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MINIREVIEWS

A hypothesis on the relationship between tea drinking and sexual activity

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Abstract

As a major beverage in the world, the health benefits of drinking tea have been reported in numerous studies. The effects of green tea are mainly attributed to its polyphenol content, although caffeine, accounting for 2%-4%, appears to be related to the adaptation of mental energy by increasing alertness, attention and cognitive function, as well as elevating mood. L-Theanine, a unique amino acid in tea, has neuroprotective and mood effects. In addition, some studies on functional neuroanatomy and cerebral control of sexual function have demonstrated that the thalamus and hypothalamus play a role in emotional changes, memory and sexual behavior patterns. Our recent epidemiology research has unexpectedly found that tea drinking was positively related with sexual orgasm and sexual satisfaction in female hypertensive patients. We therefore hypothesize that long-term regular consumption of tea may play a role in sexual activity.

Key words: Tea; Sexual activity; Endothelial; Hypothalamus

Core tip: Drinking tea has many beneficial effects on health due to its various components; some have neuroprotective and mood effects. However, no research so far has investigated the role of tea drinking in sexual activity. This paper hypothesizes a link between tea and sex by exploring the possible mechanism.

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INTRODUCTION

Tea is the most popular beverage consumed by a considerable number of people in the world, second only to water[1]. It contains more than 4000 chemical compounds that may affect the human body in many aspects[2]. Tea components have antioxidant, antimutagenic and anticarcinogenic effects and could protect humans against the risk of cancer from environmental agents[3]. There is growing evidence for the beneficial effects of tea drinking on disease prevention, either in cross-sectional and prospective cohort studies[4], especially the polyphenolic flavonoids in tea against cardiovascular disease[5]. The health-promoting effects of green tea are mainly attrib-

uted to its polyphenol content[6], particularly flavanols, which represent 30% of the fresh leaf dry weight[7]. Recently, many of the aforementioned beneficial effects of green tea have been attributed to its most abundant catechin, (-)-epigallocatechin-3-gallate (EGCG)[8], which has been proved to be a positive dietary component.

However, no association of habitual tea drinking and sexual activity has been found in the literature. Quality of life, including sexual function, has been widely evaluated in patients with cardiovascular disease, which mainly focuses on cardiovascular risk triggered by sexuality or impaired quality of sexual life due to anti-hypertensive drugs[9]. To our knowledge, the major chemical components of tea, such as catechin, polyphenol, caffeine, L-Theanine[8,9-11], have an effect on mood elevation or certain parts of the nervous system, initiating sexual desire. Flavonoids may improve endothelial function[12] so as to fight against erectile dysfunction.

Our previous research investigating the relationship of cardiovascular indices and sexual activity in hypertensive patients found that women who never drink tea showed less frequency, satisfaction and duration in sexuality compared to heavy tea drinkers[13]. As lifestyle factors are associated with sexual function, a hypothesis was proposed that tea drinking may perhaps play a role in sexual life as chemical components of tea have a certain effect on sex. The possible link between tea and sexual function are discussed in this paper. The health-promoting aspects of tea and its presumable potential effect on sexual life are briefly described, followed by evidence of the relationship between tea and disease, endothelial function and sex-related hormones. The effect of caffeine injections in animals on mating preference is also listed.

EFFECT OF TEA ON ENDOTHELIAL FUNCTION: AGAINST ERECTILE DYSFUNCTION AND THE POSSIBLE MECHANISM

A large number of clinical trials have demonstrated that tea is good for health in terms of the prevention and treatment for a range of diseases, such as cardiovascular disease[14], lung cancer[15], breast cancer[16], prostate cancer[17] and pathogenic microorganisms, *etc*. For example, tea consumption may be able to interrupt the chronic progress of atherosclerosis and thus prevent or delay the onset of ischemic stroke. Tea may also protect the artery wall by reducing blood pressure, inhibiting the migration of monocytes and smooth muscle cells to the atherosclerotic lesion, inhibiting proliferation of smooth muscles cells, and by improving endothelial function[12].

One cup of tea provides 150-300 mg flavonoids[18]. The mounting evidence that tea flavonoids can improve endothelial function and lower blood pressure has emerged in recent years. A report in 2006 showed that short-term administration of green tea in 20 young healthy smokers induced a rapid improvement of endothelial progenitor cell levels and flow-mediated endothelium dependent vasodilation. Green tea consumption may be effective in preventing future cardiovascular events in chronic smokers[19]. A Japanese study found that green tea consumption over short and long periods appeared to ameliorate endothelial dysfunction by scavenging free radicals with anti-inflammatory and anti-apoptotic properties in healthy male smokers[20]. Endothelial dysfunction has been associated with coronary artery disease and increased oxidative stress. Duffy *et al*[21] randomized 66 patients with proven coronary artery disease to consume black tea and water in a crossover design; they found that short- and long-term black tea consumption reverses endothelial vasomotor dysfunction in patients with coronary artery disease. Some antioxidants have been shown to reverse endothelial dysfunction and tea contains antioxidant flavonoids.

A proposed mechanism by which dietary flavonoids could affect flow-mediated endothelium dependent vasodilation is that they improve the bioactivity of the endothelium derived vasodilator nitric oxide (NO)[22] by enhancing NO synthesis or by decreasing superoxide-mediated NO breakdown. Flavonoids may increase endothelial NO production by stimulating Akt-mediated endothelial-derived NO synthase activity and additionally decrease levels of the vasoconstrictor endothelin-1[23,24]. A study recently reported the vasoconstrictor actions of exogenous endothelin-1 and methoxamine to be mediated by the RhoA/Rho-kinase pathway in the cavernosal circulation. While it is widely recognized that the nitric oxide-cyclic GMP-protein kinase G pathway mediates vasorelaxation and penile erection, the interaction between this pathway and the vasoconstrictor process remains to be fully elucidated. During erection, the vasoconstrictor action of methoxamine and endothelin -1 are inhibited and NO is likely to be responsible for this inhibition[25]. Erectile dysfunction in men over 40 years of age is usually of vascular (endothelial dysfunction) origin[26]. In other words, endothelial dysfunction is a causative factor in the development of erectile dysfunction. As flavonoids of tea may decrease erectile dysfunction occurrence as it may ameliorate endothelial dysfunction, we therefore hypothesize that long-term tea drinking may play a role in erectile dysfunction prevention.

POSSIBLE LINK WITH SEX-RELATED HORMONES: IMPROVING SEXUAL FUNCTION IN WOMEN

Although there are studies on the relationship between tea intake and biomarkers in animals, research on tea and sex hormones is sporadic. Green tea polyphenols have demonstrated to inhibit testosterone production in rat Leydig cells[27]. The latest research in the United States provides evidence that EGCG, the major polyphenol in green tea, a direct antagonist of androgen action and

blunts androgen receptor function in prostate cancer[28]. Data suggest that androgens are significant independent factors affecting sexual desire, sexual activity and satisfaction. For decades, physicians used various androgen preparations to improve sexual function in women[29]. However, data linking androgen levels to desire are inconclusive. There are some smaller studies that support the association between testosterone and libido. Turna *et al*[30] investigated a possible correlation between decreased androgen levels and the female sexual function index and found that decreased total testosterone and free testosterone levels were correlated positively with desire, arousal, lubrication and orgasm scores. In larger studies, the correlation between testosterone levels and sexual function has been reported to be minimal or nonexistent. In a large community-based, cross-sectional study of women aged 18-75 years, Davis and his colleagues found no significant association between low scores for any of the sexual domains evaluated and low serum total or free testosterone or androstenedione level irrespective of age[31], while black tea extract has protective effects on testosterone induced oxidative damage in the prostate[32]. In China, a population-based cohort study of 614 breast cancer patients was conducted and found that women who started tea drinking at 25 years of age or younger had a hazard ratio (HR) of 0.69 (95%CI: 0.41-1.17) to develop premenopausal breast cancer in comparison with non-tea drinkers. On the other hand, compared with non-tea drinkers, women who started tea drinking at 25 years of age or younger had an increased risk of postmenopausal breast cancer with an HR of 1.61 (95%CI: 1.18-2.20). Among premenopausal women, estrogens are converted from androgens mainly *via* aromatase in the ovary; it is conceivable that tea drinking may be more potent among premenopausal women in decreasing estrogen levels compared to those among postmenopausal women[33]. Nonetheless, there could be possible link of sex-related hormone change to tea intake.

TEA COMPOUNDS MAY STIMULATE SEXUAL DESIRE AND POTENCY THROUGH NEUROLOGICAL FUNCTION

Recent neuropharmacological research has suggested that certain constituents of tea may have modulatory effects on brain state[34]. Caffeine accounts for 2%-4% of tea. It benefits adaptation of mental energy by increasing alertness, attention and cognitive function and by elevating mood. It can be regarded as a pharmacological method to increase energy and effortful behavior in daily activities[10]. Caffeine is one of the major components of tea and the main alkaloid of coffee. Although coffee is a popular beverage in western countries, reports on the relationship between coffee intake and sexuality are limited. The earliest dates back to 20 years ago when Diokno *et al*[35] asked questions about sexual activity and its correlates in a clinical examination whose participants were identified by a household survey of the elderly, aged 60 years and over, on the medical, epidemiological and social aspects of aging. They concluded that consumption of at least one cup of coffee per day was significantly associated with a higher prevalence of sexual activity in women and with a higher potency rate in men. A related animal experiment was performed in 2005 to evaluate the effect of acute caffeine administration on paced mating behavior and partner preference in ovariectomized rats primed with estrogen and progesterone. They found that caffeine selectively increased visits to the male when physical contact was possible and the effects of caffeine on female mating behavior may reflect an increase in both sexual motivation and locomotor activity. The effects of caffeine on female sexual behavior may be mediated through the blockade of adenosine receptors in the medial preoptic area of the hypothalamus. This study is the first to demonstrate that the commonly used stimulant, caffeine, can affect female mating behavior[36].

In addition to caffeine, flavonoids are another component that may lead to enhancements in cognitive performance through increased brain blood flow and an ability to initiate neurogenesis in the hippocampus[37,38], which has a modulatory effect on sexual desire. Theanine is a characteristic component of tea. In particular, L-Theanine, a unique amino acid present almost exclusively in the tea plant, has recently received great research interest in neuroscience. It has been found to have neuroprotective[11] and mood effects, concluded both by subjective self-reports in questionnaires[39] and *via* psychological and physiological responses to stress in clinical trials.

New knowledge has emerged concerning the role of hypothalamic, limbic and brainstem structures, neuropeptides, brain monoamines and NO in the control of partner preference, sexual desire, erection, copulation, ejaculation, orgasm and sexual satiety. Studies of functional neuroanatomy and cerebral control of sexual function have found that the limbic system, including the hippocampus, dentate gyrus and cingulated gyrus, in relationship to the thalamus and hypothalamus plays an important role in emotional changes, memory and sexual behavior patterns[40,41].

CONCLUSION

Although tea is popular and consumed almost daily in Oriental populations, there is no research so far that has investigated the role of habitual tea drinking in sexual activity. There is no reason to refrain from tea for the enhancement of sexual life, in particular, in patients with certain medical conditions due to very small side effects. However, prospective studies or randomized clinical trials are required to test the possible link between tea consumption and sexual activity in order to confirm or refute our hypothesis that tea is favorable to sexual function. The precise nature of the relationship between tea

and sex remains to be determined before further clinical trials or basic research is carried out. Future studies on the underlying biological mechanisms should focus on the chemical components of tea that may have potential effects on sexual activity, assisted with epidemiology surveys based on population.

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