

Fingerprint of Tea

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Across geographies and cultures, people seem to share the belief that consumption of tea can deliver mental benefits, and may choose to consume a cup of tea when in need for these benefits. The objective of this thesis was to investigate whether there is any truth to these common beliefs; i.e., to further investigate whether the consumption of tea, and/or specific tea ingredients, can be linked to acute mental benefits, specifically cognitive and affective benefits, using validated scientific measures. In this addendum, I discuss the relevance of the current findings, the key target audiences to which findings are of interest, and describe a number of applications.

Relevance

The acute mental benefits of tea are highly relevant in this day and age of high cognitive and emotional demand. People constantly seek for things that make them feel and perform better, for example in terms of job performance, managing work-life balance and social commitments.

Cognitive benefits

As seen in **Chapters 2 to 4**, the cognitive benefits of tea consumption predominantly manifest themselves in terms of improved attention. The human brain has limited information processing capacity. Therefore, our brain is unable to deal with all the input that is continuously received externally, through its sensory systems (e.g., vision, audition) and internally, through cognitive processes (e.g., memory, reasoning). Attention is an essential aspect of cognitive functioning, because it allows our brains to effectively deal with the continuous and complex input in spite of our limited capacity to process information. As such, it is an important prerequisite for many other cognitive processes, such as memory and reasoning. Consequently, when attention is disrupted, this has profound consequences for everyday functioning. As such, the benefits of tea consumption, and consumption of theanine in combination with caffeine, on attention as seen in this thesis are relevant in the very broad context of everyday cognitive functioning.

Affective benefits

Moreover, for the first time, in this thesis tea consumption has been shown to generate immediate short-term and subtle improvements in mood. As indicated in **Chapter 5** and **6**, these findings are of importance not only to the research on the benefits of tea, but also to the research on (inductions of) positive mood in general. Improvement in mood have been related to longer-term well-being, motivational and cognitive benefits (e.g., Fredrickson, 2001; Lyubomirsky, King, & Diener, 2005). Also, positive affect has been shown to improve cognitive processes such as global information processing (Clore & Huntsinger, 2007) and creativity (Baas, De Dreu, & Nijstad, 2008). Thus, while simple everyday activities such as tea preparation and consumption may improve mood, this may also in turn affect cognitive processes, via these improvements in mood.

Target audience

Findings can be relevant to different audiences, as explained below. Firstly and most obviously, findings are relevant to scientists researching the mental benefits of tea and tea ingredients. This thesis brings together some of the previous work in the form of two reviews, confirming that the consumption of black tea (ingredients) has consistent benefits for attention performance (**Chapters 2** and **4**). Moreover, we conducted a study to replicate and extend effects of a combination of theanine of caffeine on attention (**Chapter 5**), and two studies to explore immediate effects on mood, which were to date not yet researched (**Chapter 5** and **6**). Moreover, by demonstrating benefits that stretch beyond attention and subjective alertness, and beyond an ingredient-driven mechanism, this thesis opens up novel opportunities for research, particularly around the consumption experience and the context of tea consumption, in relation to mood.

Secondly, the findings are generally relevant to researchers who investigate the effects of food and beverages consumption, particularly with respect to affective benefits. Many people report to eat, drink, or smoke to feel good (Bennet, 1988), but researchers have struggled to find ways to support some of these effects scientifically. Immediate effects of palatable foods on the reduction of negative feelings are well established (Köster & Mojet, 2015). With regard to beverages, researchers typically assessed emotional responses in relation to novel drinks (i.e. Kuenzel, Barton, Blanchette,

Zandstra, Thomas, & El-Deredy, 2010; Orjuela-Palacio, Zamora, & Lanari, 2014) or different versions of a similar drink (Gutjar, de Graaf, Kooijman, de Wijk, Nys, ter Horst et al, 2014), rather than emotional responses to familiar and common beverages, such as tea. In line with the model set-forth by Desmet and Schifferstein (2008), our research demonstrates the importance of different sources of food emotions (i.e. sensory attributes, experienced consequences, anticipated consequences, personal or cultural meaning, and actions of associated agents), and the need to further investigate these in the context of consumption.

Thirdly, findings presented in this thesis are relevant to scientists who investigate ways of inducing positive affect, and the benefits thereof. Positive affect can be induced by listening to music, recalling happy memories, moment of gratitude, and the research presented in **Chapter 5 and 6** of this thesis adds the simple everyday activity of drinking a cup of tea to that list. Moreover, increasing positive affect has been shown to promote positive, favorable characteristics, motivations and behaviours, and build enduring personal and cognitive resources (Lyubomirsky, King, & Diener, 2005; Fredrickson, 2001). Hence, it is of interest that the improvements in mood seen after consumption of a cup of tea may lead to immediate behavioural and motivational benefits, such as improved creativity and interest.

In addition to the scientific relevance of the research questions, its impact also extends beyond academia. Firstly, findings are highly relevant to (fast moving consumer goods) companies that produce and market tea and tea-based beverages. As such, these findings are relevant to Unilever, which markets tea and tea-based beverages under a number of brands, the biggest being the Lipton® brand. Last but certainly not least, findings are also of relevance to tea consumers across the world. These consumers may already see tea as their beverage of choice, whether or not due to experience with its mental benefits, and feel comforted in their choice by these findings. Or, they may choose to drink a cup of tea more often now, knowing that it could give rise to some much sought after benefits in a natural way.

Application

We can distinguish a number of concrete application activities with regard to the different findings from this thesis, in terms of communication (i.e., to the scientific community, to health influencers and/or to consumers) but also in terms of product development and improvement.

Scientific communication

Naturally, publication of the work reported in this thesis increases the scope of the scientific evidence on mental benefits of (black) tea consumption, as well as the credibility of earlier work in this area. Moreover, it enables strategic opportunities to communicate research findings to key scientific audiences at conferences and in direct interactions. Finally, it may also stimulate further research into this specific scientific area.

Communication to health care professionals

These findings can also be used for communication to health care professionals, in order to increase their knowledge of tea and its potential benefits. Unilever's health care professional program, for example, includes the communication of work from Unilever researchers as well as affiliated researchers, on benefits of tea and tea ingredient consumption for health, mood and wellbeing, and performance, through symposia, newsletters and direct interactions.

Work reported in this thesis has been used for such communication purposes. For example, the research in **Chapter 3** was presented during the 4th Tea Science Symposium (Jakarta, Indonesia in 2010), organised by Unilever. Also, during the 5th International Symposium on Tea & Human Health (Washington DC, USA in 2012) sponsored by Unilever, we presented the outcomes of the review of studies published as **Chapter 4**. Moreover, the research reported in **Chapter 4** and **5** has been included in Unilever newsletters on the topics of “*Scientific update on tea and attention*” (2012), and “*Scientific update on the psychological benefits of black tea*” (2013).

Communication to consumers

Finally, research from this thesis was and will continue to be used for consumer-oriented communication, either directly via on-product communication or advertising, or indirectly via the media.

The findings reported in **Chapter 4** for example, were presented during a media event at the Food & Nutrition Conference & Expo (FNCE; Houston, USA in 2013). Here, Lipton® hosted a 1-hour session with journalists and bloggers, presenting scientific evidence to support the launch of a new product (Lipton® Natural Energy tea). Also, the research in **Chapter 5** has been actively communicated via Unilever press releases linked to the scientific publications. Finally, on other occasions, publications were deemed relevant by the press, resulting in popular media coverage of our work, i.e., the publications shared in **Chapter 3** and **4**.

Product development

Finally, the research presented in this thesis could also leverage innovative opportunities to increase the cognitive and affective benefits from tea consumption, by optimizing the key contributing factors.

Conclusions

The findings presented in this thesis show clear relevance. It shows that consumption of a relatively common product such as black tea, can generate benefits for attention and mood, as well as taking initial steps in understanding what such mood benefits could potentially mean for subsequent behavior and performance. Moreover, these findings are relevant to a number of different audiences, both scientific and commercial. Finally, findings have been and will continue to be applied in order to stimulate communication, research and product development activities for (black) tea.

ADDITIONAL REFERENCES

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