Polyphenol Diet Improves Psychological Well-Being

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A growing body of data has emerged suggesting a potential role for diet in psychological well-being. Polyphenols, which have anxiolytic and antidepressant-like properties, have been of particular interest. The aim of the present study was to assess the effect of a high polyphenol diet (HPD) compared to a low polyphenol diet (LPD) on aspects of psychological well-being in the Polyphenol Intervention Trial (PPhIT). The HPD diet consisted of six portions of F&V (including one portion of berries per day) and 50 g of dark chocolate per day. The participants in the HPD group reported a decrease in depressive symptoms, and an improvement in physical component and mental health component scores. In summary, the study findings suggest that the adoption of a polyphenol-rich diet could potentially lead to improvements in psychological well-being.

Keywords: polyphenols ; fruits ; berries ; vegetables ; dark chocolate ; psychological well-being ; depression ; physical health ; mental health

1. Introduction

Mental ill health, manifesting itself in a wide range of conditions such as depression, anxiety and stress[1], represents one of the leading causes of burden of disease worldwide, also substantially increasing the risk of cardiovascular disease, diabetes and cancer[2][3][4], and adversely affecting quality of life (QoL), relationships and the ability to work[5].

Thus, research is required to establish inexpensive and effective techniques to reduce the incidence of mental health problems, and to improve the psychological well-being of the population. Alongside genetic and biological factors, researchers have increasingly begun to examine the role of lifestyle factors, including dietary intake, in the promotion of psychological well-being and the prevention of mental illness[6][7]. Studies that have explored potential associations between nutrient intake (namely carbohydrates, B vitamins, and antioxidants such as vitamins C, E and polyphenols) or the foods rich in those nutrients (e.g. fruits, vegetables, legumes, coffee, chocolate) and psychological well-being have produced conflicting results[8][9][10][11].

2. History and Development

Polyphenols, in particular, have gained increasing attention from health researchers in recent years due to their biological properties, as well as their abundance within the human diet[12]. A growing number of epidemiological studies support a role for polyphenols in the prevention of chronic non-communicable diseases such as cardiovascular disease (CVD)[13], cancer[14] and neurodegenerative diseases[13][15]. Furthermore, animal studies have demonstrated the ability of polyphenols to improve cognitive performance and memory[16][17] and, more recently, these results have been replicated in human studies[18][19]. Regarding mental health, a growing body of data from animal and human studies has emerged supporting the role of a variety of dietary polyphenols in affecting behaviour and mood through anxiolytic and antidepressant-like properties, mediated through multiple molecular and cellular pathways[20]. Moreover, given that recent studies have demonstrated the pathophysiological role of oxidative stress and inflammation in the onset and progression of depression, polyphenols have been examined both in vitro and in vivo as a potential antidepressant treatment, although randomised controlled trials are still scarce in the field[21][22]. The richest sources of polyphenols in the human diet include fruits (e.g. berries, grapes, apples and plums), vegetables (e.g. cabbage, eggplant, onions, peppers), plant-derived beverages including tea, coffee, red wine and fruit juices (e.g. apple juice), seeds, nuts and chocolate (particularly dark chocolate)[23][24]. In terms of a food-based approach, several of the above-mentioned foods have been studied both in observational and intervention studies for potential effects on outcomes related to mental well-being, mood, psychological distress and life satisfaction[25], although, potentially due in part to the great variation in study designs, results are not consistent. Studying diet on a dietary pattern level will be beneficial allowing potential complicated or cumulative intercorrelations, interactions and synergies to be revealed, given that different polyphenols may have different effects on outcomes of mental health[26][27][28].

The aim of the present study was to assess the effect of a polyphenol-rich dietary pattern (comprising of fruits, including berries, vegetables and dark chocolate) in comparison to a control diet (low fruits & vegetables, < 2 portions/day and no dark chocolate) on aspects of psychological well-being and mental health status including mood,

QoL, body image perception and self-esteem as secondary outcomes measured within the Polyphenol Intervention Trial (PPhIT)[29].

3. **Study Methods and Main Findings**

Ninety-nine mildly hypertensive participants aged 40–65 years completed a four-week low polyphenol diet (LPD) washout period and then randomised to either a LPD or a high polyphenol diet (HPD) for eight weeks. The intervention commenced with a four-week “washout period” for all participants, during which they were asked to consume two portions or less of fruits and vegetables (F&V) per day and to exclude berries and dark chocolate (LPD). At the end of this period, subjects were randomised to either continue with the above LPD for a further 8-week “intervention period” or to consume an HPD of six portions of F&V (including one portion of berries per day) and 50 g of dark chocolate per day. A portion of fruit and vegetables was quantitatively defined using household measures as outlined by UK guidelines (https://www.nhs.uk/live-well/eat-well/5-a-day-portion-sizes/), i.e., 1 apple, 1 orange, half a grapefruit or one glass (150 mL) fruit juice, 3 tablespoons of vegetables. All participants in the HPD had a self-selected weekly delivery of F&V and dark chocolate (Lindt® 70% cocoa) free of charge to their homes from a local supermarket and were provided with written material regarding F&V portion sizes, recipes and sample diet plans. In addition, each participant, regardless of dietary allocation, was also contacted by telephone at weekly intervals to provide support and encouragement and to discuss potential barriers encountered in relation to achieving the dietary goals.

Both at baseline and the end of intervention, participants’ lifestyle and psychological well-being using scores of the Beck Depression Inventory-II (BDI-II), the Depression Anxiety Stress Scale (DASS-21), the Positive and Negative Affect Schedule (PANAS) and the 36-Item Short Form Survey (SF-36) were assessed.

Among the participants, 53.5% of them were males. Participants had a mean age of 54.9 ± 6.9 years. By the end of the intervention, there was a significant increase in intake of F&V, berries and dark chocolate in the HPD group, and the differences in change in intake between the two groups were statistically significant. Furthermore, there was a significant increase in the concentration of biomarkers, plasma vitamin C, serum lutein, β-cryptoxanthin, α-carotene and lycopene and urinary epicatechin over the course of the intervention in the HPD group, and the differences in the change in the concentration between the LPD and HPD group were statistically significant. There was a significant between-group difference ($p = 0.01$) in change in depressive symptoms as assessed with BDI-II, but no other significant effects were found between groups with regards to depression, anxiety or stress measured using the DASS-21 or positive and negative affect measured with PANAS. There were statistically significant between-group differences in change in different component scores (general health ($p = 0.03$) and energy/fatigue ($p = 0.02$)) and the overall summary scores for the physical health component ($p = 0.04$) and mental health component ($p = 0.01$), with more positive changes demonstrated in the HPD group, measured using SF-36.

4. **Conclusions**

In conclusion, the results from the present RCT trial showed heterogeneous findings regarding the effect of a polyphenol-rich dietary pattern on aspects of psychological well-being, with positive effects demonstrated on depressive symptoms and both the physical and mental health status components of the SF-36 quality of life measure. Further studies with psychological well-being impacts as primary endpoints, with appropriate study design and sample sizes, are needed in order to confirm the benefits of a polyphenol-rich dietary pattern on these outcomes.

References

1. The World Health Organization. the World Health Report 2001 - Mental Health: New Understanding, New Hope. 2001.
2. The World Health Organization. the Global Burden of Disease: 2004 Update. 2004.
3. Correll, C.U.; Solmi, M.; Veronese, N.; Bortolato, B.; Rosson, S.; Santonastaso, P.; Thapa-Chhetri, N.; Fornaro, M.; Gallicchio, D.; Collantoni, E. Prevalence, Incidence and Mortality from Cardiovascular Disease in Patients with Pooled and Specific Severe Mental Illness: A Large-scale Meta-analysis of 3,211,768 Patients and 113,383,368 Controls. World Psychiatry 2017, 16, 163-180.
4. Lawrence, D.; Hancock, K.J.; Kisely, S. Cancer and mental illness. In Comorbidity of Mental and Physical Disorders.; Anonymous .; Karger Publishers, 2015; 179, pp. 88-98.
5. Vigo, D.; Thornicroft, G.; Atun, R. Estimating the True Global Burden of Mental Illness. The Lancet Psychiatry 2016, 3, 171-178.
6. Ljungberg, T.; Bondza, E.; Lethin, C. Evidence of the Importance of Dietary Habits regarding Depressive Symptoms and Depression. International Journal of Environmental Research and Public Health 2020, 17, 1616.

7. Velten, J.; Bieda, A.; Scholten, S.; Wannemüller, A.; Margraf, J. Lifestyle Choices and Mental Health: A Longitudinal Survey with German and Chinese Students. BMC Public Health 2018, 18, 632.
8. Lim, S.Y.; Kim, E.J.; Kim, A.; Lee, H.J.; Choi, H.J.; Yang, S.J. Nutritional Factors Affecting Mental Health. Clinical nutrition research 2016, 5, 143-152.
9. Saghafian, F.; Malmir, H.; Saneei, P.; Milajerdi, A.; Larijani, B.; Esmaillzadeh, A. Fruit and Vegetable Consumption and Risk of Depression: Accumulative Evidence from an Updated Systematic Review and Meta-Analysis of Epidemiological Studies. Br. J. Nutr. 2018, 119, 1087-1101.
10. Jacka, F.N.; O'Neil, A.; Opie, R.; Itsiopoulos, C.; Cotton, S.; Mohebbi, M.; Castle, D.; Dash, S.; Mihalopoulos, C.; Chatterton, M.L. A Randomised Controlled Trial of Dietary Improvement for Adults with Major Depression (the" SMILES'Trial)(Vol 15, 23, 2017). In .
11. Smith, D.F. Benefits of Flavanol-Rich Cocoa-Derived Products for Mental Well-being: A Review. Journal of Functional Foods 2013, 5, 10-15.
12. Cory, H.; Passarelli, S.; Szeto, J.; Tamez, M.; Mattei, J. The Role of Polyphenols in Human Health and Food Systems: A Mini-Review. Frontiers in nutrition 2018, 5, 87.
13. Potì, F.; Santi, D.; Spaggiari, G.; Zimetti, F.; Zanotti, I. Polyphenol Health Effects on Cardiovascular and Neurodegenerative Disorders: A Review and Meta-Analysis. International journal of molecular sciences 2019, 20, 351.
14. Rothwell, J.A.; Knaze, V.; Zamora-Ros, R. Polyphenols: Dietary Assessment and Role in the Prevention of Cancers. Curr. Opin. Clin. Nutr. Metab. Care 2017, 20, 512-521.
15. Renaud, J.; Martinoli, M. Considerations for the use of Polyphenols as Therapies in Neurodegenerative Diseases. International journal of molecular sciences 2019, 20, 1883.
16. Carey, A.N.; Miller, M.G.; Fisher, D.R.; Bielinski, D.F.; Gilman, C.K.; Poulose, S.M.; Shukitt-Hale, B. Dietary Supplementation with the Polyphenol-Rich Açaí Pulps (Euterpe Oleracea Mart. and Euterpe Precatoria Mart.) Improves Cognition in Aged Rats and Attenuates Inflammatory Signaling in BV-2 Microglial Cells. Nutr. Neurosci. 2017, 20, 238-245.
17. Bensalem, J.; Dudonné, S.; Gaudout, D.; Servant, L.; Calon, F.; Desjardins, Y.; Layé, S.; Lafenetre, P.; Pallet, V. Polyphenol-Rich Extract from Grape and Blueberry Attenuates Cognitive Decline and Improves Neuronal Function in Aged Mice. Journal of nutritional science 2018, 7.
18. Travica, N.; D'Cunha, N.M.; Naumovski, N.; Kent, K.; Mellor, D.D.; Firth, J.; Georgousopoulou, E.N.; Dean, O.M.; Loughman, A.; Jacka, F. The Effect of Blueberry Interventions on Cognitive Performance and Mood: A Systematic Review of Randomized Controlled Trials. Brain Behav. Immun. 2019.
19. Philip, P.; Sagaspe, P.; Taillard, J.; Mandon, C.; Constans, J.; Pourtau, L.; Pouchieu, C.; Angelino, D.; Mena, P.; Martini, D. Acute Intake of a Grape and Blueberry Polyphenol-Rich Extract Ameliorates Cognitive Performance in Healthy Young Adults during a Sustained Cognitive Effort. Antioxidants 2019, 8, 650.
20. Vauzour, D. Polyphenols and Brain Health. OCL 2017, 24, A202.
21. Nabavi, S.M.; Daglia, M.; Braidy, N.; Nabavi, S.F. Natural Products, Micronutrients, and Nutraceuticals for the Treatment of Depression: A Short Review. Nutr. Neurosci. 2017, 20, 180-194.
22. Sureda, A.; Tejada, S. Polyphenols and Depression: From Chemistry to Medicine. Curr. Pharm. Biotechnol. 2015, 16, 259-264.
23. Bhagwat, S.; Haytowitz, D.B.; Holden, J.M. USDA Database for the Flavonoid Content of Selected Foods, Release 3. US Department of Agriculture: Beltsville, MD, USA 2011.
24. Rizzoli, R.; Stevenson, J.C.; Bauer, J.M.; van Loon, L.J.; Walrand, S.; Kanis, J.A.; Cooper, C.; Brandi, M.L.; Diez-Perez, A.; Reginster, J.Y. et al. The Role of Dietary Protein and Vitamin D in Maintaining Musculoskeletal Health in Postmenopausal Women: A Consensus Statement from the European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO). Maturitas 2014, 79, 122-132.
25. Rooney, C.; McKinley, M.C.; Woodside, J.V. The Potential Role of Fruit and Vegetables in Aspects of Psychological Well-being: A Review of the Literature and Future Directions. Proc. Nutr. Soc. 2013, 72, 420-432.
26. Jesus, M.; Silva, T.; Cagigal, C.; Martins, V.; Silva, C. Dietary Patterns: A New Therapeutic Approach for Depression? Curr. Pharm. Biotechnol. 2019, 20, 123-129.
27. Li, Y.; Lv, M.; Wei, Y.; Sun, L.; Zhang, J.; Zhang, H.; Li, B. Dietary Patterns and Depression Risk: A Meta-Analysis. Psychiatry Res. 2017, 253, 373-382.
28. Jacka, F.N.; Cherbuin, N.; Anstey, K.J.; Butterworth, P. Does Reverse Causality Explain the Relationship between Diet and Depression? J. Affect. Disord. 2015, 175, 248-250.

29. Noad, R.L.; Rooney, C.; McCall, D.; Young, I.S.; McCance, D.; McKinley, M.C.; Woodside, J.V.; McKeown, P.P. Beneficial Effect of a Polyphenol-Rich Diet on Cardiovascular Risk: A Randomised Control Trial. Heart 2016, 102, 1371-1379.