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Drivers of Likelihood to Consume Carbon-Friendly Beef and Plant-Based Meat in the U.S.

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Understanding behavioral and demographic factors determining the consumption of sustainable meat and meat alternatives is critical in the context of sustainability. We used a sample of 430 US consumers to collect data on consumption behavior related to sustainable beef and plant-based meat alternatives. Results show that opinions and beliefs, past actions, and consideration of future consequences are behavioral factors, and age and political affinity are demographic factors that affect the likelihood of eating carbon-friendly beef and plant-based meat. The findings highlight the need for increasing environmental awareness of beef production and targeted marketing for growing consumption of such alternatives to conventional meats.

Key words: behavior, climate change concern, sustainable consumption

Introduction

In 2022, the agricultural sector alone contributed around 9.4% of total greenhouse gas (GHG) emissions in the United States, most of which came from the livestock sector (EPA, 2024). Methane emissions from enteric fermentation, manure management, and CO₂ emissions from continuous grazing from the beef sector, were major sources of livestock sector GHG emissions. In the context of the U.S., beef production accounts for 2.2% of all GHG emissions (Li et al., 2016).

More generally, meat production and consumption have significant implications for sustainability across various dimensions. Sustainability is a diverse concept that encompasses environmental, economic, social, and cultural aspects (Garcez de Oliveira Padilha et al., 2021). Environmentally, meat production contributes to GHGs emissions, larger water footprints and biodiversity loss (Parlasca & Qaim, 2022). Steinfeld H et al. (2006) reported that meat production and consumption generated 4.6 to 7.1 billion tons of GHGs annually. With respect to water footprints, out of the 92% of freshwater used in agriculture, one-third relates to animal products (Gerbens-Leenes et al., 2013). Machovina et al. (2015) reported that livestock accounted for about 20% of total terrestrial biomass and consumed over half of directly used human-appropriated biomass. Economically, meat production impacts resource allocation for crop production and livestock production. From a social perspective, meat production and consumption are associated with ethical and social welfare issues (Alonso et al., 2020). Global meat consumption trends show that total meat intake has increased globally due to growing population and per capita income. This trend towards increased meat consumption is expected to put pressure on various sustainability dimensions (Parlasca & Qaim, 2022), leading experts to warn that this pressure will have serious consequences for global food security and human health (Li, 2020).

Among various climate change mitigation strategies, changing meat-eating habits have been cited as an affordable option to address the issue (de Boer et al., 2013). Clune et al. (2017) reported that reducing the consumption of ruminant meat and dairy products has the highest

impact on GHG emissions compared to other foods. If the crops grown for animal feed and biofuel were instead directly consumed by humans, about 70 percent more calories would be available in the global food system, and four billion more people could be fed (Stoll-Kleemann & Schmidt, 2016). In this regard, Tilman and Clark (2014) asserted that a vegetarian diet could reduce GHG emissions from food production by 55%, and Springermann et al. (2016) predicted that a transition towards more plant-based diets could reduce global food-related GHG emissions by 29-70% in 2050 while dropping human mortality by 6-10%. Yet, demand for meat is inelastic and this means that in addition to making efforts to reduce meat consumption or switching entirely to a vegetarian diet, it is necessary to offer meat that is produced more sustainably, as well as plant-based meat alternatives. In this context, sustainable meat alternatives are produced with reduced environmental impacts, such as GHG emission reduction, water footprint, biodiversity loss, etc.; plant-based meat alternatives are food products made from vegetarian or vegan ingredients, and eaten as a replacement for meat.

Life cycle assessment studies show that compared to conventional meat (e.g., beef burger patty), plant-based meat (e.g., impossible burger) reduces GHG emission by 89% and land use by 96% (Khan et al., 2019). However, regular meat consumers are much less likely than those declaring an alternative diet, such as vegan/vegetarian/other, to select a plant-based meat item when a beef item is available (Tonsor et al., 2023). Furthermore, loyal beef consumers in the U.S. are less sensitive to beef price changes (Tonsor et al. 2018). Given this, it is important to produce beef in a sustainable way that reduces GHG emissions either through improved genetics, feed additives, manure management, or grazing management. A comparison of carbon sequestration rates between conventional and environment-friendly grazing, such as rotational/prescribed grazing, shows an increased sequestration rate for the latter, implying reduced GHG emissions from sustainably produced meat (Bosch et al., 2008).

A global transition of the food system towards consumption of more sustainably-produced meat and meat alternatives requires a wide range of activities to evoke technical changes from producers and behavioral changes from consumers (Bendz et al., 2023). A shift towards low meat diets (de Boer et al., 2017), consumption of alternatives to farm-grown meat, such as plant-based meat (Slade, 2018), and a wide adoption of sustainably-produced meat, such as carbon-friendly beef (Li et al., 2016), have received considerable attention for their potential to address climate change concerns associated with meat production and consumption.

Most of the previous research studied the effects of sustainability labels on meat consumption, hypothesizing that sustainability concerns influence meat consumption (Van Loo et al., 2014; Apostolidis & McLeay, 2019). Van Loo et al. (2014) showed that consumers prefer animal welfare aspects more than organic and carbon footprint labels on meat. Previous studies report that food consumption overall is inelastic to taxes to reduce GHG emissions (Afshin et al., 2017), but beef consumption declined when GHG taxes were applied in the EU (Biasini et al., 2021). Related to this, a recent study from the U.S. showed that policies targeting a reduction of GHG emissions are likely more cost-effective for reducing beef consumption than limiting vehicle use, another major source of GHG emissions (McFadden et al. 2022); although Kilders and Caputo (2024) found that market demand for beef with a reduced carbon footprint is small in the U.S. on the margin of 3%-5%.

Given this, it is imperative to gain an understanding of the factors influencing the consumption of sustainably produced meat and meat alternatives. To inform food policies, and develop market and outreach efforts, this study analyzes behavioral and socio-demographic factors that affect US consumers' readiness to consume sustainably produced beef and plant-based meat. To do so, we collected data from 430 US consumers and employed a logistic regression model to estimate the effect of behavioral and demographic factors on the willingness to consume carbon-friendly beef and plant-based meat. Results suggest that opinions and beliefs, past actions, and consideration of future consequences, as well as age and political affinity affect the likelihood of eating carbon-friendly beef and plant-based meat.

Background Information on Drivers of Consumption of Sustainable Meat and Meat Alternatives

Behavioral Factors

A person's behavior is affected by factors related to the person, including physical factors (e.g., health), personal and emotional factors (e.g., personality, beliefs, emotions, attitudes, expectations), life experiences (e.g., family, culture, friends) and context. In this section, we summarize previous studies that examined the effect of behavioral factors on sustainable meat consumption, which includes consumption of sustainably produced meat and meat alternatives.

Dietary Habits

Studies examining the effect of dietary habits on consumers' willingness to replace conventional meat with meat alternatives show mixed evidence. For example, Slade (2018) studied preferences for different types of burgers and found that frequent meat eaters were less likely to buy plant-based burgers. Positive reactions toward meat alternatives in terms of taste, texture, appearance, and smell were shown for regular consumers of meat alternatives suggesting that current consumption patterns influence the acceptance of meat alternatives (Michel et al., 2021). However, Hwang et al. (2020) found that the frequency of meat consumption did not influence the decision to purchase plant-based alternatives.

Meat Attachment

Meat attachment is a positive bond towards meat measured using hedonism, affinity, entitlement, and dependence. Previous studies showed that those who were strongly attached to meat were less willing to reduce meat consumption or buy plant-based meat substitutes (Graca et al., 2015). Profeta et al. (2020) found significant and negative associations with meat attachment and meat substitution in Germany. A comparative study of the U.S., China, and India by (Bryant et al., 2019) showed a negative effect of meat attachment on the likelihood of purchasing plant-based meat in the U.S., a positive effect in China and no effect in India.

Environmental Concerns

Several studies show that concerns related to climate change and the environment can influence food purchase decisions (Bryant et al., 2019; Circus & Robison, 2019; Hwang et al., 2020; Szejda et al., 2021). Consumers who endorse the value of caring for the environment are more likely to prefer plant-based substitutes than consumers who do not (de Boer and Aiking, 2011; Hoek et al., 2011). Li et al. (2016) showed that consumers who were more concerned with climate change, the environment, and local food were willing to pay more for carbon-friendly beef. However, some studies report that environmental concerns do not affect consumers' decisions on consuming meat or sustainably produced meat. For example, Arora et al. (2020) did not find any effect of environmental concern on meat purchase decisions, and Ishaq et al. (2023) did not find any effect of climate change concern on willingness to pay for sustainable meat alternatives, such as carbon-friendly beef.

Time Preference

Numerous studies have identified time preferences as a significant driver of health-related behavior, but very few have examined the effect of time preferences on food choice behavior. De Marchi et al. (2016) used the Consideration of Future Consequences (CFC) scale adopted from

Joireman et al. (2012) to measure time preference and its effect on food choice behavior. The study found that CFC significantly influenced consumer valuation for the USDA organic label. Tortora and Ares (2018) also found that respondents having a higher CFC made more healthful food choices, and Dassen et al. (2015) concluded as well that CFC has a strong relationship with healthy eating.

Perceptions and Knowledge

Perceptions regarding health and nutrition aspects of food are expected to drive consumer food choices (Rimal, 2005). Studies show that health-related perceptions and information influence preferences for meat alternatives (Van Loo et al., 2020; IFIC, 2021; SmartProtein, 2021). Sogari et al. (2021) analyzed factors affecting the intention to purchase meat-mushroom blended burgers and found that a positive perception of a sustainable diet, a positive attitude towards food innovation, and a positive motivation to process sustainability and nutrition information were significant drivers. Peschel et al. (2016) found that both subjective and objective knowledge influence environmentally-sustainable food choices.

Food Labels

Food labels play an important role in determining consumers' food choices. Several studies have been conducted to examine the role of food labels on meat and meat alternatives consumption (Apostolidis & McLeay, 2016, 2019; Edenbrandt & Lagerkvist, 2021; Carlsson et al., 2022; Marshall et al., 2022; Ortega et al., 2022). However, the usefulness of these food labels depends on consumers' attention and trust (Pieniak et al., 2010). While Mosier (2022) showed that consumers are willing to pay a premium for sustainable products if they trust the information on food labels and the information provider, Ishaq et al. (2023) found no significant influence of trust on the willingness to pay for sustainable ribeye beef steak.

Socio-demographic Factors

In this section, we briefly summarize prior research on the effects of key socio-demographic factors on sustainable meat consumption.

Age

Evidence of the effect of age on willingness to consume plant-based meat and other meat alternatives is mixed. Some studies found a negative association of age with meat alternatives (Slade, 2018; Van Loo et al., 2020) and others found no significant effect (Arora et al., 2020; Hwang et al., 2020; Szejda et al., 2021).

Gender

With regards to gender, Bryant et al. (2019) found that women are more likely to buy plant-based meat substitutes in China and in the U.S. A study conducted in Europe found among older adults that women are more eco-friendly compared to men (Broeckhoven et al., 2021). However, other studies found no significant differences in gender for purchasing decisions of meat alternatives (Slade, 2018; Bryant et al., 2019; Arora et al., 2020; Szejda et al., 2021).

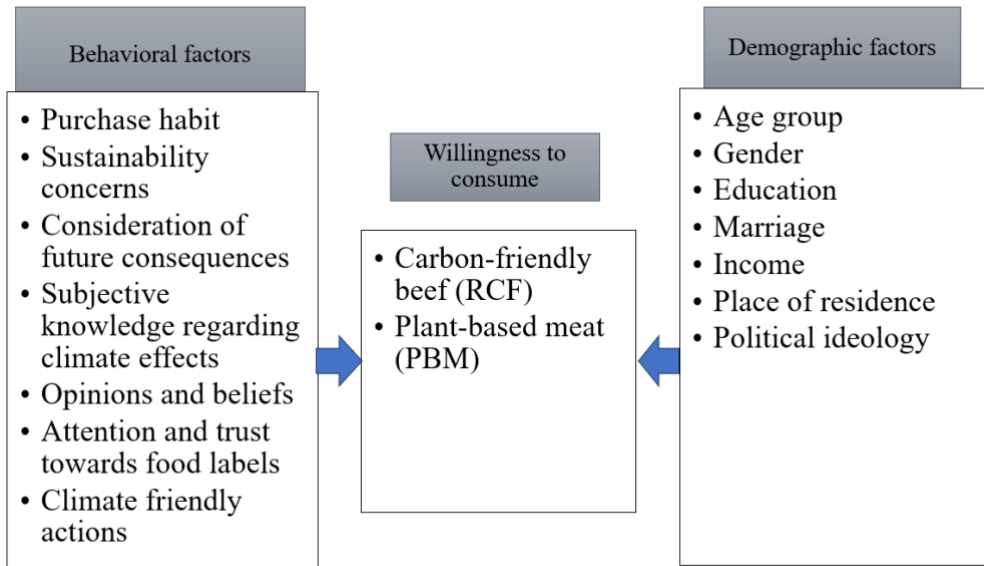


Figure 1. Conceptual Framework: Socio-Behavioral Factors of Willingness to Consume Sustainable Meat Options and Meat Alternatives

Education

Similar to age and gender, evidence on the effects of education on consumers' willingness to eat sustainable meat alternatives is mixed. There are studies that show a positive effect of education on preferences for meat alternatives (IFIC, 2020, 2021; Van Loo et al., 2020) and others that found a negative relationship between education and the willingness to buy plant-based meat alternatives (Hwang et al., 2020; Szejda et al., 2021).

Income

The evidence on the effect of income on willingness to consume meat alternatives is mixed, as well. The International Food Information Council (IFIC (2020) conducted a survey in the U.S. and found a positive association between income and the likelihood of trying plant-based alternatives. However, this association was negative in India, and no significant association was found in China (Bryant et al., 2019). In addition, Byrant et al. (2019) and Van Loo et al. (2020) did not find significant income effects on the purchase intention of meat alternatives or on market shares of meat alternatives; and Slade (2018) found no significant effect of income on the willingness to pay for plant-based burgers for Canadian consumers.

Deriving Research Questions

The discussed previous studies highlight many different factors that affect the consumption of sustainably produced meat and meat alternatives. Nevertheless, research that has analyzed several behavioral and socio-demographic factors together is scarce, especially in the U.S. context. Hence, this study investigates the influence of behavioral and demographic factors on consumers' willingness to consume sustainably produced beef (carbon-friendly beef) and a meat alternative (plant-based meat). Specifically, two research questions are posed:

1. What are the behavioral characteristics of those who are willing to consume carbon-friendly beef and plant-based meat?
2. What are the demographic characteristics of those who are willing to consume carbon-friendly beef and plant-based meat?

To answer these research questions, we collected data on consumer behavioral and demographic characteristics, as displayed in the conceptual framework in Figure 1. We then used descriptive analysis to examine similarities and differences between consumers willing to consume carbon-friendly beef and plant-based meat. Afterwards, we employed a logistic regression model to estimate the marginal effects of behavioral and demographic characteristics on the likelihood of being willing to eat carbon-friendly beef and/or plant-based meat.

Materials and Methods

Data Collection

We used an online survey facilitated by Qualtrics to collect the data.¹ The study received Institutional Review Board approval from *omitted for review* before conducting the survey. We collected data from 430 U.S. consumers. Screening questions related to age, meat shopping and consumption were asked in the beginning of the survey to ensure participants are 18 years or older, and are primary shoppers who purchase and consume meat. The authors developed the survey instrument that included questions related to demographic and behavioral characteristics. Age, gender, education, income, marital status, place of residence, and political ideology were the major demographics recorded. We also collected information about behavioral factors following those described in the previous section. The review of the literature presented in section 2 informed the development of the survey instrument described below.

Willingness to Consume Beef Raised Carbon-Friendly and Plant-Based Meat

The willingness to consume carbon-friendly beef was measured as a binary variable with a yes/no question on their willingness to consume beef produced using the rotational grazing approach. The willingness to consume plant-based meat was measured using a 3-point scale (very likely, somewhat likely and not likely) which was then converted into a binary variable by combining very likely and somewhat likely coded as one and, zero otherwise.²

Meat Purchase Habits

To assess meat purchase habits, respondents were asked about their beef purchasing frequency. The answers provided were daily (6), two times per week (5), weekly (4), once in two weeks (3), monthly (2), a few times per year (1) and never (0).

Sustainability Concerns

To measure sustainability concerns, a climate change concern scale was designed comprised of 11 items, such as ‘*Global climate change is happening*’, and ‘*I am concerned about the climate*

¹ Note: Part of the data has been used by Ishaq et al. (2023).

² We framed the questions for carbon-friendly beef and plant-based meat differently because the study respondents were meat consumers. Hence, we felt comfortable asking them a simple yes/no question regarding their willingness to consume carbon-friendly beef. Although meat alternatives are already on the market, we did not expect all respondents to be familiar with plant-based meat. Hence, we framed the response on 3-point Likert Scale.

change consequences'. Each of the items were rated on a seven-point Likert scale ranging from 1=strongly disagree to 7=strongly agree. The complete list of items is reported in Table A1 in the Appendix. To include participants' level of concern in the analysis we calculated an index by summing up the scores for all items and dividing it by 11. This was then standardized by subtracting the mean and dividing it by the standard deviation when used in the subsequent regression analysis.

Consideration of Future Consequences

Consideration of future consequences was measured using the statement '*I try to think how my actions will impact others long term*' on a 5-point Likert scale with 1= strongly disagree and 5 = strongly agree.

Subjective Knowledge Regarding Climate Effects

Subjective knowledge regarding climate effects of products and services was assessed using three items, measured on a 7-point Likert Scale ranging from 1= strongly disagree to 7= strongly agree. The items include '*I consider myself knowledgeable about the climate effects of products and services*'; '*I consider myself equipped to compare and evaluate the climate friendliness of different products and services*' and '*I am considered an expert in the field of climate effects of products and services by people who know me*'. To include participants' subjective knowledge in the analysis we calculated an index by summing up the scores for all items and dividing it by 3. This was then standardized by subtracting the mean and dividing it by the standard deviation to be used in subsequent regression analysis.

Measuring Climate Friendly Behavior

Climate friendly behavior was elicited using four statements measured as binary variables (Yes=1/No=0) to be used in subsequent regression analysis. Statements included were: (1) *Have you ever recycled or reused any product due to concern for climate change?* (2) *Have you ever carpooled or rode a bike to reduce carbon emissions?* (3) *Have you purchased a food item that is labeled as sustainable in the last three months?* and (4) *Have you reduced beef consumption or tried plant-based meat to mitigate climate change?*

Measuring Beliefs

We elicited the beliefs related to the contribution of beef production to GHG emissions by asking "*Do you believe beef production is contributing to Green House Gas (GHG) Emission?*" Answers were given on a 5-point Likert scale ranging from 1=strongly disbelieve to 5=strongly believe. We also asked, "*How positive or negative is your opinion about sustainable beef production practices?*" This was measured on a 5-point Likert scale ranging from 1=very negative to 5=very positive.

Table 1. Variable Definitions, Hypothesized Signs, and Summary Statistics of Explanatory Variables in Regression

Variable	Definition	Hypothesized sign		Mean (Standard deviation)
		RCF	PBM	
Behavioral characteristics				
BFREQ	Beef purchasing frequency (Scale 1-6)	-	-	3.94 (1.37)
CCCS	Climate change concern scale (Scale 1-7)	+	+	4.94 (1.08)
CFCS	Consideration of future consequences scale (Scale 1-5)	+	+	3.63 (1.03)
KNOW	Subjective knowledge regarding climate effects (Scale 1-7)	+	+	4.19 (1.43)
RECYCLE	1 if consumer does recycling/reusing	+	+	0.78 (0.41)
CARPOOL	1 if consumer does carpool	+	+	0.50 (0.50)
PSUS	1 if consumer purchase food items labelled as sustainable	+	+	0.54 (0.50)
TPBM	1 if consumer has reduced meat consumption or tried plant based to mitigate climate change	+	+	0.43 (0.50)
BELIEF	Belief about beef production and GHGs emissions (Scale 1-5)	+	+	3.18 (1.13)
OPINION	Opinion about sustainable beef production (Scale 1-5)	+	+	3.89 (0.91)
ATTN	Attention to labels on food packaging (Scale 1-3)	+	+	2.40 (0.60)
TRUST	1 if consumer trusts labels on food packaging	+	+	0.77 (0.42)
Demographic characteristics				
AGE	1=18-24, 2=25-34, 3=35-44, 4=45-54, 5=55-64, 6=65+ (in years)	+	-	3.78 (1.67)
GENDER	1 if female 0 otherwise	+	+	0.66 (0.47)
EDU	1= Below high school, 2= High school graduate/Associate degree and 3= College degree or higher	+	+	2.47 (0.57)
MARRY	1 if married 0 otherwise	+	+	0.56 (0.50)
INCOME	1= <10,000 to 24,999, 2= 25,000 to 49,999, 3=50,000 to 74,999, 4= 75000 to 99,999, 5=100,000 or more	+	+	2.88 (1.38)
URBAN	1 if consumer lives in urban area	+	+	0.73 (0.44)
DEMO	1 if consumer prefers democrats	+	+	0.53 (0.50)
REPUB	1 if consumer prefers republicans	-	-	0.24 (0.43)

Note: RCF= Willingness to consume carbon-friendly beef and PBM = Willingness to consume plant-based meat

Measuring Attention and Trust towards Food Labels

Attention to food labels was measured with the question “How much attention do you pay to labels on food packages?” The options provided were 1= never, 2=somewhat and 3= very much. Trust towards food packaging was measured by asking “Do you trust labels on food packaging?” (Yes=1/No=0).

Data Analysis

We used two separate binary logit regression models represented by equations (1) and (2) to analyze drivers of consumers' willingness to consume beef raised carbon-friendly (RCF), which is regarded as sustainably produced meat and plant-based meat (PBM) regarded as a meat alternative. The binary models take the following forms:

$$(1) \quad Y_{iRCF}^* = \beta X_i + \varepsilon_i$$

$$(2) \quad Y_{iPBM}^* = \beta X_i + \varepsilon_i$$

where Y_i^* is the expected utility for individual i (for RCF in equation 1 and PBM in equation 2); X_i is a matrix of covariates for individual i and ε_i is a random error term with mean 0 and variance $\frac{\pi^2}{3}$. The distribution of Y_i^* is unobserved and we observe the discrete variable Y_i such that

$$(3) \quad y_{iRCF} = \begin{cases} 1, & \text{if willing to consume carbon - friendly meat} \\ 0, & \text{otherwise} \end{cases}$$

$$(4) \quad y_{iPBM} = \begin{cases} 1, & \text{if most or somewhat likely to consume plant - based meat} \\ 0, & \text{otherwise} \end{cases}$$

The equations take the following forms: willingness/likeliness to consume carbon-friendly beef and plant-based meat, respectively.

$$(5) \quad y_{iRCF}^* = \beta_0 + \beta_1 BFREQ_i + \beta_2 CCCS_i + \beta_3 CFCS_i + \beta_4 KNOW_i + \beta_5 RECYCLE_i + \beta_6 CARPOOL_i + \beta_7 PSUS_i + \beta_8 TPBM_i + \beta_9 BELIEF_i + \beta_{10} OPINION_i + \beta_{11} ATTN_i + \beta_{12} TRUST_i + \beta_{13} AGE_i + \beta_{14} GENDER_i + \beta_{15} EDU_i + \beta_{16} MARRY_i + \beta_{17} INCOME_i + \beta_{18} URBAN_i + \beta_{19} DEMO_i + \beta_{20} REPUB_i + \varepsilon_i$$

$$(6) \quad y_{iPBM}^* = \beta_0 + \beta_1 BFREQ_i + \beta_2 CCCS_i + \beta_3 CFCS_i + \beta_4 KNOW_i + \beta_5 RECYCLE_i + \beta_6 CARPOOL_i + \beta_7 PSUS_i + \beta_8 TPBM_i + \beta_9 BELIEF_i + \beta_{10} OPINION_i + \beta_{11} ATTN_i + \beta_{12} TRUST_i + \beta_{13} AGE_i + \beta_{14} GENDER_i + \beta_{15} EDU_i + \beta_{16} MARRY_i + \beta_{17} INCOME_i + \beta_{18} URBAN_i + \beta_{19} DEMO_i + \beta_{20} REPUB_i + \varepsilon_i$$

where β_0 is the intercept term, β_1 through β_{20} are the coefficients to be estimated by maximizing the log-likelihood function with respect to each variable. Table 1 fully defines the explanatory variables and their summary statistics. Table A2 in the Appendix presents the correlation matrix for the behavioral variables included in the analysis.

Empirical results

Sample Characteristics

The study sample characteristics of age, income and ethnicity were closely comparable with the U.S. population (USCB 2010; USCB 2015 a; USCB 2015 b). The median age of respondents was 35-44 years, which corresponded with the 37.2 years for the U.S. population. Most of the respondents in the study sample were White (59.53% versus 72.4 % of the U.S. population), followed by Hispanic or Latino (18.14% versus 16.30%), Black or African American (13.72% versus 12.6%), and Asian ethnic groups (5.81 % versus 4.8%). Native American/Alaska Natives constituted the smallest ethnic group in the sample (0.47% versus 0.90%). Education ranged from a college degree or higher (50% compared to 32.50% of the population), high school graduate (46.51% versus 55.90%) to associate degree (4%). The median income of the respondents was \$50,000-\$74,999, which corresponded closely with the median income of the U.S. population (\$56,516). Out of the 430 respondents, about 65.81 % were female, which was higher than the 50.80% for the U.S. population. The higher sample share of female participants,

Table 2. Descriptive Statistics of Behavioral Factors Affecting Willingness to Consume Sustainable Meat

	Full sample (n=430)	WTC RCF (Yes=370)	WTC PBM (Yes=267)
<i>Beef purchasing frequency</i>			
A few times per year	4.19%	4.32%	3.00%
Monthly	14.19%	13.51%	11.24%
Once in two weeks	14.65%	15.14%	12.36%
Weekly	30.70%	30.81%	27.34%
Two times per week	22.56%	22.16%	26.59%
Daily	13.72%	14.05%	19.48%
<i>Sustainability concern</i>			
Climate change concern scale (mean score on 7-point agreement scale)	4.94	5.02	5.07
<i>Consideration of future consequences</i>			
I try to think how my actions will impact others in long term (mean score on 5-point agreement scale)	3.62	3.66	3.88
<i>Subjective knowledge</i>			
Knowledge regarding climate effects of products and services (mean score on a 7-point agreement scale)	4.19	3.37	4.68
<i>Opinion about sustainable beef production</i>			
Very negative	1.16%	0.54%	0.37%
Somewhat negative	3.26%	2.97%	2.25%
Neutral	30.47%	28.38%	21.35%
Somewhat positive	35.35%	35.14%	41.20%
Very positive	29.77%	32.97%	34.83%
<i>Belief about contribution of beef production to GHGs</i>			
Strongly disbelieve	9.77%	8.65%	4.12%
Somewhat disbelieve	15.35%	15.14%	11.61%
Neutral	33.02%	30.27%	32.21%
Somewhat believe	30.70%	33.24%	38.95%
Strongly believe	11.16%	12.70%	13.11%
<i>Attention to food labels</i>			
Never	5.81%	5.14%	0.75%
Somewhat	48.60%	49.19%	41.57%
Very much	45.58%	45.68%	57.68%
<i>Trust labels on food packaging</i>			
Yes	76.98%	78.92%	82.77%
No	23.02%	21.08%	17.23%
<i>Climate friendly actions</i>			
Done recycling/reusing	78.14%	81.89%	85.77%
Carpooled or rode a bike to reduce carbon emission	50.00%	52.16%	62.17%
Purchased food item labelled as sustainable	53.85%	56.91%	68.80%
Reduced beef consumption or tried plant-based meat to mitigate climate change	42.56%	44.05%	57.68%

Note: WTC RCF = Willingness to consume carbon-friendly beef and WTC PBM= Willingness to consume plant-based meat

however, is in line with women being over-proportionally responsible for grocery shopping and should not present a negative bias.

Behavioral Characteristics

Purchasing Habits

Table 2 shows the purchasing habits in terms of beef purchasing frequency for the total sample, as well as for those who are willing to consume carbon-friendly beef and are likely to eat plant-based meat. 31% of the total sample purchased beef weekly, 23 % purchased beef two times per week, and 14% purchased it daily. The beef purchasing habits of those willing to consume carbon-friendly beef is comparable to the full sample: 31% purchased beef weekly, 22% purchased it two times per week and 14% it daily. Among those willing to consume plant-based meat, 27% purchased beef weekly, 27% purchased it two times per week, and 20% purchased it daily. The results indicate that a majority of the study sample were frequent meat purchasers who were likely to eat carbon-friendly beef or plant-based meat.

Sustainability Concern

Table 2 reports the mean sustainability concern for consumers willing to consume plant-based meat and carbon-friendly meat. The overall score for the climate change concern scale was 4.94, indicating that, on average, participants were concerned about climate change. The items were internally consistent, as suggested by a Cronbach's alpha of $\alpha=0.84$ (Table A1). As shown in Figure 2, consumers who are likely to eat carbon-friendly beef and plant-based meat were more concerned than the full sample and those not likely to eat these alternatives. Consumers likely to eat plant-based meat and carbon-friendly beef had comparable levels of climate change concerns. Mean differences of the climate change concern scale for likely eaters and non-eaters of RCF and PBM were significant at 1% level of significance (see Figure 2).

Consideration of Future Consequences

Meat consumers' consideration of future consequences (those who are thinking about long-term consequences of their present actions) is shown in terms of mean consideration of future consequences agreement score in Table 2. Overall, the sample scored slightly higher than neutral (3.6) showing that on average, participants care somewhat about future consequences of their actions. The relatively higher mean score for those likely to eat plant-based meat implies that they care more about the long-term consequences of their actions than those willing to eat carbon-friendly beef. We observe that consumers who are likely to eat sustainable meat alternatives think more about the long-term consequences of present actions (consideration of future consequences score=3.9) than those not likely to eat these alternatives (consideration of future consequences score= 3.2) (see Figure 3). The mean difference of the scores for likely eaters and non-eaters of PBM was significant at 1% level of significance.

Subjective Knowledge on Climate Effects of Products and Services

Table 2 reports the mean value for subjective knowledge of participants regarding the climate effects of products and services. The overall knowledge score of 4.2 with an acceptable Cronbach's alpha 0.76 (Table A3) implies that survey respondents were somewhat knowledgeable regarding climate effects of products and services. Consumers likely to eat carbon-friendly beef and plant-based meat were more knowledgeable with regards to climate effects of products and

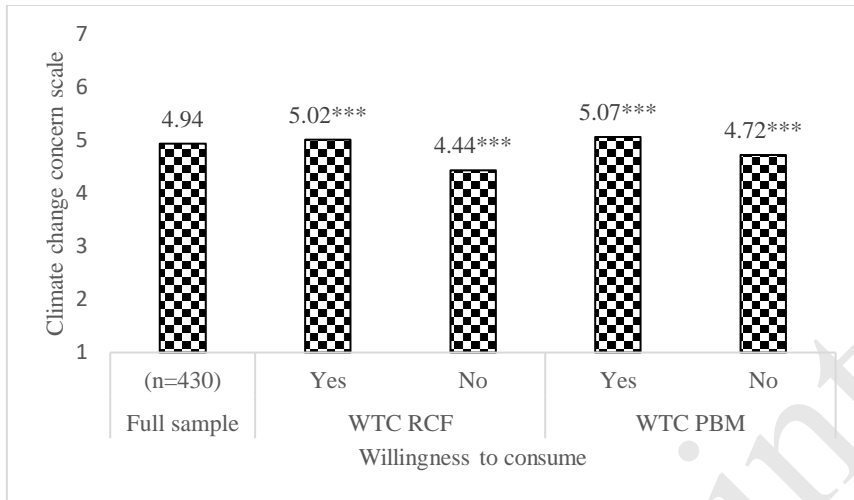


Figure 2. Relationship between Climate Change Concern and Willingness to Eat Sustainable Meat and Meat Alternative

WTC RCF= Willingness to consume carbon-friendly beef and WTC PBM = Willingness to consume plant-based meat.

1= strongly disagree to 7= strongly agree

Note: ***denote statistical significance at 1%. Mean values of willing and not willing to consume RCF and PBM were compared using an independent sample t-test.

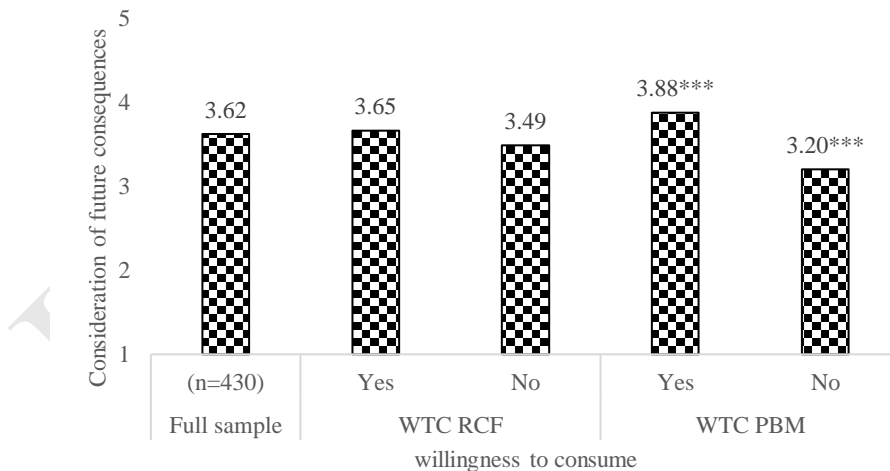


Figure 3. Relationship between Consideration of Future Consequences and Willingness to Eat Sustainable Meat and Meat Alternative

WTC RCF= Willingness to consume carbon-friendly beef and WTC PBM = Willingness to consume plant-based meat.

1= strongly disagree to 5= strongly agree

Note: ***denote statistical significance at 1%. Mean values of willing and not willing to consume RCF and PBM were compared using an independent sample t-test.

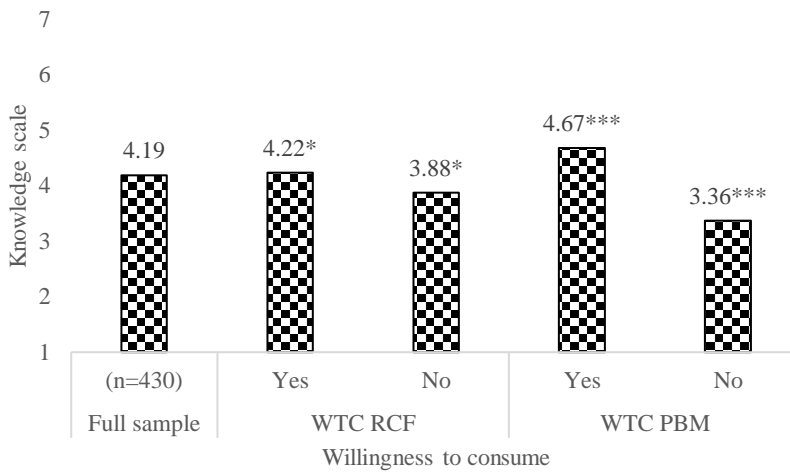


Figure 4: Subjective Knowledge on Climate Effects and Willingness to Consume Sustainable Meat and Meat Alternative

WTC RCF= Willingness to consume carbon-friendly beef and WTC PBM = Willingness to consume plant-based meat.

1= strongly disagree to 7= strongly agree

Note: ***denote statistical significance at 1%. Mean values of willing and not willing to consume RCF and PBM were compared using an independent sample t-test.

services than those who were not likely to eat these options (See Figure 4). Consumers likely to eat plant-based meat were more knowledgeable about climate effects of products and services than those who were likely to eat beef raised carbon-friendly (see Figure 4 and Table A3). The mean difference of subjective knowledge for willingness to consume RCF and PBM was statistically significant at 5% and 1% levels of significance, respectively.

Opinions and Beliefs

The summary of opinions and beliefs of respondents regarding sustainable beef production and beef production’s contribution towards GHG emissions is provided in Table 2. Results show that most respondents likely to eat sustainable meat and meat alternatives hold a positive opinion about sustainable beef production (35% somewhat positive and 30% very positive). There were very few consumers with negative opinions about sustainable beef production (1% very negative and 3% somewhat negative). There were also many consumers belonging to the neutral categories for likely eaters of sustainable meat alternatives (28% for carbon-friendly beef and 21% for plant-based meat). Regarding consumers’ beliefs about the contribution of beef production to GHG emissions, 33% of the total sample (the largest share) fell under the neutral category, followed by those who somewhat believed (31%). About 30% and 32% of the neutral category were likely to eat carbon-friendly beef and plant-based meat. Almost 33% and 39% of the somewhat believe category were likely to eat carbon-friendly beef and plant-based meat. Consumers with a strong disbelief constituted the smallest group (10%).

Attention and Trust on Food Labels

The results for attention to food labels in Table 2 show that, on average, most respondents pay some attention to food labels (49% somewhat and 46% very much). The share of consumers who

never pay attention to food labels is small (6%). A larger portion of those who paid attention to food labels were likelier to eat carbon-friendly beef and plant-based meat. Regarding trust on food labels, most of the respondents (77%) trusted labels on food packaging. The share of consumers who trust food labels was higher for plant-based meat (83%) than for carbon-friendly beef (79%).

Climate Friendly Actions

Climate-friendly actions adopted by respondents to mitigate the effects of climate change are displayed in Table 2. Respondents likely to eat sustainable meat and meat alternatives mostly had adopted climate-friendly actions in the past; 78% indicated recycling or reusing, 50% carpooled or rode a bike to reduce GHG emissions, 54% purchased food items labeled as sustainable, and 43% reduced beef consumption or tried plant-based meat to mitigate climate change. It is evident from Table 2 that overall, respondents who were likely to eat plant-based meat engaged in more climate-friendly actions than those who were likely to eat beef raised carbon-friendly.

Demographic Characteristics of Consumers

Table 3 displays the similarities and differences in demographic characteristics of the total sample and respondents likely to eat carbon-friendly beef and plant-based meat. Since we summarized the demographic characteristics of the total sample earlier, we focus on the characteristics of consumers who are willing, i.e., likely to consume carbon-friendly beef and plant-based meat. The results show that there was a greater percentage of consumers likely to eat carbon-friendly beef (86%) than plant-based meat (62%). Women accounted for a larger share of the total sample (66%) and were likely consumers of carbon-friendly beef (65%) and plant-based meat (63%).

When looking at the age of consumers, we observe that the older age group (65+ years) of consumers consisted of the largest share (26%) of likely eaters of carbon-friendly beef. Consumers 25-34 years old held the second largest share of likely eaters of carbon-friendly beef. In contrast, younger consumers (25-34 years) were the most likely eaters of plant-based meat (32%). Consumers 35-44 years old were the second largest group of likely eaters of plant-based meat at 26%.

With respect to education, more than 50 percent of the likely eaters of carbon-friendly beef and plant-based meat had college degrees or higher-level education. Very few consumers had lower-than-high school-level education for both sustainable alternatives. A greater number of consumers (more than 50%) were employed and likely to eat these sustainable options compared to their counterparts.

Consumers with income levels \$50,000 to \$74,999 constituted the largest share (24%) of potential consumers for sustainable options. Consumers with income levels of \$25,000-\$49,000 accounted for the second largest share of likely eaters for raised carbon-friendly beef, and those with income levels of \$75,000-\$99,999 accounted for the smallest share. In contrast, consumers with an income level of \$100,000 or more accounted for the second largest group of likely eaters of plant-based meat, and those with an income level of \$25,000-\$49,999 accounted for the smallest share.

Regarding consumers' residence, urban residents were more likely to eat sustainable options, 75% and 78%, respectively, for raised carbon-friendly beef and plant-based meat. A greater number of married consumers were willing to eat both sustainable options. With respect to political ideology, a higher number of respondents identified as Democrats who were more likely to eat sustainable options (54% for carbon-friendly beef and 64% for plant-based meat) than those who identified as Republicans and Independents.

Table 3. Demographic Characteristics of Consumers Willing to Consume Carbon-Friendly Beef (RCF) and Plant-Based Meat (PBM)

	Full sample (n=430)	WTC RCF Yes=370 (86%)	WTC PBM Yes=267 (62%)
<i>Gender</i>			
Male	34.19%	34.59%	37.08%
Female	65.81%	65.41%	62.92%
<i>Age group</i>			
18-24 years	5.58%	5.14%	6.37%
25-34 years	23.95%	24.32%	32.21%
35-44 years	21.40%	21.62%	26.22%
45-54 years	11.66%	12.16%	11.61%
55-64 years	10.93%	10.81%	9.74%
65+ years	26.51%	25.95%	13.86%
<i>Education</i>			
Below high school	3.49%	2.97%	3.75%
High school	46.51%	45.95%	40.07%
Graduate/associate degree			
College degree or higher	50.00%	51.08%	56.18%
<i>Income</i>			
< \$10,000 to \$24,999	20.70%	18.65%	17.60%
\$25,000 to \$49,999	21.86%	21.35%	16.85%
\$50,000 to \$74,999	24.19%	25.95%	23.97%
\$75,000 to \$99,999	15.58%	15.41%	19.85%
\$100,000 or more	17.67%	18.65%	21.72%
<i>Residence</i>			
Urban	73.49%	74.59%	78.28%
Rural	26.51%	25.41%	21.72%
<i>Marriage status</i>			
Married	56.18%	57.99%	62.92%
Unmarried	43.82%	42.01%	37.08%
<i>Political ideology</i>			
Republican	23.78%	23.83%	18.80%
Democrat	52.68%	53.66%	63.53%
Independent	23.54%	22.49%	17.67%

Note: WTC RCF = Willingness to consume carbon-friendly beef and WTC PBM= Willingness to consume plant-based meat

Socio-Behavioral Drivers of Willingness to Consume Sustainable meat

Table 4 presents the findings from two separate binary logistic regressions for willingness to consume carbon-friendly beef and likelihood to eat plant-based meat. Results show that behavioral factors, including beliefs about the contribution of beef production to GHG emissions and engaging in climate-friendly actions of purchasing food items labeled as sustainable, increase

Table 4. Marginal Effects of Behavioral and Demographic Factors on Willingness to Consume Sustainable Meat Options

Variables	WTC RCF dy/dx(se)	WTC PBM dy/dx(se)
<i>Purchasing habit</i>		
Purchase frequency	-0.02 (0.01)	0.01 (0.01)
<i>Sustainability concerns</i>		
Climate change concern scale	0.01 (0.02)	-0.02 (0.02)
<i>Time preference</i>		
I try to think how my actions will impact others in long term	-0.03* (0.02)	0.05*** (0.02)
<i>Subjective knowledge</i>		
Knowledge regarding climate effects of products and services	0.00 (0.02)	0.03 (0.02)
<i>Opinion and belief</i>		
Opinion about sustainable beef production	0.07*** (0.02)	-0.01 (0.02)
Belief about contribution of beef production to GHGs	0.03** (0.02)	0.05*** (0.02)
<i>Attention and trust on food label</i>		
Attention to labels on food package	-0.06** (0.03)	0.11*** (0.03)
Trust labels on food packages	0.05 (0.04)	0.02 (0.04)
<i>Climate friendly actions</i>		
Done recycling/reusing	0.11*** (0.04)	0.00 (0.05)
Carpooled or rode a bike to reduce carbon emission	0.01 (0.04)	0.02 (0.04)
Purchased food item labelled as sustainable	0.07* (0.04)	0.10*** (0.04)
Reduced beef consumption or tried plant-based meat to mitigate climate change	-0.02 (0.04)	0.18*** (0.04)
<i>Sociodemographic characteristics</i>		
Age group	0.01 (0.01)	-0.05*** (0.01)
Gender (Female)	0.00 (0.03)	-0.05 (0.04)
Education	-0.01 (0.03)	0.01 (0.03)
Married	-0.01 (0.04)	0.01 (0.04)
Income	0.02 (0.02)	-0.01 (0.01)
Residence (urban)	0.03 (0.04)	0.06 (0.04)
Democrat	-0.03 (0.04)	0.15*** (0.04)
Republican	0.03 (0.05)	0.03 (0.05)
LR χ^2	55.96***	229.11***
Pseudo R ²	0.16	0.40

Note: ***, ** and * denote statistical significance at 1%, 5% and 10% level of significance respectively. WTC RCF = Willingness to consume carbon-friendly beef and WTC PBM= Willingness to consume plant-based meat

the likelihood of consuming beef raised carbon-friendly and plant-based meat in the future. Respondents who have strong positive opinions about sustainable beef production are more likely to eat beef raised carbon-friendly, while no such effect is present for plant-based meat. Respondents who have a reduced beef consumption or tried plant-based meat in the past are more likely to eat plant-based meat, while no such effect is present for beef raised carbon-friendly. With respect to attention to food packaging labels, the more attentive respondents were, the more likely they were to eat plant-based meat but less likely to eat carbon-friendly beef. Respondents who reported that they care about the long-term impact of their actions were more likely to eat plant-based meat but less likely to eat carbon-friendly beef.

Among the demographic characteristics, only age and political affiliation influenced respondents' willingness to consume sustainable options. According to our results, younger consumers and those who identified as Democrats are more likely to eat plant-based meat, while no such effect is present for carbon-friendly beef.

Discussion and Policy Implications

A thorough understanding of the factors that may hinder or encourage a dietary transition towards sustainability enables the development of more effective policies and strategies to reduce high levels of meat consumption (Apostolidis & McLeay, 2016). Wolstenholme et al. (2021) asserted that identifying psychological variables associated with behavior can be useful in maximizing positive attitudes, subjective norms, and perceived behavioral control that encourage behavior change towards more sustainable diets. However, behavioral factors are often neglected even though they are important drivers of food choices. Therefore, in this study we examined the effect of both behavioral and demographic characteristics related to future consumption decisions of beef raised carbon-friendly and plant-based meat.

Descriptive analysis of behavioral characteristics shows most of the consumers willing to eat both sustainable alternatives had a higher meat purchasing frequency (mostly weekly followed by two times per week and daily). This suggests that there is an opportunity to reduce unsustainable meat consumption by decreasing conventionally grown beef purchase frequency. Replacing the purchase of regular meat with that of carbon-friendly beef and plant-based meat could reduce the possible GHG emission impact of conventional meat.

Consumers who are more likely to eat sustainable meat options are characterized with higher levels of concern regarding climate change, care about long-term consequences of consumption, feel more knowledgeable about climate effects of products, hold positive opinions about sustainable production, believe that beef production emits GHG, and adopt climate friendly actions. Overall, consumers more likely to eat plant-based meat showed more climate friendly behavior than those who were more likely to eat carbon-friendly beef.

The descriptive analysis of demographic characteristics shows that more women were likely to eat sustainable meat alternatives than men. These findings complement the findings that women opt for more eco-friendly options than men (Bryant et al., 2019; Broeckhoven et al., 2021). For carbon-friendly beef, the age group 65+ years dominated the share of those more likely to eat sustainably-produced beef. In contrast, as reported by (Slade, 2018; Van Loo et al., 2020), younger consumers, particularly the age group 25-34, were the largest consumer segment indicating a likelihood to eat plant-based meat. This finding suggests that consumers' preferences for sustainable options differ based on age and gender. Results also suggest that consumers with higher education levels, living in urban areas, having no farm, and identifying as Democrats are a dominant consumer group who is more likely to eat both sustainable alternatives.

Our econometric analysis showed that several factors influenced the likelihood of willingness to consume carbon-friendly beef and plant-based meat. With regards to behavioral factors, the econometric analysis highlights that they were more important drivers of the likelihood to eat sustainable meat options in our study than demographic factors. Similar to Bradford et al. (2018) and Schaub (2022), this research provides evidence that those who were more concerned about long-term consequences were more likely to eat plant-based meat and less likely to eat carbon-friendly beef. This finding highlights that concern about the future consequences of their actions are also important in shaping consumer choices. Therefore, consideration of future consequences for consumers should also be considered while developing strategies and outreach efforts to encourage sustainable food choices, such as the consumption of sustainably produced meat and meat alternatives.

Our results also highlighted the significance of opinions and beliefs in determining green consumption behavior. Consumers with a stronger belief in the contribution of beef production to GHG emissions were more likely to eat both sustainable meat alternatives. Those who had

positive opinions about sustainable beef production were more likely to eat carbon-friendly beef. Another important determinant of sustainable meat consumption is attention to and trust in food labels. Findings show that those who pay attention to food labels are more likely to eat plant-based meat and less likely to consume carbon-friendly beef. Like Wang et al. (2021), our study also found that consumers' attitude towards green consumption has a positive impact on their intention to consume sustainable meat alternatives. This underscores the importance of using food labels with reliable information to cultivate positive opinions, beliefs, and attitudes towards sustainable products, thereby enhancing the intention to consume green products, such as, carbon-friendly beef and plant-based meat.

Lacroix and Gifford (2019) opined that the identification of consumer segments helps to predict dietary patterns and consumers' willingness to change their dietary patterns, which could be useful in designing conventional meat-reduction interventions. Hence, all these characteristics can be used for the targeted marketing of more sustainable meat alternatives. Our findings suggest blanket marketing strategies and policy interventions will likely not work to reach all consumers. Rather, these strategies should be targeted in accordance with their characteristics. The strategies should focus on addressing consumers' knowledge level, opinions, and beliefs. Further, labeling can be instrumental in promoting sustainable meat products. Therefore, the food industry could consider these demographic and behavioral factors when designing appropriate marketing strategies.

Our results indicated that recycling had a positive effect on the likelihood of eating beef raised carbon-friendly. Similarly, past purchases of sustainable food items had a positive effect on the likelihood of eating plant-based meat and carbon-friendly beef. Similar to the findings by de Boer and Aiking (2022), our study also found that those who reduced beef consumption or tried sustainable food items were more likely to eat plant-based meat. These results are in line with the findings of (de Boer & Aiking, 2022). The findings emphasize the importance of leveraging consumers who display more climate-friendly behavior in the efforts to scale up the consumption of sustainable meat alternatives. Results also revealed that consumers who are younger and identify as Democrats were more likely to eat plant-based meat.

This research is not without limitations. One of the potential caveats of our study is that we did not use validated scales for the measurement of behavioral factors, such as climate change concern, consideration of future consequences (time preferences), knowledge level, opinions and beliefs. Future studies could use validated scales to analyze the effect of these constructs on the consumption of sustainably produced meat. In addition, we used subjective knowledge (self-reported knowledge) and did not test how much participants really know (objective knowledge). While previous studies have shown subjective knowledge to affect choice (Peschel et al. 2016), future studies could test the effect of objective knowledge as well. Our results showed that climate change concern does not influence willingness to consume both alternatives. This finding contradicts the results of (Yue et al., 2020) but is in line with findings of (Arora et al., 2020; Ishaq et al., 2023). This implies that although consumers are concerned about climate change issues, this may not be enough to change their consumption patterns. Therefore, translating the environmental concern into actual green consumption behavior requires more attention. This opens an avenue for future research regarding the factors that affect this green attitude-behavior gap (ElHaffar et al., 2020) and designing appropriate marketing strategies, such as the use of information nudges, to close this gap. Finally, we estimated logit regression models to identify the factors influencing consumption decisions. Future research could employ latent class analysis to observe whether or how behavioral characteristics and demographics interact.

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Appendix

Table A1. Climate Change Concern Scale of Meat Consumers

S.N.	Items	Scale (1-7)
1.	Global climate change is happening	5.51
2.	I am concerned about the climate change consequences	5.37
3.	Climate change is a serious problem, and its effects are likely to be catastrophic for future generation and environment	5.22
4.	The seriousness of climate change has been exaggerated	4.46
5.	Human activities cause global climate change	5.26
6.	Climate change is inevitable and has nothing to do with human activity	4.48
7.	Climate change is a problem to be solved by future generation	4.51
8.	We should burden future generation as little as possible with the consequences of climate change	4.70
9.	Knowing about environmental problems and issues are important to me	5.12
10.	I can do my part to make the world a better place for future generations	5.33
11.	There is not much I can do that will help solve environmental problems	4.38
Cronbach's alpha		0.84

Note: 1= strongly disagree to 7= strongly agree. The fourth, sixth, seventh and eleventh items in Table A1 were reverse coded to maintain consistency in the direction

Table A2: Correlation Matrix of Behavioral Variables Included in the Regression Analysis

Variables	PBM	RCF	BFREQ	CCCS	CFCS	KNOW	RECYCLE	CARPOOL	PSUS	TPBM	BELIEF	OPINION	ATTN	TRUST
PBM	1	0.11	0.26	0.16	0.32	0.45	0.24	0.31	0.38	0.39	0.31	0.26	0.37	0.18
RCF	0.11	1	0.00	0.19	0.05	0.09	0.23	0.10	0.16	0.08	0.18	0.21	0.03	0.11
BFREQ	0.26	0.00	1	-0.07	0.12	0.37	0.09	0.20	0.11	0.12	0.03	0.23	0.25	0.16
CCCS	0.16	0.19	-0.07	1	0.26	0.15	0.42	0.19	0.26	0.16	0.43	0.23	0.10	0.15
CFCS	0.32	0.05	0.12	0.26	1	0.36	0.27	0.14	0.23	0.19	0.20	0.31	0.27	0.17
KNOW	0.45	0.09	0.37	0.15	0.36	1	0.22	0.31	0.35	0.34	0.23	0.39	0.47	0.28
RECYCLE	0.24	0.23	0.09	0.42	0.27	0.22	1	0.26	0.31	0.34	0.20	0.21	0.18	0.14
CARPOOL	0.31	0.10	0.20	0.19	0.14	0.31	0.26	1	0.24	0.28	0.15	0.23	0.21	0.13
PSUS	0.38	0.16	0.11	0.26	0.23	0.35	0.31	0.24	1	0.34	0.23	0.21	0.20	0.08
TPBM	0.39	0.08	0.12	0.16	0.19	0.34	0.34	0.28	0.34	1	0.22	0.15	0.20	0.07
BELIEF	0.31	0.18	0.03	0.43	0.20	0.23	0.20	0.15	0.23	0.22	1	0.31	0.15	0.16
OPINION	0.26	0.21	0.23	0.23	0.31	0.39	0.21	0.23	0.21	0.15	0.31	1	0.36	0.16
ATTN	0.37	0.03	0.25	0.10	0.27	0.47	0.18	0.21	0.20	0.20	0.15	0.36	1	0.26
TRUST	0.18	0.11	0.16	0.15	0.17	0.28	0.14	0.13	0.08	0.07	0.16	0.16	0.26	1

Table A3. Relationship between Subjective Knowledge and Willingness to Consume Sustainable Meat and Meat Alternative

Items	Full sample	WTC RCF	Not WTC RCF	WTC PBM	Not WTC PBM
<i>'I consider myself knowledgeable about the climate effects of products and services'</i>	4.52 (1.45)	4.58 (1.42)	4.13 (1.61)	4.90 (1.27)	3.90 (1.52)
<i>'I consider myself equipped to compare and evaluate the climate friendliness of different products and services'</i>	4.50 (1.56)	4.57 (1.56)	4.08 (1.57)	4.95 (1.39)	3.77 (1.56)
<i>'I am considered an expert in the field of climate effects of products and services by people who know me'</i>	3.55 (1.86)	3.57 (1.89)	3.42 (1.62)	4.21 (1.79)	2.46 (1.39)
Mean knowledge	4.19 (1.43)	4.24 (1.43)	3.88 (1.40)	4.68 (1.26)	3.37 (1.30)

Cronbach's alpha = 0.76

Note: Scale: 1= strongly disagree to 7= strongly agree. Standard deviation in parentheses. WTC PBM = Willingness to consume plant-based meat and WTC RCF= Willingness to consume carbon-friendly beef