

World War 'V': Emissions change if Birmingham became vegetarian and contemporary attitudes towards vegetarianism

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Abstract

This study uses quantitative analysis to assess the current dietary habits of 27 vegetarian and 144 non-vegetarian Birmingham residents. Results suggest that environmental reasons are a more popular motivating factor for becoming vegetarian than in previous studies. Using published nutrition and emissions data, the impact of all residents of Birmingham eating only vegetarian meals, both at-home and when dining in Birmingham restaurants, was assessed. These data show that the average Birmingham resident can save approximately 906 kg of carbon dioxide a year by only eating vegetarian meals totalling 3,924,920,776 KgCO₂e (equal to 0.85% of the UK's emissions output). However, the results indicate that city-wide vegetarianism is not currently feasible for the Birmingham population as some residents do not deem any factors as sufficient motivation.

1. Introduction

England is one of eight countries to have declared a climate emergency, owing to overwhelming evidence of rapid anthropologically-caused climate change, including a 70% global increase of greenhouse gas emissions over the last forty years (Hallstrom et al., 2014).

Subsequent increased public demand for sustainability has led to research improvements including, transport (hybrid/electric cars, use of public transport and carpooling systems), recycling accessibility (Ivanova et al., 2020) and smart meters within homes to monitor and reduce electricity and water consumption (Kelly, 2012).

Reducing individual environmental footprints is frequently researched through diet alteration, often involving reduction of animal products (Aleksandrowicz et al., 2016). Meat production uses high levels of fossil fuels, land and water consumption, animal effluence and methane release. Public association of 'green' and sustainable is therefore connected with 'meat-free' (Chandrasekar, 2019; Freeman, 2011)

High-meat consumption has been linked to obesity, diabetes and cancers (Raphaely and Marinova, 2013; Flynn and Schiff, 2017; Hallstrom, 2014), however affluent Western culture encourages meat intake beyond 'healthy' levels (Raphaely and Marinova, 2013; Helenius, 2009). Currently, 2 out of 3 Britons opt for a meat-favourable diet (The Vegan Society, 2019). This majority, coupled with increasing population and disposable income allowing for more out-of-home dining, increases emissions released from animal husbandry (Pohjolainen et al., 2016; Scarborough, 2014; Poore and Nemecek, 2019). Agriculture is responsible for 20% of the UK's greenhouse gas emissions (Scarborough, 2014) and 25-30% of global

greenhouse gas emissions (Bacon, 2018; Aleksandrowicz et al., 2016; Poore and Nemecek, 2019).

This report aims to (1) understand current dietary habits of Birmingham residents, and (2) calculate the average emissions reduction if every meal eaten by a Birmingham resident, both at home and at a Birmingham food establishment, was vegetarian. Birmingham was chosen as it is the UK's second largest city behind London, which already has a prevalent vegetarian community (PETA, n.d.).

2. Methods

To evaluate the current dietary habits of Birmingham residents, two questionnaires (one for vegetarians/vegans (V), one for non-vegetarians (NV)) were distributed using 'snowballing' recruitment via social media and emails. In the four-week period the questionnaire links were active, 144 NV (102 females, 42 males) and 27 V (24 females, 3 males) responded (December, 2019). Respondents were anonymous and answered both open and closed ended questions to reduce response bias. A statistical t-test was conducted on open-ended answers for further analysis at a significance level of 95% and respecting the following criteria in order to reject the null hypothesis:

Critical two tale value < T stat < – Critical two tale value

Results and analysis were generalised to Birmingham's population, however having such a small study sample reduces the validity of the generalised assumptions.

Emissions data was calculated using a standard 170 g protein per restaurant meal (Scarborough, 2014) and 75.3 g protein per at-home meal; dividing the national daily protein average of 226 g by three (Viva!Health, n.d.). Vegetarian protein value uses mean emissions of eggs, soybeans and pulses.

Restaurant data was collected from the Mailbox Birmingham, Grand Central station, the Bullring and restaurants in the suburb of Sutton Coldfield. The overall suburb value used restaurant numbers from Sutton Coldfield multiplied by 37, allowing for easier analysis but reducing the accuracy. Main protein sources were categorised, normalised for the annual frequency the population dines outside the home, and scaled to Birmingham's population (4,332,629; worldpopulationreview.co.uk, 2019), using the UK average for 3% of vegetarians. Used in accordance with the restaurant emissions data, the output was calculated for non-vegetarian meals, vegetarian meals and the overall total for the emissions created when a Birmingham resident dines at a Birmingham establishment. The potential emissions reduction if the same number of all vegetarian meals sold was then calculated.

The 'at-home' meals were calculated assuming Birmingham's population eats three meals a day minus the number of meals eaten outside the home. Questionnaire data was used to calculate how many non-vegetarian meals were eaten at home, again generalising the respondents' answers to the wider Birmingham population. Data from the 2017/18 family

food survey data (Food Standards Agency, 2018) was used to calculate the weekly grams of each animal protein bought per person. The emissions data was used to calculate total, vegetarian and non-vegetarian outputs and the subsequent overall emissions change if all meals became vegetarian.

It is important to note this method does not take into account other factors such as the other components of the meals, people visiting from outside of Birmingham and eating at these establishments and the actual numbers concerning vegetarian and non-vegetarian meals. However, allowing such generalised terms allows for a larger area to be studied (the metropolitan city of Birmingham) and is useful in terms of creating an informed estimation of the figures that can be used for further study.

3. Results

3.1 Non-vegetarian questionnaire

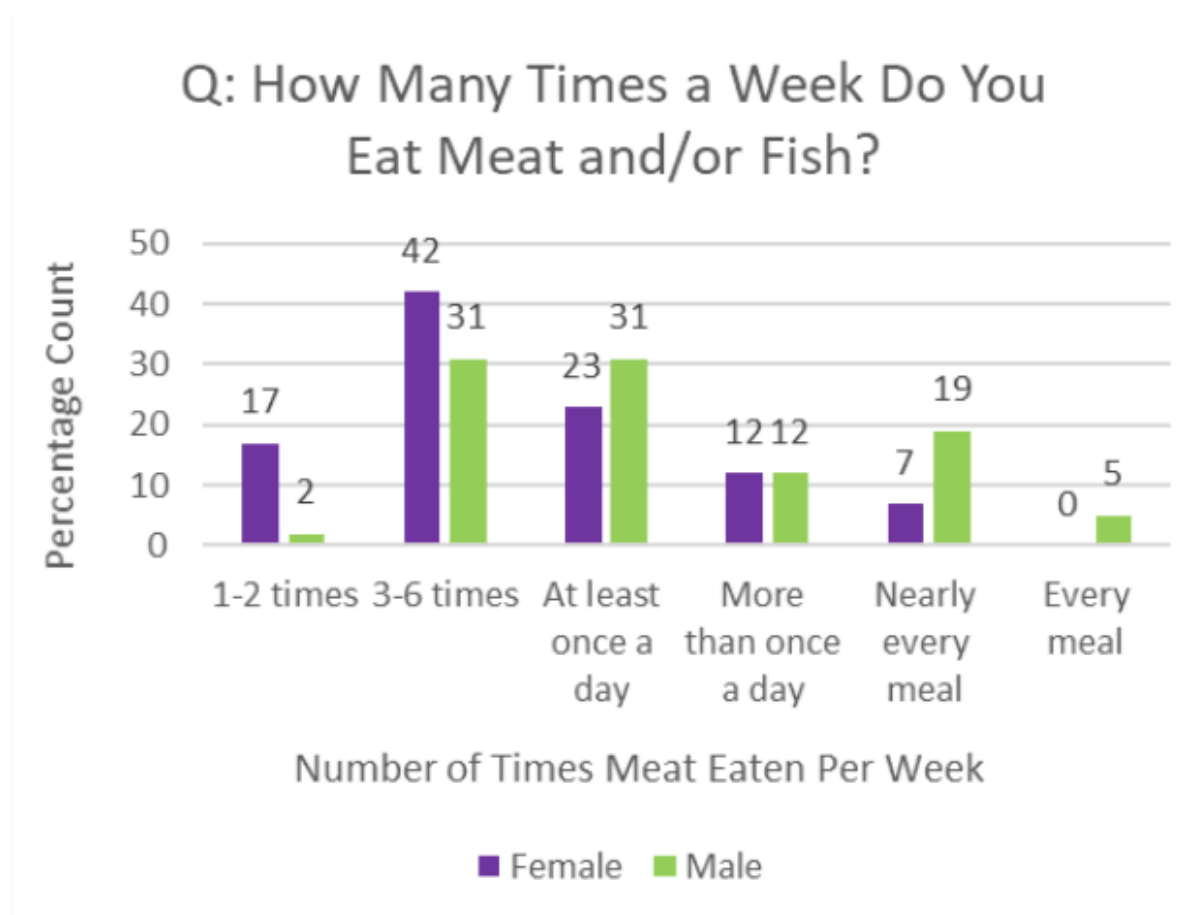


Figure 1 Weekly amounts of meat/fish eaten

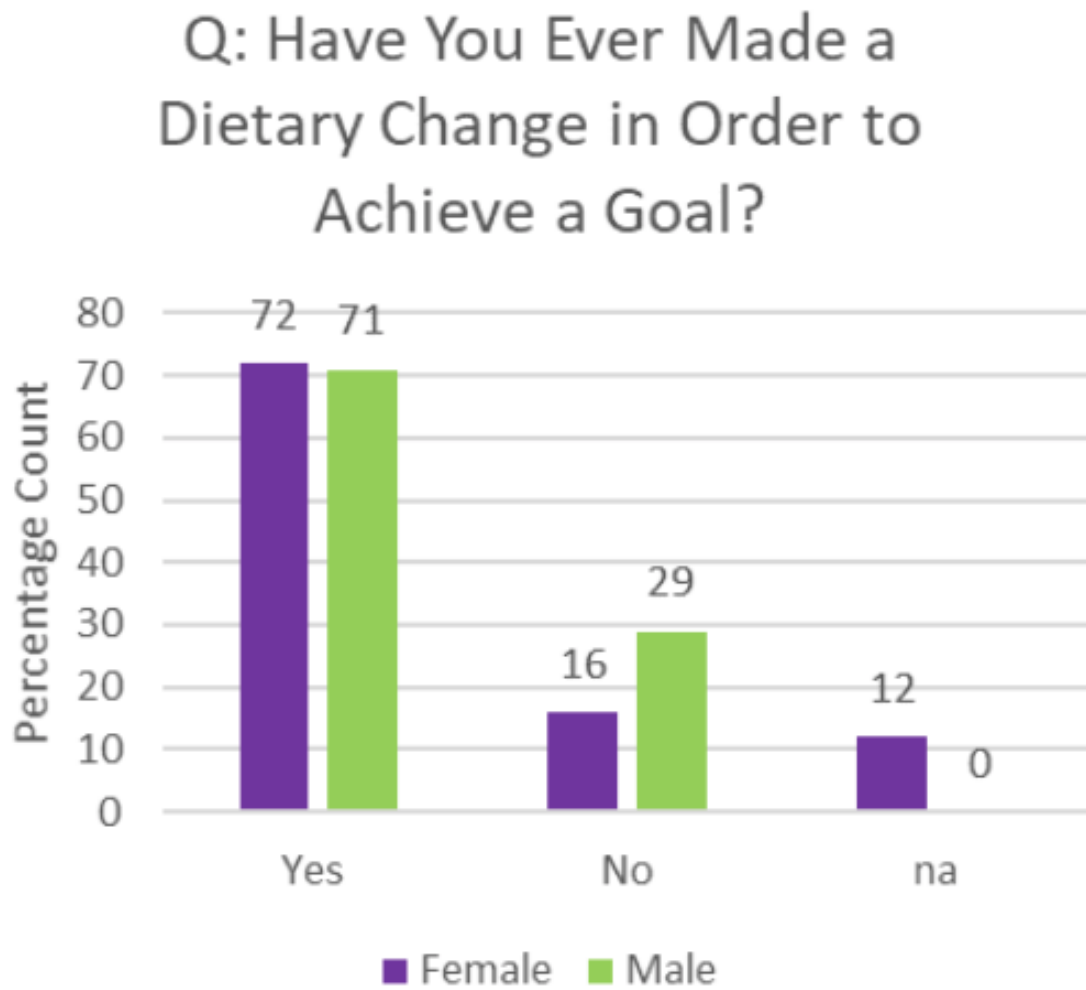


Figure 2 Dietary alteration to achieve a goal

Q: Do You Consider the Environmental Implications of Your Meals?

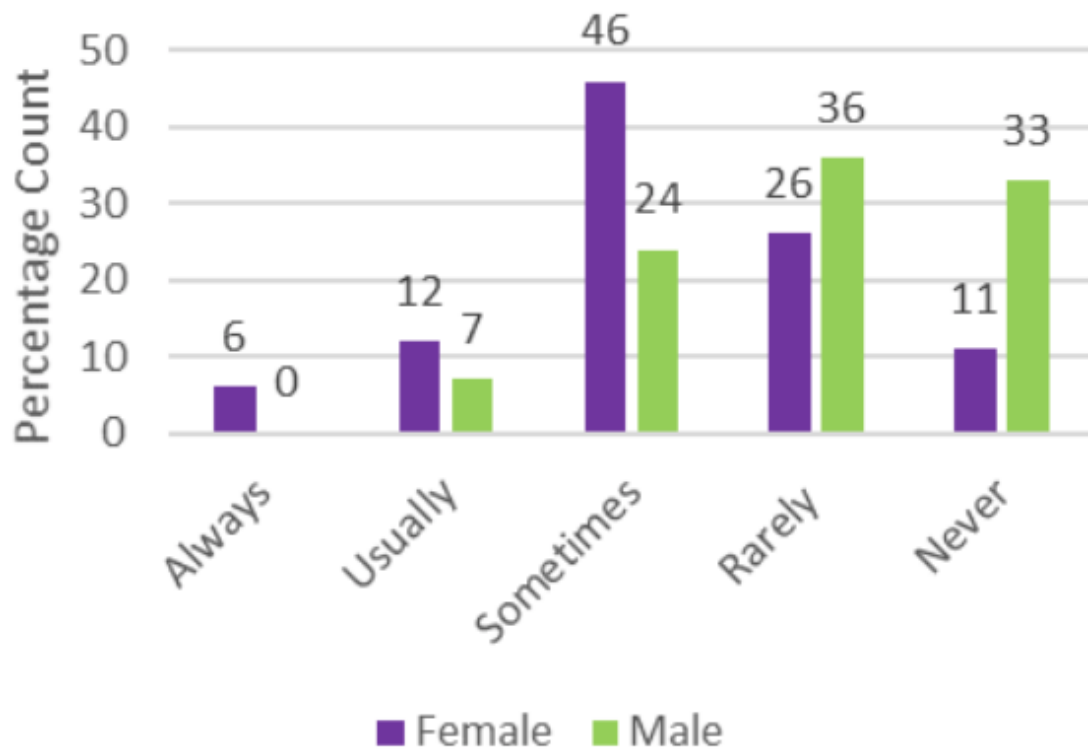


Figure 3 Environmental Consideration taken with meals

Q: Would You Consider Yourself Environmentally Aware?

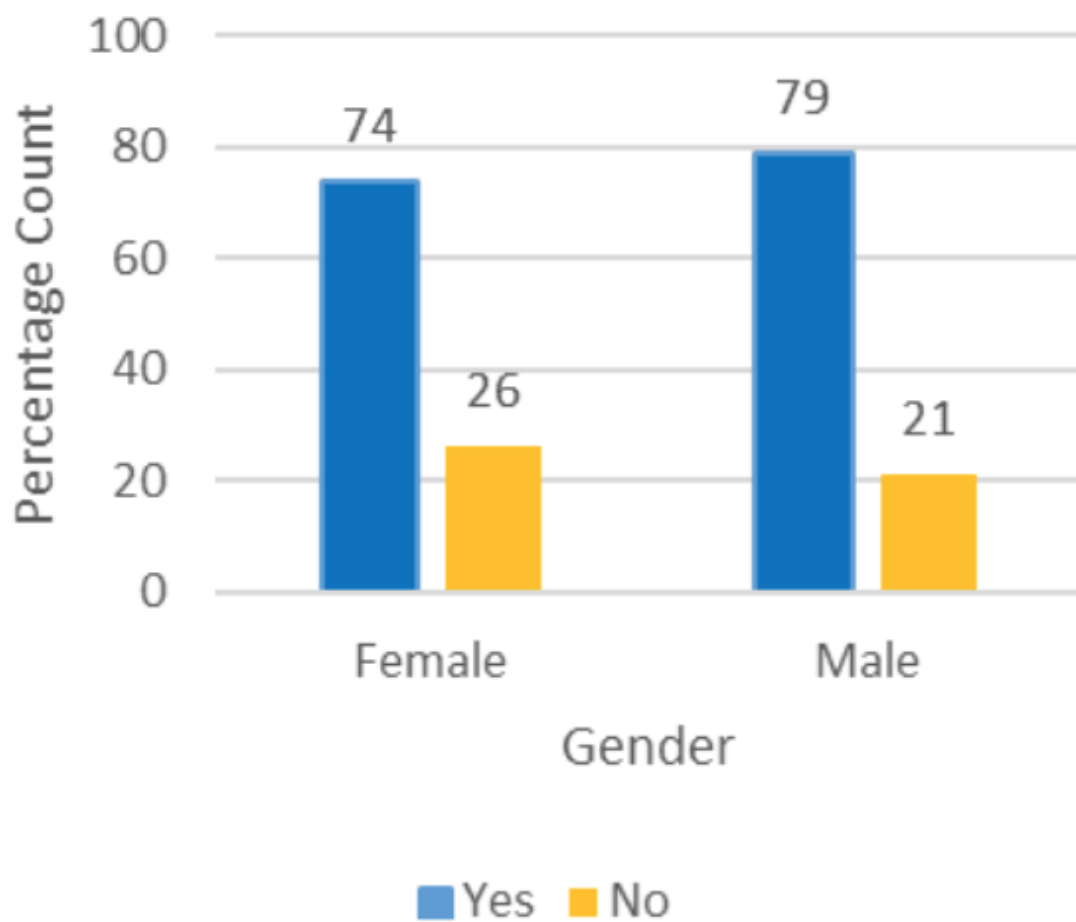


Figure 4 Environmental awareness of the respondents

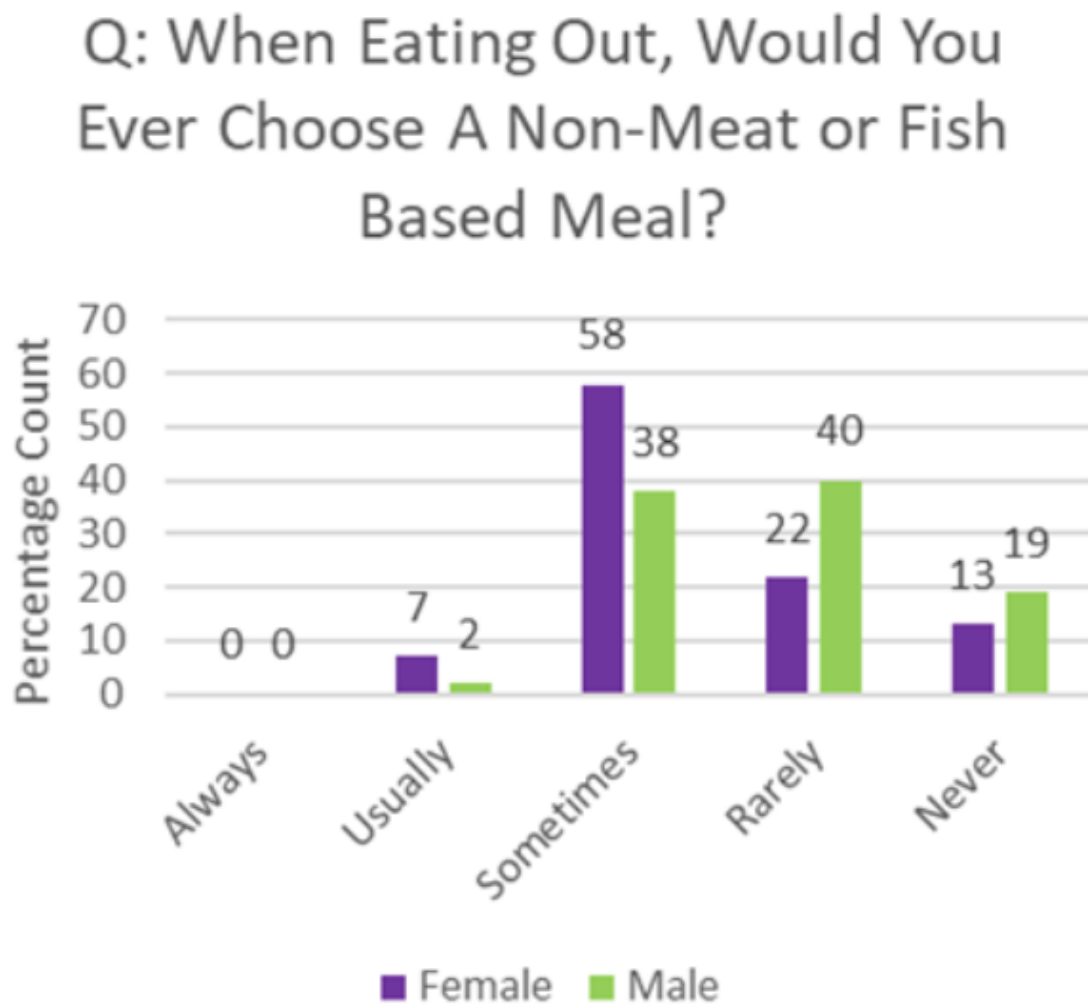


Figure 5 Frequency of vegetarian meals eaten outside the home

Q: Have You Ever Faced Prejudice for Your Dietary Choices?

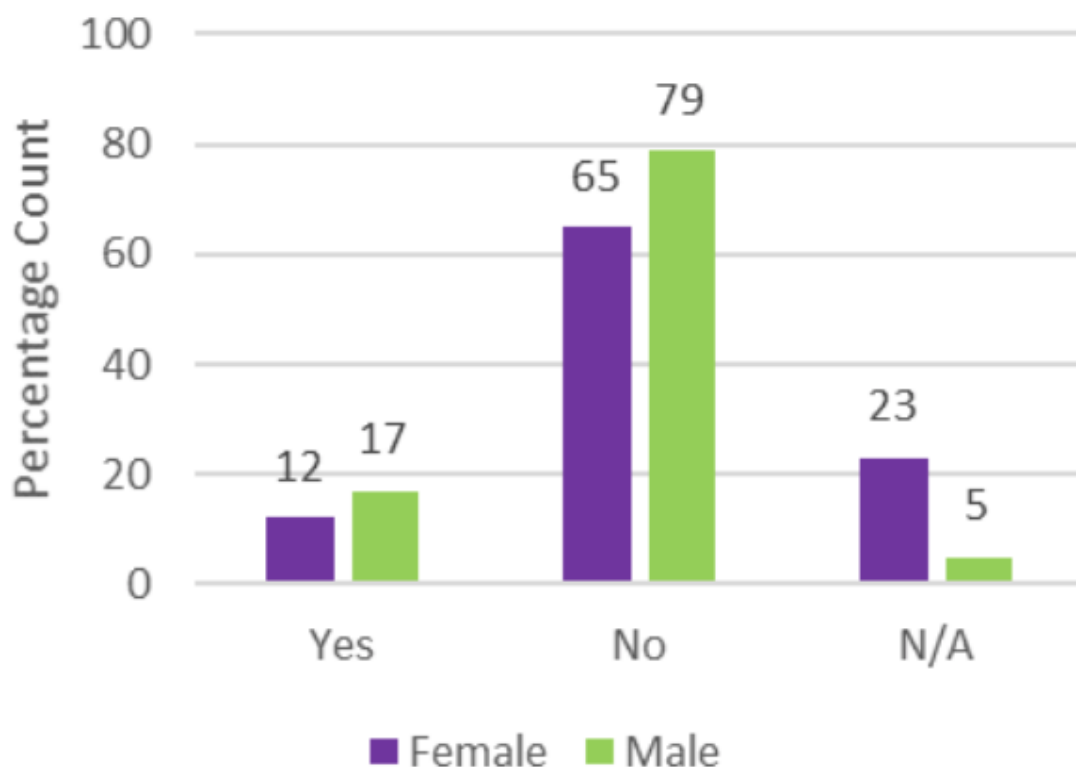


Figure 6 Dietary prejudice

On average, men eat more meat than women daily (Fig. 1), whilst women are also more likely to order a non-fish/meat-based meal when dining outside of the home (Fig. 5). Men think themselves more environmentally aware (79%) compared to women (74%), however women are more likely to be conscious about the environmental implications of their meals (Fig. 3).

Similar numbers of both genders (72% men, 71% women) admitted to changing their diet previously to achieve a goal (Fig 2.) The majority of respondents said they did not feel as though they had faced prejudice for their dietary choices (Fig. 6). However, of those who had, more were men.

Q: Which of These Factors, if Any, Would Influence You to Become Vegetarian?

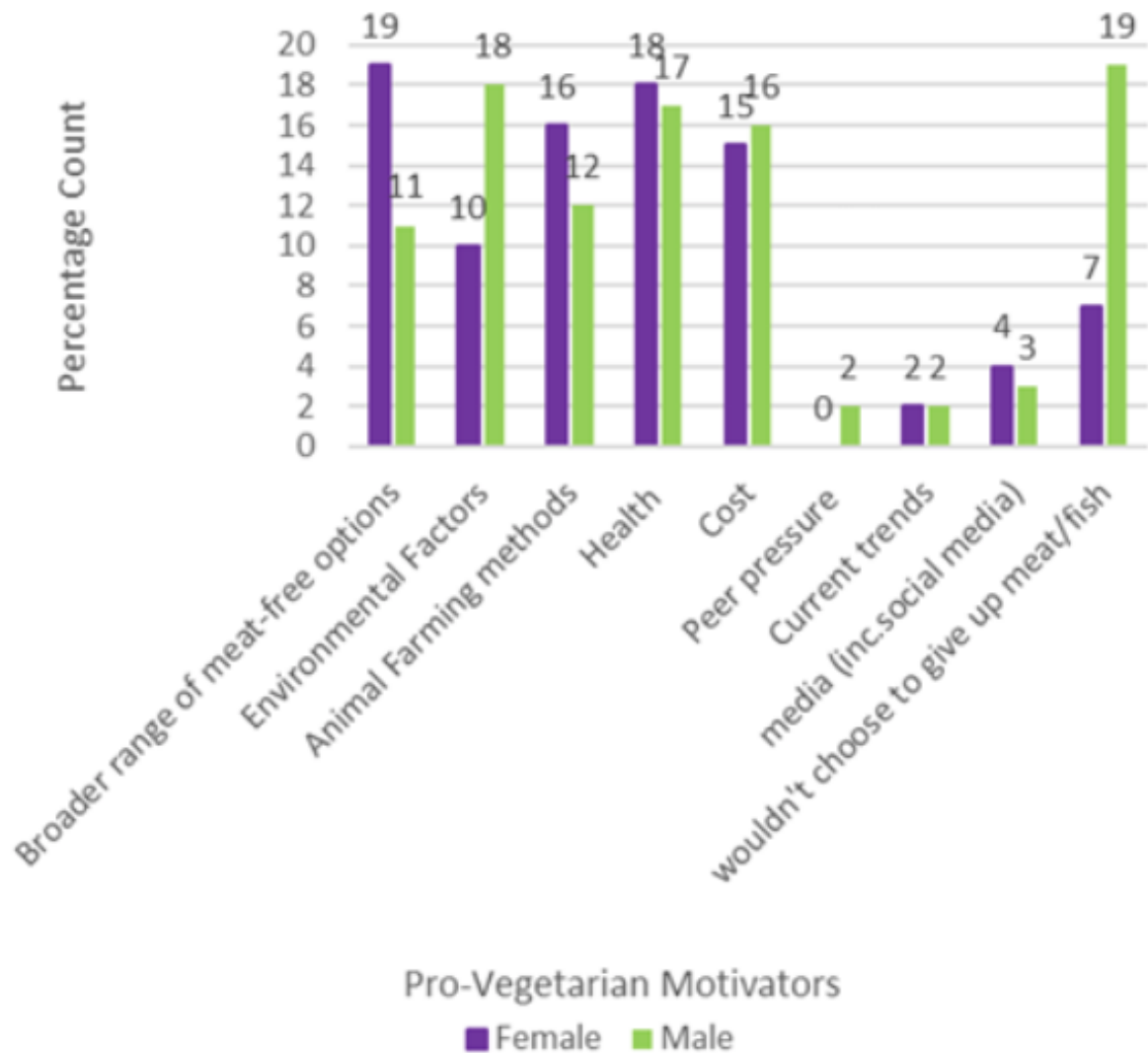


Figure 7 Motivating reasons for vegetarianism by non-vegetarians

Q: What Do You Think You Would Find The Most Difficult When Having to Give Up Meat and Fish?

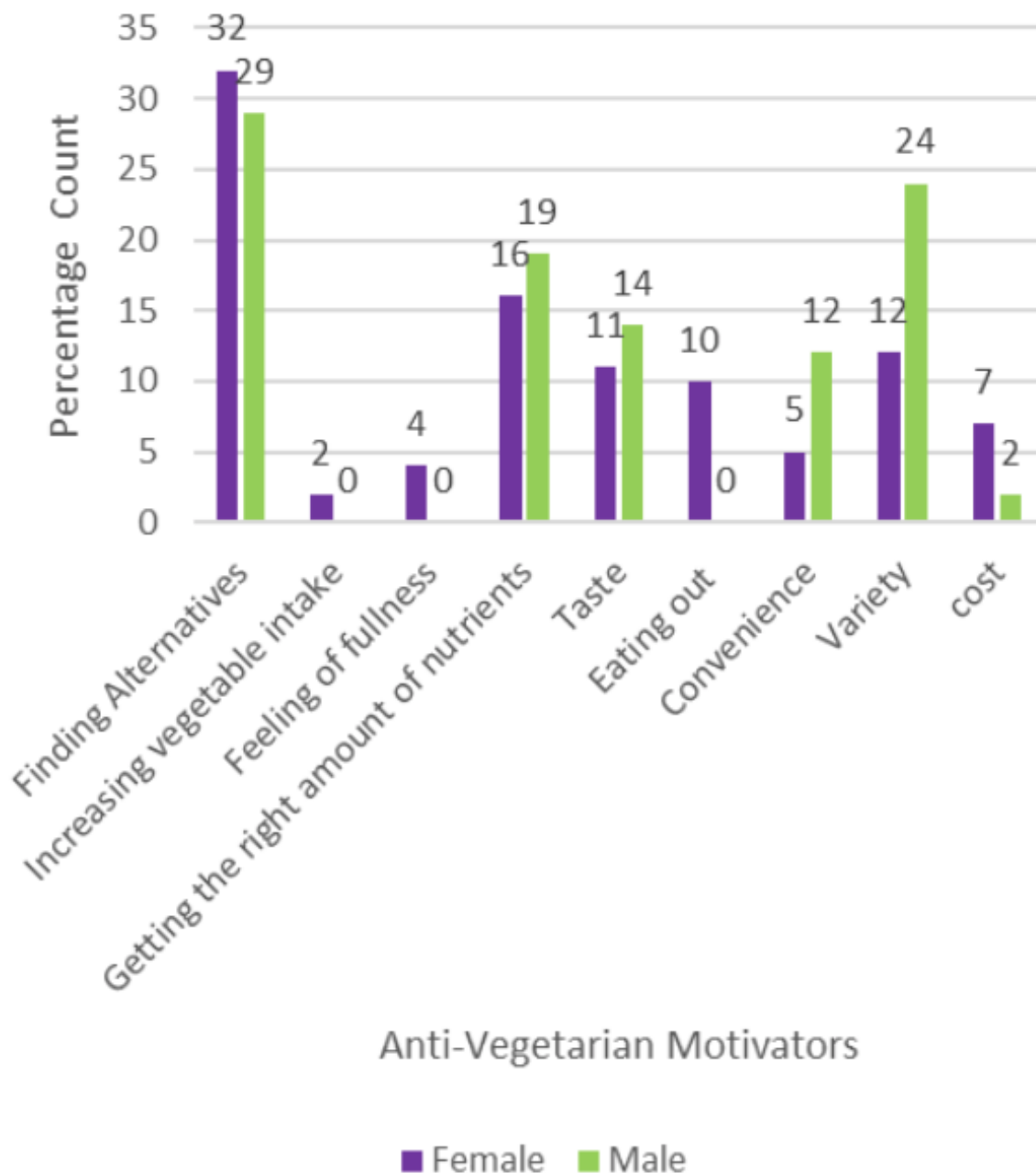


Figure 8 *Opposing reasons for vegetarianism by non-vegetarians*

Table 1: *Statistical analysis for Figures 7 and 8*

Figure	Null hypothesis	Critical two-tail value	T-Stat Value	Reject/Accept Null Hypothesis?	Statistically Significant/Insignificant?
7	'There is no difference between males and females in their possible pro-vegetarian motivations'	2.228	2.439	Reject	Significant
8	'There is no difference between males and females and their reasons for not being vegetarian'	2.160	0.611	Accept	Insignificant

Table 1 Statistical analysis for Figures 7 and 8

Statistically, males and females' vegetarian motivations are different, furthered by the data in figure 7 showing males being more environmentally motivated whilst females require a broader range of options. Men are also more likely to opt not to become vegetarian.

Both genders felt the absence (or belief of the absence) of sufficient alternatives to be the main reason for not being vegetarian, as well as attaining necessary nutrient levels, taste and variety also being common. These similarities were reinforced by there being no statistically significant difference.

3.2 Vegetarian questionnaire

Q: How Long Have You Been a Vegetarian/Vegan?

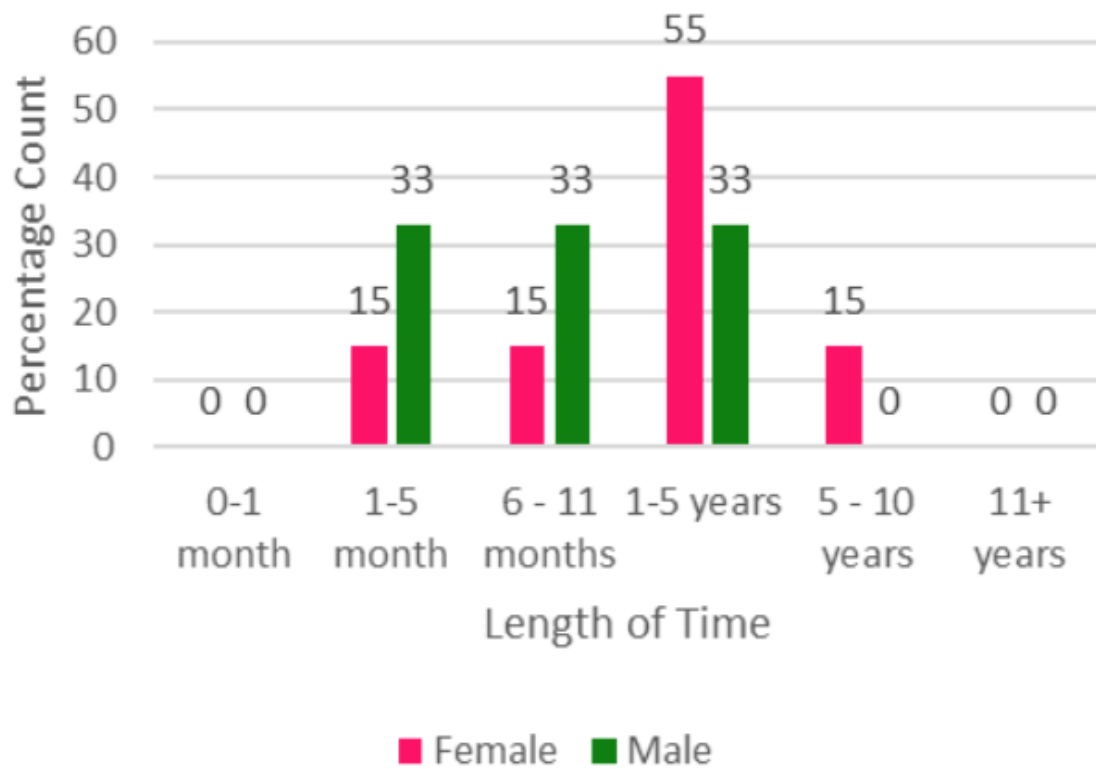


Figure 9 Length of time following vegetarianism

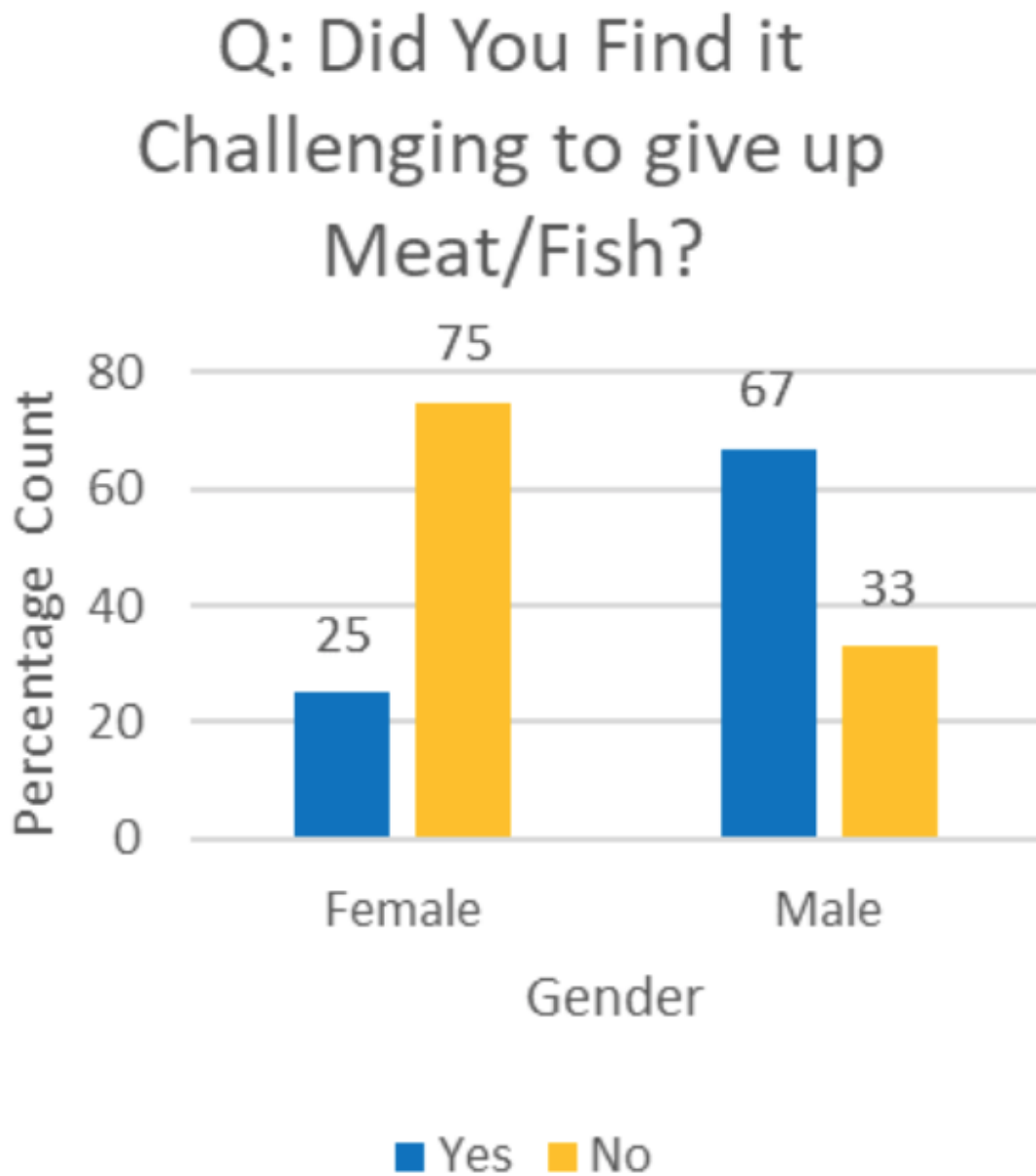


Figure 10 Difficulty becoming vegetarian

Q: Have You Ever Faced Prejudice Because of Your Diet?

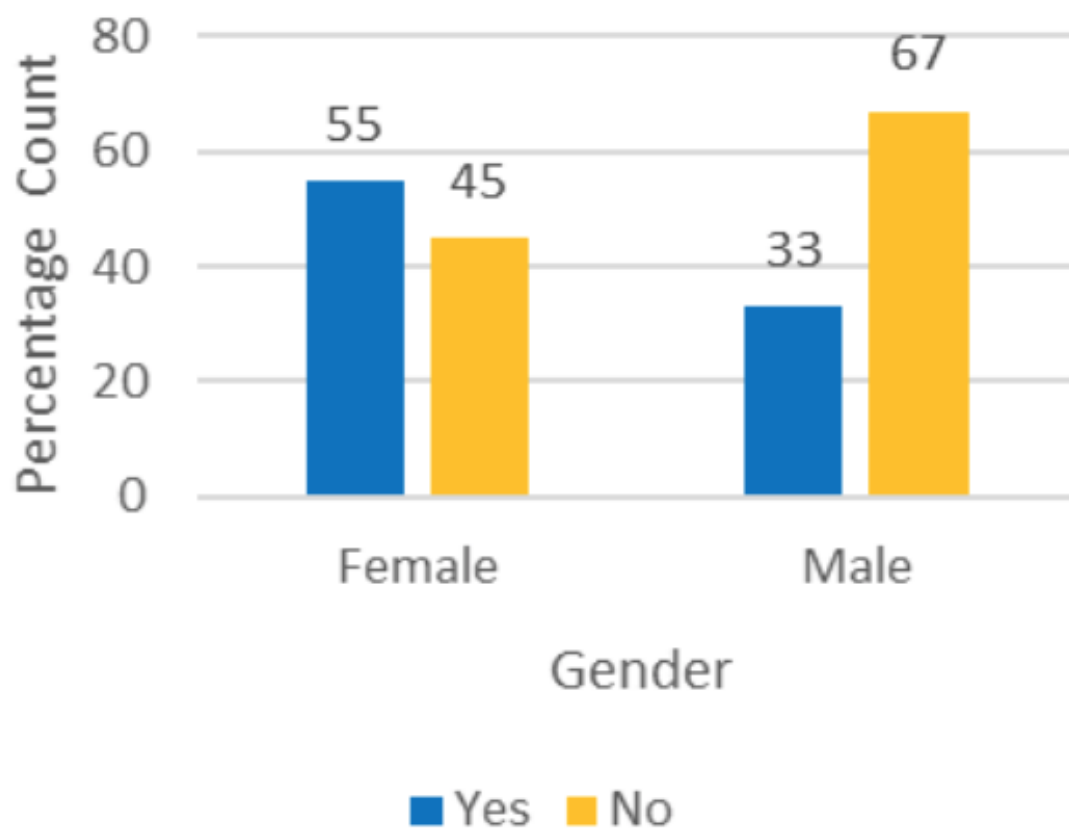


Figure 11 Dietary Prejudice

Q: Do You Think There is Availability For You In Terms of Day-to-Day Life?

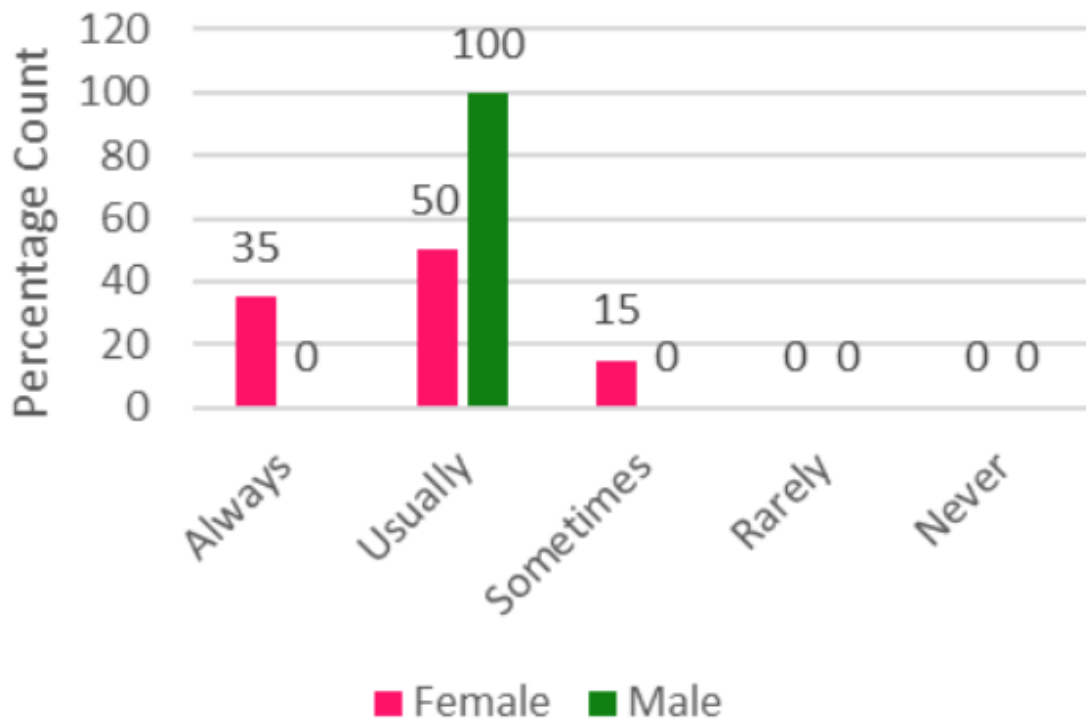


Figure 12 Availability daily in terms of diet

Q: Has Your Dietary Change Had an Impact on Anyone in Your Life?

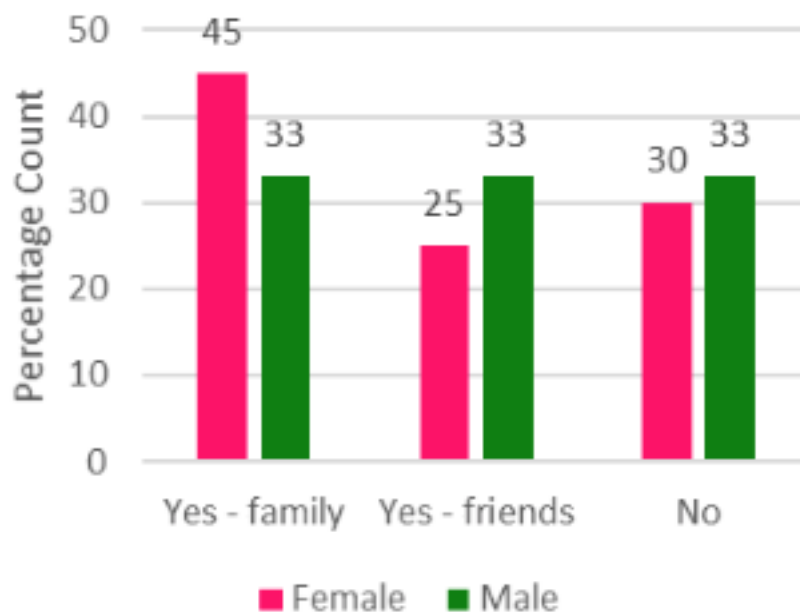


Figure 13 Impact had on family and friends through vegetarianism

Female vegetarians, on average, had been following the vegetarian practice longer than male respondents (Fig. 9) whilst also finding it easier to give up meat than males (Fig. 10). Women were also more likely to have felt prejudice for their dietary choices. The majority of both genders felt that there were 'usually' options for them in day-to-day life, as well as both genders citing that their diet had impacted those around them, more commonly for family.

Q: Have You Felt Any Changes Within Yourself Due to Making the Dietary Change, And If So, What?

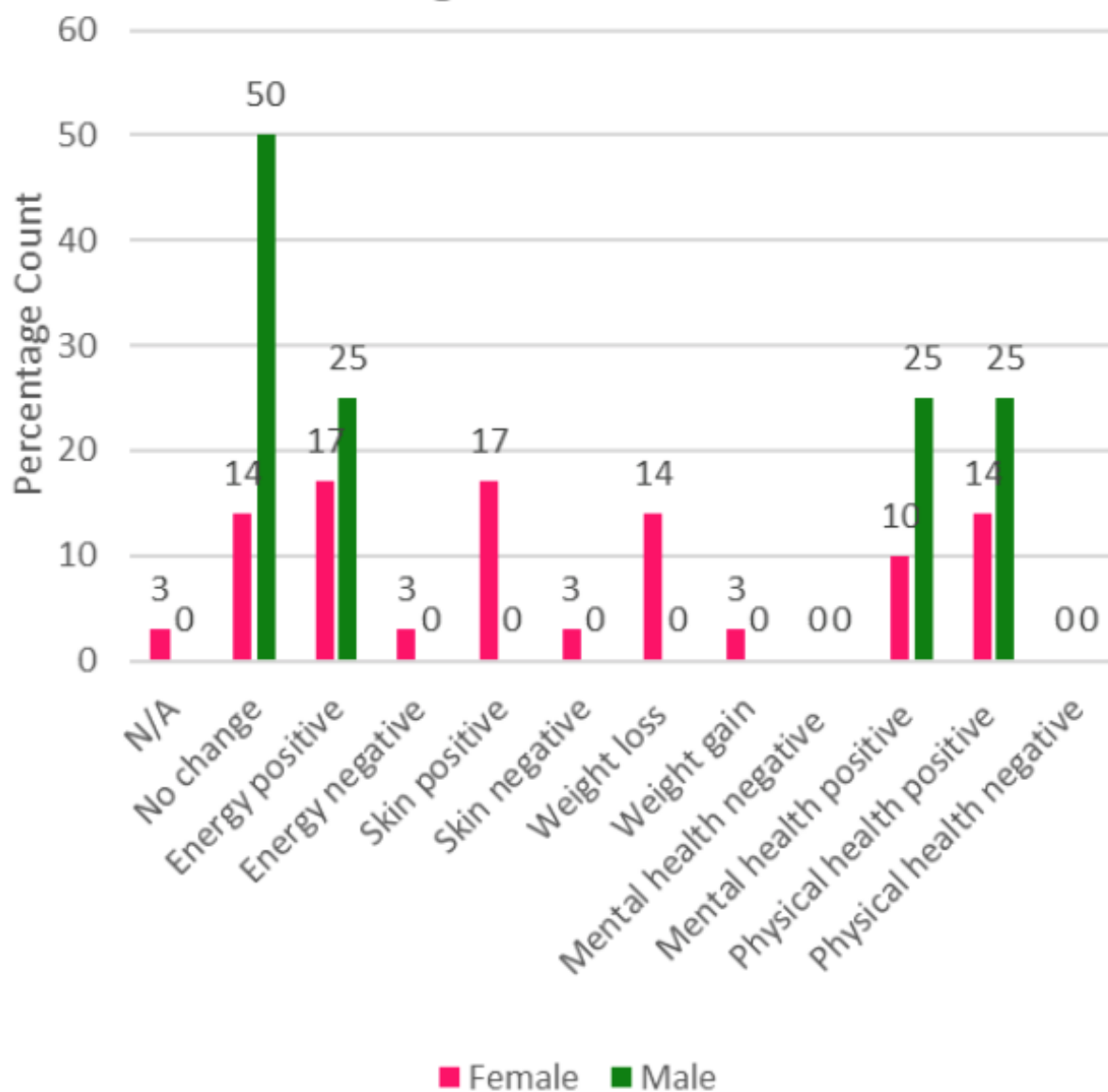


Figure 14 Quantitative analysis of difficulties concerning vegetarianism

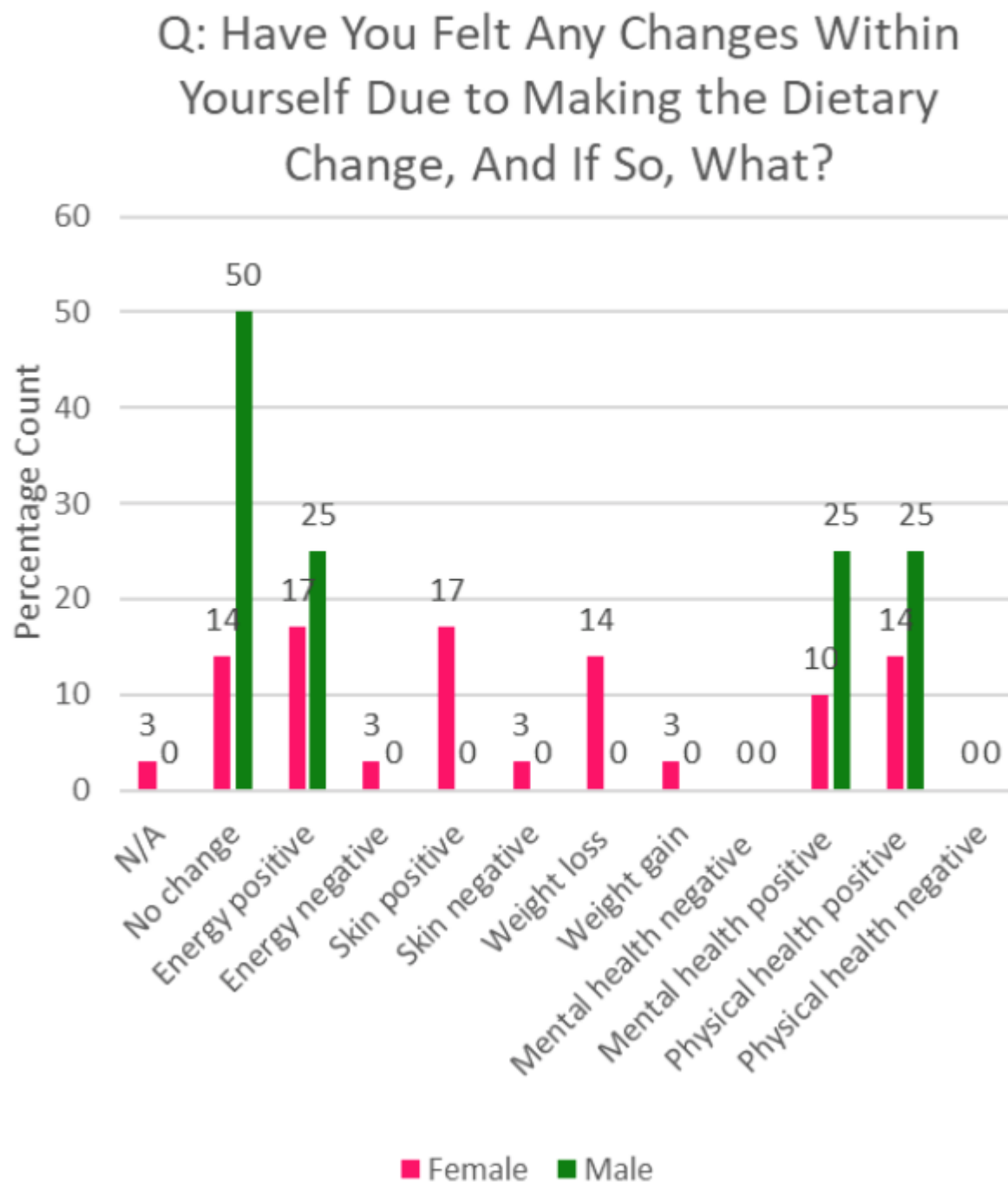


Figure 15 Quantitative analysis of changes felt becoming vegetarian

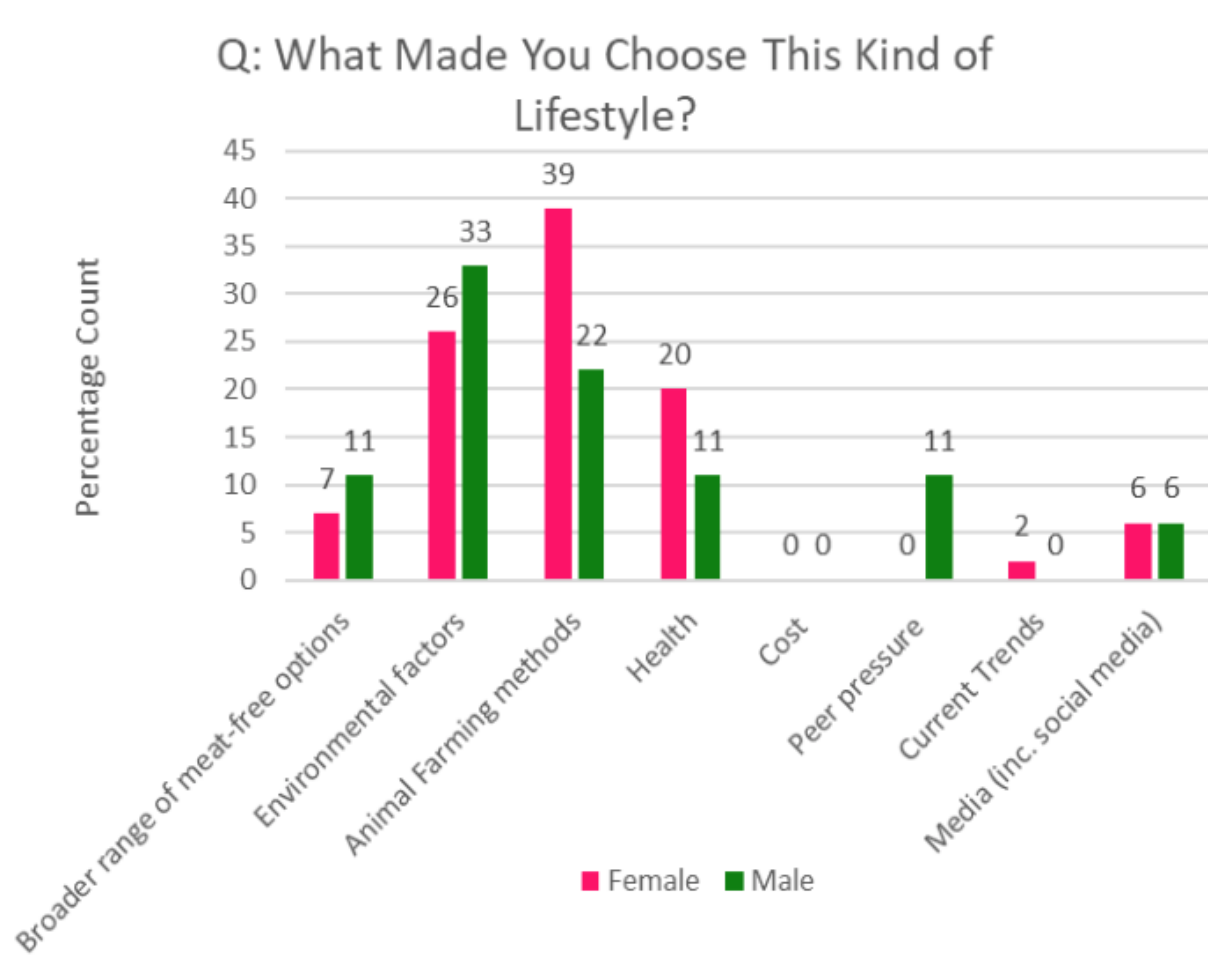


Figure 16 Vegetarian motivations

Figure	Null Hypothesis	Critical Two-tail Value	T-Stat Value	Reject/Accept the Null Hypothesis?	Statistically Significant/Insignificant?
14	'There is no difference between changes felt by males and females when becoming vegetarian'	2.145	3.303	Reject	Significant
15	'There is no difference between males and females'	2.447	2.294	Accept	Insignificant

and their current dietary difficulties'					
16	'There is no difference in males and females and their motivations to become vegetarian'	2.228	2.366	Reject	Significant

Table 2 Statistical analysis for figures 14, 15 and 16

There was a statistically significant difference between males and females in the changes they felt since becoming vegetarian (Fig. 14), and their motivations to become vegetarian (Fig. 16). The majority of males said that they felt no change (Fig. 15) and were motivated by environmental factors (Fig. 16) whilst women mostly felt a positive change in energy and were more motivated by animal farming methods. Both genders did not cite any negative effects.

Whilst the results in figure 15 were not statistically significantly different, the graph shows dissimilarities between the genders; men found eating out and cost to be the most difficult factors compared to convenience and variety for women.

3.3 Vegetarian versus non-vegetarian data

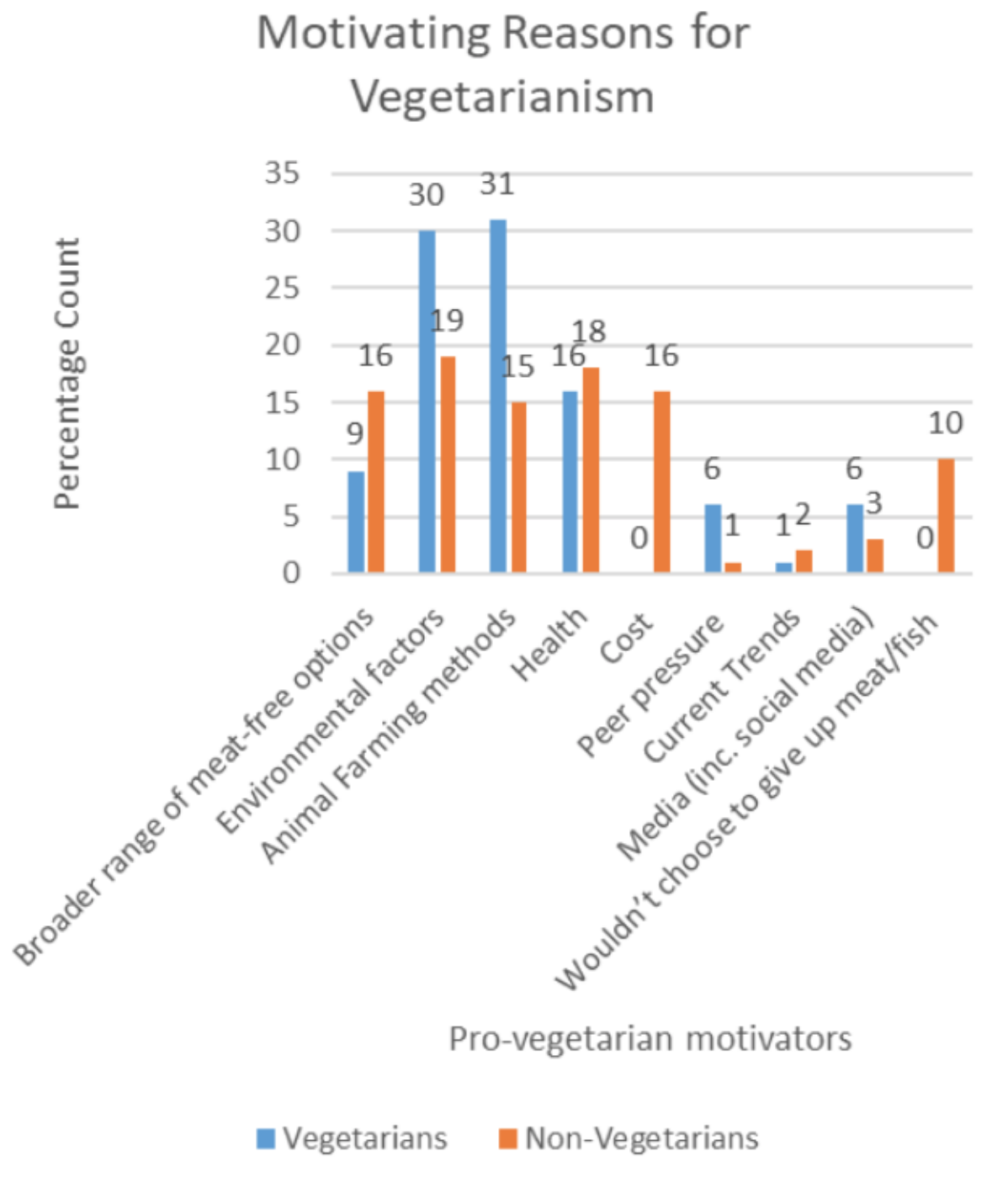


Figure 17 Comparison of pro-vegetarian motivators for both vegetarians and non-vegetarians

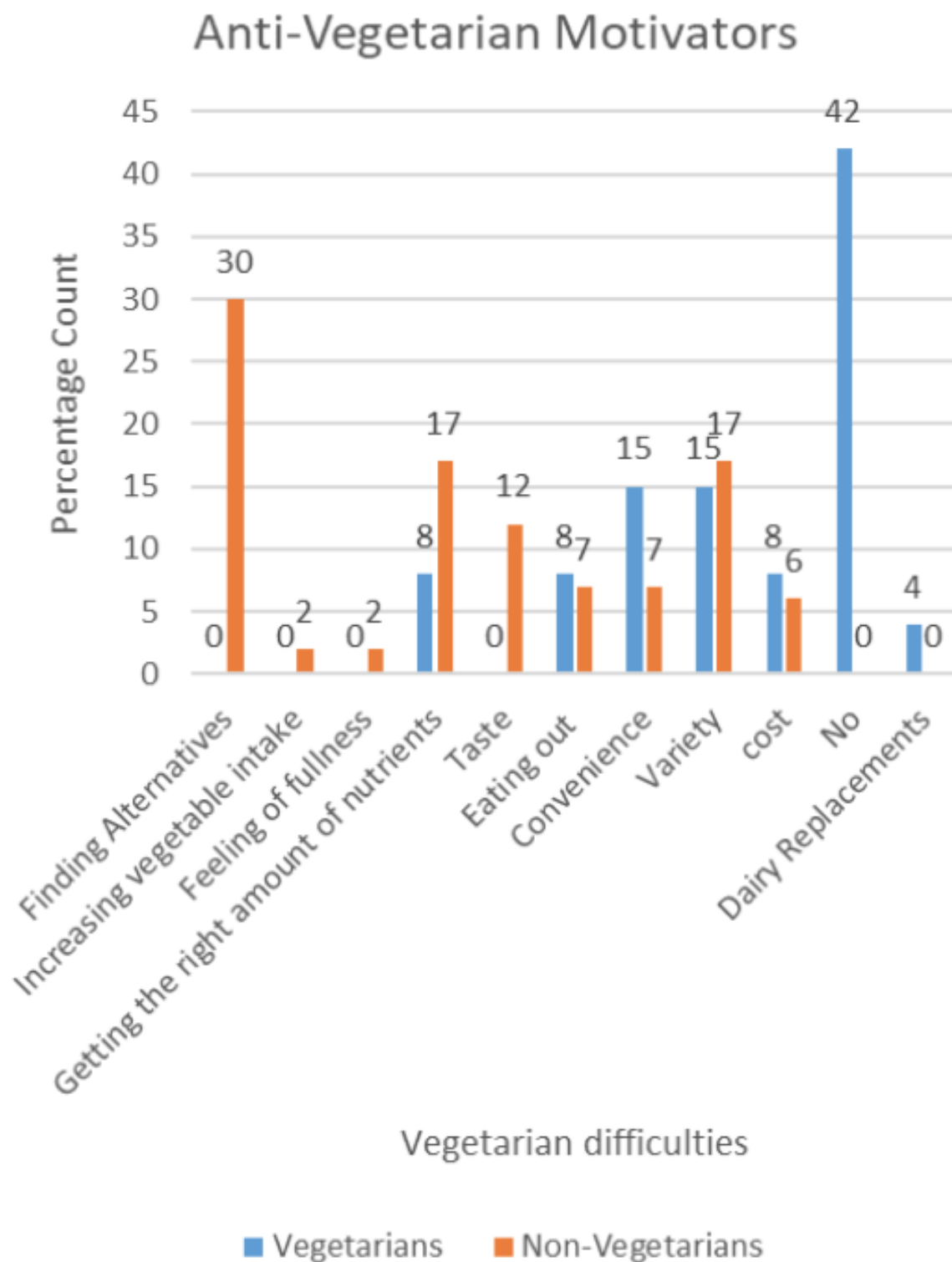


Figure 18 Comparison of current dietary difficulties for vegetarians and potential vegetarian difficulties for non-vegetarians

Figure	Null Hypothesis	Critical Two-Tale Value	T-Stat Value	Reject/Accept the Null Hypothesis?	Statistically Significant/ Insignificant?
17	'There will be no difference between vegetarians and non-vegetarians in their motivations behind vegetarianism.'	2.131	1.258	Accept	Insignificant
18	'There will be no difference between vegetarians and non-vegetarians in their current and potential differences in a vegetarian diet'	2.179	2.472	Reject	Significant

Table 3: Statistical analysis for figures 17 and 18

There was no statistically significant difference between the groups and their motivations that already/potentially drive vegetarianism (Fig. 17). The top three most common factors for both groups of people were: environmental factors, animal farming methods, and health.

However, there was a statistical difference between the groups concerning dietary difficulties associated with vegetarianism. Most vegetarians do not have difficulties whilst non-vegetarians felt they would have few alternatives if following the same diet (Fig. 18). Both groups, however, felt variety, eating out and cost is a vegetarian difficulty.

3.4 Emissions data

	Total Meals	Total Vegetarian Meals	Total Non-Vegetarian Meals	Total Emissions (KgCO ₂ e)	Total Vegetarian Emissions (KgCO ₂ e)	Total Non-Vegetarian Emissions (KgCO ₂ e)
Restaurant Emissions	211,432,295	47,487,694	163,944,602	734,163,655	27,447,887	706,715,768

Table 4 Calculated values for both restaurant and personal emissions data for total, vegetarian and non-vegetarian meals

	Potential Annual Emissions (KgCO ₂ e)	Potential Annual Emissions Saving (KgCO ₂ e)	Emissions Saved
Restaurant emissions	122,207,867	611,955,788	2.9kg per meal
Personal emissions	1,387,035,595	3,312,964,988	764.7kg per capita
Total Annual Emissions	1,509,243,462	3,924,920,776	905.9kgCO ₂ e per capita per year

Table 5 Calculated potential emissions savings due to a city-wide implementation of vegetarianism

Total calculated emissions saved by city-wide vegetarianism is equivalent to 0.85% of the UK's overall emissions (CAIT, 2020).

4. Discussion

City-wide vegetarianism across Birmingham is unattainable, as indicated by 19% male and 7% female NV saying they would refuse to give up meat and fish. The larger proportion of males within that ratio may be due to societal association of meat with masculinity, creating a reluctance to give up meat in fear of being perceived as 'weaker' (Rosenfeld, 2020).

The Birmingham population resonates strongly with environmental factors (30% V and 19% NV), more so than other motivating factors such as health, which has been a stronger motivator previously (Fox and Ward, 2007). Ethics (animal farming methods) is a resounding motivator for vegetarians both in this study (31%) and in previous studies (Fox and Ward, 2007), however not for non-vegetarians (15%).

Buying behaviour between vegetarians and non-vegetarians differs due to psychological factors. Altruism in vegetarians leads to connection between food and its origin (Bacon, 2018; Dhakal, 2014). Whilst non-vegetarians do not experience this as strongly, utilisation of the environmental awareness non-vegetarians have (79% males, 74% females) may be

useful for introduction of flexi- and vegetarian consumption habits. It may also be useful in reducing the negative societal connotations between men and meat (Rosenfeld, 2020).

Including health and financial benefits discussed in previous studies may further be used as motivation towards a vegetarian lifestyle as Flynn and Schiff (2012) found animal products to be the most expensive component of meals. Use of social influence through peers may also be useful, as 70% females and 66% males (V) stated their diet had an impact within their social circles. Previous research also shows that social pressure influences consumer buying behaviour (Jung Jang et al., 2011).

This study only took the main protein source into account and not the other dish components, place of origin, cooking or growing technique such as previous studies have done (Madin and Macreadie, 2015; Flynn and Schiff, 2012; Leuenberger, 2010; Helenius, 2009; Carlsson-Kanyama, 1998). However, it still produced a comparable estimated emissions savings of 2.9 kg CO₂e per meal in vegetarian-only Birmingham restaurants and 0.70 kg CO₂e per at-home meal.

Similar studies modelling vegetarianism found an emissions reduction of 20% and 15-25% per capita annually compared to 13.68% per capita in this study (Grabs, 2015; Hallstrom et al., 2014). However, Swedes eat an extra 1.5kg of meat per person annually whilst emitting 1.43 tonnes of CO₂e per capita annually less than Britons (Statistics Sweden 2019; Knoema, 2018).

The emissions saving by the vegetarian Chinese and Mahayan Buddhists is calculated to be equivalent to 7.2% and 8.9% of the UK's (2012) annual greenhouse gas emissions (Tseng, 2017a, 2017b). This study's emissions saving is equivalent to 0.7% using the same emissions data or 0.85% using more recent (2016) emissions data (CAIT, 2020), reiterating that wide-scale consumer change is needed for an observable effect (Helenius, 2009).

5. Conclusion

City-wide implementation of vegetarianism in Birmingham is calculated in this study to save emissions of ~ 39254 kilotonnes CO₂e. On average that is approximately 906kg CO₂e per person annually.

The majority of the Birmingham population are environmentally aware with an understanding of the environmental benefits of reducing animal products in their diet. However, reluctance to adopt vegetarianism is commonplace amongst the population, therefore more information is required in order for integration of a vegetarian diet and consequential emissions reduction.

Further research could be employed to increase the validity of the results by having a larger study sample or sampling all of the suburbs' emissions individually rather than generalising.

6. Acknowledgements

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7. References

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