**Supplementary material 2**

**Sensitivity analyses**

Sensitivity analyses were undertaken to simulate their effect on overall dietary emissions (Table S1). Numerous sensitivity analyses were assessed: a 20% reduction in the emission factors of animal based products; the meat component of composite dishes to increase to 50%; US emission factors adopted where possible over those adopted from the UK; and UK dairy emission factors used instead of those obtained for Ireland. It was observed that adopting US emission factors had the greatest impact on GHGE associated with food consumption with an 18% reduction elicited. This was followed by a 10% reduction if the emission factors of animal based produces were to be reduced by 20%. Conversely, a slight increase in emissions (+3.3%) would be induced if the meat component of composite dishes was to increase from 35% to 50%, and if UK dairy emission factors were used.

Table S1. Percentage impact on dietary emissions (GHGE) from sensitivity analyses

|  |  |  |
| --- | --- | --- |
| **Sensitivity analysis** | **GHGE (gCO2eq/day)** | **% Impact** |
| 20% decrease in the emission factors of animal based products | 5881.1 | -10.0 |
| Meat component of composite dishes increased to 50% | 6751.1 | +3.3 |
| US emission factors adopted where possible | 5308.2 | -18.7 |
| UK dairy emission factors applied | 6744.7 | +3.3 |

**Replacing beef with other food groups**

Nutritional data from McCance and Widdowson provided information on the calorific and protein content of individual foods and was subsequently used to demonstrate the complexities of replacing one food group with another (67). Various scenarios were assessed in which average beef intake from the NANS was substituted with kidney beans, baked beans, or broccoli. If mean beef intake from the corresponding NANS food group (18.2 g) was hypothetically replaced by kidney beans, baked beans, or broccoli then various quantities of each would need to be consumed to compensate for the calories and protein foregone. The analysis was very simplistic in its nature and only served to demonstrate the challenge in adhering to diets which are low in GHGE but also nutritious.

Table S2. Typical values per 100 g intake of beef, kidney beans, baked beans, average beef, topside beef, and broccoli in terms of calories, protein content, and GHGE. The mean quantity of beef consumed from the NANS is also shown as well as its corresponding GHGE.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Typical values of selected foods** | | |  | **Beef consumption in NANS** | |
|  | kcal/100g\* | protein/100g\* | g CO2eq/100g |  | g/day | g CO2eq |
| Kidney beans | 92 | 6.9 | 150 |  | **18.2** | **642.9** |
| Baked beans | 80 | 5.0 | 170 |  |  |  |
| Broccoli | 28 | 3.3 | 170 |  |  |  |
| Average beef | 533 | 15.5 | 3540 |  |  |  |
| Topside beef | 202 | 36.2 | 3540 |  |  |  |

\*Values are from McCance and Widdowson using food codes 13-561, 13-532, 13-583, 18-005, and 18-090 for kidney beans, baked beans, broccoli, average beef, and topside beef respectively(67).

The specific type of beef consumed is not specified in the NANS food group classified as beef. However, the variety of beef may have an effect on the capability of each alternative food as a replacement. Therefore, two beef varieties of varying qualities from McCance and Widdowson were deemed appropriate; ‘Beef, fat, average, cooked’ (code: 18-005; average of eight cuts) and a high protein cut ‘Beef, topside, roasted well-done, lean’ (code: 18-090; average of ten samples). ‘Beef, fat, average, cooked’ and ‘Beef, topside, roasted well-done, lean’ were called ‘average beef’ and ‘topside beef’ respectively for the purpose of this study. Table S2 illustrates the typical values of calories, protein, and GHGE per 100g consumed for various food types as well as the mean intake of beef from NANS and its corresponding GHGE.

Table S3. The impact of replacing mean beef intake (18.2 g: either as average beef or as topside beef varieties) with kidney beans, baked beans, or broccoli.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Replacing calories: average beef** | | | |  | **Replacing calories: topside beef** | | | |
|  | Intake (g) | Protein (g) | g CO2eq | kcal |  | Intake (g) | Protein (g) | g CO2eq | kcal |
| Kidney beans | 105.2 | 7.3 | 157.8 | 96.8 |  | 39.9 | 2.8 | 59.8 | 36.6 |
| Baked beans | 119.5 | 6.0 | 203.1 | 96.8 |  | 45.3 | 2.3 | 77.0 | 36.6 |
| Broccoli | 345.7 | 11.4 | 587.7 | 96.8 |  | 131.0 | 4.3 | 222.7 | 36.6 |
|  |  |  |  |  |  |  |  |  |  |
|  | **Replacing protein: average beef** | | | |  | **Replacing protein: topside beef** | | | |
|  | Intake (g) | kcal | g CO2eq | Protein |  | Intake (g) | kcal | g CO2eq | Protein |
| Kidney beans | 40.8 | 37.5 | 61.2 | 2.8 |  | 95.3 | 87.7 | 142.9 | 6.8 |
| Baked beans | 56.3 | 45.6 | 95.7 | 2.8 |  | 131.5 | 106.5 | 223.5 | 6.8 |
| Broccoli | 85.3 | 23.9 | 145.0 | 2.8 |  | 199.2 | 55.8 | 338.7 | 6.8 |

Table S3 demonstrates the required intake and subsequent calories/protein and GHGE of the alternative foods to replace the calories and protein attained from consuming 18.2 g of the two beef types. Consumption of kidney beans and baked beans would compensate for calories and protein displaced but with less GHGE if they were used to replace both beef varieties. However, large intakes of kidney beans and baked beans would be required to reach parity with the 6.8 g of protein provided through 18.2 g consumption of topside beef. Indeed, the capacity of the bean varieties to maintain calorific and protein levels was higher when compared to the average beef category rather than the topside; therefore highlighting the importance of meat quality with regards to GHGE. Broccoli has higher protein contents than many vegetables and was deemed appropriate for comparative analysis. Nevertheless, a substantially greater quantity of the vegetable was needed to achieve parity with both beef varieties. Furthermore, the GHGE acquired by consuming broccoli to match the calorific content of an average beef cut was somewhat comparable to beef itself.