'Plant-based' versus 'Vegan' & 'High protein' versus 'Low carbon': Exploring Situational Myth-busting, Product Labels, and Green Nudges that Increase Sustainable Meal Choices

Chris Macdonald[*]

Fellow at Lucy Cavendish College, University of Cambridge
*Corresponding author: chrismacdonald@dr.com

Abstract Recent models suggest that even if fossil fuel emissions were to stop overnight, our global food systems would prevent us from achieving the IPCC's target of limiting global warming to 1.5°C. When studying the environmental impact of the food sector it is apparent that meat and dairy products, in particular, produce a vast amount of emissions. Furthermore, the livestock sector is the single most significant source of methane which is a particularly potent greenhouse gas. Animal agriculture is also a leading cause of deforestation and biodiversity loss. Accordingly, behavioural scientists are attempting to uncover practical interventions that help to promote the consumption of more plant-based products. In particular, a range of green nudges, such as displaying the carbon emissions of menu items have been effective at increasing the consumption of meatless options. The reported experiments in this paper suggest that product naming, positive framing, and 'situational myth-busting' may also be effective tools. In Experiment 1, the label 'plant-based' outperformed the label 'vegan' by 9 percentage points. In Experiment 2, the added description of 'high protein content' outperformed the added description of 'low carbon emissions' by 16 percentage points. Both experiments were conducted online with 800 UK students (every participant was male, aged 18-25, and was non-vegan and non-vegetarian). While further studies are required, the results suggest that simple low-cost or no-cost product labelling and signage interventions may be an effective strategy for increasing sustainable meal choices. The paper concludes by introducing the term 'green nudge by proxy' and encourages further exploration into this approach.

Keywords: behavioural economics, consumer psychology, green nudges, communication, plant-based, vegan, sustainability, climate action, climatarian diets

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1. Introduction

Recent models suggest that even if fossil fuel emissions were to stop overnight, our global food systems would prevent us from achieving the IPCC's target of limiting global warming to 1.5°C [1]. When studying the environmental impact of the food sector it is apparent that meat and dairy products, in particular, produce a vast amount of emissions [2,3,4]. And, when looking at the emissions from meat, the emissions from the beef industry produce a disproportionate amount, evidenced in the graph below.

The UK government are, in many ways, leading the way with regard to emissions targets. The UK government became the first major economy to set a national goal of net zero by 2050, and, importantly, this was then put into law. Accordingly, the UK government have announced a series of progressive plans and policies, such as a ban on the sale of new fossil fuel vehicles by 2035. However, there have been no such announcements with regard to banning or limiting the consumption of high-emission food products. Furthermore, while there have been many reports advocating the taxation of high-emission foods [5,6,7], the UK government has not yet decided to implement taxation in this area.

In response to the disproportionately high emissions of meat and dairy products and the lack of governmental enthusiasm for political intervention, many researchers have been exploring the efficacy of alternative behavioural interventions that may increase more sustainable consumer choices [8,9,10]. These are often referred to as 'green nudges'. More specifically, to be deemed a mere 'nudge', it must promote beneficial behavioural change without preventing the other options [11].
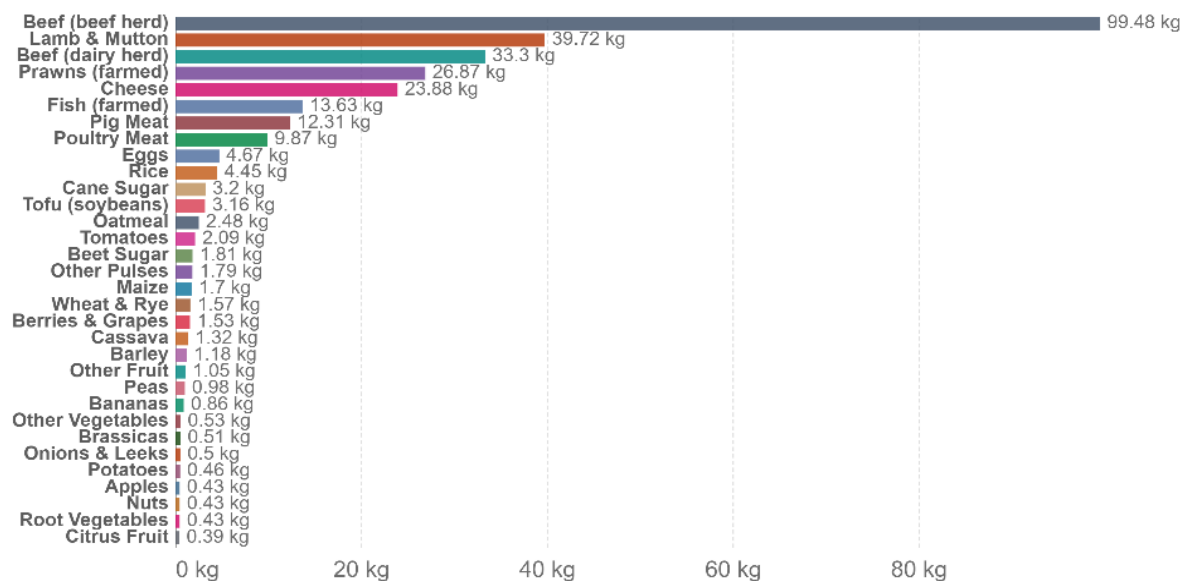
Figure 1. *Data source [2]. Graph (*OurWorldinData.org*).

Examples of green nudges include reorganising a canteen in such a way that the consumer has to walk past the low-carbon meal options to arrive at the options that result in greater emissions and therefore render the climatarian choice easier [12]. And indeed this was shown to be effective, providing the options were widely separated [12]. It was also found that doubling the proportion of low-emission food options can promote more climate-friendly choices [13].

In addition to adding more plant-based options or altering the physical placement of meals, researchers have found that small discounts [14,15] and displaying carbon emissions can also be effective green nudges [8,9,10,16,17].

Therefore, current research suggests that low-cost and no-cost interventions can be effective tools for increasing lower-emission meal choices. In this research paper, I will explore the efficacy of interventions that target product labels and signage. In particular, interventions that may address consumer concerns and misconceptions.

2. Experiment 1: 'Plant-based' versus 'Vegan'

In Experiment 1, I wanted to compare the efficacy of the labels 'plant-based burger' and 'vegan burger'.

As noted by the British Dietetic Association, a plant-based diet is "based on foods that come from plants with few or no ingredients that come from animals." [18] Whereas vegans don't eat any animal products at all [18]. Therefore, although a meatless meal may be appropriately labelled as either plant-based or vegan, the term vegan could be associated with greater restrictions which may discourage product purchases. Perhaps accordingly, prior research has shown that while 58% of consumers would buy plant-based foods, only 43% would buy vegan [19].

The more restrictive label of vegan could be viewed as a negative framing whereas the label of plant-based could be viewed as a more positive framing as it is highlighting what the product contains rather than what it does not. A positive framing has been shown to be a more effective influence on consumer behaviour in past experiments [20,21] perhaps this helps to explain why consumers appear to prefer the term plant-based [19]. In short, the label of vegan may be interpreted as 'getting less of something' whereas the label of plant-based may be interpreted as 'getting more of something'. In other words, the same meatless menu item has the potential to be viewed as 'getting less meat in your diet' or 'getting more plants in your diet' and the labelling of the product may be a contributing factor.

It could also be said that the term plant-based is more descriptive whereas the term vegan is somewhat nebulous which may result in confusion or suspicion. Prior research has shown that nonvegans often view vegan products as 'unnatural' [22]. One might assume that consumers might be less inclined to hold this view if the product were labelled as plant-based.

In short, not only may the term plant-based be seen as a more positive framing, but it may also result in the menu item appearing more familiar, reassuring, and perhaps, more 'natural'. This may facilitate increased consumption as consumers will often refrain from food choices that might attract attention or judgment from their peers [23,24,25].

2.1. Hypothesis

In Experiment 1, I wanted to test the hypothesis that more participants would choose the non-beef menu item when it was labelled as 'plant-based' when compared to it being labelled as 'vegan'. In particular, I wanted to test this hypothesis with men. Men eat more meat and are less likely to avoid or limit meat consumption [26,27] and, as a

result, they will be a more challenging audience to influence.

2.2. Experiment Design

In Experiment 1, participants were sent a link giving them access to a private online portal where they were asked to look at a lunchtime menu and indicate which item they would choose. 400 UK students took part. Every participant was male, aged 18-25, and was non-vegan and non-vegetarian.

The participants were randomly assigned to one of two groups: Group VB and Group PB. There were 200 participants in each group.

In Group VB, the menu had two items: A beef burger and a vegan burger. In Group PB, the menu contained two items: A beef burger and a plant-based burger.

To help incentivise the non-beef option, it was 10% cheaper than the beef option.

Group VB
Lunchtime menu
Beef Burger £5.00
Vegan Burger £4.50

Group PB
Lunchtime menu
Beef Burger £5.00
Plant-based Burger £4.50

Therefore, the only difference between the menus was that Group VB had the option of a vegan burger whereas Group PB had the option of a plant-based burger.

2.3. Results

In Group VB (*n* = 200), 34 participants chose the non-beef option. In Group PB (*n* = 200), 52 participants chose the non-beef option.

The hypothesis was that more participants would choose the non-beef menu item when it was labelled as 'plant-based' (Group PB) when compared to it being labelled as 'vegan' (Group VB). The data supports this hypothesis as in Group VB, 17% of participants chose the non-beef option whereas, in Group PB, 26% of participants chose the non-beef option.

The responses required to assess the hypothesis involve binary variables: either the participants chose the non-beef option or they did not. Accordingly, to assess for statistical significance, I ran a test of proportions. The test of proportions revealed that there was a statistically significant difference between Group VB and Group PB ($\chi 2$ (1) = 4.28, *P* = 0.039). Therefore, the hypothesis holds.

3. Experiment 2: 'High protein' versus 'Low carbon'

In Experiment 2, I wanted to compare the efficacy of the labels 'low carbon emissions' and 'high protein content'.

While displaying carbon emissions has been shown to be an effective green nudge [10,16,17], it may not be the most efficient use of limited display real estate

(e.g. a printed menu, website, or display board). For example, prior research suggests that while vegan food consumption is widely reported as being better for the environment, consumers of vegan products may be more interested in other aspects such as nutrition [28].

When looking at micronutrients and macronutrients, protein has been noted as one of the main nutrients that consumers look for when selecting meal options [19]. Furthermore, when specifically looking at diets that limit or remove meat products, there is a common consumer concern that it might result in a protein deficiency [29,30,31].

However, as there are many high-protein vegan meals, there need not be consumer concern. Furthermore, elite athletes who require above-average amounts of protein for optimal performance are able to meet their nutrient targets on a meat-free diet, evidenced by the growing number of vegan professional bodybuilders and powerlifters.

And so, to help placate concern and better inform consumers, signage and labels that indicate plant-based protein content may be beneficial. And, given that prior research suggests that protein is a key focus and concern when considering meatless options, it may be more effective than displaying carbon emissions. Protein content labels may act as a 'situational myth-buster' and therefore remove a key barrier to the uptake of climatarian diets. In addition to this, as with the label of 'plant-based', a 'high protein content' label may provide valuable positive framing by focusing on what the product has rather than what it does not have.

Therefore, given that the term 'plant-based' outperformed 'vegan' in Experiment 1, given that positive framing has been shown to be an effective consumer influence in prior studies [20,21], and given that concerns of protein deficiencies appear to be a particular focus for those considering meat-free options [30,31], I predicted that the label of 'high protein content' would outperform the label of 'low carbon emissions' despite the fact that displaying the carbon emissions of menu items has been shown to be an effective green nudge in prior experiments [10,17].

3.1. Hypothesis

In Experiment 2, I wanted to test the hypothesis that participants would be more likely to purchase the non-beef menu item when it was labelled as 'high protein content' when compared to it being labelled as 'low carbon emissions'.

3.2. Experiment Design

In Experiment 2, participants were sent a link giving them access to a private online portal where they were asked to look at a lunchtime menu and indicate which item they would choose. 400 UK students took part. To maintain consistency across the experiments, every participant was male, aged 18-25, and was non-vegan and non-vegetarian.

The participants were randomly assigned to one of two groups: Group LC and Group HP. There were 200 participants in each group.

In Group LC and Group HP, the menu had two items: A beef chilli and a bean chilli. However, next to the non-beef option, Group LC and Group HP had different additional information written in parentheses.

To help incentivise the non-beef option, it was 10% cheaper than the beef option.

Group LC
Lunchtime menu
Beef Chilli £5.00
Bean Chilli £4.50 (Low carbon emissions)

Group HP
Lunchtime menu
Beef Chilli £5.00
Bean Chilli £4.50 (High protein content)

Therefore, the only difference between the menus was that Group LC had 'Low carbon emissions' written in parentheses whereas Group HP had 'High protein content' written in parentheses.

3.3. Results

In Group LC (*n* = 200), 87 participants chose the non-beef option. In Group HP (*n* = 200), 119 participants chose the non-beef option.

The hypothesis was that more participants would choose the non-beef menu item when it was labelled as 'high protein content' when compared to it being labelled as 'low carbon emissions'. The data supports this hypothesis as in Group LC, 43.5% of participants chose the non-beef option whereas, in Group HP, 59.5% of participants chose the non-beef option.

The responses required to assess the hypothesis involve binary variables: either the participants chose the non-beef option or they did not. Accordingly, to assess for statistical significance, I ran a test of proportions. The test of proportions revealed that there was a statistically significant difference between Group LC and Group HP (χ^2 (1) = 9.618, P = 0.0019). Therefore, the hypothesis holds.

4. Conclusion

Lowering the emissions of the food sector is critical to achieving the IPCC's target of limiting global warming to 1.5°C [1]. When studying the environmental impact of the food sector it is apparent that meat and dairy products, in particular, produce a vast amount of emissions [2,3,4]. Furthermore, the livestock sector is the single most important source of methane which is a particularly potent greenhouse gas [32]. Animal agriculture is also a leading cause of deforestation and biodiversity loss [2,33]. Accordingly, behavioural scientists are attempting to uncover practical interventions that help to promote the consumption of more plant-based products.

In particular, a range of green nudges, such as product placement and displaying the carbon emissions of menu items have been effective at increasing the consumption of meatless meal options [8,9,10,14,15,16,17].

My research suggests that product naming may also be an effective tool. My research suggests that 'plant-based' may be a more effective term when compared to 'vegan', and 'high protein content' may be a more effective term when compared to 'low carbon emissions'.

Prior food studies have shown that nutrition may be the most important influence on meal choices, followed by other practical factors such as taste, cost, time, and familiarity [34,35,36]. While the best solution may be a combination of many approaches, I encourage future researchers to explore the names of products and ways to display their nutrients to explore how this may promote more climatarian choices. In particular, experiments that help to address misconceptions of meatless options lacking sufficient protein. In other words, nutrient labels may act as a 'green nudge by proxy' and may potentially be more effective than the more direct approach of displaying emissions data or environmental impact. Prior research suggests that even simple and discrete nutrition labelling can be effective at promoting more healthy meal choices [37,38,39] and so this may be particularly fertile ground for effective interventions relating to climatarian food choices.

Prior research also suggests that meal preferences vary significantly by demographics [35,40,41], therefore targeted interventions for specific groups may be optimal in future research. In particular, females are more likely to associate meat with environmental concerns and are more likely to follow a vegan diet [15,42]. Adding to the nuance of sustainable food choices, the setting and situation in which meat-free options are consumed is said to have a significant impact on the acceptance of these products [43,44]. As is widely noted by many researchers in this area, more research is needed to better understand the underlying mechanisms and more research is needed to better understand the long-term effects of interventions and their ability to shift habits [45]. As noted by Rust et al., due to the complexity of factors that contribute to meat eating, a combination of "sustained, context-specific interventions are likely to work better than brief, one-dimensional approaches." (2020).

I encourage more researchers to explore this fascinating and nuanced area. There is much to be explored and significant potential for the reduction of GHG emissions [2,3,4,46,47,48]. Current research suggests that UK citizens are highly concerned about climate change, they want to do something to help, and they believe that reducing the consumption of animal products will help [36,40], perhaps, UK consumers merely require the right combination of deeply considered nudges.

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