations (Table 7). This is in line with findings from Gómez-Luciano et al. (2019) and Verbeke et al. (2015). Moreover, the health, safety, and nutritional value of cultured meat have been identified as important factors influencing acceptance in numerous studies (Bryant et al., 2020; Franceković et al., 2021; Liu et al., 2021). For British Muslim respondents, a one-unit increase of this factor increased the probability of the WTPu with 69%, and for non-Muslim British respondents with 55%. Our results indicate that further development of cultured meat should focus on improving its healthiness, safety, and nutritional characteristics, regardless of religious alignments. Furthermore, when cultured meat becomes widely available to consumers, these characteristics should be emphasized in the marketing strategies of cultured meat products.

## 5 | CONCLUSIONS

The British Muslim and the British non-Muslim population are largely aligned in their considerations about food in general, livestock meat, and cultured meat. The few significant differences found in this study suggest the British Muslim community to be a marginally more accepting of cultured meat compared to the general British community. With regard to the willingness to purchase cultured meat, further product development and marketing strategies should focus on the same factor for both populations: the healthiness, safety, and nutritional characteristics of cultured meat. We are currently developing a follow-up study in which we employ more qualitative methods (e.g., focus

groups, interviews) to gain insight into the factors that underpin the findings from this paper.

## INFORMED CONSENT STATEMENT

Informed consent was obtained from all subjects involved in the study.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## ORCID

Frank Vriesekoop  <https://orcid.org/0000-0001-7129-9992>

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