Chapter 1

MENTAL HEALTH AND NUTRITION: AN OVERVIEW

Bushaira. V

Assistant Professor, Dept. of Home Science, KAHM Unity Women's College, Manjeri

Introduction

Individuals' nutritional status and dietary habits have a significant impact on mental health and the emergence of psychiatric diseases. The majority of scientific research on mental health concerns are depression, cognitive function, and dementia; information regarding other psychiatric disorders, such as schizophrenia, is scarce. The longer people live, the more common mental illnesses become, and the greater the attention that follows. Nutrients like omega-3 fatty acids, phospholipids, cholesterol, niacin, folate, vitamin B6, and vitamin B12 may be good for mental health. Simple sugar and saturated fat are thought to be harmful to cognitive function, and blood cholesterol levels are inversely correlated with depression risk. Comfort foods provide a temporary sense of wellbeing, and they make a person feel good, by transposing it into a happy past, when it was taken care of or pampered. Researchers have found that physiological and psychological needs influence the people's attraction to a specific food.

Mental Health and Nutrition

Mental well-being is a core component of optimal health, and is a status that individuals can manage stress from daily living and make positive achievements pursuing public interest and contribution to the community. Maintaining individual's mental health is important to improve personal life values, to reduce medical cost and other social expenses to deal with mental disorders, and to enhance national competitiveness.

Mental disorders are clusters of syndromes which disturb an individual's cognition, emotion regulation or behaviour. Several factors affecting the development of mental disorders include genetic factors, stress, diet, physical inactivity, drugs, and other environmental factors. Among these factors, dietary factors may aggravate or ameliorate symptoms and the progression of the disorders although those are not major aetiologies'.

Feeding the brain with a diet that provides adequate amounts of complex carbohydrates, essential fats, amino acids, vitamins, minerals and water can support healthy neurotransmitter activity. It can protect the brain from the effects of oxidants, which have been shown negatively to impact mood and mental health. Evidence of nutrition's protective qualities can be identified across the life course. From a young age, good nutritional intake has been linked to academic success, with a number of studies reporting that providing children with breakfast improves their academic performance. A number of published studies have shown that hungry children behave worse in school, with reports that fighting and absence are lower and attention increases when nutritious meals are provided. As the age increases, the protective effect that diet has on the brain is evidenced in research findings that a diet high in essential fatty acids and low in saturated fats slows the progression of memory loss and other cognitive problems.

Nutrition plays a key role in promoting mental health. A diet that provides all essential nutrients will prevent any deficiencies, which may contribute to mental health conditions. Proper nutrition, including adequate fibre intake, promotes healthy gastrointestinal (GI) function. Food choices can impact our mood and even future food choices.

Food choices, mood and mental health are very interwoven. Mood drives food choices. Food choices can drive mood and future choices. This impacts not only the mental health; it can lead to other chronic diseases too. When the food choices are consistently snack foods with few nutrients, increase the risk of nutrition-related diseases such as type two diabetes and hypertension. Some mental health conditions can cause changes in appetite. Skipping meals can lead to deficiencies of important nutrients. Cravings are also associated with mental health conditions. Carbohydrate cravings are correlated with low serotonin levels. Promoting healthy levels of serotonin can be accomplished by a healthy, balanced diet, which would decrease cravings.

Emotional eaters consume significantly more food when feeling sad than happy. Moreover, when people eat emotionally, they choose sweet over salty food (van Strien et al., 2013). A positive mood increases the preference for healthy foods over indulgent foods as a tendency to project long term health objectives, while a negative mood prompts for immediate, impactful goals such as mood control, leading to greater preference for indulgent foods over healthy foods (Gardner, Wansink, Kim, & Park, 2014).

Particular foods come to be associated with the relief of distress and modify or change emotional states or feelings. This shows that mood plays a significant role in food selection and comfort foods are preferred under certain circumstances, such as when individuals are experiencing illness (Locher, Yoels, Maurer, & Van Ells, 2005). People choose to eat comfort foods when they have the blues or feel lonely (Spence, 2017). Males prefer warm, hearty, meal-related comfort foods (such as steak, casseroles, and soup), while females instead choose comfort foods such as chocolate and ice cream (Wansink, Cheney, & Chan, 2003). Sweet foods high in calories - ice cream, cookies, and chocolate, for example, elevate mood due to serotonin and opiates production (Stein, 2008).

The relationship between nutrition and mental health is bidirectional: the foods we eat affect our mental health, and our mental health status affects what and how well we eat. Nutritional factors relating to mental health have a common aspect in that those factors are associated with the risk of CVD. Omega-3 FAs are famous for cardio-protective effects. Folate, vitamin B6 and B12 are parts of homocysteine metabolism, and deficiencies of these nutrients result in increased blood levels of homocysteine, which aggravate mental health. Niacin is an effective modulator to increase high-density lipoprotein cholesterol and to improve lipidomic profiles, and vitamin D is associated with the risks of CVD and metabolic syndrome. These nutrients are beneficial for mental health. Conversely, excess intake of saturated fat and sugar, which are risk factors for CVD, is detrimental to brain function. In addition, recent studies add promising evidence that specific dietary patterns including Mediterranean diet can be applied as effective strategies to prevent mental disorders.

How does the food affect our mood?

Food is any natural or processed product/substance that serves as nurture for maintaining life, sustaining growth, vital processes and furnishing energy. From a nutritional point of view, food contains macronutrients – carbohydrates, proteins and fats, and micronutrients – minerals and vitamins (Mahan, Escott-Stump, & Krause, 2008). Any imbalance sustained on a sufficiently long enough term can create physical and psychological disorders. As any other organ, the brain is nurtured with substances present in the diet. Therefore, the nutritional properties of food impact on brain functions related to mood and emotion. Food may spark rapid

emotions by sensory stimulation, but it can influence mood by slower changes in brain chemistry as well (Shepherd & Raats, 2006).

Eating leads to widespread opioid release in the brain, likely signalling feelings of satiety and pleasure. A study revealed that a significant amount of endorphins is released in the entire brain after eating the pizza and, surprisingly, even more are released after the consumption of the tasteless nutritional drink. The magnitude of the opioid release was independent of the pleasure associated with eating (Tuulari et al., 2017).

It is a popular belief that a bit of chocolate can give a boost of happiness and improve the mood, while a sip of coffee energizes and makes us more alert. The excitants caffeine and Theo bromine, along with the sweet taste and some psychological mechanisms contribute to enhancing the disposition, however, it has also been proved that chocolate, if eaten in sufficient amounts on an empty stomach, might encourage the synthesis of the serotonin (Shepherd & Raats, 2006).

The neurotransmitter serotonin (or 5-hydroxytryptamine; 5-HT) is formed from the precursor essential amino acid, tryptophan (TRP) in the presence of an enzyme - tryptophan hydroxylase, which converts TRP to 5-hydroxytryptophan. 5-HT has long been involved in sleep, as well as in affective disorders such as depression and anxiety (Shepherd & Raats, 2006). Serotonin and tryptophan are known to promote well-being (Rao et al., 2008).

Role of Nutrients in Mental Health

Carbohydrates

These brain chemicals' production (5-HT and TRP) is triggered by carbohydrate rich foods. Carbohydrates have been found to affect mood and behaviour. They are the macronutrients that trigger the release of insulin in the body, a hormone which enables the transformation of glucose into energy at the cellular level, and helps with facilitating the entry of tryptophan into the brain (Rao et al., 2008).

Sugars, especially sweets, can provide an immediate but short-lasting effect on the mood, nevertheless, it is rather recommended the consumption of low glycaemic index (GI) foods such as fruits and vegetables, and complex carbohydrate foods - whole grains, pasta, which bring a moderate but more enduring effect on brain chemistry, mood, and energy level (Rao et al., 2008).

Proteins:

Protein intake, due to the containing amino acids, also affect the brain functioning and mental health. The neurotransmitters that impact mood are made of amino acids – dopamine from tyrosine, serotonin from tryptophan. The limitation of these amino acids leads to poor synthesis of the neurotransmitters and hence to low mood, whereas the excess may lead to brain damage and mental retardation (Rao et al., 2008). Protein in elevated proportion was associated with higher chances of depression and arousal, whereas increased carbohydrate proportion predicted less depression and more calmness. Moreover, the reduction of TRP seems to disrupt mood and to have a greater impact than increasing the carbohydrate intake (Shepherd & Raats, 2006).

Food containing tryptophan increases serotonin levels in the brain and alters neural processing in mood-regulating neurocircuits. However, tryptophan competes with other large-neutral-amino-acids (LNAA) for transport across the blood–brain-barrier, a limitation that can be mitigated by increasing the tryptophan/LNAA ratio. The LNAA include tyrosine, threonine, methionine, valine, isoleucine, leucine, histidine and phenylalanine. The results of an experiment that increased the ratio in a customized drink suggest that this can lift disposition by affecting mood-regulating neurocircuits (Kroes et al., 2014).

Omega-3 fatty acids

The brain is a fat-rich organ and the lipidic brain membrane contains phospholipids, sphingolipids, and cholesterol. It has been estimated that brain's grey matter contains 50% fatty acids that are polyunsaturated (PUFA), out of which 33% belong to the omega-3 family (Rao et al., 2008). Clinical and epidemiologic studies suggest that inadequate dietary n-3 polyunsaturated fatty acids (PUFA) may increase predisposition to several psychiatric disorders, particularly depression (McNamara, 2009). N-3 PUFAs - DHA and EPA - mitigate inflammation by modulating the level and length of the inflammatory response. Thus, n-3 PUFAs could contribute to antidepressant effects and/or resistance to depression through anti-inflammatory mechanisms (McNamara, 2009).

Docosahexaenoic acid (DHA, 22:6n-3) is the most abundant PUFA in the brain, representing approximately 15% of the total fatty acids in that tissue. These long-chain PUFAs

are synthesized endogenously from α-linolenic acid (18:3n-3) and Eicosapentaenoic acid (EPA 20n-5:3) (Levant, 2013). However, DHA and arachidonic acid (AA)-(omega 6) cannot be synthesized by mammals and they have to be supplied through the diet. Dietary or tissue n-3 PUFAs alone do not need to cause depression in humans; however, they likely create a vulnerability that increases susceptibility to depression when the other contributing factors (specific genotypes, stressors) are also present (Levant, 2013). 1.5 to 2g of EPA per day have been shown to stimulate mood elevation in depressed patients. However, doses of omega-3 higher than 3 g do not present better effects than placebos and may not be suitable for some patients, such as those taking anti-clotting drugs (Lakhan & Vieira, 2008). Western diets are low in omega-3 fatty acids, including the 18-carbon omega-3 fatty acid alpha linolenic acid found mainly in plant oils, and DHA, which is found mainly in fish (Innis, 2008).

Micronutrients

Depressive symptoms are the most common manifestation of folate deficiency. Patients with depression have 25% lower blood folate (B9) levels than healthy subjects. Vitamins B6 and B12, among others, are directly involved in the synthesis of some neurotransmitters (Rao et al., 2008). Supplementation with cobalamin (B12) improves cerebral and cognitive functions and preserves the integrity of myelin sheath of the nervous fibers; (Rao et al., 2008).

Supplementation of nine vitamins, in excess, for 1-year improved mood in all subjects, according to a study. Moreover, these changes in mood were recorded after a year, even though the blood levels reached a plateau after 3 months. The mood improvements were predominantly correlated with vitamin B1, B2 and B6 (Benton et al., 1995).

Alcohol

Another obvious association is that of alcohol and mood. The effect of alcohol on mood is undeniable. Alcohol has long been perceived to provide a temporarily relief of negative emotions, and to briefly increase pleasure and relaxation. A major study - Global Drug Survey (GDS) - that interviewed 30,000 of 18-34 year-olds from 21 countries, has examined the link between the type of alcohol (spirits, red and white wine, beer) and the reactions it triggers in consumers: feeling energized, relaxed, sexy, confident, tired, aggressive, ill, restless and tearful,

thus showing the complexity of the effects that the consumption of drugs has upon the temperament of a person (Ashton, Bellis, Davies, Hughes, & Winstock, 2017).

At low doses, ethanol is possibly useful, acting to depress brain function, very much in the style of an anaesthetic and sparking feelings of relaxation and good mood. Alcohol consumption affects neurological pathways that impact the dopaminergic, serotoninergic, γ-amino butyric acid (GABA) and glutamate pathways, enhancing reward, arousal, and addiction circuits (Banerjee, 2014).

Antioxidants

The brain is vulnerable to oxidative stress because it has lipid-rich area especially in neuronal membrane and is metabolically active. Tight balance between oxidative stress and antioxidant system is required to maintain the structural integrity and optimal functions of brain. Vitamins A, C, and E are major non-enzymatic antioxidants in foods, and there are emerging evidences that these antioxidant vitamins are protective against cognitive decline and mental disorders including anxiety disorders, attention-deficit/hyperactivity disorder, autism, bipolar disorder, depression, schizophrenia, and substance abuse. Low blood levels of antioxidant vitamins are observed in subject with various mental disorders.

Subjects with high tertile of vitamins C and E intakes have lower risk of AD than subjects with lower intake tertiles of these antioxidant vitamins in the Rotterdam Study. Especially, amyloid-beta deposition in brain relating to increased oxidative stress is one of the major causes of AD, and low levels of vitamins C and E in blood and/or cerebrospinal fluid were observed in AD patients. Vitamin E intervention reduces amyloid-beta deposition, reactive oxygen species as well as nitric oxide synthesis, and prevents against cognitive impairment and the progression to AD.

Mediterranean diet

A research study by Sadhukhan (2020) focused on finding a connection between nutrition and mental health. It revealed that a traditional or Mediterranean diet is beneficial for maintaining mental health. Avoiding foods with a lot of sugar, saturated fat, and processed food is important for mental wellness. Our moods can be improved by food. Food habits and food preferences can be influenced by psychological factors such as stress, mood, and eating

disorders. To maintain good mental health, wholesome diet is more vital than tasty food. Research study suggests that incorporating dietary modifications and antioxidant supplementation along with exercise into a comprehensive treatment plan may offer substantial benefits for individuals with mental health concerns and contribute to the promotion of mental well-being.

Therefore, more attention should be given to medium- and long-term diet changes and our food consumption should focus more on complex carbohydrates, plant-based foods/fruits and vegetables containing fibres that positively influence microbial composition, on good fats (omega 3) to modulate of inflammation. In this respect, given the fact that a large prospective study has found that the Mediterranean diet has a potential protective role with regard to depressive disorders, the return to a traditional Mediterranean diet is an obvious recommendation (Sánchez-Villegas et al., 2009).

As far as supplementation for healthy people is concerned, a diverse diet should weigh more than opting for supplements, as humans do not consume nutrients in isolation and foods come with a balanced composition of macro and micro nutrients, and fibres (Jacka, 2017). However, in the wake of positive result-trials, some supplements are needed and recommended especially as treatment for mental disorders, where they can successfully replace medication that comes with side effects.

The Mediterranean diet has been found to be the most beneficial diet in regard to the improvement of overall mental health as well as symptoms associated with mental health disorders.

Includes	Excludes
A wide variety of vegetables, fruits and whole grains	Refined grains: white bread, white pasta and pizza dough containing white flour
Healthful fats, such as nuts, seeds and olive oil	Refined oil: Canola oil and soybean oil
Moderate amounts of dairy and fish	Foods with added sugars, such as pastries, sodas and candies

Very little white meat and red meat	Meats, hotdogs and other processed meats
Few eggs	Processed or packaged foods
Red wine in moderate amount	

The Mediterranean diet is helpful because in contains several nutrients shown to decrease mental health problems

Nutrients	Benefits	Food sources
Selenium	Might help improve mood and reduce anxiety	Brazil Nuts, Fish, Meat, Beans, Oatmeal, Milk products, Enriched Foods
Vitamin D	May help improve the systems of depression	Fortified Milk and Juices, Fatty Fish, Eggs and from the Sun
Omega 3	Reduce the risk of mood disorders and brain diseases by enhancing brain function and preserving the myelin sheath that protects nerve cells	Cold-water fish, such as salmon, sardines, tuna and mackerel. Flaxseed, Chia seeds, Walnuts.
Antioxidants Vitamin A, C & E	Antioxidants help to remove free radicals, which are the waste products of natural bodily processes that can build up in the body. If the body cannot eliminate enough free radicals, oxidative stress can develop. A number of health problems can result, which may include anxiety and depression	Vitamin A: Sweet Potatoes, Carrots, Broccoli, Spinach, Capsicum, Apricots, Eggs and Fortified foods Vitamin C: Citrus fruits, Capsicum, Strawberries, Tomato juice, Amla and Fortified foods Vitamin E: Sunflower seeds, Almonds, Vegetable oils, Peanut butter, Fortified cereals

B Vitamins B12 & Folate	Protects and maintain the nervous system, including the brain. They may help reduce the risk and symptoms of mood disorders.	B12: Meat and Milk Products Folate: Leafy greens, Beans, Peas, Lentils
Zinc	Boosts the immune system and may influence depression. Zinc levels may be lower in people with depression.	Lean meat, Poultry, Seafood, Milk, Whole grains, beans, seeds and nuts
Protein	Protein enables the body to grow and repair, but it may also help people with depression	Lean meat, Poultry, Eggs, Beans, Peas, Soy foods, Quinoa, nuts and seeds
Probiotics	May boost the levels of beneficial bacteria in the gut. Healthy gut micro biota may reduce the symptoms and risk of depression	Yogurt, Kefir

References

Coelho M, Oliveira T, Fernandes R. Biochemistry of adipose tissue: an endocrine organ. Arch Med Sci. 2013;9(2):191–200. doi:10.5114/aoms.2013.33181.

Gelinda Deacon, Christine Kettle, David Hayes, Christina Dennis & Joseph Tucci (2017) Omega 3 polyunsaturated fatty acids and the treatment of depression, Critical Reviews in Food Science and Nutrition, 57:1, 212-223, DOI: 10.1080/10408398.2013.876959.

Jacka, F.N., O'Neil, A., Opie, R. et al. A randomised controlled trial of dietary improvement for adults with major depression (the 'SMILES' trial). BMC Med 15, 23 (2017). https://doi.org/10.1186/s12916-017-0791-y.

Lakhan, S.E., Vieira, K.F. Nutritional therapies for mental disorders. Nutr J 7, 2 (2008). https://doi.org/10.1186/1475-2891-7-2.

O'Neil A, Quirk SE, Housden S, et al. Relationship between diet and mental health in children and adolescents: a systematic review. Am J Public Health. 2014;104(10): e31–e42. doi:10.2105/AJPH.2014.302110.

Owen, L., & Corfe, B. (2017). The role of diet and nutrition on mental health and wellbeing. Proceedings of the Nutrition Society, 76(4), 425-426. doi:10.1017/S0029665117001057.

Psaltopoulou, T., Sergentanis, T.N., Panagiotakos, D.B., Sergentanis, I.N., Kosti, R. and Scarmeas, N. (2013), Mediterranean diet, stroke, cognitive impairment, and depression: A meta-analysis. Ann Neurol., 74: 580-591. doi:10.1002/ana.23944.

Strandwitz P. Neurotransmitter modulation by the gut microbiota. Brain Res. 2018;1693(Pt B):128–133. doi:10.1016/ j. brainres.2018.03.015.

Altman, S. E., Shankman, S. A., & Spring, B. (2010). Effect of acute tryptophan depletion on emotions in individuals with personal and family history of depression following a mood induction. Neuropsychobiology, 62, 171–176. doi:10.1159/000319358.

Anderberg, R. H., Hansson, C., Fenander, M., Richard, J. E., Dickson, S. L., Nissbrandt, H., Bergquist, F., & Skibicka, K. P. (2016). The Stomach-Derived Hormone Ghrelin Increases Impulsive Behavior. Neuropsychopharmacology: official publication of the American College of Neuropsychopharmacology, 41(5), 1199–1209. doi:10.1038/npp.2015.297.

Appleton, J. (2018). The Gut-Brain Axis: Influence of Microbiota on Mood and Mental Health. Integrative medicine (Encinitas, Calif.), 17(4), 28–32.

Ashton, K., Bellis, M. A., Davies, A. R., Hughes, K., & Winstock, A. (2017). Do emotions related to alcohol consumption differ by alcohol type? An international cross-sectional survey of emotions associated with alcohol consumption and influence on drink choice in different settings. BMJ Open, 7(10). doi:10.1136/bmjopen-2017-016089.

Benton, D., Haller, J., & Fordy, J. (1995). Vitamin supplementation for one year improves mood. Neuropsychobiology, 32(2), 98-105. doi:10.1159/000119220.

Bushman, B. J., DeWall, C. N., Pond, R. S., & Hanus, M. D. (2014). Low glucose relates to greater aggression in married couples. Proceedings of the National Academy of Sciences of the United States of America, 111(17), 6254 – 6257.

Gardner, M. P., Wansink, B., Kim, J., & Park, S. B. (2014). Better moods for better eating? How mood influences food choice. Journal of Consumer Psychology, 24, 320-335. doi: 10.1016/j.jcps.2014.01.002.

Hidaka, B.H. (2012). Depression as a disease of modernity: explanations for increasing prevalence. Journal of affective disorders, 140 3, 205-14 Holford, P. (2007). Optimum Nutrition for the Mind. London, Piatkus Books Ltd.

Hooper, L. V., Littman, D. R., & Macpherson, A. J. (2012). Interactions between the microbiota and the immune system. Science (New York, N.Y.), 336(6086), 1268–1273. doi:10.1126/science.1223490.

Sánchez-Villegas, A., Delgado-Rodríguez, M., Alonso, A., Schlatter, J., Lahortiga, F., Serra Majem, L., & Martínez-González, M. A. (2009). Association of the Mediterranean Dietary Pattern with the Incidence of Depression: The Seguimiento niversidad de Navarra/University of Navarra Follow-up (SUN) Cohort. Arch Gen Psychiatry, 66(10), 1090–1098. doi:10.1001/archgenpsychiatry.2009.129.

Spence, C. (2017). Comfort food: A review. International Journal of Gastronomy and Food Science, 9, 105-109. doi: 10.1016/j.ijgfs.2017.07.001.

Tuulari, J., Tuominen, L., deBoer, F., Hirvonen, J., Nuutila, P., & Nummenmaa, L. (2017). Feeding releases endogenous opioids in humans. The Journal of Neuroscience, 37, 8284–8291. doi:10.1523/JNEUROSCI.0976-17.2017.

Sadhukhan, M. (2020). Relationship Between Nutrition and Psychology. International Journal of Research in Engineering, Science and Management, 3(7), 337–338. Retrieved from https://journal.ijresm.com/index.php/ijresm/article/view/93.