

# The environmental, nutritional and cost impacts of vegan, vegetarian and meat-based meals

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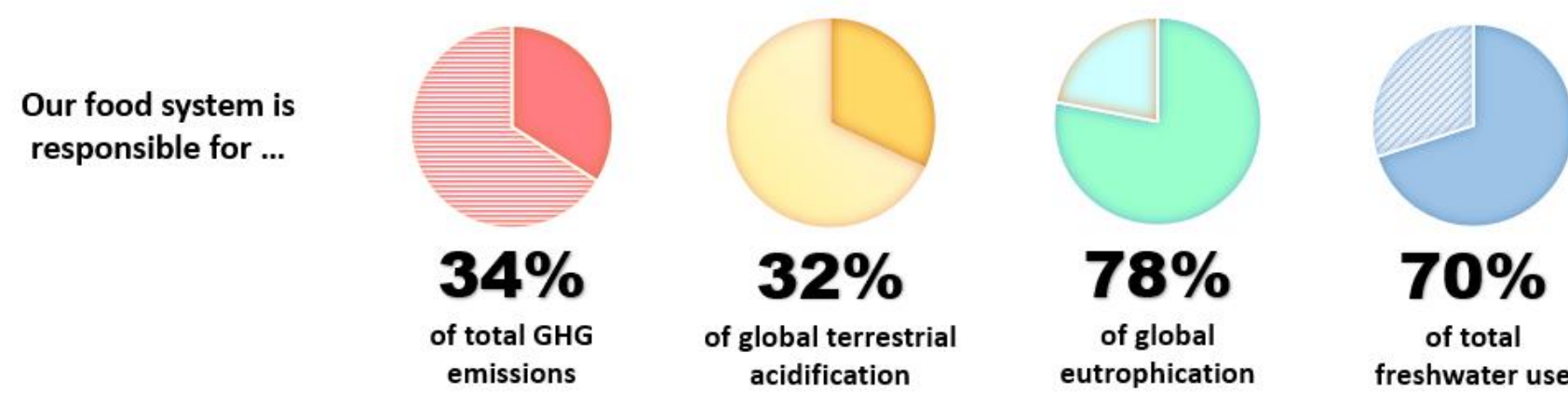
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## 1. Introduction

Food production and consumption are main drivers of:

- anthropogenic climate change<sup>1</sup>
- environmental degradation<sup>2, 3</sup>
- non-communicable diseases such as heart disease, cancer, diabetes etc., which account for 71% of all deaths globally<sup>4</sup>.



Our everyday food choices have profound impacts on our health, the environment, and other species, even if it is not always apparent.

**Research aim:** to better understand the environmental impacts, nutritional quality and cost of different types of meals and how they compare with each other.

Four commonly consumed meals (lasagne, chilli, curry and teriyaki) and their recipe variations ('meat-based', 'vegetarian', 'vegan', and 'whole-food vegan recipes) were compared.

## 2. Methods

Meals analysed in this study were offered at a university canteen's lunch service.

In total, 13 recipes, made with 33 different ingredients, were assessed.

**Environmental impacts:** estimated using Life Cycle Assessment (LCA):

- Global warming potential (GWP)
- Freshwater eutrophication potential (FEP)
- Terrestrial acidification potential (TAP)
- Water depletion potential (WDP)

LCA calculated from **cradle to plate** and included all stages from agricultural produce and ingredient production, to transportation and storage of ingredients and meal preparation.

**Nutritional quality:** assessed using a nutrient profiling model, the Nutrient Rich Food Index (NRF 17.3):

- 17 nutrients to encourage (protein, fibre, vitamin A, B1, B2, B9, B12, C and E, and minerals: K, Ca, Mg, Fe, I, Cu, Zn, Se)
- 3 nutrients to limit (saturated fat, added sugars, and sodium).

**Recipe costs:** included ingredients cost and wastage costs. Other life cycle costs were excluded due to limited primary data.

### References:

1. Crippa, M., Solazzo, E., Guizzardi, D., Monforti-Ferrario, F., Tubiello, F.N., Leip, A., 2021. Food systems are responsible for a third of global anthropogenic GHG emissions. *Nat. Food* 2, 198–209.
2. Poore, J., Nemecek, T., 2018. Reducing food's environmental impacts through producers and consumers. *Science*, 360, 987–992.
3. UNEP, 2016. Food Systems and Natural Resources. A Report of the Working Group on Food Systems of the International Resource Panel. Westhoek, H, Ingram J., Van Berkum, S., Özay, L., and Hajer M.
4. WHO, 2021. Noncommunicable diseases Factsheet. Available at: <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>. Last accessed: 09/05/2022.

## How sustainable is your lunch?



## Food for thought:

The power of our food choices

We eat between 20-30 meals a week.

That is 20-30 times we can make a difference each week.

What we eat matters.  
For our health.  
For the planet.  
For the animals.

Now that you better understand the impact of your food choices, which meals will you choose?

## Policy recommendations for plant-based food systems

- ✓ Reform & reallocate subsidies toward the production of whole, plant-based foods.
- ✓ Legislation to provide healthy, plant-based meals in public-sector institutions
- ✓ Promote plant-centred nutrition



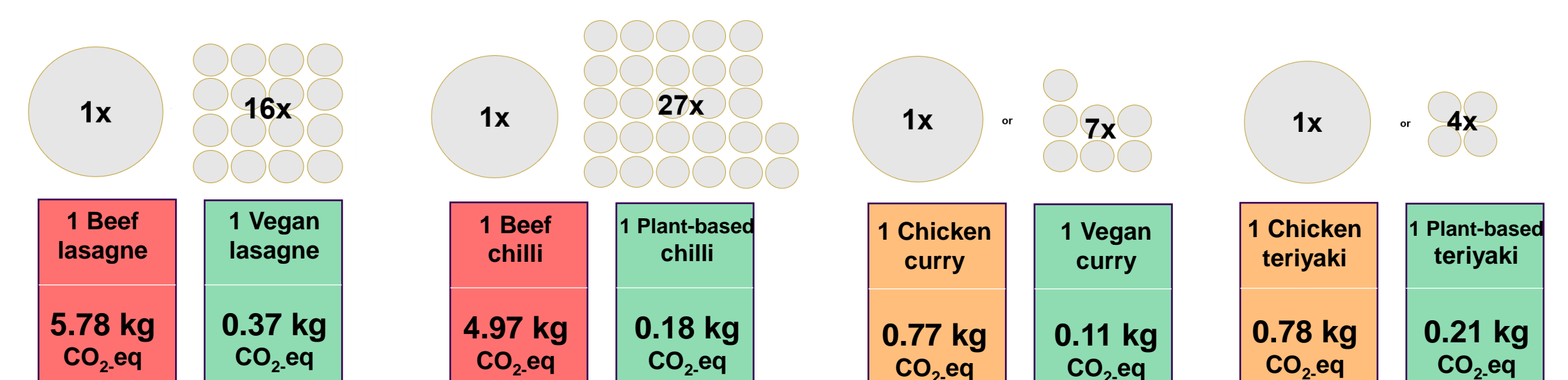
Hope comes from the actions we take & the choices we make.

## 3. Results

### Environmental impacts:

Plant-based (vegan & whole-food vegan) meals had substantially lower environmental impacts than their animal-based versions (meat and vegetarian).

Below the global warming potential (GWP) of animal vs plant-based meals are illustrated. One beef lasagne has the same GWP as 16 vegan lasagnes, while 1 beef chilli has the same GWP as 27 plant-based chillis. That is almost a whole month's worth of plant-based lunches vs 1 single beef chilli for lunch.



### Nutritional quality:

Plant-based meals also had higher nutrient density than their animal-based versions. Figure 1 below shows the NRF 17.3 scores of meals plotted against their GWP. In general, meals made with whole plant foods had the highest nutrition scores and the lowest GWP. Trends were similar for other environmental impacts as well.

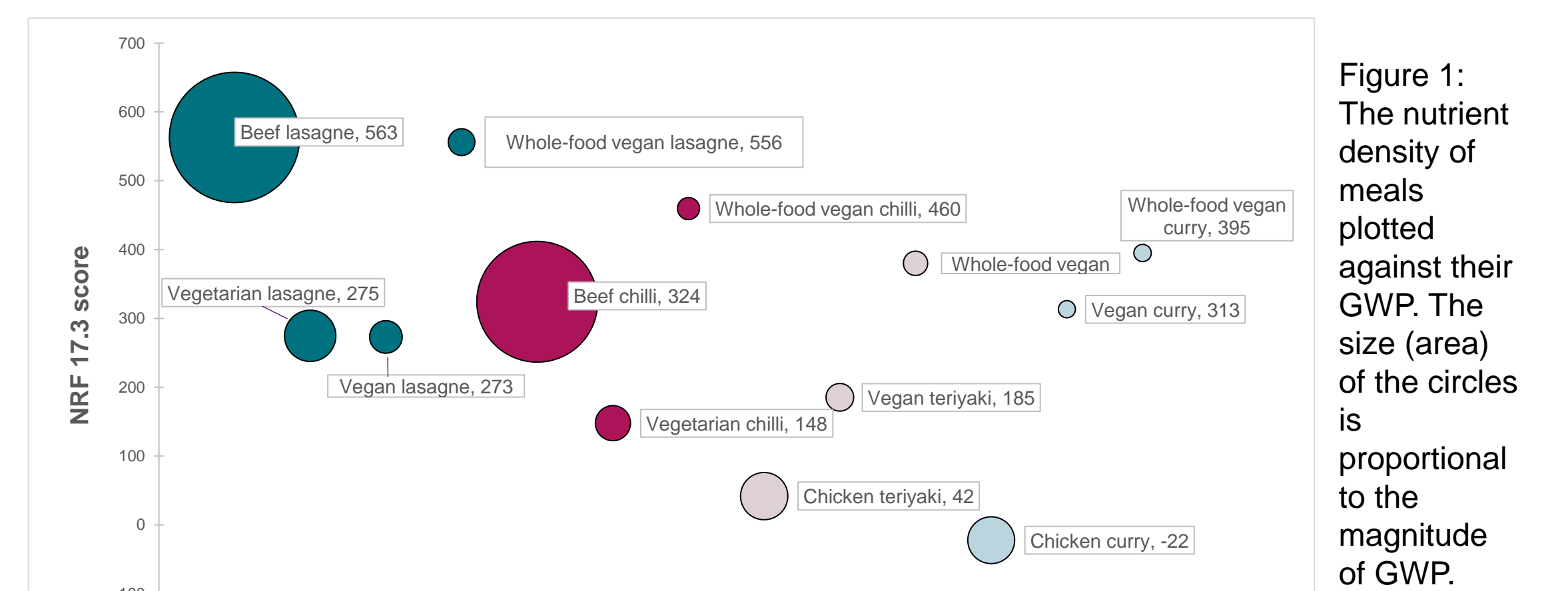


Figure 1: The nutrient density of meals plotted against their GWP. The size (area) of the circles is proportional to the magnitude of GWP.

### Costs:

On average, plant-based meals cost less to prepare than meat-based and vegetarian meals.

Meat-based meal	Vegetarian meal	Vegan meal	Whole-food vegan meal
£1.60	£1.41	£1.12	£1.29

### Overall sustainability:

Table 1 shows the overall sustainability of meals. Plant-based meals consistently have the best overall performance irrespective of the type of cuisine.

	Environmental score	Nutritional quality score	Recipe cost score	Final score	Final rank
Whole-food vegan chilli	0.99	0.67	0.82	2.48	1
Whole-food vegan curry	1.00	0.53	0.94	2.46	2
Whole-food vegan lasagne	0.97	1.00	0.47	2.45	3
Vegan curry	1.00	0.38	1.00	2.38	4
Vegan teriyaki	0.95	0.34	0.67	1.96	5
Vegetarian lasagne	0.84	0.39	0.55	1.78	6
Vegan lasagne	0.94	0.37	0.46	1.77	7
Whole-food vegan teriyaki	0.97	0.71	0.06	1.74	8
Vegetarian chilli	0.92	0.32	0.36	1.60	9
Beef chilli	0.17	0.44	0.65	1.27	10
Chicken curry	0.86	0.00	0.33	1.19	11
Chicken teriyaki	0.85	0.09	0.07	1.01	12
Beef lasagne	0.00	0.88	0.00	0.88	13

Table 1: Overall ranking of meals when environmental impacts, nutrition and costs are weighted equally. Green = best performance Red = worst performance

## 4. Conclusions

This research, along with a growing body of evidence, showed that **wholesome, vegan meals** have substantially **lower environmental impacts, higher nutrient density, and cost less** to prepare than their meat-based alternatives.

This research provides evidence-based information for consumers, food service providers and policy makers to make more informed decisions\*. Shifting to plant-based food systems would put the **UK at the forefront of leading the way for sustainable & healthy food systems.**

\*Please note that results are based on a small number of meals offered in one canteen only so results may not be generalised to a wider context.

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