Meat, Organs, Bones and Skin

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Nutrition for Mental Health

SUMMARY

• My anxiety disorders became seriously aggravated on a vegetarian diet but were resolved after including nutrient-dense animal foods in my diet.

• Consistent with my personal experience, seven out of eight studies have shown that vegetarians are more likely than their non-vegetarian counterparts to experience mental disorders.

• These studies cannot prove cause and effect, but vegetarian diets may induce a number of nutrient deficiencies that could contribute to the development of mental disorders.

• Vitamin B_{12}, folate, methionine and glycine support the proper regulation of a biochemical process called methylation, which in turn regulates the neurotransmitter dopamine.

• This biochemical process contributes to the appropriate balance between mental stability and mental flexibility, which is needed for optimal mental health.

• Meat, bones, skin and organ meats such as liver provide a balance of the nutrients needed to support the proper regulation of methylation, and thus to support robust and vibrant mental health.

• Nutrient-dense plant foods are also beneficial.

When I look back on my life and consider my struggles with anxiety, nothing stands in sharper relief than the healing power of nutrient-dense animal foods such as meat, bones, organs and skin. In my late teens, I became a vegetarian, thinking I would save the environment, the animals and even my own health. Six months later I became a vegan, excluding all animal products from my diet. Rather than improving my health, however, I developed problems with digestion and lethargy, a mouth full of tooth decay, and a profound aggravation of the anxiety disorders I had struggled with since my mid-teens.

After a year and a half, I slowly began including animal foods such as eggs, milk and eventually fish in my diet. Nothing seemed to help. After about two years, I caved in to strong cravings for red meat at Christmas dinner. I feasted luxuriously on such meats thereafter, and within two weeks my regular panic attacks had ceased. Nevertheless, I still suffered from the phobias and obsessive-compulsive disorder I had had prior to becoming a vegetarian. Several months later, I discovered the work of Weston A. Price.

Aiming to cure my tooth decay, I began incorporating nutrient-dense animal foods such as cod liver oil, liver and other organ meats, bone broths, and animal skins into my diet. Not only did my tooth decay come to a crashing halt, but within months my anxiety disorders disappeared. I thus realized that my health, both physical and mental, had undergone a revolution.

VEGETARIANISM AND MENTAL DISORDERS

To understand why nutrient-dense animal foods seem to have cured my anxiety disorders, it makes sense to ask a simple question: was I alone? Or do others who exclude animal products from their diet also struggle with mental disorders? Prior to 2012, seven studies had

addressed this question. Four found that vegetarians were more likely than non-vegetarians to have eating disorders,[1,2,3,4] two found they were more likely to be depressed,[5,6] one found they had lower self-esteem and more anxiety,[3] and one found they were more likely to have contemplated or attempted suicide.[1]

One study conducted among Seventh-Day Adventists, however, found that vegetarians within this religious group had fewer negative emotions than their non-vegetarian counterparts.[7] Although Seventh-Day Adventism does not require vegetarianism, it strongly encourages this way of eating. It is possible this study stands apart from the others because vegetarians within this group experience greater esteem among their peers, are more confident in their own spirituality, or are more conscientious in other areas of their lives just as they adhere more strongly to the teachings of their religion. Regardless of the precise reason for this one anomaly, six out of these seven studies found that vegetarians are more likely to experience mental disorders.

Nevertheless, all of these studies have several limitations: they relied on self-reporting of mental disorders rather than on professional diagnosis; they were conducted in limited populations, most of them in adolescents, one in young women, and one in Seventh-Day Adventists; none of them were matched for sociodemographic characteristics, which are known to differ between vegetarians and their nonvegetarian counterparts; and none of them determined whether the subjects developed mental disorders before or after they became vegetarians.

A study published in 2012 addressed each of these limitations.[8] The study included over four thousand respondents to the German National Health Interview and Examination Survey and its Mental Health Supplement, reflecting the general population of Germany rather than a specific subgroup. Clinically trained psychologists and physicians assessed the prevalence of mental disorders by administering a diagnostic interview rather than relying on self-reporting. The investigators took into account socio-demographic characteristics such as age, education, sex, marital status and community size, which was important because vegetarians were younger, more educated, more likely to be female, less likely to be married, and more likely to come from an urban environment. Finally, the investigators determined whether vegetarians with mental disorders began their vegetarian diet before or after the estimated onset of their mental disorder.

Compared to omnivores matched for socio-demographic characteristics, vegetarians were more than twice as likely to be depressed, more than 2.5 times as likely to suffer from an anxiety disorder, and over four times as likely to suffer from an eating disorder. We could interpret these data in three ways: vegetarianism might contribute to the development of anxiety disorders, a pre-existing mental disorder might make someone more likely to become a vegetarian, or an unknown factor might predispose someone both to become a vegetarian and to develop a mental disorder. For example, perfectionism is not a mental disorder and could be beneficial in certain contexts, but the trait could contribute to an anxiety disorder if it gets out of hand, and a perfectionist may see vegetarianism as a way of making their diet “perfect.”

These interpretations are not mutually exclusive, however: someone might be more likely to become a vegetarian because of a particular psychological trait, but vegetarianism could then induce nutrient deficiencies that interact with that psychological trait to produce a disorder. In the German study, half of vegetarians with eating disorders, two-thirds of those with depression, and over 90 percent of those with anxiety disorders developed their mental disorder before becoming a vegetarian, suggesting that vegetarianism was not the singular “cause” of their mental disorders, at least in the large majority of cases. Nevertheless, as shown in Figure 1, vegetarianism could have made many of the subjects more likely to be diagnosed with a mental disorder by aggravating pre-existing negative psychological traits. In my own case, vegetarianism did not “cause” my anxiety disorders, but it seriously aggravated them, and including abundant amounts of nutrient-dense animal foods in my diet cured them.

We should keep in mind that all eight studies examining the relation between vegetarianism and mental disorders are observational in design and therefore incapable of determining cause and effect, which would require an experimental design. Nevertheless, it is reasonable to suggest the possibility that seven out of eight of them found vegetarians are more likely to suffer from mental disorders at least in part because nutrient-dense animal foods are required for optimal mental health.

SUPPORTING METHYLATION

There are a number of potential deficiencies and imbalances that could develop on a diet devoid of nutrient-dense animal foods: some people may become deficient in cholesterol if they do not make enough of their own; plant goitrogens, some of which require vitamin B_{12} and sulfur amino acids for their detoxification, could contribute to thyroid problems; deficiencies of vitamin B6, long-chain omega-6 and omega-3 fatty acids, zinc, and fat-soluble vitamins A, D and K_2 could also develop. This article, however, will focus on the role of vitamin B_{12}, sulfur amino

acids, and glycine in supporting and regulating a process known as methylation, which is critical for mental health.

We can see how important these nutrients and the process of methylation are to mental health by considering the neurological and cognitive consequences of severe vitamin B_{12} deficiency. This condition involves nervous system degeneration, loss of sensation beginning in the toes and progressing to the feet and hands, stiffness and involuntary muscle spasms, disturbed gait, and mental disturbances ranging from mild personality changes and memory loss to psychosis and occasional delirium. Although we do not yet completely understand the exact mechanisms by which vitamin B_{12} deficiency causes these problems, the primary role of vitamin B_{12} within our bodies is to support the process of methylation, so a breakdown in this process is almost certainly an important part of the picture.

Methylation is a fancy biochemistry term that simply means the addition of a carbon atom with a small assortment of hydrogen atoms (a "methyl group") to a wide variety of molecules. Methylation is required for the synthesis of many compounds such as creatine, and the regulation of many others, such as dopamine. As such, it is critical for a broad range of biological processes including tissue growth and repair, cellular communication, and controlling cancer. Among the many molecules whose production or regulation is dependent on methylation, both creatine and dopamine are critical to mental health. This article, however, will focus on dopamine.

TONIC AND PHASIC DOPAMINE

In order to begin exploring the relationship between methylation, dopamine and mental health, we must first understand the difference between tonic and phasic dopamine.[10] As shown in Figure 2, tonic dopamine is the modest amount of dopamine that has a constant presence in our brain. It is like a stable body of water, and is important for mental stability. Phasic dopamine is like a wave that comes crashing in, making an appearance for only fractions of a second, and is important for mental flexibility. Methylation regulates tonic dopamine, while our brains have other ways of regulating phasic dopamine.

Nevertheless, as shown in Figure 3, our brains judge the size of the phasic dopamine "wave" by how high it stands above the background of tonic dopamine. A higher level of tonic dopamine makes the "wave" of phasic dopamine look a lot smaller, and our brains react to it accordingly. Thus, as shown in Figure 4, methylation regulates the balance between mental stability and mental flexibility: too much methylation will favor too much flexibility, not enough methylation will favor too much stability, and the level of methylation that is just right will provide the appropriate balance between the two. Thus, our goal is not to increase methylation or decrease methylation, but to provide our brains with the raw materials they need to regulate the process properly.

MENTAL STABILITY AND FLEXIBILITY

Two analogies should prove useful to help us understand the need to balance mental stability with mental flexibility. In the first, we could imagine a potter who makes clay flexible by moistening it before attempting to make something out of it. Too little moisture will lead to brittle clay: it is too dry to shape into anything, and applying enough force to change its shape will simply make it break, exposing rough and sharp edges. Too much moisture will make it easy to manipulate, but no shape given to it will hold. The right amount of moisture will make the clay malleable enough to manipulate into something useful or beautiful, and yet stable enough to retain the shape given it.

Similarly, not enough methylation could lead to "brittle" mental states. Such states are difficult to change, but when they do change, the transitions are sudden and without warning. This brittleness could lead to dangerous situations. For example, ordinarily when we get angry, the process is gradual enough that we may realize what is happening to us and stop ourselves from acting out in our anger, or someone else may notice that we are becoming angry and intervene to diffuse the situation. If our mental states are too brittle, however, we may act violently without warning, giving neither ourselves nor those around us any opportunity to recognize what is happening and intervene. Alternatively, too much methylation could make our minds like a bowl of liquid clay: easy to make a mess with, but difficult to shape into something beautiful or useful.

In the second analogy, we could consider our consciousness like a net through which thousands of thoughts fly every day. These thoughts could be about basic biological drives and needs like food, sex, and sleep; they could be about the multitude of things we need to get done; or they could be thoughts that motivate us, whether to do good things or to do things that would get us into trouble. To achieve mental health, our net of consciousness needs enough flexibility that we are able to manipulate it as each thought approaches, choosing either to let it pass

through or to hold on to it. This net also needs enough stability, however, to hold onto beneficial thoughts for as long as they are needed. Without flexibility, we hold onto everything that comes our way indiscriminately. Without stability, we cannot hold onto anything at all. With a proper balance, we become masters of our thoughts rather than their captives.

Evidence from genetic studies supports the role of methylation in maintaining this balance. Some of us have a high or low rate of methylating dopamine for genetic reasons. In those who methylate dopamine at a low rate, unpleasant pictures cause a dramatic stimulation of activity in emotional centers of the brain.[11] These people are also much more likely to invest energy into cognitive activity when they are exposed to these emotionally stimulating pictures, and the more energy they invest in cognitive activity the less likely they are to become noticeably disturbed.[11] This suggests that low methylation contributes to excessive mental stability. The unpleasant image gets "stuck" in the person's mind instead of passing through uneventfully, and the person must invest a lot more mental energy to break free of the image's grasp.

Since being held captive by our own thoughts is a central problem in mental disorders such as depression and anxiety, some researchers have suggested that those who methylate dopamine at a low rate are "worriers," while those who methylate dopamine at a high rate are "warriors." While the distinction has some merit, making low methylation the "bad" trait and high methylation the "good" trait is too simplistic.

Between the "worrier" and the person who indiscriminately engages in every battle, there lies the cautious person who picks and chooses her battles. Moreover, genetic studies show that while those who methylate dopamine at a low rate have more difficulty with emotional processing, those who methylate dopamine at a high rate have more difficulty with cognitive processing.[12] Psychoses, such as those seen in schizophrenics[10] or those suffering from severe vitamin B_{12} deficiency,[13] can manifest in some people with symptoms of excessive mental stability and in other people with symptoms of excessive mental flexibility. Examples include "rigidity of thoughts" on the one hand, and "flight of ideas" on the other. Perhaps the clearest indication that balance is best is that those with genetically high or low rates of methylating dopamine constitute roughly equal proportions of the population, and the majority of us have the genetics for an intermediate rate. If one trait were the "bad" one and the other the "good" one, natural selection would have weeded the "bad" one out long ago.

The question before us, then, is this: regardless of genetics, what kind of nutritional approach can we use to provide our brains with the raw materials they need to maintain the right amount of methylation to support the appropriate balance of mental stability and flexibility needed for optimal mental health?

MEAT, ORGANS, BONES, AND SKIN

As shown in Figure 5 and discussed in more detail in the Fall 2012 issue of *Wise Traditions*,[14] the most basic nutrient we need for the process of methylation is the amino acid methionine. The "meth-" in the word "methionine" refers to this process. Animal proteins are about twice as rich in methionine as plant proteins as a proportion of total protein. Plant foods, moreover, tend to contain much less protein than meats. People who exclude all animal products from their diets thus likely consume three to five times less methionine than those who eat a diet rich in animal products, leading to a dramatic decrease in the raw materials needed for methylation.

As also shown in Figure 5, consuming less methionine should generate less homocysteine. Paradoxically, however, compared to omnivores, vegetarians are twice as likely and vegans are three times as likely to have elevated homocysteine.[15] Figure 5 provides a resolution to this paradox: while vegetarians and vegans may generate less homocysteine, they also have lower intakes of vitamin B_{12}, which is needed to recycle homocysteine back to methionine.

Indeed, using the highest quality markers of vitamin B_{12} status, investigators have estimated that up to 73 percent of vegetarians and up to 90 percent of vegans are deficient in B_{12}.[15] This should be unsurprising since vitamin B_{12} is found almost exclusively in animal products, and even that which occurs in eggs, a key vegetarian source of animal protein, is poorly bioavailable.[16] Thus, methylation takes a double-whammy: less methionine is available to begin with, and what is available often gets trapped as homocysteine rather than being recycled.

Figure 5 provides another key part of the balance. When methionine concentrations rise, for example after eating a protein-rich meal, the amino acid glycine acts as a buffer to prevent excessive methylation. Although animal foods are not richer in glycine than plant foods as a proportion of total protein, a diet that includes animal products provides more glycine than one that does not simply because it is richer in total protein.

Vegetarians excrete almost twice the level of a unique marker of glycine deficiency in their urine as omnivores.[17] This suggests that excluding animal products from the diet could not only lead to a generally inadequate level of methylation because of lower intakes of methionine and vitamin B_{12}, but the lower intake of glycine could also lead to transient periods of excessive methylation. This could theoretically result in seesawing between excessive mental stability and excessive mental flexibility.

The purpose of this article, however, is not to denigrate vegetarian diets but to emphasize the importance of nutrient-dense animal foods. A standard omnivorous diet is hardly the ideal. Even omnivores excrete substantial amounts of the marker of glycine deficiency discussed above in their urine.[17] This could be because the typical omnivore fails to make use of skin and bones in their diet. Protein from skin is three times richer in glycine than meat, while protein from bones is six times richer.[14] Thus, most omnivores may stand to gain substantial improvements in mental health by including glycine-rich skin and bones (in the form of bone broth) in their diets.

Moreover, Figure 5 shows that folate assists vitamin B_{12} in its support of the methylation process. Folate is found primarily in legumes, leafy greens and liver. Vegetarians tend to consume more leafy greens and legumes than omnivores, and most omnivores fail to take advantage of liver or other organ meats. Many omnivores may thus improve their mental health even further by including folate-rich plant foods and liver in their diets.

HARNESSING GOOD NUTRITION FROM ALL SOURCES

Vegetarians and vegans may adhere more strongly than omnivores to other health-promoting habits as well. This is especially important to consider if we are interested in preventing all diseases rather than just mental disorders. For example, Figure 5 shows that glycine helps convert homocysteine to glutathione, the master antioxidant and detoxifier of the cell, and a key regulator of protein function. We might predict from this that vegetarians and vegans should have lower glutathione status than omnivores because of lower intakes of methionine and glycine.

Some studies, however, have shown that while vegans have lower glutathione status than omnivores, vegetarians have slightly higher glutathione status.[18] Unlike the vegans, the vegetarians in such studies may have been consuming plenty of milk and eggs. Thus, the vegetarians and omnivores may have had similar intakes of methionine and glycine. Both the vegetarians and vegans may have been consuming more fruits and vegetables. These provide vitamin C, which spares glutathione from oxidation, polyphenols, which increase the production of glutathione, and, especially in their raw state, glutathione itself.

Adequate glutathione status protects against degenerative diseases of all kinds. The best way to support glutathione status would likely be to consume a traditional diet that includes plenty of nutrient-dense foods of all kinds: meat, organs, bones, skin, folate-rich legumes and leafy greens, and fresh fruits and vegetables rich in vitamin C, polyphenols, and glutathione.

VIBRANT MENTAL HEALTH

Overall the evidence supports a key role for nutrient-dense animal foods in mental health. Seven out of eight relevant studies show vegetarians have a higher risk of mental disorders than omnivores. These studies cannot demonstrate cause and effect, but both dietary and biochemical data suggest that vegetarians are less able than omnivores to support methylation, and are thus likely less able to support the appropriate balance between mental stability and flexibility needed for optimal mental health. Standard meat-inclusive diets are hardly ideal, however. We should emphasize a wide variety of nutrient-dense foods, including not only meat, but also many animal foods banished from our modern menus, especially bones (usually as bone broth), skin, and organs. Such a diet is the surest way to obtain the robust and vibrant mental health of our ancestors.

REFERENCES

1. Perry CL, Mcguire MT, Neumark-Sztainer D, Story M. Characteristics of vegetarian adolescents in a multiethnic urban population. *J Adolesc Health*. 2001;29(6):406-16.

2. Neumark-Sztainer D, Story M, Resnick MD, Blum RW. Adolescent vegetarians. A behavioral profile of a school-based population in Minnesota.

Arch Pediatr Adolesc Med. 1997;151(8):833-8.

3. Bas M Karabudak E, Kiziltan G. Vegetarianism and eating disorders: association between eating attitudes and other psychological factors among Turkish adolescents. *Appetite*. 2005;44(3):309- 15.

4. Robinson O'Brien R, Perry CL< WAll MM, Story M, Neumark-Sztainer D. Adolescent and young adult vegetarianism: better dietary intake and weight outcomes but increased risk of disordered eating behaviors. *J Am Diet Assoc*. 2009;109(4):648-55.

5. Larsson CL, Klock KS, Nordrehaug Astrom A, Haugejorden O, Johansson G. Lifestyle-related characteristics of young low-meat consumers and omnivores in Sweden and Norway. *J Adolesc Health*. 2002;31(2):190-8.

6. Baines S, Powers J, Brown WJ. How does the health and well-being of young Australian vegetarian and semi-vegetarian women compare with non-vegetarians? *Public Health Nutr*. 2007;10(5):436-42.

7. Beezhold BL, Johnston CS, Daigle DR. Vegetarian diets are associated with healthy mood states: a cross-sectional study in Seventh Day Adventist adults. *Nutr J*. 2010;9:26.

8. Michalak J, Zhang XC, Jacobi F. Vegetarian diet and mental disorders: results from a representative community survey. *Int J Behav Nutr Phys Act*. 2012;9(1):67.

9. Carmel R. Cobalamin (Vitamin B12). In Shils et al., eds. *Modern Nutrition in Health and Disease*. Baltimore, MD and Philadelphia, PA: Lippincott Williams & Wilkins (2006): 482-497.

10. Bilder RM, Volavka J, Lachman HM, Grace AA. The catechol-O-methyltransferase polymorphism: relations to the tonic-phasic dopamine hypothesis and neuropsychiatric phenotypes. *Neuropsychopharmacology*. 2004;29(11):1943-61.

11. Rasch B, Spalek K, Buholzer S, Luechinger R, Boesiger P, de Quervain DJ, Papassotiropoulos A. Aversive stimuli lead to differential amygdala activation and connectivity patterns depending on catechol-O-methyltransferase Val158Met genotype. *Neuroimage*. 2010;52(4):1712-9.

12. Mier D, Kirsch P, Meyer-Lindenberg A. Neural substrates of pleiotropic action of genetic variation in COMT: a meta-analysis. *Mol Psychiatry*. 2010;15(9):918-27.

13. Kalita J, Misra UK. Vitamin B12 deficiency neurological syndromes: correlation of clinical, MRI and cognitive evoked potential. *J Neurol*. 2008;255(3):353-9.

14. Masterjohn C. Beyond Good and Evil: Synergy and Context with Dietary Nutrients. *Wise Traditions*. Fall 2012.

15. Hermann W, Schorr H, Obeid R, Geisel J. Vitamin B-12 status, particularly holotranscobalamin II and methylmalonic acid concentrations, and hyperhomocysteinemia in vegetarians. *Am J Clin Nutr*. 2003;78(1):131-6.

16. Watanabe F. Vitamin B12 sources and bioavailability. *Exp Biol Med* (Maywood). 2007;232(10):1266-74.

17. Jackson AA, Persaud C, Meakins TS, Bundy R. Urinary excretion of 5-L-oxoproline (pyroglutamic acid) is increased in normal adults consuming vegetarian or low protein diets. *J Nutr*. 1996;126(11):2813-22.

18. Krajcovicova-Kudlackova M, Simoncic R, Bederova A, Brtkova A, Magalova T, Bartekova S. [Alternative nutrition and glutathione levels.] *Cas Lek Cesk*. 1999;138(17):528-31. Article in Slovak, only abstract available.

Figures

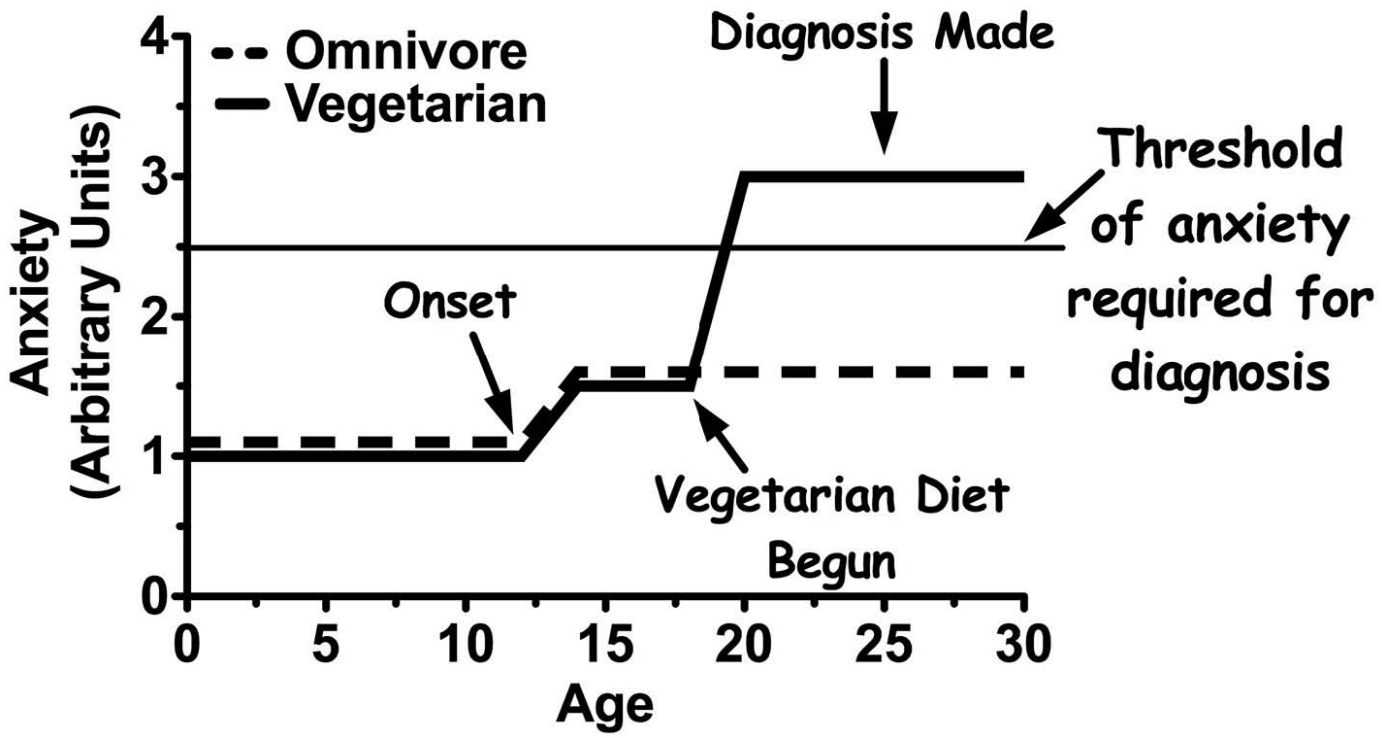

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FIGURE 1: The figure shows a hypothetical explanation for how vegetarianism might contribute to the development of a mental disorder even if the onset of the disorder, as estimated retrospectively by a diagnostic interview at a later time, may have occurred before the adoption of a vegetarian diet. We could suppose that two people have a similar predisposition to increased levels of anxiety. Early in life, they both have "normal" levels of anxiety, represented arbitrarily by the number "1." Both of them experience an increased level of anxiety in their early teens, but the anxiety does not reach the level that would be required for a diagnosis of a true disorder. One of the individuals, represented by the dotted line, remains an omnivore throughout the time period considered. The other, represented by the solid line, eventually becomes a vegetarian. Vegetarianism aggravates the pre-existing tendency towards anxiety, pushing it beyond the threshold required for diagnosis of a disorder. If both individuals undergo a diagnostic interview at the age of 25, the vegetarian would be diagnosed with a disorder and the omnivore would not. The clinician may designate the onset of the disorder in the person's early teens, when the level of anxiety first began increasing. This would be before the onset of the vegetarian diet, yet nutrient deficiencies from the vegetarian diet may have contributed to the ultimate development of the disorder.

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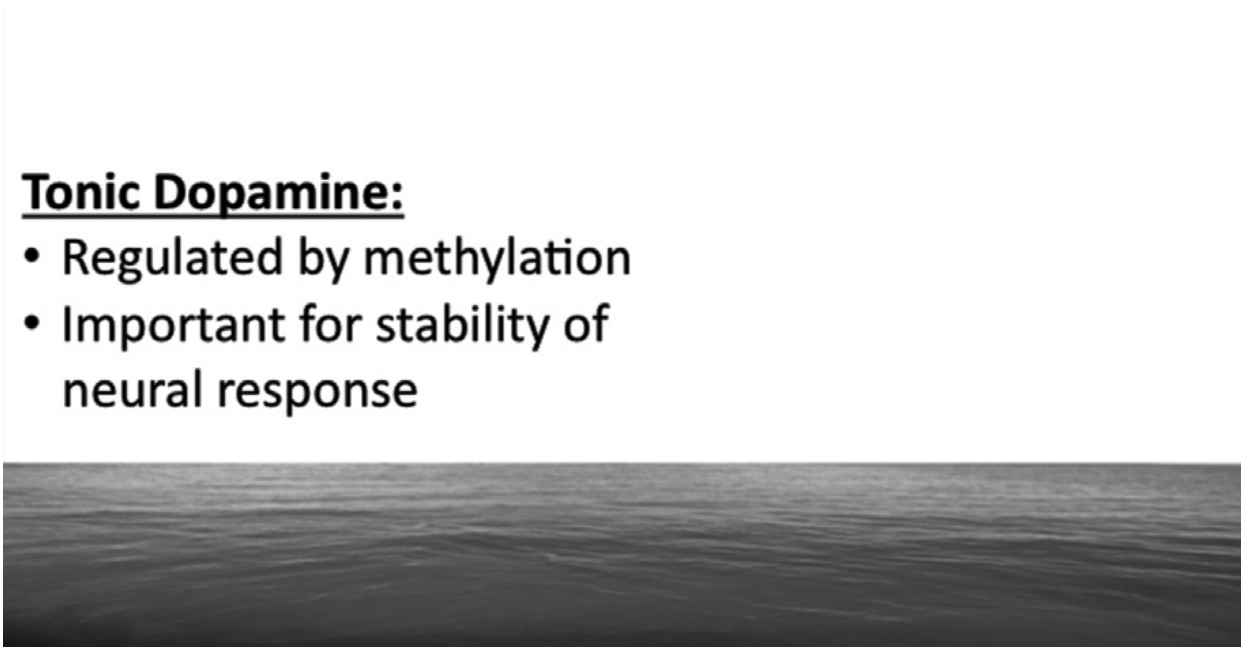
A

FIGURE 2: Tonic dopamine (A) is the modest amount of



dopamine that is always present in our brains, and could be thought of as a stable body of water, or the background level of water in a sea through which waves pass. It is responsible for the stability of neural responses. Phasic dopamine (B) is a pulse of dopamine that lasts only a fraction of a second. It is responsible for the flexibility of neural responses. Tonic and phasic dopamine are distributed differently in the brain, allowing the brain to control their levels through different mechanisms. We inactivate tonic dopamine primarily by methylating it. By contrast, we inactivate phasic dopamine primarily by oxidizing it or by removing it from the area in which it is active. Thus, a greater degree of methylation will decrease the level of tonic dopamine, but will have little effect on the level of phasic dopamine.

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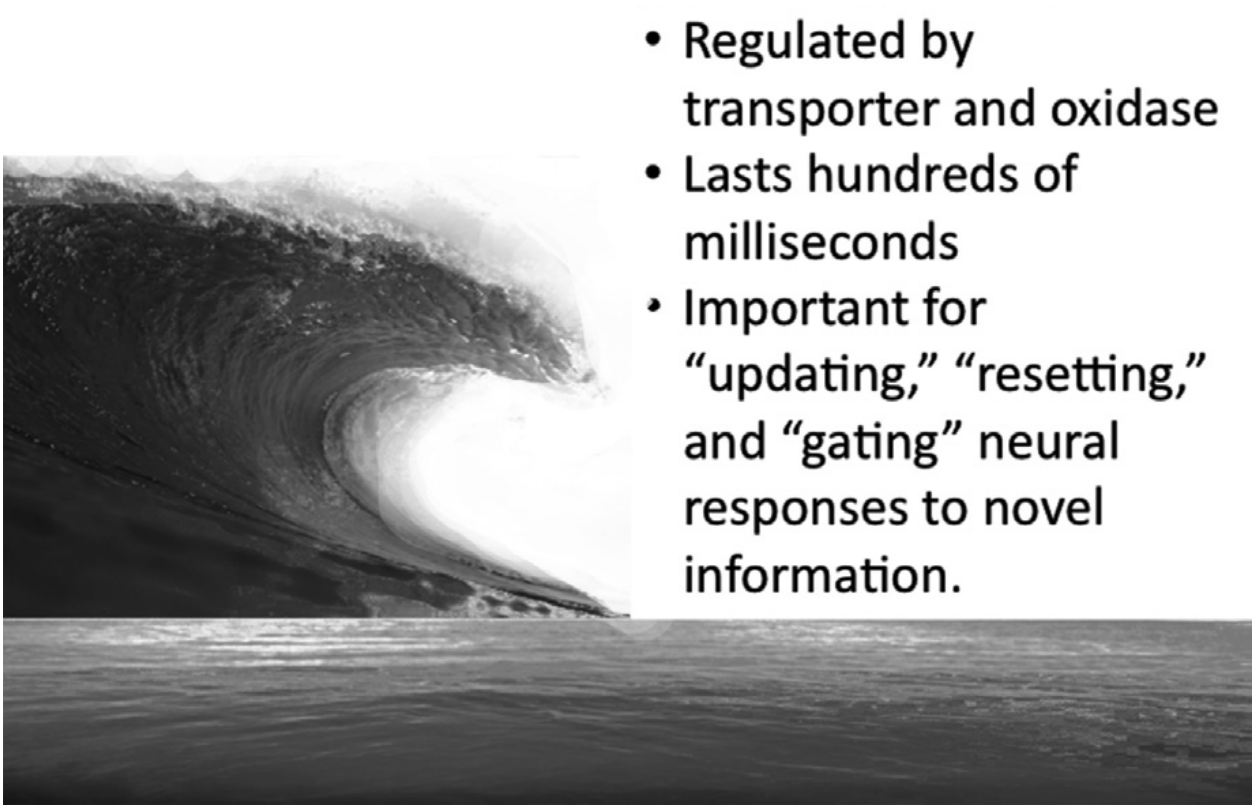
FIGURE 3: Tonic dopamine regulates the brain's response to phasic dopamine. Our brain judges the size of the phasic dopamine "wave" according to how high it rises above the background of tonic dopamine. A "wave" of the same size will look larger when the level of tonic dopamine is low (A) and smaller if the level of tonic dopamine is high (B). Thus, a greater level of tonic dopamine not only promotes mental stability, but also decreases our response to phasic dopamine, thereby decreasing mental flexibility. Since methylation decreases the level of tonic dopamine (Figure 2), a greater degree of methylation will decrease mental stability and increase mental flexibility.

B

Phasic Dopamine:



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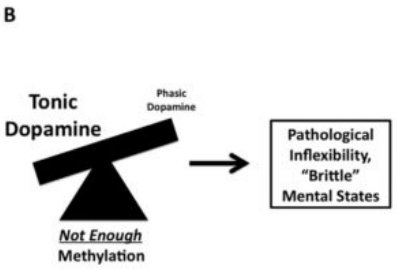

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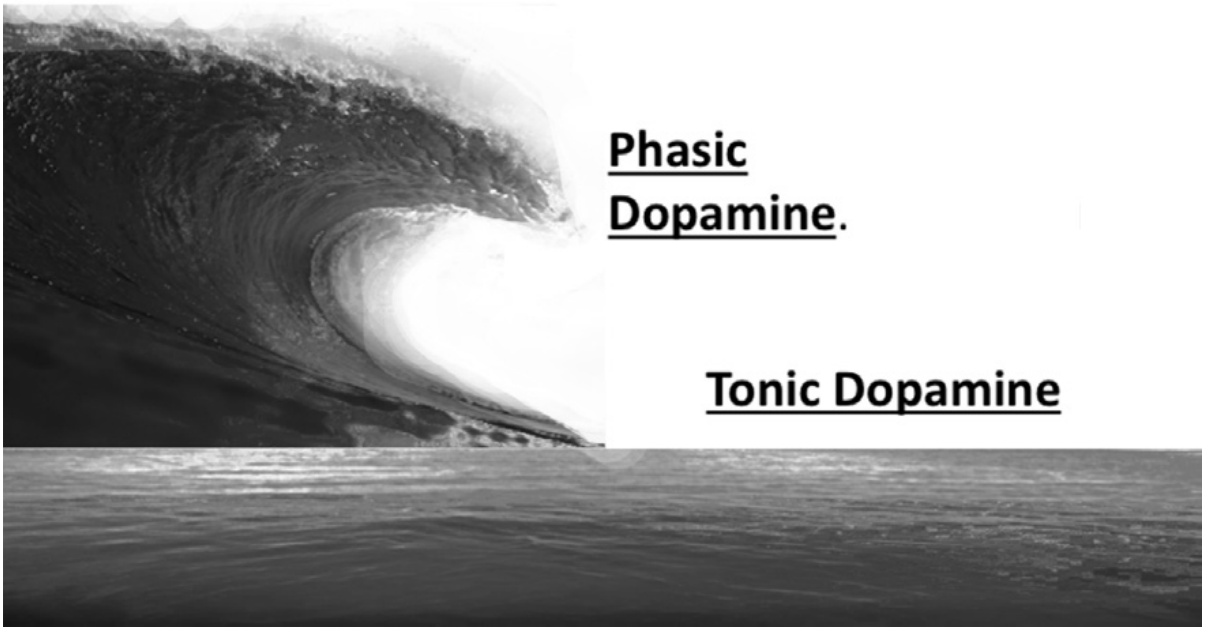
A

FIGURE 4: Optimal mental health requires a balance of mental stability and



flexibility, which in turn requires a level of methylation that is "just right." Too much methylation will contribute to too much flexibility, making us too easily distracted and unable to hold onto beneficial thoughts and mental states (A). Not enough methylation will contribute to too much stability, making us unable to tolerate healthy amounts of change, and making our mental states "brittle," which means that any given mental state will take a lot of energy to break and the transitions will never be smooth (B). A balanced level of methylation will contribute to the appropriate balance between mental stability and mental flexibility, which will support vibrant and robust mental health (C).

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FIGURE 5: The figure shows methionine metabolism at low (A) and high (B) concentrations of methionine. The pathways are simplified, and were explained in more detail in the Fall 2012 journal. Briefly, to support sufficient methylation of dopamine we need adequate methionine. After each methylation reaction, however, methionine generates homocysteine. Recycling homocysteine back to methioinine is important both to prevent cardiovascular disease and to support the methylation process. This requires vitamin B_{12} and folate. At high concentrations of methionine, for example, in the hours after we eat a protein-rich meal, glycine acts as a buffer to prevent excess methylation and also supports the conversion of homocysteine to glutathione. Glutathione is the master antioxidant and detoxifier of the cell, and a key regulator of protein function. Adequate glutathione protects against degenerative diseases of all kinds.

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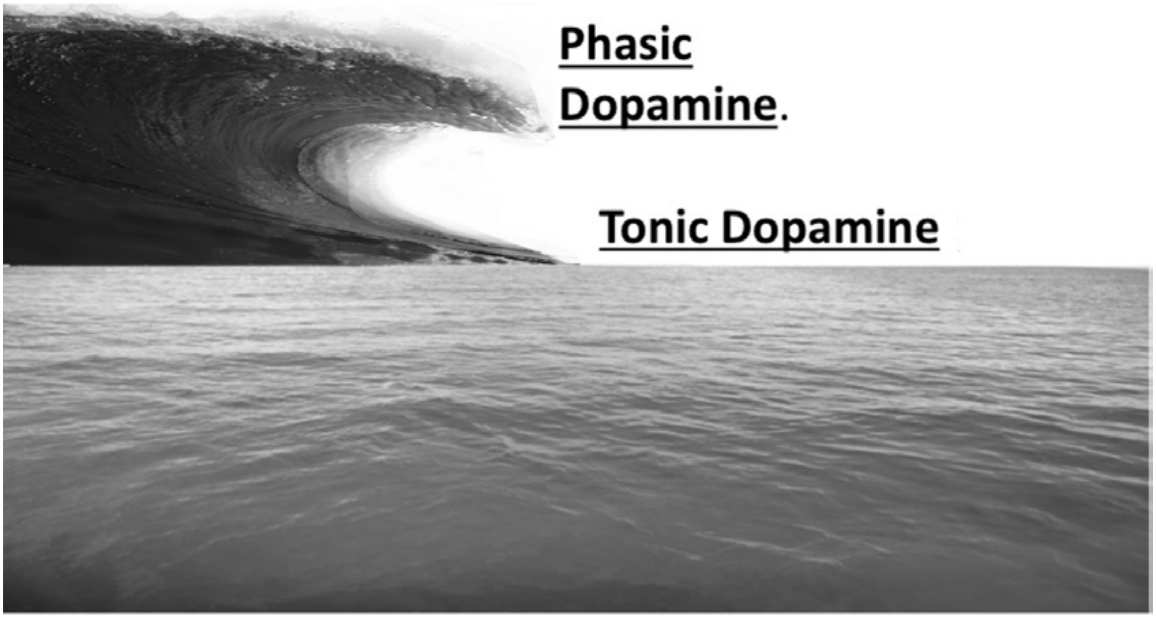
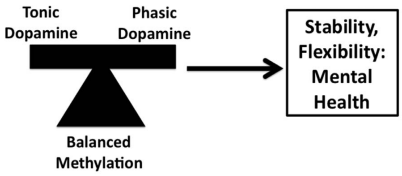
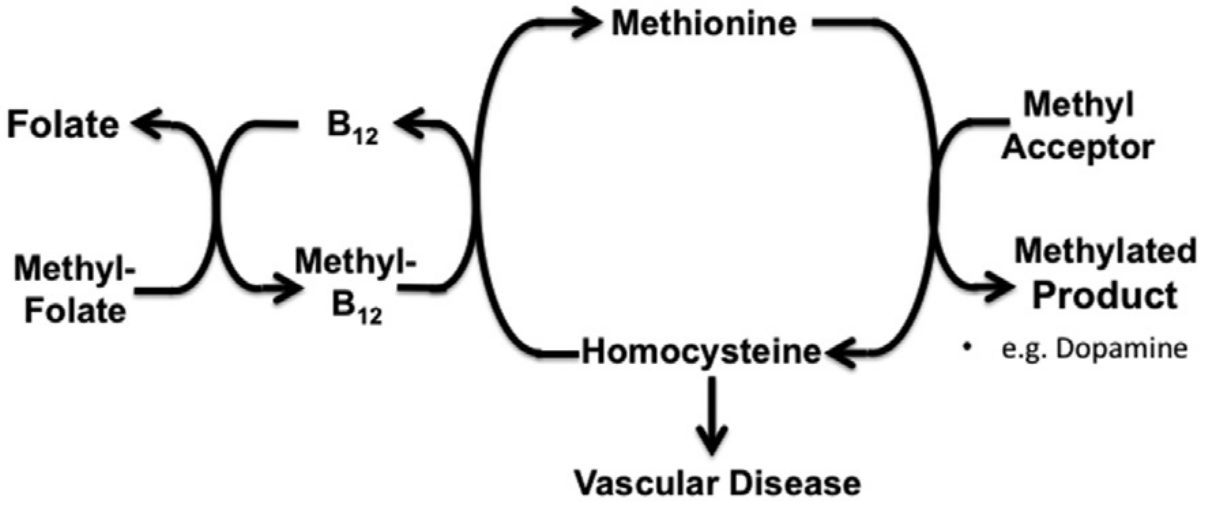
B


Phasic
Dopamine.
Tonic Dopamine

C

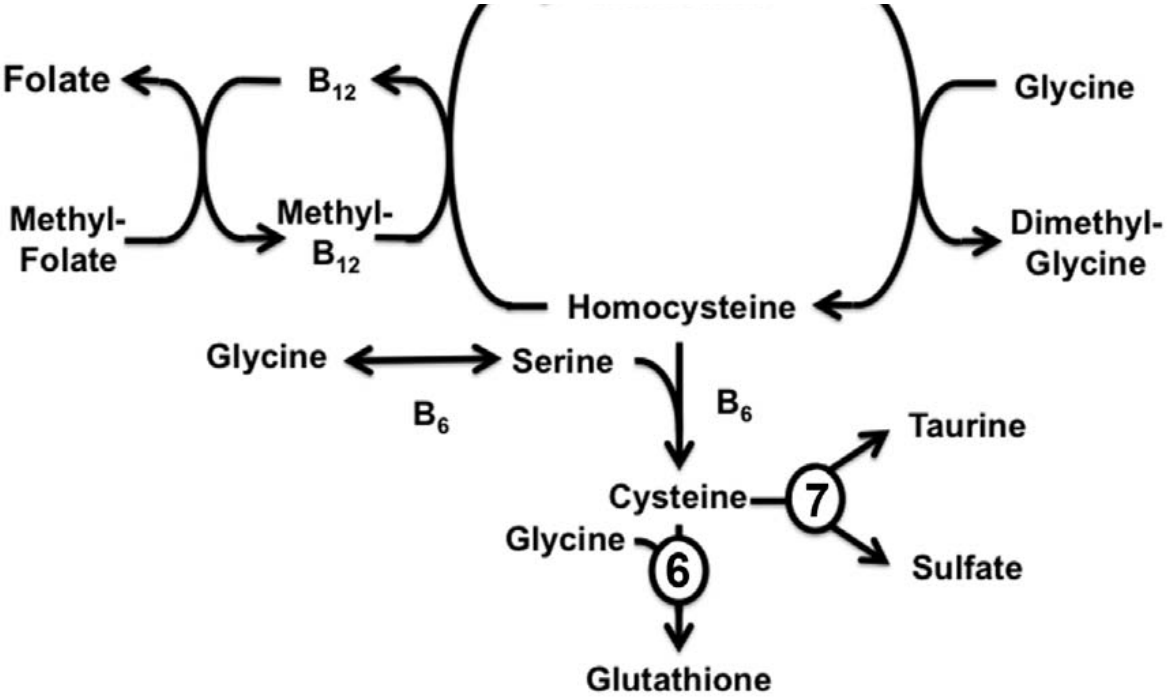

Tonic
Dopamine
Phasic
Dopamine
Balanced
Methylation
Stability,
Flexibility:
Mental
Health

A


Methionine
Folate
B_{12}
Methyl
Acceptor
Methyl-
Folate
Methyl-
B_{12}
Methylated
Product
• e.g. Dopamine
Homocysteine
Vascular Disease

B


Methionine



Read this in: Español (https://www.westonaprice.org/es/health-topics/carne-organos-huesos-y-piel-nutricion-para-la-salud-mental/)

About Christopher Masterjohn

Chris Masterjohn, PhD, is creator and maintainer of www.chrismasterjohnphd.com. Chris is a frequent contributor to Wise Traditions, the quarterly journal of the Weston A. Price Foundation, and is a perennial speaker at the annual Wise Traditions conference. He has written five peer-reviewed publications, and has submitted two additional experimental papers for peer review, one of which has been accepted for publication. Chris has a PhD in Nutritional Sciences from the University of Connecticut and has worked as a Postdoctoral Research Associate at the University of Illinois where he studied interactions between vitamins A, D, and K. The contents of this blog represents his independent work and does not necessarily represent the positions of the University of Illinois.