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Identifying Foods within the UK diet that are rich sources of the micronutrient Queuosine (Q)

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Theme Highlight. Queuosine (Q) is a vital micronutrient crucial for protein translation and cellular function in humans. Deficiencies of Q have been linked to chronic illnesses, such as inflammatory bowel disease, neurodegenerative diseases, and various cancers. Human requirements for this micronutrient have not yet been established. Thus far, there has been no systematic investigation of the human diet to understand typical intakes. It is necessary to measure the levels of Q metabolites in commonly consumed foods to identify the richest dietary sources and determine Q intake. Only then can its role in human health and disease be established.

This study aimed to comprehensively analyse Q distribution in the UK diet by quantifying it in foods, identifying rich sources, and ultimately, enabling the design of dietary intervention studies assessing Q absorption/bioavailability.

Data from the UK National Diet and Nutrition Survey (NDNS 5Y) were processed to identify the most frequently consumed foods in 31 main categories, reflecting the dietary habits of >99.5% of UK consumers. Extraction techniques were developed, including a methanol-based method for extracting free Q metabolites and a specialized approach for isolating tRNA-bound Q metabolites from various food matrices. Quantitative LC-MS/MS (SCIEX 5500+) was utilized to accurately measure queuine (q), Q, Q monophosphates (QMPs), and Q precursor (PreQ1) in food samples. These values were summed to determine Total Q levels. Additionally, four-day food diary data from 93 participants in the Northern Ireland Dietary Assessment Study (NIDAS) were analysed to determine the average daily consumption of Q metabolites in adults. Dairy sources were considered promising, so five commercial probiotic yoghurt brands were compared side-by-side.

Q metabolite levels varied significantly across various food types. Total Q metabolite levels in foods ranged from 0.05ng/g to 80ng/g, with a mean level of 20ng/g. The calculated Q consumption of participants in NIDAS ranged from nil/day in some individuals to 170μg/day in others, with a typical mean intake of 18μg/day. The mean amounts (ng/g) of Total Q metabolites (tRNA-bound + free) measured in food categories were dairy 57.2 ± 9.7, meat 20.1 ± 9.9, poultry 4.9 ± 4, and plant-based milk 15.3 ± 10, fruits 2 ± 1.3, vegetables 5.3 ± 2.8, starchy foods 2.2 ± 0.7. Dairy products emerged as significant sources of Q metabolites based on these findings. Concentrations observed in shortlisted probiotic yoghurts ranged from 32 to 352 ng/g.

This study determined typical Q intakes and is the first to identify Q-rich food sources in the UK diet. The highly Q-enriched probiotic yoghurt products could be used in controlled dietary intervention studies to assess Q absorption/bioavailability and this micronutrient's role in human health and disease.

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