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Supplementary material S1 for
Healthy and sustainable diets that meet GHGE reduction targets and are affordable for different income groups in the UK.

In this study, the objective was to minimize the environmental impact of the diet (i.e., GHGEs) for specific income quintiles. To construct a diet that consisted of amounts of n food groups (x_1,x_1, …,x_n). In this study *n*= 202 (101 foods in the home and 101 foods out of the home), each food group was associated with the GHGE per unit weight of an amount e_i as follows:

GHGE of the diet = $e_1 x_1 + e_2 x_2 + \cdots + e_n x_n$ (1)

The diet had to provide sufficient energy and meet the nutrient requirements listed in Table 2 of the main text. With macronutrient and micronutrient requirement limits, which were denoted as b_1, b_2,…, b_m, and with each food group *i* contributing a_{ij}, per unit weight to requirement *j*, a set of *j* dietary constraints were established such that

$$a_{1j} x_1 + a_{2j} x_2 + \cdots + a_{nj} x_n \geq b_j \quad (2)$$

As listed in the table 2, constraints were of the following 3 types: constraints with a lower limit, constraints with an upper limit and a constraint for which there was exact equality.

One constraint used was a varying lower bound for every food item, and a fixed upper bound (200% of the 2013 weight). In the first run of the linear programme, a varying lower bound was set initially at 0% of the weight of all food items in the 2013 diet. This was increased by 1% per each successive iterations of linear programme run until no feasible diet could be found (i.e. 0% to 1%, 1% to 2% etc.).

The other way this could be understood is at the 0% lower bound, items in the 2013 diets could be excluded from the optimised diet, while at the 1% lower bound all items in the 2013 diet had to be included at a minimum of 1% of their 2013 weights. This means that a maximum of 99% negative deviation and 100% positive deviation (due to the 200% upper bound) was possible at the 1% lower bound. Likewise at the 51% lower bound this meant that all items in the 2013 diet had to be included at a minimum of 51% of their 2013 weights –a maximum negative deviation of 49% (and 100% positive deviation) was possible).

The iteration with the highest lower bound calculated by the linear programme to have a feasible diet is referred to in this paper as the 'final lower bound scenario'. This method allowed, where possible, for us to include food items that are currently eaten in the 2013 diet to remain in the optimised diet. Food items that are more expensive, unhealthy, or higher GHGE were consumed at their minimum (i.e. the lower bound constraint) if there are other cheaper, healthier or lower GHGE substitutable foods still available. Due to the lower bound constraint, foods that were not eaten in the current (2013) diet are not included in the feasible diets except for the 0% lower bound scenario. This means that foods that are exclusively consumed in specific quintiles are only able to be consumed in those quintiles in the optimised diets.

Linear programming was carried out by using the GNU Linear Programming Kit as implemented in the Rglpk (0.3–5) package of the R (3.20) statistical software environment.