

Serotonin Increase Without Pharmaceuticals

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Serotonin

Serotonin is a neurotransmitter that has been shown to aid in the regulation of the central nervous system and the brain (Shabbir et al., 2013). Depression and anxiety (Young, 2007) as well as agreeability (Aan het Rot, Moskowitz, Pinard, & Young, 2006), sleep, and the experience of satiety (Shabbir et al., 2013) are also influenced by serotonin levels. Serotonin deficiency is also believed to be part of bulimia, anorexia nervosa, and carbohydrate cravings (Denniston, Topping, Woodrum, & Caret, 2014). Serotonin is made in the brain and in the gut from the essential amino acid tryptophan, the precursor to serotonin (McIntosh, 2015). As the body does not produce tryptophan, it must be taken in through diet, supplements, or medications. Serotonin does not easily cross the blood brain barrier (BBB) (Shabbir et al., 2013; Young, 2007). However, tryptophan is believed by some to easily cross the BBB, particularly as L-tryptophan (Pytliak, Vargova, Mechirova, & Felsoci, 2010) and therefore can be enhanced via dietary choices and supplement intake, leading to increased overall brain serotonin levels. In addition, social engagement and mood might affect brain serotonin levels (Perreau-Linck et al., 2007) while exercise may also play an important role in serotonin metabolism (Melancon, Lorrain, & Dionne, 2014; Rethorst, Landers, Nagoshi, & Ross, 2010). Following is evidence regarding social behavior, diet, and exercise, and their influence on overall brain serotonin levels.

Medication and serotonin

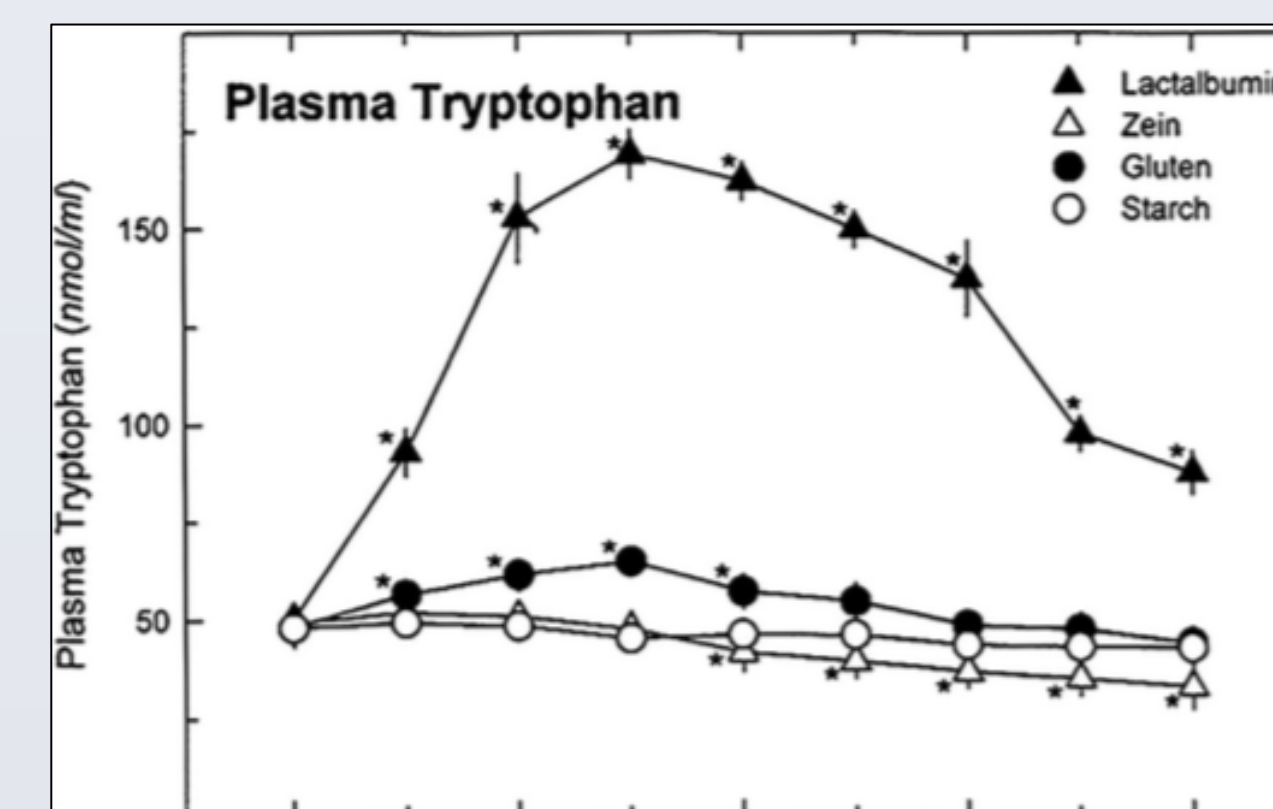
Serotonin has been found to play an important role in mood regulation (Denniston et al., 2014; Rethorst et al., 2010). A common protocol to increase serotonin in the brain is the use of selective serotonin reuptake inhibitors (SSRI), yet there is evidence suggesting that there may be many negative side effects of using SSRIs (Solberg et al., 2004). SSRIs are widely used to treat conditions such as depression and anxiety. Some medical professionals feel that they are overprescribed in instances of mild depression and anxiety (Kelly, 2004), and argue they are among the most prescribed medication in the United States (Denniston et al., 2014). In Great Britain they are banned for children, and have been found to be no more effective than a placebo (Kondro, 2004). Additionally, one medical professional conducted his own investigation into the negative side effects of SSRIs by administering the medication to himself and conducting a thorough investigation into its side effects during a mindfulness meditation retreat, a time during which careful observation of one's internal states is well supported (Walsh, Victor, & Bitner, 2006). Walsh (2006) found that his experiences of joy and love were far less affecting as they had been for him during other non-medicated retreats, additionally the medication did not affect states of anger, fear, or even the ability to concentrate the mind. In light of these reports on the use and effects of SSRIs, it may be of value to determine if serotonin can be increased without the use of pharmacological drugs, but rather through lifestyle, diet, and supplements.



Diet and Serotonin

Tryptophan, being the precursor to serotonin, is an essential amino acid, necessary to ingest for proper serotonin production (Fernstrom et al., 2013). Many foods have been identified as having the essential amino acid tryptophan (*DUJS Online*, 2011). Whether or not this amino acid is metabolized and converted into serotonin in the brain, aiding in mood regulation, is uncertain. Eating foods that are rich in tryptophan such as pork, milk, lentils, spinach, brown rice, and sunflower seeds may be beneficial to overall brain tryptophan levels (Shabbir et al., 2013). Carbohydrates eaten alone appear to increase brain tryptophan levels most predictably (Fernstrom et al., 2013); however, when combined with protein intake, there is evidence that synthesis of tryptophan differs depending on what protein it is ingested with. In an experiment utilizing isolated proteins consumed with tryptophan supplements, milk protein (lactalbumin) had a positive effect on plasma tryptophan concentrations (55%), wheat protein (gluten) produced a modest decrease in plasma tryptophan concentrations (25%), and corn protein lowered plasma tryptophan concentrations to the greatest extent (50%), while corn starch showed no change in humans. The same values occurred in rats and also correlated to an increase in brain tryptophan concentrations with milk protein and a decrease with wheat and corn proteins (Fernstrom et al., 2013). These findings suggest that taking tryptophan as a supplement, or assimilating it from food consumption, may be most effective with dairy products rather than meat or wheat. Consuming carbohydrate rich foods, such as whole grains, without including protein in the meal may also aid in tryptophan assimilation. In addition, isolating dairy protein from meat and grains in a given meal may allow available tryptophan to be better absorbed and utilized.

Absorption of Tryptophan with Isolated Proteins



Social Behavior and Serotonin

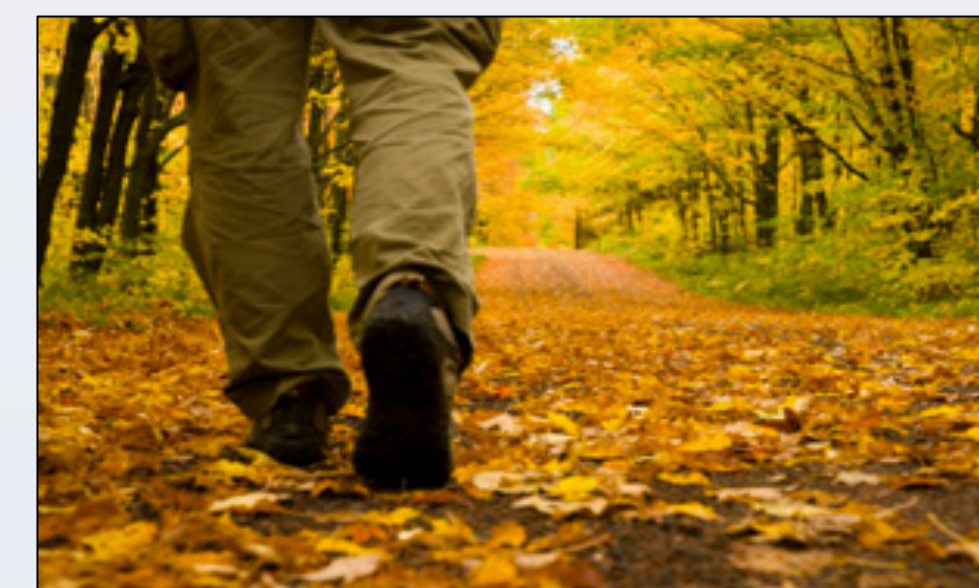


Social support is shown to be beneficial in the alleviation of depressive symptoms and general stress (Young, 2007). In a study investigating whether ingestion of a tryptophan supplement could alter disagreeable behavior in individuals who reported to have high levels of disagreeability, it was found that tryptophan did increase agreeability in both men and women, with a greater effect on the agreeability of the male participants (Aan het Rot et al., 2006).

Social Behavior and Serotonin Cont.

In addition to tryptophan supplements affecting mood, one study queried whether mood could affect brain tryptophan and serotonin levels. With professional actors self-inducing sad, happy, and neutral states for 60 minute periods, there was a positive correlation between elevated tryptophan levels corresponding to self-induced happy states, and lowered tryptophan levels corresponding to self-induced sad states (Perreau-Linck et al., 2007). It appears that happiness might lead to increased tryptophan levels. If tryptophan, when converted to serotonin and metabolized in the brain, were to produce greater agreeability and experiences of happiness led to increased tryptophan levels, it might be the case that positive interactions increase utilization of available brain tryptophan and production of serotonin.

Exercise and Serotonin



Physical activity is commonly prescribed as a remedy for depression and anxiety (Shim et al., 2014). Whether the mood elevating effects of exercise specifically relate to the serotonergic system or not is in question. In a study with active college students, it was found that physical activity did show benefit to the serotonergic system. Furthermore, moderate as opposed to high or low levels of physical activity were most beneficial (Rethorst et al., 2010). Participants who engaged in low and high amounts of exercise showed more depressive symptoms, related to low serotonin levels, than did their moderately active counterparts. It has also been demonstrated that exercise increases the uptake of tryptophan into the brain. With older adults, the effects of chronic exercise, lasting 16 weeks or more was measured, showing that overall, exercise does improve mood and increase serotonin levels, however, there was an attenuation of tryptophan levels during the experiment that may be related to post-training exercise stress which can decrease sympathetic nervous system activity and thus tryptophan assimilation (Melancon et al., 2014). It appears that moderate exercise is the most beneficial for tryptophan metabolism and overall brain serotonin levels. With regards to serotonin alone, exercise that does not stress the body but rather gently increases sympathetic activity may produce more consistent mood elevation and overall well-being.

Conclusion

The data show that tryptophan levels can be increased, leading to improved serotonin synthesis, by properly taken supplements, social interactions that induce happiness, and moderate exercise. This evidence provides alternative therapies, from within the field of mind-body-medicine, that are backed by reports of efficacy. For individuals who suffer from low serotonin conditions such as depression, anxiety, irritable bowel syndrome, insomnia, and anorexia, to name a few, these alternative therapies to SSRIs, and the accompanying side effects of pharmacological drugs, may be health-promoting options.

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