Tea and Human Health

- Physiological Effects of Tea - Jitters
- Effects of Pesticides and Fertilizers

Physiological Effects of Tea - Jitters

[Please note that the footnotes appear inline].

This report will answer two questions:

1) What do most people mean when they say "jitters"?
2) What causes "jitters?

Sometimes people experience “jitters” when drinking tea. This type of “jitters” is different from “coffee jitters” where people report experiencing shaky hands, increased heartbeat, bursts of energy. The experience of “jitters” from tea is somewhat different from “coffee jitters” as people tend to ask why they get jitters from tea (examples here, here, and here). Other times, you might hear people feeling “tea drunk”, a “buzz”, or a kind of “high” when drinking tea.

Some broad distinctions can be offered to better explain what we mean when people talk about physiological or sensory experiences with tea.

Sometimes the sensation of feeling jitters is more directly related to a caffeine rush. Some people have reported feeling shakes, dizziness, cold sweats, and heart palpitations. These kinds of sensations can happen when one is drinking tea on an empty stomach or from excessive amounts of drinking tea. In addition, people often mention caffeine and L-theanine in discussions about tea and physiological responses.

L-theanine is a non-protein amino acid that is found naturally in tea plants that contributes to the taste profile of tea (Vuong, 2011). The amount of L-theanine can vary depending on the type of the tea and brewing time (Keenan et al., 2011). The effects of L-theanine are associated health and cognitive benefits, and is often cited as a factor for feeling relaxed, but alert (Vuong, 2011). L-theanine has also been found to counteract the negative effects of caffeine (Vuong, 2011) which may explain why individuals do not often report feeling negative effects when drinking tea.

The reason for why some might experience jitters could be physiological imbalances between caffeine and L-theanine. The dosage amount of L-theanine needed to counter effects of caffeine is unclear. High amounts of L-theanine is not easy to achieve. For example, 150 - 250 mg of L-theanine would require drinking nine and 15 cups of tea per day (Vuong, 2011). Also, caffeine levels of a tea may depend on the geographic region and whether roasting processing was involved (Fu et al., 2024).

In other instances, people might be talking more about how the tea makes them feel or the

“energy” of tea. This sensation may sometimes be described as feeling “heavy”, “drugged, “euphoria”, “body feel”, “a high”, “blood flowing through the veins” or “getting smacked by a tea that’s too strong”. In a more poetic sense, the sensation can be described as an unspeakable sense of openness (Ma, 2023). This can be referred to as chaqi[pinyin: chá qì simplified:].

What is chaqi?[The idea of “Chaqi” sounds less scientific and more mystical in the way the concept is sometimes described. The idea of “chaqi” being mystical or scientific is a separate issue for the time being. From a western perspective, it’s easy to overthink the word having more connotations than it should.] No single definition can probably capture this concept, but some balance must be maintained. Too strict a definition means loss of information that contribute to experiences of understanding chaqi. Too loose a definition does not help either because anything can be considered chaqi. Language matters too because of the limitations in being able to translate descriptions of sensations across languages (e.g., Chinese to English).[I do not discuss further, but Traditional Chinese Medicine (TCM) cannot be ignored because the idea of is rooted in TCM. TCM also influences how tea is discussed as some might say green teat is “cold” and fermented/oxidized tea is considered “hot”.]

Discussions about what is and what is not chaqi are not always clear. The experience of chaqi can be somewhat subjective because individuals will have different responses to the same tea. Two points of consideration can help clarify what people mean when saying statements like “this has good chaqi”.

The first point of consideration is that chaqi can refer to the strength or power of the tea. These kind of descriptions are more directly related about the tea whether it is talking about the aroma, taste, liquor, and mouthfeel. They talk more about the quality of the tea itself. For example, an experienced tea drinker would probably understand the statement “a fresh Bulang is more aggressive than a Yiwu” or “Yiwu is more relaxing than a Bulang.” Both example statements are more commonly overhead in China in which chaqi is meant to refer to the body feel of the tea.

The second point of consideration is that chaqi can refer to the effects of tea consumption. This can refer to a change in mental state, such as feeling perceptive, mediative, or alert. This can also refer to changes in one’s physical state, such as sweating, blood rush, or increased heart rate. These effects are more dependent on the individual and can sometimes seem more subjective.
What are factors that contribute to why some people report difference sensation experiences?

The first is that certain types of teas seem to provide more chaqi than others. Sheng pu’er, shu pu’er, yancha, and dancong are types of teas often discussed in relation to chaqi. For example, it’s more common to hear about the chaqi from a pu’er tea than from a green tea. For example, a good aged sheng pu’er is sometimes described as being heavy, relaxing, and in a state of sedation. In contrast, a young sheng pu’er can be considered more “wirey” or “jittery” likely because these teas are fresh off production and have not had sufficient time to undergo years of fermentation. Some research also suggest chemical differences between sheng and shu pu’er due to processing differences and changes in bioactivity from the aging process (see Wang et al., 2022).

Second is whether the material is sourced from older or younger tea trees. Ancient tea trees[No clear standard definition, but generally refers to tea trees 100+ years.] then to have more chaqi

than terrace teas[Generally refers to teas planted at terraced or leveled land on mountain sides. These are cultivated tea bushes and typically planted neatly.]. One reason for the difference is because ancient tea trees have developed roots deep in the ground that have access and can absorb minerals and nutrients that contribute to the complex taste reported in tea (Hung, 2016). The same ancient tea trees are rarely disturbed by humans unlike terrace teas that require more intervention from humans. The age of the tree seems to explain why teas that use younger material don't provide as much body feel compared to teas that use older material.

In one study, experts could identify which pu'er samples were from ecological forests or terrace production stating the former has more of a bitter taste (Ahmed et al., 2010). When analyzing the phytochemicals of pu'er, the levels of Total Catechin Contents (TCC) and Total Methylxanthine Contents (TMC) were different depending on source material. In general, pu'er samples from ecological forests had higher mean TCC levels than pu'er samples from terrace plantations (Ahmed et al., 2010). Pu'er samples from terrace plantations had higher mean TMC levels than pu'er samples from ecological forests (Ahmed et al., 2010). Overall, these results demonstrate differences in chemical composition between teas from ecological forests of tea plantations.

The difference in chemical composition probably explain why people have different experiences when drinking pu'er tea. The sensation of only experiencing jitters or feeling caffeinated might stem from drinking pu'er made from terrace plantations that usually have low levels of total catechin and high levels of total methylxanthine which include caffeine. If one experiences a sort of "high" or chaqi, this might stem from pu'er made from ecological forests that usually have high levels of total catechin (Ahmet et al., 2010).

Summary

Defining people's physiological or sensory experiences with tea can be tricky for a number of reasons.

First, people may not have the sufficient vocabulary or experience to delineate differences, especially when much of the tea culture is built around training and defining taste and sensory experiences. The notion of articulating these experiences with specific terminology can be seen as too abstract or pretentious (Ma, 2023). In addition, concepts may not be easily translated or understood across languages which can create difficulties in describing these experiences.

Second, what is "jitters" can depend on what physiological or sensory experiences we are referring. At a basic level, one might define it as something more akin to a "caffeine rush" in which they are overstimulated. In another sense, one might be referring to the "high" or "buzz" that can be more abstract but often has more positive sensory associations. Still, in other cases, one might be talking more directly about the tea itself in terms of its strength. These descriptions are not always in isolation and can sometimes overlap in trying to describe the sensation.

Third, what factors affect these sensory experiences? Drinking tea on an empty stomach or drinking too much tea can contribute to negative sensory experiences. The type of tea can matter as certain teas like sheng pu'er, shu pu'er, yancha, and dancong lend to sensory experiences. In the case of pu'er tea, the source material from ancient trees of terrace plantations have different

chemical constituents which may explain why these teas lead to different physiological and sensory experiences. The aging process also matters as bioactivity levels change over time as part of the fermentation process.

References

Ahmed, S., Unachukwu, U., Stepp, J. R., Peters, C. M., Long, C., & Kennelly, E. (2010). Pu-erh tea tasting in Yunnan, China: Correlation of drinkers' perceptions to phytochemistry. Journal of Ethnopharmacology, 132(1), 176–185. https://doi.org/10.1016/j.jep.2010.08.016

Fu, Z., Chen, L., Zhou, S., Hong, Y., Zhang, X., & Chen, H. (2024). Analysis of differences in the accumulation of tea compounds under various processing techniques, geographical origins, and harvesting seasons. Food Chemistry, 430, 137000. https://doi.org/10.1016/j.foodchem.2023.137000

Hung, P.-Y. (2016). Tea Production, Land Use Politics, and Ethnic Minorities: Struggling over Dilemmas in China's Southwest Frontier. Springer.

Keenan, E. K., Finnie, M. D. A., Jones, P. S., Rogers, P. J., & Priestley, C. M. (2011). How much theanine in a cup of tea? Effects of tea type and method of preparation. Food Chemistry, 125(2), 588–594. https://doi.org/10.1016/j.foodchem.2010.08.071

Ma, Z. (2023). Making "Senses": The qualia of Pu'er tea and sensorial encounters between tea producers and traders in southwest China. Journal of Material Culture, 28(1), 40–62. https://doi.org/10.1177/13591835211066811

Vuong, Q. V., Bowyer, M. C., & Roach, P. D. (2011). L-Theanine: Properties, synthesis and isolation from tea. Journal of the Science of Food and Agriculture, 91(11), 1931–1939. https://doi.org/10.1002/jsfa.4373

Wang, S., Qiu, Y., Gan, R.-Y., & Zhu, F. (2022). Chemical constituents and biological properties of Pu-erh tea. Food Research International, 154, 110899. https://doi.org/10.1016/j.foodres.2021.110899

Effects of Pesticides and Fertilizers

This report will answer the following question:

What are known negative effects to humans (if any) when pesticides and fertilizers are used for tea?

I discuss fertilizers and pesticides separately and then discuss both in relation to tea farmers.

Fertilizers

Fertilizers play an important role in the cultivation of tea as they are highly-nutrient intensive. Tea plants are often picked for young leaves and shoots and constant harvesting of young leaves can deplete soil nutrients. Tea plantations have been adopting the use of chemical fertilizers, especially nitrogen fertilizers as results support that it can be effective in yield and quality production (Han et al., 2008; Kang et al., 2019). The use of fertilizers to increase yield production is reasonable to meet global demands for tea as natural gardens do not produce high yields. However, excessive fertilization can lead to environmental problems such as land degradation, soil acidification, and greenhouse gas emissions (see Kang et al., 2019). In fact, an overview of tea gardens in China found that overuse of chemical fertilizers was a common problem with over 30% of tea plantations suffering from excessive use (Kang et al., 2019).

To my knowledge, no research can be found on the effects of fertilizers in relation to human health. Most research focuses on the effects of fertilizer on the environment, crop yield, and quality of the tea (Kang et al., 2019; Raza et al., 2025). In this case, fertilizer use is likely to have an indirect effect towards human health as existing research supports that overuse of poor management can affect the production of tea (Kang et al., 2019; Raza et al., 2025).

Pesticides

Pesticides are often used to control for insects and pests, but pesticides usage can introduce toxicity and pollutants into the environment. Food safety standards have set maximum residue limits (MRLs) regarding the maximum amount of pesticide residues for various crops. MRLs are the maximum concentration of a pesticide residue expressed in milligrams per kilo (mg/kg) (FAO and WHO, 2025, p. 19). Countries and organizations can have different standards for what MRL values are considered acceptable.

In the case of tea, pesticides can be problematic without proper care. Unlike other fresh leaves, tea leaves are not typically washed of chemicals as tea leaves are manufactured directly after harvest (Fernandes et al., 2023). Pesticide residues can be left on tea leaves over time as certain types teas are valued for their aging process.

The research on the effects of pesticide residue on human health is mixed. Some research suggests that the risk of pesticide residues to human health are negligible (Feng et al., 2022; Yang et al., 2020). However, others call for more careful research of using pesticides in tea (Lu et al., 2020; Fernandes et al., 2023). Taiwanese researchers have found that pesticide residues from triazophos, carbofuran, and endosulfan pose significant risk to human health as these pesticides are known to be highly toxic and soluble (Lu et al., 2020). A review of existing papers found that the among the different types of Chinese teas, scented tea had the most heavy metal contamination that exceeded safety standards (Hu et al., 2023). Scented teas are often sprayed with chemical pesticides which explain the high amounts of heavy metals present in detection (Hu et al., 2023). In addition, the types and concentrations of pesticide use can vary which call for more studies regarding long term effects (Fernandes et al., 2023).

Tea Farmers and Fertilizer/Pesticide Use

In general, tea farmers may opt to avoid using pesticides and fertilizers.[1] In Kūnmíng, informants state that tea forests tend to grow well without the use of fertilizers and pesticides (Ma, 2018). In Jǐngmài, farmers report that they do not use fertilizers and pesticides as part of their management system (Li et al., 2023). In Fènghuáng, some farmers opt to use natural methods for deterring insects and producing their own fertilizers (Lin et al., 2022). The skepticism of using commercial pesticides and fertilizers is because of concerns that using chemicals will damage the biotic and abiotic parts of the ecosystem that are beneficial for the growth and quality of tea (Lin et al., 2022). As one farmer states:

"*I do not use those market-bought fertilizers because I am not sure what has been added to them. I compost and fertilize with soybean residue and the tea trees grow very well.*" (page 11, Lin et al., 2022)

Informants and farmers claim that using pesticides and fertilizers can have negative affects on the ecological system (Lin et al., 2022; Ma, 2018). In extreme cases, the abuse of chemical fertilizers and pesticides have lead to the death of tea tress in Fènghuáng (Lin et al., 2022). Evidence from tea plantations support that intensive management can lead to crops being more susceptible to pests and diseases, which in turn can ultimately harm the environment and human health (Yan et al., 2020).

Pesticides and fertilizers are often used in modern farming conventions and some evidence suggests these applications can affect the quality of tea. One recent paper examined the quality of five varieties of oolong tea under two different management systems (He et al., 2024). The first management system was an artificial tea garden that was naturally grown for 35 years without any artificial management, deep soil ploughing, or use of pesticides and fertilizers. The second was a conventional management system that involved cutting plantings, pruning management, conventional herbicide weeding, conventional pesticide use, and standard deep ploughing. They found that oolong varieties produced through conventional management system had higher aesthetic appeal and higher catechines compared to naturally grown varieties. However, naturally grown varieties were found to have better taste and aroma compared to varieties that were

conventionally managed.

Conclusion

Both fertilizers and pesticides are important in manging tea production as they have effects in the growth of tea and deterring unwanted pests. Fertilizers are not known to have negative effects on health health, and some evidence suggest that the effect of pesticide residue on human health is negligible. However, research has called for further investigation into investigated certain types of pesticides and long-term effects. Moreover, the overuse of fertilizers and pesticides can have negative effects on the surrounding ecosystem which thereby affect the quality of the tea.

References

FAO and WHO. 2025. Codex Alimentarius Commission Procedural Manual – Thirty-first edition. Rome. https://doi.org/10.4060/cd7978en

Feng, C., Xu, Q., Qiu, X., Jin, Y., Ji, J., Lin, Y., Le, S., Xue, L., Chen, Y., She, J., Xiao, P., Lu, D., & Wang, G. (2022). Profiling of pesticides and pesticide transformation products in Chinese herbal teas. Food Chemistry, 383, 132431. https://doi.org/10.1016/j.foodchem.2022.132431

Fernandes, I. de A. A., Maciel, G. M., Bortolini, D. G., Pedro, A. C., Rubio, F. T. V., de Carvalho, K. Q., & Haminiuk, C. W. I. (2023). The bitter side of teas: Pesticide residues and their impact on human health. Food and Chemical Toxicology, 179, 113955. https://doi.org/10.1016/j.fct.2023.113955

Han, W. Y., Ma, L. F., Shi, Y. Z., Ruan, J. Y., & Kemmitt, S. J. (2008). Nitrogen release dynamics and transformation of slow release fertiliser products and their effects on tea yield and quality. Journal of the Science of Food and Agriculture, 88(5), 839-846.

He, H., Jiang, Y., Su, C., Min, Q., Wu, W., Xie, K., Yue, L., Chen, Z., Lin, W., & Yi, P.-I. (2024). The quality difference in five oolong tea accessions under different planting management patterns in south Fujian of China. Frontiers in Agronomy, 6, 1304559. https://doi.org/10.3389/fagro.2024.1304559

Hu, C., Zhang, X., Zhan, N., & Liu, Y. (2023). Current Status and Health Risk Assessment of Heavy Metals Contamination in Tea across China. Toxics, 11(8), 662. https://doi.org/10.3390/toxics11080662

Li, W., Zhang, Q., Fan, Y., Cheng, Z., Lu, X., Luo, B., & Long, C. (2023). Traditional management of ancient Pu'er teagardens in Jingmai Mountains in Yunnan of China, a designated Globally Important Agricultural Heritage Systems site. Journal of Ethnobiology and Ethnomedicine, 19(1), 26. https://doi.org/10.1186/s13002-023-00598-0

Lin, X., Zhu, H., & Yin, D. (2022). Enhancing Rural Resilience in a Tea Town of China: Exploring Tea Farmers' Knowledge Production for Tea Planting, Tea Processing and Tea Tasting. Land, 11(4), 583. https://doi.org/10.3390/land11040583

Lu, E.-H., Huang, S.-Z., Yu, T.-H., Chiang, S.-Y., & Wu, K.-Y. (2020). Systematic probabilistic risk assessment of pesticide residues in tea leaves. Chemosphere, 247, 125692. https://doi.org/10.1016/j.chemosphere.2019.125692

Ma, Z. (2018). Sensorial Place-Making in Ethnic Minority Areas: The Consumption of Forest Puer Tea in Contemporary China. The Asia Pacific Journal of Anthropology, 19(4), 316–332. https://doi.org/10.1080/14442213.2018.1486453

Ni Kang, Liao Wan-you, Yi Xiao-yun, Niu Shi-yun, Ma Li-feng, Shi Yuan-zhi, Zhang Qun-feng, Liu Mei-ya, Ruan Jian-yun. Fertilization status and reduction potential in tea gardens of China. Journal of Plant Nutrition and Fertilizers, 2019, 25(3): 421-432. DOI: 10.11674/zwyf.18078

Raza, A., Li, L., Luo, L., Asghar, M. A., Shoaib, N., & Yin, C. (2025). Rational application of combined fertilizers improved tea growth and quality components. Journal of the Science of Food and Agriculture, 105(7), 3923–3930. https://doi.org/10.1002/jsfa.14181

Yan, P., Wu, L., Wang, D., Fu, J., Shen, C., Li, X., Zhang, Liping, Zhang, Lan, Fan, L., & Wenyan, H. (2020). Soil acidification in Chinese tea plantations. Science of The Total Environment, 715, 136963. https://doi.org/10.1016/j.scitotenv.2020.136963

Yang, J., Luo, F., Zhou, L., Sun, H., Yu, H., Wang, X., Zhang, X., Yang, M., Lou, Z., & Chen, Z. (2020). Residue reduction and risk evaluation of chlorfenapyr residue in tea planting, tea processing, and tea brewing. Science of The Total Environment, 738, 139613.

https://doi.org/10.1016/j.scitotenv.2020.139613

Footnote

[1]One consideration is the use of pesticides from the perspective of the tea industry. Generally, discussion of pesticides are often considered taboo. The reason is because admitting pesticide use can lead to negative stigmas of not buying your tea. The more pressing concern is farmers using pesticides and the lack of personal protective equipment (PPE). Will from Farmerleaf provides a thoughtful discussion here: https://www.youtube.com/watch?v=DNWZJTOBeDc

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