The Effect of Nutrition and Exercise on Mental Illness

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Abstract

Research has shown nutrition and exercise are especially effective in helping relieve mental illness. Particularly, mental health can be aided through dietary alterations such as increasing intake of omega-3 fatty acids, fermented foods, certain vitamins, minerals, and amino acids. Proper nutritional patterns help regulate neurotransmitters and assist in the betterment of brain functioning, offering protection from and maintenance of mental illness. Furthermore, the Mediterranean diet provides to be most beneficial for mental health compared to the standard American diet which contains additives harmful to the human brain. Physical exercise also provides to be a possible therapy for those suffering from mental illness. In particular, aerobic exercise is especially influential in reducing symptoms of depression and schizophrenia. Overall, mental health can be positively affected by regular physical exercise and by maintaining a balanced diet.

The Effect of Nutrition and Exercise on Mental Illness

Introduction

Mental illness, also known mental disorder or psychiatric disorder, is a behavioral or mental pattern that causes significant distress or impairment of personal functioning. Symptoms accompanied with mental illnesses may be persistent, relapsing, or as a single episode. People suffering from mental illnesses are revealed to have a 20-year mortality gap (Teasdale, 2017). However, as research has shown, adequate nutrition and regular physical exercise can provide relief and possibly pose as treatment options for those with mental illness.

Serious mental illness can accompany lifestyle habits such as unhealthy diets, sedentary behaviors, low physical activity level, and tobacco use. These behaviors contribute to increased mortality rate (Romain, 2020). An awareness of this can increase one's ability to decipher which foods are best for the body and mind. Also, understanding risks associated with poor diet can help increase the amount of people who take their health seriously (Hayford, 2004). As Paul Bragg once stated, "Many people suffer in poor health not realizing that their unhealthy lifestyle habits are the main cause of their sickness." In addition, Former A.M.A President, James McLester once stated, "The greatest tragedy that comes to man is emotional depression, the dulling of the intellect and the loss of initiative that comes from nutritive failure."

The importance of nutrition in relation to mental health is crucial, as Hippocrates once stated, "let food be thy medicine." There is no better way to carry out Hippocrates' famous quote than by practicing it on mental health disorders, especially in American diet culture. Professionals have expressed the importance of diet when it comes to mental normality because one's health can be related to and affected by consumption of food. Science is beginning to

discover much of what was considered hereditary is a result of habitual poor eating and an unhealthy lifestyle.

In addition, what has become culturally acceptable to eat is not beneficial to the human body, resulting in a multitude of symptoms and diseases developed over time. The human body is capable of telling the mind what is being consumed is not beneficial (Hayford, 2004). Furthermore, because modern medical approaches such as antipsychotic medication have failed many, people are becoming more aware of the impact diet has on disease (Hayford, 2004). For example, antipsychotic medication is associated with increased hunger, as well as, unhealthy eating (Meader, 2018).

Lifestyle Patterns of Mentally-ill Humans

It has been estimated approximately 75% of the Western diet consists of various processed foods, establishing each person is now consuming an average of 8-10 pounds of food additives every year, with some individuals consuming more (Tuormaa, 1994). In today's American diet culture, consuming processed foods and fast foods may kill more people and injure more minds prematurely when compared to cigarette smoking (Fuhrman, 2018).

People with severe mental illness are more likely to engage in health risk behaviors, compared to the general population (Meader, 2018). These health risk behaviors include poor dietary and sleeping patterns, low levels of physical activity, and higher rates of tobacco smoking (Firth, 2019). Another study affirms rates of health-risk behaviors such as tobacco smoking, physical inactivity, poor diet, and risky sexual behaviors are heightened in people with serious mental illness (Henderson, 2006). Further, people with serious mental illness have mortality rates 2 to 3 times higher than the overall US population (Colton, 2006).

Conversely, exercising releases endorphins (Goldfarb, 1997), and foods such as amino acids build neurotransmitters, which become brain chemical balancers (Dow, 2018). The human brain depends on various nutrients for fuel such as vitamins, trace elements, minerals, and amino acids which control the chemical factories that direct our cells (Pearson, 1982). Further, the brain is "immersed in a chemical environment in which even slight imbalances can alter cognitive and emotional functioning" (Pearson, 1982), which means a correlation can exist between dietary practices, exercise and mental health.

Unhealthy lifestyle patterns with insufficient physical activity, sedentary motives, and high-calorie food intake are reported to be more common in individuals with mental illness, including schizophrenia and bipolar disorder:

> One study revealed German individuals with mental illness almost never consumed fresh vegetables or fruits but instead ate more fast food, and sweet or salty snacks daily when compared to the healthy population. Another study on Scotch schizophrenia patients noted individuals with mental illness consumed fruits, vegetables, legumes, and milk substantially less compared to non-mentally ill humans. The adverse reactions of treatment and the presence of psychiatric symptoms adversely affect the patients' wills and abilities to be involved in physical activities. Further, the German study revealed unhealthy dietary habits such as smoking, alcohol consumption, and narcotic substance use were more common in individuals with mental illness. Unhealthy nutritional habits and insufficient exercising were found to be common lifestyle practices of individuals with mental illness, leading to excessive weight gain in those patients (Celik, 2018).

Dietary Patterns of Mentally-ill Humans

Few people are aware of the connection between nutrition and mental illness (Rao, 2008). “Suboptimal dietary intake, frequent alcohol intake, changes in appetite due to aging, food allergies or sensitivities, special diets, and eating disorders can negatively affect nutritional status” (Leyse-Wallace, 2013). In continuation, the typical American diet is lacking in whole, fresh, natural foods which have vital nutrients needed for proper brain function and mental health, revealing a mind-body connection between food and mental stability (Malkmus, 2006).

Research shows the severity of depression and other mental imbalances can be rooted in diet (Hayford, 2004). One study revealed increased consumption of a diet rich in fruit and vegetables is associated with increased happiness and heightened levels of mental health and well-being (Conner, 2017). A cross-sectional study revealed the most common findings among mentally ill individuals include diets low in fruit and fiber with a higher intake of takeaway food, sugary foods, and sugary drinks (Dipasquale, 2013). Further, the standard American diet is not only contributing to physical imbalance and deterioration, but mental and emotional deterioration as well (Hayford, 2004).

In the world, the most prevalent mental disorders are bipolar disorder, schizophrenia, and obsessive-compulsive disorder (Murray, 1996). One study on the health needs of the world’s population shows a contributing factor to these mental illnesses is the fact the “dietary intake pattern of the general population in many Asian and American countries reflects that they are often deficient in many nutrients, especially essential vitamins, minerals, and omega-3 acids” (Murray, 1996). A notable feature in the diets of mental disorder patients is often deficiency in nutrients such as omega-3 fatty acids (American Psychiatric Association, 1994).

The importance of consuming whole foods cannot be stressed enough, as processing techniques involving milling, separating, exposures to air, light, heat, or radiation, changes in

acidity or osmolality, or other techniques during freezing, drying, canning, or vacuum packing "can and do alter the content of nutrients and other nonessential bioactive food constituents" (Weaver, 2014). Bipolar disorder, in particular, is thought to exist more frequently among people suffering from chronic medical conditions such as dyslipidemia, hypertension, diabetes, and obesity (Kilbourne, 2007). Many people do not realize that these conditions, which often lead to premature death, are often preventable or at least manageable through diet, exercise, and when needed, medication (Kilbourne, 2007).

Food Associated with Mental Illnesses

Research shows specific foods can contribute to the worsening of mental illness. As a result of the societal norm of poor eating habits, a dramatic rise in mental illness has been recorded (Johnson, 2008) and many foods play a larger role in enhancing mental disorders than others. For example, soy can be an influencer in mental health and result in symptoms of severe depression and anxiety (Hayford, 2004). A study on the negative effects of soy-based foods revealed soy to be negatively associated with cognitive function decline among elderly Taiwan citizens (Lin, 2018).

Mental disorders can also be affected by the consumption of the additive MSG (monosodium glutamate). MSG is used by food industries as a flavor enhancer and it is best to avoid at all costs because of its toxicity to the human body (Quadri, 2020). Side-effects of MSG can appear in the form of severe irritability, angry outbursts, depression, anxiety and panic attacks, hyperactivity, behavioral problems, ADD, lethargy, and insomnia (Hayford, 2004). MSG is now estimated to be added to over two-thirds of pseudo food brands, meaning foods containing high level of calories and fats, offering the human body few-to-no nutrients (Bird,

2011). MSG is often found in soups, broths, sauces, salad dressings, frozen meals, and candy. (Hayford 2004).

Inflammation and Mental Illness

Inflammation has emerged as an important factor in mood disorders (Melo, 2019). Interestingly, inflammatory processes are thought to be one of the pathogenic mechanisms for depressive disorder (Libuda, 2017). In addition, excessive consumption of high-fat and high-sugar foods can increase systemic inflammation (Firth, 2018). Obesity and nutritional components, for example, saturated fatty acids, have been considered triggers of subchronic inflammation, which contributes (in the long term) to the metabolic syndrome and deterioration of mental health (Libuda, 2017). Neuroinflammation stands out as a component of brain disorders that could be linked to peripheral metabolic dyohomeostasis caused, once again, by an unhealthy diet (Melo, 2019).

One study on pathways to mental health problems revealed strong evidence that inflammation precedes depression (Oddy, 2018). Also, the study showed that inflammation was associated with all mental health outcomes, particularly depressive symptoms (Oddy, 2018). Diets promoting inflammation are low in omega-3 fatty acids which are a crucial part of normal brain functioning (Oddy, 2018).

Microbiota-gut-brain axis

Newer evidence has shown relation between nutritional psychiatry and targeting the modulation of the gut microbiota (Owen, 2017). Honing in on gut microbiota can be done through consumption of probiotic and prebiotic foods and supplements which promote a novel therapy for the treatment of numerous neuropsychiatric conditions (Owen, 2017). Further, “the bidirectional communication between the gut microbiota and the brain has shown to influence

neurotransmission and the behavior that is often associated with neuropsychiatric conditions, and likewise the microbiome has been associated with multiple systemic pathologies and obesity" (Owen, 2017).

The microbiome is a critical component in the complex interplay of nutrition, the immune system, and mental health (Libuda, 2017). A growing portion of evidence has led to the concept of the microbiota-gut-brain axis. Particularly in schizophrenia patients, there have been many studies investigating the gut microbial composition. Two studies discovered significant changes in the gut microbiota of schizophrenics after receiving antipsychotic treatment (Schwarz, 2018). Further, studies have shown the gut-brain axis can play a role in the origin and cure for autism spectrum disorder as well (Chen, 2019).

Members of the microbiota are known to produce neurotransmitters which is why it is so important when it comes to mental health (Ouabbou, 2020). The gut microbiota has been shown to affect the levels of brain-derived neurotrophic factor in the brain (nourishment of nerve cells) (Bercik, 2011). Diet has a very large impact on gut microbiota and certain foods can help regulate interactions between the gut and the brain (Mota de Carvalho, 2018).

For example, positive mental health has been linked to the consumption of fermented foods (Mota de Carvalho, 2018). Fermentation is the modulation of chemical constituents improving bioavailability of food and the incorporation of microbes in natural foods which have been known to enhance neuroprotective effects (Mota de Carvelho, 2018). Probiotics have also shown to have positive health effects on gut microbiota in relation to brain functions and cognitive health (Mota de Carvelho, 2018). One study discovered those with social anxiety showed fewer symptoms when regularly consuming fermented foods (Hilimire, 2015). Further,

an 8-week study on patients with chronic fatigue syndrome showed a 73.7% improvement when taking a 24 billion colony probiotic (Rao, 2009).

Neurotransmitters and the Brain

Every food consumed affects how brain neurotransmitters are balanced, and neurotransmitters are responsible for emotional normality (Malkmus, 2006). Many of the neurotransmitters in the brain are built from amino acids (Rao, 2008). According to the *Cambridge Dictionary* a neurotransmitter can be defined as, "A chemical that carries messages between neurons or between neurons and muscles."

Neurotransmitters and neuropeptides are synthesized from the chemical content found within food (Pearson, 1982). Such chemicals transport information from one neuron to the next throughout the body's central nervous system (Pearson, 1982). Deficits in these chemicals lead to neurological imbalances which impede the human brain's capacity for normal functioning (Pearson, 1982). A few important neurotransmitters are serotonin, dopamine, and acetylcholine, which help balance brain chemicals. Because of the lack of effectiveness with psychiatric pharmacy, in addition to experts revealing medication can do more harm than good, health professionals have been urged to reflect on the idea that nutrition can positively influence mental health (Rucklidge, 2015).

Brain chemicals become unbalanced in two distinct ways. The first is when too much of a neurotransmitter is circulating in the body (Andrew, 2007). For example, constant stress and traumatic events cause the body to overproduce neurotransmitters. An overload of neurotransmitters causes malfunctions in the brain due to overstimulation from excess brain chemical (Andrew, 2007). The second way is when there is a deficiency in a certain

neurotransmitter, prohibiting proper brain function. A deficiency is typically caused by the lack of certain nutrients in the diet, such as omega-3 fatty acids (Andrew, 2007).

The brain is capable of manufacturing the chemicals it needs if it is given the necessary raw materials, simply speaking, nutrients from foods. Many people in America do not maintain sufficient diets in order to prohibit mental disorders. Stress, worry, emotional dips, drugs, alcohol, pollution, and many other factors of modern life deplete neurotransmitter levels (Andrew, 2007). According to Clark (1995), the brain has a region called the addiction center and if this center is stimulated it produces pleasure-chemicals. Constant stimulation of the addiction center is dangerous:

> For example, when a toxic substance, beryllium, is inhaled it circulates with the blood to the brain and may land at the addiction center. The more beryllium is inhaled the more likely it will occupy the addiction center. The brain cells in the addiction center have receptor sites for glutamate (the same glutamic acid that comes from the protein in our food). Normally, glutamate activates the addiction center; however, when beryllium "steals" seats, the glutamate is powerless to activate the joy and happiness center. The result is a low-level chronic depression. When one drinks alcohol, puts it on the skin (mouthwash, tinctures, medicine), or produce it by fermentation in the intestines, a substance, salsol, is formed. Salsol reacts with beryllium. Because of this reaction, a large amount of pleasure-chemical can be released. However, the amount is larger than normal because so many clogged cells are activated together. It is dangerous to have constant stimulation of the addiction center because when the reaction stops, increased symptoms of depression and anxiety will set in (Clark, 2006).

Neurotransmitters are prevalent when it comes to mental health since they play a pivotal role in everyday life. Neurotransmitters affect stress levels, energy, appetite, sleep, mood, memory, sex drive, anger, addictions, and numerous other daily functions. Further, amino acids such as tryptophan, tyrosine, phenylalanine, and methionine have been found to reduce symptoms since they are converted to neurotransmitters, alleviating depression and other mental health issues (Rao, 2008). Deficiencies in neurotransmitters such as serotonin, dopamine, noradrenaline, and γ-aminobutyric acid (GABA) are related to depression (Rao, 2008).

Mental Illness, B Vitamins, and Zinc

Deficiencies in zinc as well as B vitamins such as B12, B9 (folate) can produce symptoms of depression such as low mood, fatigue, cognitive decline, and severe irritability (Lachance, 2015). Evidence linking diet to mental illness has evolved from a concentration on specific nutrient deficiencies to an emphasis on overall dietary pattern (Lachance, 2015). Further, dietary patterns high in processed foods, also known as a "western dietary pattern," are strongly correlated with an increased risk of developing depression, mild cognitive impairment, and ADHD (Lachance, 2015).

One study revealed a low intake of B-vitamins was associated with increased mental illness in adolescents (Herbison, 2012). In older age groups, folate and B6 levels were lower in depressed populations (Gilbody, 2007). Further, vitamin B6 and serotonin supplementation has been linked to improvement of depressive symptoms and randomized controlled trials have successfully used folic acid to improve the efficacy of antidepressant medications (Coppen, 2000). The best way to naturally raise serotonin levels is to take activated vitamin B6, as well as, B12 (Andrew, 2007). B6 can be found in red peppers, and B12 in yellow and orange peppers.

Omega-3 Fatty Acids, vitamins, and minerals

It is important to note the brain is an organ with very high metabolic and nutrient demands. The brain consumes 20% of a person's daily caloric intake, approximately 400 calories every day (Lachance, 2015). Impaired brain metabolic activity intertwined with other disorders has been proven to be corrected through nutrient supplementation (Rucklidge, 2015). The brain is composed of 60% fat and contains high concentrations of cholesterol and polyunsaturated fatty acids (PUFAs) such as omega-3s (Lachance, 2015). Further, production of monoamine neurotransmitters such as serotonin, norepinephrine, and dopamine depend on adequate building blocks of amino acids, and mineral dependent co-factors (Lachance, 2015). These neurotransmitters are especially important because they determine the mental illness pathophysiology.

Omega-3 fatty acids form a crucial part of neuronal cell membranes and influence a number of essential processes in the central nervous system such as neurotransmission which is the process that drives information between neurons and their targets (Lachance, 2015). Furthermore, omega-3s act as antioxidants and have anti-inflammatory properties (Lachance, 2015). However, the Western diets have an abundance in omega-6 fatty acids and a deficit in omega-3s. This uneven ratio of omega-6s and omega-3s is a phenomenon that has developed because of the shift toward modern and processed food (Lachance, 2015). For example, omega-6 fatty acids are often the primary fatty acid in numerous vegetable oils. However, long chained omega-3 fatty acids are found in fish, seafood, and grass-fed beef (Lachance, 2015).

Vitamin and mineral deficiencies can also be culprits of imbalanced brain chemicals. The most common nutritional deficiencies in patients with mental disorders are omega-3 fatty acids, B vitamins, minerals, and amino acids (tryptophan and tyrosine) which are precursors to neurotransmitters (Maurizi, 1990). Minerals that affect mental health are calcium, chromium,

iodine, iron, selenium, and zinc (Rao, 2008). For example, a study by the university of Wales revealed low selenium intake is associated with lowered mood status (Benton, 2002). Also, iodine plays a pivotal role in mental wellbeing since the thyroid hormone provides iodine and ensures the energy metabolism of the cerebral cells (Rao, 2008).

Spirulina is useful superfood in human nutrition due to the high quality and quantity of its protein (Demelash, 2018). Spirulina's nutritive value of a protein is linked to the quality of amino acids (Demelash, 2018). The superfood contains the essential amino acid, tryptophan, which is known to help regulate serotonin levels. Furthermore, increasing tryptophan levels can increase serotonin synthesis as much as twofold (Murray, 1996). A notable feature of diets of patients suffering from mental disorders is severe deficiency in spirulina (Van, 1982)

Certain deficiencies in some vitamins may increase one's chance of depression (Andrew, 2007):

Table 1

Common Mental Illness Deficiencies

Vitamin:	Deficiency May Cause:
B1 (Thiamine)	Psychosis, mental depression, anxiety, irritability.
B5 (pantothenic acid)	Restlessness, irritability, depression, fatigue.
Biotin & B12 (cobalamin)	Psychotic state, depression, irritability, memory loss, hallucinations, delusions, paranoia.
Folic acid	Forgetfulness, insomnia, apathy, irritability, depression, psychosis, delirium, dementia.
C (ascorbic acid)	Hysteria, depression

B3 (niacin)	Apathy, anxiety, depression, hyperirritability.

In regards to depression, dietary implementations can be helpful. For example, omega-3 fatty acids are one of the top nutrients for prevention of depression (Andrew, 2007). As reported in several studies, the amino acids tryptophan, tyrosine, phenylalanine, and methionine are helpful in treating many mood disorders, including depression (Rao, 2008). Tryptophan, among the most studied, is an essential amino acid and of major interest because of its ability to act as an upstream precursor of bioactive metabolites related to sleep, serotonin, and melatonin (Godos, 2020).

When tryptophan, a precursor of serotonin, is consumed alone on an empty stomach, it is usually converted to serotonin (Rao, 2008). Further, tryptophan can induce sleep and tranquility, restoring serotonin levels, leading to diminished depression precipitated by serotonin deficiencies (Rao, 2008). Researchers have attributed the decline in consumption of omega-3 fatty acids to an increasing trend in the incidence of major depression (Rao, 2008).

The neurotransmitter dopamine is made from the amino acid tyrosine, whereas the neurotransmitter serotonin is made from the amino acid tryptophan. More studies have shown if there is a lack of these two amino acids (Tyrosine and Tryptophan), there will not be enough synthesis of the respective neurotransmitters, which are associated with low mood and aggression in patients (Rao, 2008). In addition, tyrosine and sometimes its precursor phenylalanine are converted into dopamine and norepinephrine. Dietary supplements containing phenylalanine and/or tyrosine cause alertness and arousal (Rao, 2008). Methionine combines with adenosine triphosphate (ATP) to produce S-adenosylmethionine (SAM), which assists the production of neurotransmitters in the brain (Rao, 2008).

Furthermore, on the topic of omega-3s, the brain requires DHA. The omega-3 fat docosahexaenoic (DHA) is the building block of the human brain tissue and is abundant in the grey matter of the brain and the retina of the eye. Low levels of DHA have recently been associated with depression, memory loss, dementia, and visual problems. In addition, it is challenging to get enough omega-3 fats; however, many foods contain the adequate amount required for one's diet. For example, flaxseeds, flax meal, flaxseed oil, walnuts, brazil nuts, filberts, pumpkin seeds, etc. Flaxseed oil, in particular, is one of the best sources of alpha-linolenic acid, which fights depression (Johnson, 2008).

In continuation, the main polyunsaturated fatty acids (PUFAs) that exert effects on the brain cells are docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) (Godos, 2020). Further, DHA is a crucial structural component of membrane phospholipids in the brain. DHA is responsible for neuronal membrane integrity, fluidity, and functioning (Godos, 2020).

In addition, the two omega-3 fatty acids, eicosapentaenoic acid (EPA) which the body converts in docosahexanoic acid (DHA), found in fish oil, have been found to elicit antidepressant effects in human (Rao, 2008). Epidemiological data and clinical studies have distinctly shown that omega-3 fatty acids can effectively treat depression (Rao, 2008). Particularly depressed patients have shown that daily consumption of dietary supplements of omega-3 fatty acid containing 1.5-2 g of EPA has significantly stimulated mood elevation (Rao, 2008).

Grass-fed beef omega-3 content varies greatly; however, it typically contains 100mg of long-chained omega-3 fatty acids per 100g serving (Lachance, 2015). Omega-3 fatty acids have proven to be effective either alone or as an adjunctive treatment for ADHD, major depressive disorder, bipolar depression, and PTSD (Lachance, 2015). Also, an elevated omega-6 to omega-3

fatty acid ratio in the blood has been associated with major depressive disorder (Lachance, 2015). According to Janicak, (1988) along with omega-3 fatty acids, vitamin B and magnesium deficiencies have been linked to depression:

> The results of several case studies where patients were treated with 125-300 mg of magnesium (as glycinate or taurinate) with each meal and at bedtime led to rapid recovery from major depression in >7 days for most of the patients.
>
> Biotin is one of the lesser-known B vitamins; however, it is also closely associated with states of depression (Janicak, 1988).

Biotin can be found in meat, dairy products, and whole-grain cereals. The *Journal of the American Medical Association* reported a study in which patients were deprived of biotin to determine the effect on the body. After "ten weeks, subjects began to report symptoms of depression and fatigue. Placing biotin back into their diets relieved all symptoms" (Andrew, 2007). Folic acid (a form of vitamin B) and vitamin B12 are two of the most common nutrient deficiencies in the world, and interestingly, depression is a common symptom of their shortages:

> In a study among psychiatric patients in a psychiatric hospital, as many as 30 percent were shown to be deficient in folic acid, and in one study, 67 percent of patients admitted to a psycho-geriatric ward were folic acid deficient. In a study of forty-eight patients in a psychiatric hospital, it was found the lower a patient's serum folic acid level, the more severe the patient's depression. Furthermore, research has demonstrated serum folic acid or B12 levels are low in a substantial proportion of patients suffering from various psychiatric syndromes, especially depression (Andrew, 2007).

Niacin is used during the metabolism of food and when one is deficient, significantly less energy will be generated in the brain. In addition, niacin supplementation can cause an increase

in tryptophan, an amino acid used in brain functions responsible for processes such as perception and thought (Andrew, 2007). Niacin may also be a possible factor used to support the treatment of schizophrenia (Godos, 2020). In addition, vitamin D may also be involved in the prevention of neurodegenerative disorders (Godos, 2020).

Vitamin B6 (pyridoxine) is also an important component of the brain's chemistry. Vitamin B6 is a coenzyme in the synthesis of compounds called monoamines in the central nervous system. Pyridoxine levels are often quite low in depressed patients, especially in those using oral contraceptives (Andrew, 2007). Further, studies have shown that depressed patients with low pyridoxine or vitamin B6 levels respond very well to supplementation (Andrew, 2007).

Dr. Asa Andrew, author of "Empowering Your Health" recommends several treatments in order to help combat depression naturally:

- Adopt a regular exercise program with thirty minutes of aerobic activity three times per week.
- Eliminate smoking, oral contraceptives, and caffeine.
- Use the food wheel approach to eating by consuming equal portions of fats, proteins, and carbohydrates.
- Use supplementation, including omega-3 oils such as cod liver oil.

Berries, such as blueberries, strawberries, blackberries, and raspberries are super foods containing some of the highest levels of antioxidants known to man. In particular, blueberries contain antioxidant compounds that show promise in reversing some of the effects of aging, especially cognitive function (Rubin, 2004). Recent epidemiological findings indicated the consumption of antioxidant-rich foods such as berries are associated with lowered risk of

Parkinson disease (Gao, 2012). Furthermore, the powerful antioxidant properties of fruits such as berries are discovered to be suitable for combating various stress-related disorders (Tan, 2020).

Furthermore, in biblical times, frankincense was used as holy anointing oil, to enhance meditation, for embalming, and in perfume. Today frankincense is used to help maintain normal cellular regeneration, to stimulate the body's immune system, and as an aid for people suffering from depression and brain damage resulting from head injuries (Rubin, 2004). Andrew (2007) claims vitamin C deficiencies are also associated with depression:

> In a 1983 study of 885 psychiatric patients, the average plasma level of vitamin C was 0.51 milligrams, compared to a level of 0.87 milligrams on 110 healthy, non-psychiatric patients – a 40 percent difference. This study revealed that supplementation with vitamin C relieves symptoms of some disorders, including depression. In a study reported by the *British Journal of Psychiatry*, forty male psychiatric patients randomly received either vitamin C or a placebo. After three weeks, researchers noted a significant decrease in depression with those receiving vitamin C, but no change with those receiving the placebo. Numerous important studies demonstrate that many patients being treated for depression are deficient in vitamin C (Andrew, 2007).

In regards to the issue of anxiety, when high-anxiety subjects ate dark chocolate for two weeks, the researchers found that levels of the stress markers cortisol and adrenaline decreased in their urine, as well as two markers called p-cresol and hippurate, which are metabolites of gut bacteria (Li, 2019). One study (Lua, 2010) revealed female nurses who regularly consumed dark chocolate had significantly improved levels of anxiety compared to the nurses who did not eat dark chocolate.

People suffering with mental illnesses, including schizophrenia, major depressive disorder, and bipolar disorder are shown to have excessive caloric intake, a low-quality diet, and poor nutritional status because of the standard American diet (Firth, 2018). Consumption of diets low in carbohydrate tend to precipitate depression, since the production of brain chemicals serotonin and tryptophan that promote the feeling of well-being, is triggered by carbohydrate rich foods (Rao, 2008). Further, diets promoting low carbohydrate intake, such as the keto diet, may be unsuitable for those with mental health disorders. Also, folate deficiencies have shown to significantly reduce the response to antidepressants, prohibiting one's medication to be effective (Bodnar, 2005).

Coppen's study (2000) revealed patients with depression have blood folate levels 25% lower than healthy controls:

> A controlled study has been reported to have shown that 500 mcg of folic acid enhanced the effectiveness of antidepressant medication. Folate's critical role in brain metabolic pathways has been well recognized by various researchers who have noted that depressive symptoms are the most common neuropsychiatric manifestation of folate deficiency (Coppen, 2000).

Mediterranean Diet and Mental Health

In regards to dietary choices for mental health support, observational evidence supports the protective role of a healthy dietary pattern, for example, the Mediterranean diet on depression risk. Studies have shown the more one eats a Western (highly processed) diet, the more one is at risk for developing psychiatric symptoms such as depression and anxiety (Rucklidge, 2016). Another source states, "the more one eats a Mediterranean-style diet, the more one is protected from developing a mental disorder (Owen, 2017).

Many highly refined foods and sweetened drinks have a higher glycemic index, which concludes they are digested rapidly and ignite a temporary spike in blood sugar and insulin trailed by a decrease in blood sugar levels (Dog, 2010). According to Dog (2010), constant fluctuation in blood glucose has been revealed to have negative effect on one's mood:

> A Tufts University study of 46 healthy overweight adults (body mass index 25-29.9 kg/m^2) was undertaken to evaluate the effect of a high glycemic (HG)- and low glycemic (LG)- load diet on cognition and mood. Those on the HG diet experienced worsening of mood as assessed by Profile of Mood States for tension and depression at 6 months, whereas those on the LG diet experienced an improvement in these two parameters of mood. In addition to the potential effect on mood, meta-analyses reveal that LG diets improve glycemic control in diabetes and reduce the risk of heart disease. Given what we know so far, a modified low-glycemic load, Mediterranean-style diet appears to be optimal for mood as well as overall health (Dog, 2010).

In observational studies, "traditional eating patterns such as the Mediterranean diet have been shown to be protective for mental health" (Libuda, 2016). People with severe mental illness more often maintain diets considerably more energy-dense, highly processed, higher in salt, and contain less fruit and vegetables, compared with the general population (Teasdale, 2018).

The more one eats a diet rich in fruits, vegetables, healthy fats, nuts, fish, and low amounts of processed foods, the more one is protected from developing a mental disorder (Rucklidge, 2016). Dietary patterns have repeatedly shown to precede the onset of psychiatric symptoms, clearly supporting the avenue of causality (Rucklidge, 2016). A high intake of processed foods, consisting of sweetened desserts, fried food, processed meats, and refined cereals, is associated with increased risk, suggestive of deleterious effects (Opie, 2017).

According to Lachance (2015), Mediterranean diet is rich in fresh fruits, vegetables, fish, extra virgin olive oil, and whole grains:

> A "whole foods," traditional, and a Mediterranean diet have been found to be protective against developing depression among other mental illnesses. For instance, a prospective cohort study of over 10,000 university students over 4.4 years of follow up, found that students who most closely adhered to a Mediterranean dietary pattern had a 42% reduced risk of developing depression (Lachance, 2015).

In addition, one study showed participants who adhered closest to the Mediterranean diet were associated with better cognitive function, lower levels of cognitive decline, and reduced risk of Alzheimer disease (Petersson, 2016). Also, one meta-analysis showed high Mediterranean diet adherence was also linked to reduced risk of depression and cognitive impairment (Petersson, 2016).

Exercise in Aiding Mental Illness

Exercise improves mental health and well-being, reduces depression and anxiety, as well as, enhances cognitive functioning (Celik, 2018). Physical exertion can be highly influential when it comes to prohibiting and managing mental health disorders, as exhibited in a study by Osborn (2018):

> Osborn conducted a descriptive study to determine the physical activities, nutritional habits, and cardiovascular risk factors of the individuals with mental illness. The study determined that the individuals with mental illness eat low fiber food with saturated fat and live a life with insufficient physical inactivity, which are the two risk factors for cardiovascular disorders, and which were found to be twofold more in those patients compared to the normal population. Stubbs (2017) conducted a cross-sectional study to

> investigate the association of the sedentary lifestyle and the daily number of steps taken with the cardiometabolic (blood pressure, glucose, cholesterol levels, etc.) variables in schizophrenic patients. It was observed that the sedentary lifestyles were associated with the poor metabolic status and the physical activity was found to be an important factor for metabolic improvements. The same study found that the number of the steps taken a day was found to be lower in schizophrenic patients than the recommended figures and that the rate of sedentary lifestyles was high. The study by Vancampfort (2012) found that the individuals with mental illness spending more than 10.4 h a day while sitting had higher body mass indices, waist circumferences, and impaired glucose tolerances compared to those spending less than 5.8 h of a day while sitting. The study by Stubbs stressed that decreasing the proportion of the sedentary lifestyles and increasing the physical activities would prevent the metabolic disorders in psychotic patients (Osborn, 2018).

According to Melo (2019), nutrition and physical activity go hand-in-hand when it comes to mental health:

> Western societies experienced drastic changes in eating habits during the past century. The modern nutritional profile, typically rich in saturated fats and refined sugars, is recognized as a major contributing factor, along with reduced physical activity, to the current epidemics of metabolic disorders, notably obesity and diabetes. Alongside these conditions, recent years have witnessed a gradual and significant increase in prevalence of brain diseases, particularly mood disorders (Melo 2019).

One possible mechanism underlying psychiatric symptoms is “inborn metabolic dysfunction associated with slowed metabolic activity due to suboptimal availability mineral and vitamin cofactors” (Rucklidge, 2015). Furthermore, any “evidence that biological factors may

explain the beneficial effects of exercise on depression derives from research showing that exercise promotes the secretion of neurotransmitters like serotonin" (Celik, 2018). In addition, animal studies suggest exercise stimulates the secretion of endogenous morphine (endorphins), producing a state of euphoria and helping mental health (Celik, 2018). People suffering from severe mental illnesses have often shown to engage in lower levels of physical activity, as well as, have higher rates of smoking and substance use (Teasdale, 2018).

One systematic review concluded aerobic exercise to be effective in the treatment of raised anxiety (Aylett, 2018). The study also revealed high intensity exercise programs to be more effective compared to the low intensity programs (Aylett, 2018). In addition, one study showed physical exercise had a significant effect on depression (Kvam, 2016). Further, one meta-analysis found exercise to have significant antidepressant effects patients with depression compared to non-active control conditions (Schuch, 2016). All in all, research has provided robust evidence that exercise can be considered for treatment and management of depression (Schuch, 2016).

One cross-sectional study found that more active individuals report lower depression scores than the more sedentary individuals (Bhui, 2000). Research has also shown which type of exercise is most effective in reducing mental illness. For example, the three basic types of exercise are cardiorespiratory or aerobic exercise (walking, jogging) where oxygen is metabolized to produce energy; muscular strength and isometric anaerobic exercise (weightlifting) when energy is provided without the use of inspired oxygen. And finally, flexibility exercise (yoga, stretching) that is used to improve range of motion (Brosse, 2002).

After only 12 weeks, significant reduction in depression scores were found (Greist, 1979). In addition, Klein (1984) found aerobic exercise, in particular, to be as effective in

reducing depressive symptoms as psychotherapy. Klein's study assigned three treatment conditions to seventy-four participants, the first treatment being running therapy (1984). Another study (Fremont, 1987) also found exercise to be as effective as psychotherapy in treating depressed individuals. It is evident physical activity can be beneficial in relieving mental illness, particularly depression.

A study done on veterans with schizophrenia also offers a significant of evidence revealing the effect exercise can have on mental health. For example, the 16-week study revealed short-term treadmill-walking to be statistically and clinically beneficial for the veterans (Beebe, 2005). In addition, a study conducted by Pelham (1993) showed aerobic exercise to significantly reduce depression and anxiety in persons with schizophrenia. Similarly, exercise has been shown to aid in bipolar disorder symptoms as well. For example, one study comprised of a nurse-led, 40-min walk each day of the week showed significantly lower total depression, anxiety, and stress scores (Ng, 2007).

Conclusion

Overall, it can be assured nutrition and physical exercise play a pivotal role in mental health. Nutrition and regular exercise pose to be significant contributors in maintaining a balanced, stable mind. Nutritional factors such as fatty acids, amino acids, minerals, vitamins, etc. all impact mental health in some capacity. Further, these essential dietary nutrients help regulate neurotransmission and balance brain chemistry, offering to be important elements when it comes to controlling and treating mental illness. Many studies have also discovered the Mediterranean diet to be especially effective in preventing and relieving mental illness whereas the standard American diet contains harmful additives known to provoke symptoms of mentally ill individuals.

Exercise can also benefit mental health. As mentioned, much research has shown exercise can aid symptoms associated with anxiety, depression, bipolar disorder, and schizophrenia. Aerobic exercise proved to be the most influential when it came to reducing symptoms of depression and schizophrenia. Nutrition and physical exercise offer countless options of treatment for mental illness; however, many of the possible nutrition aids are not utilized because of the strong influence of the standard American diet.

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