coffee&health

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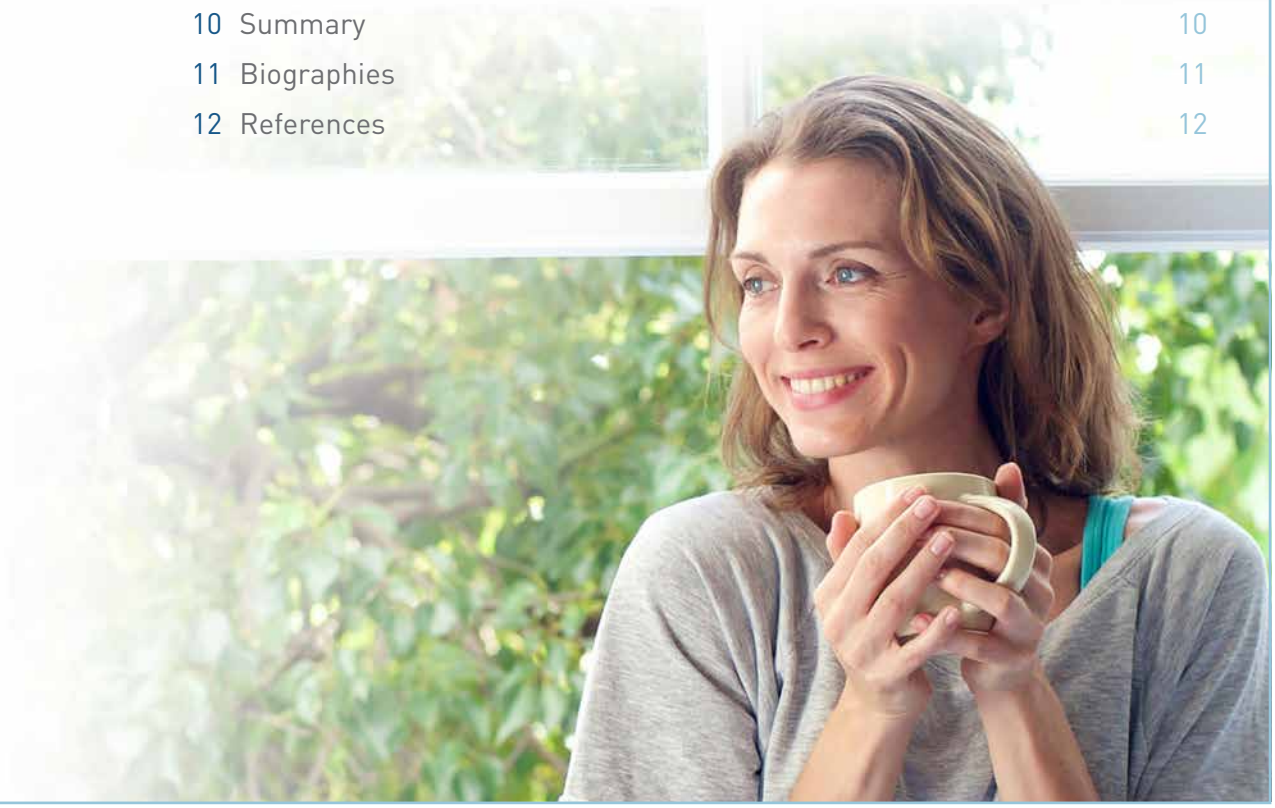
EXPERT REPORT

The good things in life: coffee, mood and emotion

Contents



Introduction

As one of the most-consumed beverages in the world, coffee's physiological effects have been thoroughly researched for decades. However, coffee's impact on mood and emotion is an emerging field of study. Indeed, the scientific community has struggled somewhat to define the terms 'mood' and 'emotion', and objective measurement of either emotion or mood is challenging. This report explores the science relating to the possible connections between moderate coffee consumption, mood and emotion, and considers the potential effects in both healthy populations, and in a subset of individuals with diagnosed depression.

Expert panel on coffee, mood and emotion

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Foreword

By Dr Crystal Haskell-Ramsay, roundtable moderator

Caffeine is a complex compound and arguably one of the most researched components of the diet. There is convincing scientific research, for example, to show that moderate caffeine intake helps to improve alertness and attention (concentration). The European Food Safety Authority has concluded that a cause and effect relationship can be established between a 75mg serving of caffeine (a typical cup of coffee contains around 75–100mg caffeine) and both increased attention and alertness. However, difficulties experienced in measuring our moods and emotions mean that this is a challenging area to study in detail. Expectation and belief associated with the consumption of a cup of coffee may also affect the outcome of a study — an additional difficulty. Yet despite these challenges, our understanding of coffee's effect on our moods and emotions is improving. Just as every individual's moods and emotions are unique to them at a time point, there are many factors that affect an individual's response to coffee. An individual's genetics, for example, can change the way they experience coffee.

This report discusses a selection of the relevant science, looking at what we currently know about coffee's effect on mood and emotion, considers the potential mechanisms behind the observed effects, and highlights some interesting areas for future research.

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Associate Professor and Associate Director
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Defining mood and emotion

The roundtable began with Dr Coppin's insights into current scientific definitions of both mood and emotion, highlighting the difficulties in defining and studying terms that are often casually used in everyday conversation, yet highly subjective in their meaning.

Mood is defined as an affective state that is experienced without concurrent awareness of its origin. Mood can have a social, cognitive or physiological basis, although an individual may not always be able to pinpoint the actual cause of any given mood state. Typically, moods are relatively long-lasting, ranging from a few hours to several months[1,2]. Mood is notoriously difficult to measure objectively.

In contrast, emotions are relatively short-lived, lasting only seconds or minutes. Emotions are a particularly individual response, as they are triggered and differentiated by a person's subjective interpretation of the personal significance of an event[2,3]. An event that an individual does not consider important will not elicit emotional reactions, whilst one of great significance will[2,3]. For example, a person with a fear of flying will become anxious when boarding an aeroplane, while to a person with no such fear, the 'event' of boarding a plane will not elicit the same emotional response. It is also important to consider that the same situation does not always elicit the same emotional response in an individual. For example, a person who has confidently boarded many flights may then become anxious when boarding if they have been told to expect bad turbulence.

Although difficult to measure, the manifestation of emotional responses encompasses a number of responses[3]:

- **Emotional expressions** — such as smiling, frowning
- **Action tendencies** — i.e. how likely it is that the person will approach or back away from the cause of the emotion (a person is likely to move away from something that elicits fear, but towards something that elicits happiness)
- **Bodily reactions** — such as blushing, sweating, increase in heart rate
- **Subjective feeling** — a person's conscious appraisal of the emotion they feel, such as 'happy' or 'sad'
- **Appraisal** — how a person evaluates the situation

Mood, emotions, food and drink

"Mood and emotion can influence food intake, but likewise, food intake can influence mood and emotion. Considering the former first, a person may 'comfort eat' when upset[4], for example; or be offered a cup of coffee or tea to 'cheer them up'. In contrast, food intake may affect mood and emotion; research suggests that low blood sugar levels could increase feelings of tension in a person when hungry[5].

Research has shown that social aspects also affect food consumption. Social facilitation increases food intake, meaning that we may eat more in the presence of others, such as at a family dinner[6]. In contrast, eating in the presence of someone we admire leads to modelling — potentially reducing our food intake to match theirs[6]. We may also reduce food intake because of impression management — modifying eating behaviour in order to create a particular impression — if feeling watched or judged by others when eating[7]."

Dr Géraldine Coppin

Coffee, caffeine and mood

Coffee is a well-studied component of the diet, with many studies evaluating the effect of caffeine consumption on the body.

A number of studies demonstrate that moderate caffeine intake helps to improve alertness and attention (concentration). The European Food Safety Authority (EFSA) has concluded that a cause and effect relationship can be established between a 75mg serving of caffeine (a typical cup of coffee contains around 75–100mg caffeine) and both increased attention and alertness[8].

A review by A. Nehlig suggests that repeated administration of 75 mg of caffeine (the equivalent of one cup of coffee) every four hours can result in a pattern of sustained improvement of mood over the day, however high intakes may be associated with an increase in tense arousal including anxiety, nervousness and jitteriness[9]. A dose-related improvement in subjective measures of calmness and interest were found after consuming caffeine, suggesting that mood improvement may depend on baseline arousal[9]. Highly-fatigued subjects may be more likely to experience larger subjective mood changes than non- or moderately-fatigued subjects[9].

Of interest is the difference in the effect of caffeine on alertness in those who regularly drink coffee compared to those who do not, as research suggests that the response to caffeine intake is moderated by habitual intake. At baseline (typically the start of the day before consumption of any caffeinated beverages) coffee drinkers have a lower state of arousal, possibly linked to a small degree of withdrawal following overnight abstinence from caffeine[10]. Consumption of 75–100mg caffeine increases alertness in both habitual and non-habitual consumers but the effect on mood is enhanced in those who habitually consume caffeine[10].

Expectation and belief

Dr Haskell-Ramsay explained that the expectation of drinking a caffeinated beverage, particularly in the morning, can have a major impact on mood. In a research setting, participants in a study who are told to avoid caffeinated beverages on the morning of the study itself may show a change in mood simply because they are not consuming a coffee at their usual time of day. In fact, Dr Haskell-Ramsay referenced the fact that studying mood in relation to coffee intake is difficult, since participants are aware that they have abstained from coffee and as mood is subjective, any expected effects of withdrawal will impact on study outcomes.

"According to these study results, alertness can be increased simply by believing a beverage contains caffeine[11,12]."

Belief is also a key consideration, and complication, in the study of coffee consumption on mood and emotion. Dr Haskell-Ramsay cited research that has shown an increase in subjective alertness in study participants who believed they were drinking a caffeinated beverage, but were actually drinking a non-caffeinated beverage. In contrast, participants in the same study who believed they were drinking a non-caffeinated beverage, but were actually drinking a caffeinated beverage, showed no change in their subjective alertness. According to these study results, alertness can be increased simply by believing a beverage contains caffeine[11,12]. As an element of the effect of coffee consumption may be driven by the belief that one is consuming caffeine, researching this area can be complicated.

Research has considered feelings of 'jitteriness' or 'anxiety': in one study, these feelings increased with a higher intake of caffeine in habitual consumers[10]. However, an earlier study's results found that a higher consumption of caffeine seemed to cause more jittery feelings in coffee abstainers than in regular drinkers[13]. This difference is potentially explained by a genetic polymorphism or variation, which leads to an increase in anxiety following caffeine consumption in those who have a specific genotype group[14]. Dr Haskell-Ramsay's research has suggested that a person's tolerance for caffeine could be increased by regular consumption of caffeine[15].

Role of compounds

Caffeine plays a recognised role in the effect of coffee on alertness: however, other compounds may be involved in coffee's effects on mood. Dr Haskell-Ramsay noted that aside from caffeine, the other components of coffee are less well-researched and so no conclusions can be drawn from the current literature. However, research into compounds in other caffeinated drinks is worthy of note: theanine, an amino acid found in tea, may work in combination with caffeine, with one study showing a synergistic increase in alertness[16]. Research on cocoa has suggested that some intake levels result in cognitive improvements, which has been attributed to compounds including polyphenols[17]. This is of interest to coffee intake too, as coffee itself contains significant amounts of polyphenols.

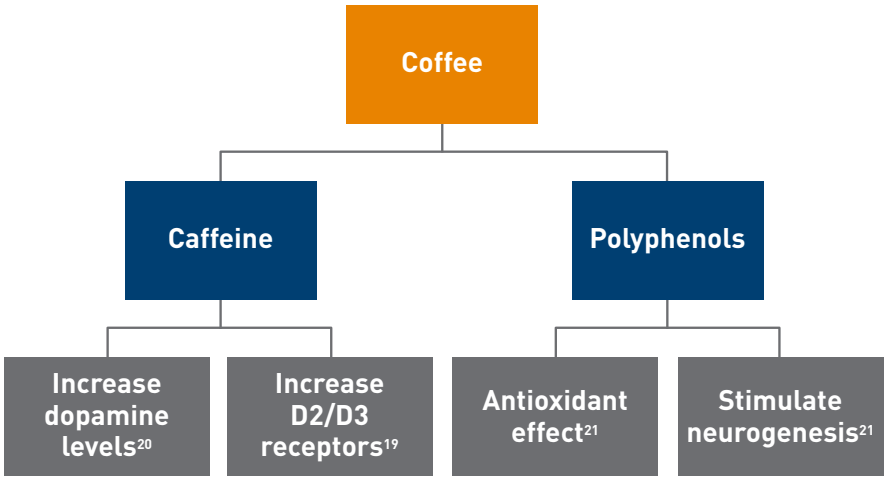
Coffee intake and reduced risk of depression

Specific research has considered the impact of coffee and caffeine consumption on a particular health condition, namely, depression. Dr Grosso explained that while current research of an association is limited, a systematic review of observational studies does suggest that the risk of developing depression decreases with moderate intake of coffee (equivalent to approximately 3–5 cups a day)[18]. The association can be explained with a 'J' shaped curve, showing lower risk at moderate intakes but no additional benefits with higher intakes. Dr Grosso commented that when comparing data on coffee intake and total caffeine intake, the results suggested that the effect of coffee may be modulated by compounds in coffee other than caffeine[18]. Researchers such as Dr Grosso are keen to explore the potential connection between nutrition and health outcomes in more depth to gain knowledge of what is currently only a suggested association, and to understand the exact mechanisms at play.

Dr Grosso suggested that, aside from caffeine, other mechanisms may also be associated with a reduced risk of depression: dopamine, for example, is a neurotransmitter that helps to control the brain's reward and pleasure centres and also helps to regulate emotional responses[19,20]. Caffeine intake increases dopaminergic tone, potentially through an increase of dopamine levels in the body and the amount of dopamine receptors[19].

Coffee and Depression

Potential mechanisms of action of coffee consumption and risk of depression



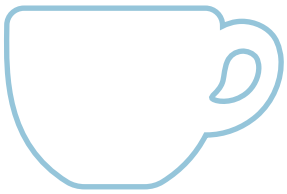
Discussing the hypothesised mechanisms behind the association between coffee and depression, Dr Grosso highlighted the importance of the polyphenols found in coffee, as they show an antioxidant effect, potentially helping to reduce the inflammatory response. Polyphenols may also be involved in stimulating neurogenesis, improving the functionality of neurons[21]. Depression is often associated with a reduced plasticity in the central nervous system and thus the stimulation of neurogenesis could be helpful[21].

Dr Grosso pointed out that the most important confounding factor when reviewing associations between caffeine and depression is study participants' smoking status. He stressed the importance of controlling for smoking status when reviewing data and drawing conclusions[22].

Future research

Caffeine in coffee is a well-recognised, important compound when researching the effects of coffee on mood and emotion. However, some newer theories have hypothesised that other compounds in coffee, notably polyphenols, could also be a mechanism behind some of coffee's effects. Dr Grosso put forward the suggestion that if polyphenols do have a positive effect on reducing depression risk, more research will be needed to understand which polyphenols cause this effect — and this could ultimately help people choose diets that are naturally rich in those polyphenols. He also suggested that further research may even reveal that the caffeine in coffee may act as a 'tool' that increases the benefits of the polyphenols. Dr Coppin also discussed the need for more understanding of the behavioral and psychological factors that also affect mood and emotion, to ensure that when conducting research into coffee, these factors are taken into consideration. Dr Haskell-Ramsay added that even within scientific circles, the definitions of 'mood' and 'emotion' are not always well-understood.

The panel also noted that although individuals have different responses to coffee (based on factors such as genotype, age, or consumption patterns), overall, the general population tend to be adept at moderating their coffee intake to suit their personal comfort levels (e.g. self-regulating intake to avoid jitteriness). However, they also commented that specific intake advice is required for particular groups, including pregnant women[23] and those who are slow caffeine metabolisers. A moderate intake of coffee (equivalent to about 3–5 cups a day)[8] has been associated with a number of effects on mood and emotion, notably, increased alertness for healthy individuals; as well as potentially reducing the risk of depression for diagnosed individuals.



"A moderate intake of coffee (equivalent to about 3–5 cups a day)[8] has been associated with a number of effects on mood and emotion."

Summary

Although the effect of coffee intake on mood and emotion is difficult to study, as coffee drinking is part of an ingrained daily ritual for many, there is convincing evidence that a moderate intake of coffee improves alertness and attention, and is associated with increased feelings of pleasantness and reduced feelings of anxiety. When studying the effects of coffee, researchers have to be conscious of the fact that disrupting the daily routine, particularly at the start of the day, may affect mood and emotion, irrespective of coffee consumption's physiological effects. Likewise, the expectation of consuming caffeine has been shown to affect mood and emotion, even if no caffeine has actually been drunk.

The mechanisms behind the observed effects are likely to include a role for caffeine but also for other compounds present in coffee, including polyphenols, although further research is required in this area.

About ISIC

The Institute for Scientific Information on Coffee (ISIC) is a not-for-profit organization, established in 1990 and devoted to the study and disclosure of science related to "coffee and health." Since 2003 ISIC has also supported a pan-European education programme, working in partnership with national coffee associations in nine countries to convey current scientific knowledge on "coffee and health" to health care professionals.

ISIC respects scientific research ethics in all its activities. ISIC's communications are based on sound science and rely on evidence and scientific studies derived from peer-reviewed scientific journals and other publications.

ISIC members are six of the major European coffee companies: illycaffè, Jacobs Douwe Egberts, Lavazza, Nestlé, Paulig, and Tchibo.

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Biographies

Dr Crystal Haskell-Ramsay is an Associate Professor and Associate Director of the Brain, Performance and Research Centre at Northumbria University, UK. Her current research interests lie primarily in the biobehavioural effects of caffeinated plants, such as tea, coffee and cocoa. This extends from her doctoral thesis, which examined the behavioural effects of caffeine in isolation as well as in combination. Her research also covers neurocognitive, mood and haemodynamic effects of a number of other food components and supplements including (poly) phenolic compounds present in berries, micronutrients and herbal extracts.

Dr Géraldine Coppin is a senior researcher and lecturer in affective psychology at the University of Geneva and at the Swiss Center for Affective Sciences. She has a PhD in psychology and affective sciences and worked at the John B. Pierce Laboratory, Yale University and the Max Planck Institute for Metabolism Research in Cologne, Germany, before returning to the University of Geneva. Dr Coppin studies the psychology and neurosciences of chemosensory perception (i.e. olfactory and flavour perception) and food intake. Her research includes the investigation of behavioural and neural correlates of food preferences and choices in healthy individuals as well as in clinical populations, i.e., overweight and obese individuals, patients with type 1 diabetes and patients with olfactory and/or gustatory disorders.

Dr Giuseppe Grosso is a Research Fellow at the Integrated Cancer Registry, Azienda Ospedaliera Universitaria Policlinico Vittorio Emanuele, Italy and a Senior Collaborator at NNEdPro Global Centre for Nutrition and Health, St John's Innovation Centre, Cambridge, UK. Dr Grosso's research focuses on evidence-based nutrition, a recently-emerged field of Health Technology Assessment applied to food and nutrition. His main interests include the impact of dietary and lifestyle habits on common non-communicable diseases. In particular, he has produced over 80 papers on the effects of dietary patterns (i.e., Mediterranean diet) and specific antioxidant-rich foods (i.e., coffee, tea), as well as individual antioxidants (polyphenols, n-3 PUFA) on cardiovascular and metabolic diseases, cancer, and depression.

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