

From observation to intervention: time to put 'food and mood' to the test

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It is well documented that the UK is in the midst of a mental health crisis that healthcare services are grappling with.¹ This issue is not limited to the UK, and in 2018 it was estimated that more than one in six people in the European Union suffered from a persistent mental health issue.² Mental health disorders include a wide range of conditions and severities, including but not limited to: anxiety disorders, depressive disorders, addiction disorders, bipolar disorders and schizoaffective disorders. Mental well-being was previously artificially dichotomised into either an absence or presence of mental illness, but there is now a greater appreciation for mental health and well-being existing on a continuum.

As mental health has become more widely understood and appreciated, many have looked beyond traditional interventions to more novel mechanisms. This is true of food, and nutrition. As such, the need for good-quality research and dedicated space in international journals has grown accordingly, making this special collection on Food, Mood and Mental Health, one of great interest but also one of great importance.

Mental ill health is the result of a complex, multifactorial aetiology, unique

to each individual, but with a universally detrimental effect on society. It has been estimated that suffering from depression can shorten healthy life years, with an impact comparable to smoking.³ In 2009/2010, the estimated costs of mental health problems in England alone stood at over £105 billion, comprised of direct healthcare costs, loss of productivity and human suffering, an increase of 36% from a previous iteration of a study in 2002/2003.⁴ The COVID-19 pandemic has added further cause for concern with experts warning that up to 10 million people may require new or additional mental health support in the wake of the pandemic.⁵

Current main treatments for mental illnesses include medication and psychotherapy,^{6–8} provided in community, primary care, secondary care and in-patient settings. Like all drugs, those used to treat mental illnesses such as antidepressants, antipsychotics and antianxiety medications have unintended side effects, some of which notably reduce tolerance and adherence.^{9,10} As a result, many seek complementary approaches to modern medicine, including dietary interventions, to help maintain mental well-being and prevent and treat mental illness, while managing the unwanted side effects of medications.

Food is a central component of celebrations, culture and religious festivals globally with an ability to act as a gift, a donation in a time of need or offered as a sign of peace or solidarity. While culturally and behaviourally we may accept its importance for human mood and behaviour, hard evidence is less forthcoming. Accordingly, before diet and food-based interventions become a standard tool for those working in psychiatry, clinical psychology and within wider mental health services, further research is needed to elucidate the

complex pathways involved. As with all emerging areas, there is a need to maintain the rigorous scientific standards. With BMJ NPH inviting further publications, there now exists a dedicated space for new evidence that will lead the way in the future. To date, the BMJ NPH 'Food, mood and mental health' special collection emerges insights from Lee *et al*¹¹ on potential effects of plant-based diets on depression, whilst Noonan *et al*¹² affirm that pre/probiotic therapy warrants further investigation in mental health, and Hayhoe *et al*¹³ underpin the need for public health nutrition strategies to optimise mental well-being in children.

Evidence to date suggests diets of higher quality (such as adherence to Mediterranean eating patterns and diets lower in saturated fat, salt and sugar) tend to be associated with more favourable mental health outcomes throughout the life course.^{14–16} One prospective cohort study demonstrated an increased likelihood of depression among postmenopausal women, with progressively higher intakes of high glycaemic index foods.¹⁷

A subtle but important factor is the effect of nutritional status on mental health outcomes. After dietary consumption, how does one's nutritional reserves impact their mental well-being? The issue that often arises with nutritional studies and mental health is the nature of the associations studied; it is difficult to know whether reverse causality or confounding is present, and we cannot conclude that an association rules out causation.

Low levels of vitamin C have been associated with lower mood and depression,¹⁸ described by self-assessment questionnaires. What remains unclear, is whether this is cause or effect. These studies suffer the same issues as many in nutrition; association does not imply causation and that, reverse causality (or confounding) might be at play. Yet it is also entirely plausible, that a higher quality diet may promote positive mental health outcomes and support individual well-being. In relation to vitamin C, however, there exists no convincing evidence to show benefit of supplementation in these groups.

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This relationship between vitamin C and mood, showcases many of the challenges faced when studying the effect of food, or specific nutrients, on mental health outcomes. Many studies demonstrate correlations which cannot imply causation. Without placebo-controlled intervention trials demonstrating effect, nutrition is unlikely to make its way into a mental health clinician's routine care. While there is an association between mental health and dietary patterns, efforts still need to be made to decipher whether it is the effects of mental illness leading to changes in dietary behaviours and subsequently markers of nutritional status, or whether nutritional deficiency and unfavourable dietary behaviours contribute to mental illness. In some cases, there can also be a circular relationship connecting the two possibilities. This collection seeks to begin to unravel some of these knots.

Despite the lack of robust data, there have been attempts to elicit the role of nutrition in mental illness. Patients with psychosis frequently have elevated homocysteine levels. One study¹⁹ theorised that reducing homocysteine would result in symptom improvement among patients with psychosis, through supplementation of vitamin B₆, B₁₂ and folic acid. Despite significantly reduced homocysteine levels among participants, it had no effect on symptoms of the condition.¹⁹ A meta-analysis on effects of dietary improvement on symptoms of depression and anxiety does hold promise for the potential role of dietary improvement to ameliorate symptoms of depression, but the majority of studies were not looking at participants with clinical levels of depression.²⁰

Finally, consider the impact of food and diet on mental health in patients whose dietary intakes, and therefore, nutritional status, is affected by management of existing mental health conditions. Evidence has shown that patients who suffer from mental ill health are more likely to be nutrient deficient²¹ and suffer from obesity.²² The SHINE project²³ highlighted the inequalities faced by patients with schizophrenia, whose lifespans are several decades shorter than the general population, mainly due to lifestyle and dietary factors.²⁴

Patients on antipsychotic medications such as olanzapine and clozapine are at an increased risk of cardiovascular disease and adverse events.²⁵ A contributory factor in this increased risk is the increase in appetite that results from the use of antipsychotic medications.²⁶ These patients would benefit from nutritional intervention drawing from an evidence base with greater precision.

Individual adaptation of nutritional guidelines is important in all populations, and this may be truer of those suffering from mental illness. Introducing more readily accessible resources on adequate and beneficial nutrition for individuals with mental health conditions and their carers should be a priority in addressing mental health patients more holistically.

Recommendations to follow specific diets may not be achievable for all patients due to cost, accessibility or cooking literacy which needs to be considered in both research and clinical practice. One must also acknowledge the considerable genetic variabilities which exist. These may mean that even if two individuals were to experience the same mental illness, and follow the same dietary advice, they may still experience very different symptoms or severity of symptoms.

Implementing existing evidence on the benefits of a healthy dietary patterns for example, Mediterranean diet, alongside regular physical activity for those with mental health conditions may prove beneficial. *Live More* is one example of an initiative seeking to combine mental healthcare and physical activity by making exercise accessible to psychiatric inpatients, with positive outcomes in terms of recovery from illness and sustained lifestyle improvements.²⁷ Accredited nutrition education for healthcare professionals, including those working in mental health services, should be made a priority across healthcare systems.

The therapeutic use of nutrition interventions in the management and improvement of mental health is an emerging area of practice with clear associations between diet and mental health. It should also be useful in educating and informing the next generation of clinicians, who unfortunately

appear to have an existing deficiency of nutrition training within medical curricula.²⁸

Rather than being two distinct concepts, mental and physical well-being should be interpreted as two sides of the same coin; one cannot exist without the other when considering the individual as a whole. What we eat plays a pivotal part in achieving overall health and within this domain 'Food and Mood' remains a promising in which we invite research, discussion and debate.

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REFERENCES

- 1 NHS Providers. The state of the NHS provider sector [Internet], 2020. Available: <https://nhsproviders.org/state-of-the-provider-sector-07-17/themental-health-provider-challenge> [Accessed 21 Nov 2020].
- 2 OECD. Health at a glance: Europe 2018, 2018. Available: <https://www.oecd.org/health/health-at-a-glance-europe/> [Accessed 21 Nov 2020].
- 3 Jia H, Zack MM, Thompson WW, *et al.* Impact of depression on quality-adjusted life expectancy (QALE) directly as well as indirectly through suicide. *Soc Psychiatry Psychiatr Epidemiol* 2015;50:939–49 <http://www.ncbi.nlm.nih.gov/pubmed/25660550>
- 4 Centre for Mental Health. The economic and social costs of mental health problems [Internet], 2010. Available: https://www.centreformentalhealth.org.uk/sites/default/files/2018-09/Economic_and_social_costs_2010_0.pdf [Accessed 21 Nov 2020].
- 5 Centre for Mental Health. Covid-19 and the nation's mental health: October 2020 centre for mental health, 2020. Available: <https://www.centreformentalhealth.org.uk/publications/covid-19-and-nationsmental-health-october-2020> [Accessed 21 Nov 2020].
- 6 National Institute for Health and Care Excellence. Ongoing care for adults with psychosis or schizophrenia [Internet], 2014. Available: <https://pathways.nice.org.uk/pathways/psychosis-and-schizophrenia/psychosis-and-schizophrenia-in-adults#content=view-node%3Anodes-monitoring-physicalhealth&path=view%3A/pathways/psychosis-and-schizophrenia/ongoing-care-foradults-with-psychosis-or-schizo> [Accessed 21 Nov 2020].
- 7 National Institute for Health and Care Excellence. Complex and severe depression in adults [Internet], 2009. Available: <https://pathways.nice.org.uk/pathways/depression#path=view%3A/pathways/depression/step-4-complex-and-severe-depression-in-adults.xml&content=viewnode%3Anodes-crisis-resolution-and-home-treatment> [Accessed 21 Nov 2020].
- 8 National Institute for Health and Care Excellence. Generalised anxiety disorder overview [Internet], 2011. Available: <https://pathways.nice.org.uk/pathways/generalised-anxiety-disorder-overview#content=view-index> [Accessed 21 Nov 2020].
- 9 Sansone RA, Sansone LA. Antidepressant adherence: are patients taking their medications? *Innov Clin Neurosci* 2012;9:41–6 <http://www.ncbi.nlm.nih.gov/pubmed/22808448>
- 10 Higashi K, Medic G, Littlewood KJ, *et al.* Medication adherence in schizophrenia: factors influencing adherence and consequences of nonadherence, a systematic literature review. *Ther Adv Psychopharmacol* 2013;3:200–18 <http://www.ncbi.nlm.nih.gov/pubmed/24167693>
- 11 Lee MF, Eather R, Best T. Plant-based dietary quality and depressive symptoms in Australian vegans and vegetarians: a cross-sectional study. *BMJ Nutr Prev Health* 2021;12:e000332.
- 12 Noonan S, Zaveri M, Macaninch E, *et al.* Food & mood: a review of supplementary prebiotic and probiotic interventions in the treatment of anxiety and depression in adults. *BMJ Nutr Prev Health* 2020;3:351–62.
- 13 Hayhoe R, Rechel B, Clark AB, *et al.* Cross-sectional associations of schoolchildren's fruit and vegetable consumption, and meal choices, with their mental well-being: a cross-sectional study. *BMJ Nutr Prev Health* 2021;49:e000205.
- 14 Meegan A, Perry I, Phillips C. The association between dietary quality and dietary guideline adherence with mental health outcomes in adults: a cross-sectional analysis. *Nutrients* 2017;9:238 <http://www.ncbi.nlm.nih.gov/pubmed/28273871>
- 15 Jacka FN, Kremer PJ, Berk M, *et al.* A prospective study of diet quality and mental health in adolescents. *PLoS One* 2011;6:e24805 <http://www.ncbi.nlm.nih.gov/pubmed/21957462>
- 16 Kulkarni AA, Swinburn BA, Utter J. Associations between diet quality and mental health in socially disadvantaged New Zealand adolescents. *Eur J Clin Nutr* 2015;69:79–83 <http://www.nature.com/articles/ejcn2014130>
- 17 Gangwisch JE, Hale L, Garcia L, *et al.* High glycemic index diet as a risk factor for depression: analyses from the women's health initiative. *Am J Clin Nutr* 2015;102:454–63 <http://www.ncbi.nlm.nih.gov/pubmed/26109579>
- 18 Pullar JM, Carr AC, Bozonet SM, *et al.* High vitamin C status is associated with elevated mood in male tertiary students. *Antioxidants* 2018;7. doi:10.3390/antiox7070091. [Epub ahead of print: 16 07 2018] <http://www.ncbi.nlm.nih.gov/pubmed/30012945>
- 19 Allott K, McGorry PD, Yuen HP, *et al.* The vitamins in psychosis study: a randomized, double-blind, placebo-controlled trial of the effects of vitamins B₁₂, B₆, and folic acid on symptoms and neurocognition in first-episode psychosis. *Biol Psychiatry* 2019;86:35–44 [https://www.biologicalpsychiatryjournal.com/article/S0006-3223\(19\)30001-0/fulltext](https://www.biologicalpsychiatryjournal.com/article/S0006-3223(19)30001-0/fulltext)
- 20 Firth J, Marx W, Dash S, *et al.* The effects of dietary improvement on symptoms of depression and anxiety: a meta-analysis of randomized controlled trials. *Psychosom Med* 2019;81:265–80 <http://www.ncbi.nlm.nih.gov/pubmed/30720698>
- 21 Swardfager W, Herrmann N, Mazereeuw G, *et al.* Zinc in depression: a meta-analysis. *Biol Psychiatry* 2013;74:872–8 <http://www.ncbi.nlm.nih.gov/pubmed/23806573>
- 22 Public Health England. Working together to address obesity in adult mental health secure units a systematic review of the evidence and a summary of the implications for practice [Internet], 2017. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/591875/obesity_in_mental_health_secure_units.pdf [Accessed 14 Jan 2021].
- 23 NIHR. CLAHRC NWL: improving physical health of mental health patients in the community. CLAHRC partnership programme, 2018. Available: <https://clahrcprojects.co.uk/news/clahrc-nwl-improving-physicalhealth-mental-health-patients-community> [Accessed 14 Jan 2021].
- 24 Hjorthøj C, Stürup AE, McGrath JJ, *et al.* Years of potential life lost and life expectancy in schizophrenia: a systematic review and meta-analysis. *Lancet Psychiatry* 2017;4:295–301 <https://www.sciencedirect.com/science/article/pii/S2215036617300780>
- 25 Chittaranjan A. Cardiometabolic risks in schizophrenia and directions for intervention, 2. *clin pract psychopharmacol*, 2016. Available: https://www.psychiatrist.com/JCP/article/_layouts/ppp.psych.controls/BinaryViewer.aspx?Type=Article&Article=/JCP/article/Pages/cardiometabolic-risks-inschizophrenia-and-directions-for-intervention-part-2-nonpharmacologicalinterventions.aspx [Accessed 09 Jan 2021].
- 26 Deng C. Effects of antipsychotic medications on appetite, weight, and insulin resistance. *Endocrinol Metab Clin North Am* 2013;42:545–63 <https://www.sciencedirect.com/science/article/abs/pii/S0889852913000418?via%3Dihub>
- 27 Kings College London. Postgraduate student's mental health and exercise initiative goes from strength to strength, 2019. Available: <https://www.kcl.ac.uk/news/postgraduate-students-mental-health-and-exerciseinitiative-goes-from-strength-to-strength#:~:text=Live> [Accessed 14 Jan 2021].
- 28 Macaninch E, Buckner L, Amin P, *et al.* Time for nutrition in medical education. *BMJ Nutr Prev Health* 2020;3:40–8.