Proceedings of the Nutrition Society (2024), **83 (OCE4)**, E437 doi:10.1017/S002966512400675X

Nutrition Society Congress 2024, 2–5 July 2024

Spaghetti Bolognese without the mince: analysis of meat in UK meal structures

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Climate change is strongly linked to production of livestock[1,2] and national recommendations are to reduce meat consumption, especially ruminant meat[2], as part of a more sustainable diet. However, this recommendation in isolation is no guarantee that diets would be healthy or have lower greenhouse gas emissions because foods are eaten within the context of meals and a wider diet. In this study the role of meat within the context of UK meals was examined to understand the potential knock-on consequences for meal structures.

Cross-sectional dietary intake data from UK National Diet and Nutrition Surveys[3] (2008- 2019) were analysed to compare the composition of 287,719 eating occasions. Mixed-effects logistic and gamma regressions models were used to determine the likelihood of consumption and, when eaten, the quantity consumed of selected food groups based on the coincidence of other foods in the meal. Models adjusted for age ($1.5 \leq$ years ≤ 96), gender, and time of day in addition to a random intercept for participants.

Of the eating occasions examined, 30% contained meat, rising to 42% for evening meals (5pm to 8pm). Meats were a significant determinant of the type of starchy foods within a meal, for example the likelihood of pasta was higher with beef (OR 1.06 (95% CI 1.04, 1.07) per z-score change in beef in the meal) than poultry (OR 0.87 (0.85, 0.87)) whereas rice was more likely to be eaten with chicken (OR 1.44 (1.42, 1.46)) than beef (OR 1.06 (1.04, 1.08)). The likelihood of potatoes in a meal increased with all meats, but the likelihood of bread was lower in meals containing meat, except for bacon and ham (OR 1.30 (1.30, 1.33)). The presence of meat, of almost any type, in a meal was predictive of vegetables in the meal. On average the quantity of meat increased the quantity of vegetables in the meal by approximately 11.2% (95% CI 9.5, 12.8), 8.7% (6.0, 11.4), 8.1% (5.5, 10.8), and 3.9% (2.7, 5.2)% per 100g increase of beef, lamb, pork, and poultry respectively.

Recommendations to reduce meat consumption must consider the wider impact on the whole diet

as meals are restructured. Observed meals indicate the combinations of foods currently consumed, and how people may change eating patterns if they reduce meat consumption. The consequence of reducing meat in meals may change the choice of starchy elements. Switching from beef to poultry would likely increase rice consumption and reduce use of potatoes and pasta, attenuating the net reduction in emissions. However, since meat was positively predictive of the presence and quantity of vegetable in meals, reducing meat content may, in the short term, have negative implications for public health as people restructure meals.

Acknowledgments
Funding Support: Scottish Government's Rural and Environment Science Analytical Services Strategic Research Programme

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