

## Coffee and Mental Performance throughout the day

### Overview

Coffee is one of the world's most popular beverages. It is primarily enjoyed for its taste and aroma, but also for its well-known positive effect on mental performance. Drinking coffee has been demonstrated to improve an individual's alertness and concentration so aiding better performance and also helping reduce the feeling tiredness or lethargy.

The key ingredient demonstrated to be responsible for enhanced mental performance is caffeine, which is naturally contained in coffee but also in tea and cocoa.

A wide range of studies have shown that caffeine improves mental performance. (Casas et al. 2004., Fredholm et al. 1999., Smith et al 2002., Smith et al. 2004) It helps maintain a high level of attention for longer periods and improves attention span in some individuals.

### Brain Function

"Cognitive function" is a general term that is used to describe a great variety of different brain processes which help us to understand, evaluate, store, and use information from the world around us. Our brains process these external triggers together with our personal experiences, including memories, and thoughts, enabling us to react to everyday circumstances. (Schmitt et al. 2005)

### The role of caffeine on brain or "cognitive" function

After drinking a cup of coffee, caffeine is rapidly and efficiently absorbed from the digestive system and starts to work in the body just 20 minutes after consumption and the effects may last for several hours. (Fredholm et.al 1999., Nehlig et al. 1992)

The stimulating effects of caffeine have been extensively studied. They are due to caffeine's ability to block adenosine receptors. Adenosine inhibits the release of most brain excitatory neurotransmitters; and thus eventually results in reduced arousal and increased sleep.

Caffeine works by blocking the adenosine receptors and increases the activity of the central nervous system, which improves mental alertness. (Nehlig et al. 1992., Fredholm et al. 1999., Davis et al, 2003., Daly et al. 2004; Fisone et al. 2004., Tieges, 2007)

### **Increased alertness**

Each one of us at some point has experienced the “pick-me-up” effect of a cup of coffee. Scientific studies show that caffeine or caffeinated coffee stimulates brain activity. (Lorist et al. 2003., Lorist et al. 1994) The specific effect of caffeine on alertness was demonstrated for a variety of activities and mental performance tasks, such as reaction time, (Smit et al. 2000) choice reaction time (Smith et al. 1999) and selective visual search tasks. (Lorist et al. 1994; Lorist et al. 1996., Ruijter et al. 1999; Ruijter et al. 2000)

The beneficial effects of caffeine on increased alertness are provided in a regular serving of coffee (60-100 mg of caffeine). Higher intakes of caffeine do not necessarily result in further increased alertness. (Smit et al. 2000., Quinlan et al. 2000)

The impact of caffeine on increased alertness is especially marked for individuals with decreased attention levels. Decreased fatigue and increased alertness following caffeinated coffee consumption has been shown in the context of several everyday situations:-

- Maintaining day-time alertness levels at night (Smith et al. 1993) or even reducing tiredness following a night without sleep (Lorist et al. 1994)
- Improving driving performance at night and decreasing the onset of sleepiness (Sagaspe et al. 2007)
- Restoring normal alertness level when suffering from a cold (Smith et al. 1997)
- Reducing the post-lunch dip in alertness (Robelin et al. 1998)
- Maintaining sustained attention over long working sessions e.g. when studying (Smith et al. 1999)

By improving alertness and reducing fatigue, the caffeine in a cup of coffee may be beneficial in our everyday lives. (Smith 2005)

### **Decreased reaction time and improved information processing**

Decreased reaction time after caffeine consumption has also been consistently demonstrated by a range of studies. Decreased reaction time is usually related with an improved selective attention, meaning that the mind is focusing narrowly on the task and selects the information faster, (Smith et al. 1999., Lorist et al. 1994, 1996., Ruijter et al. 2000) demonstrating increased performance in the selection of relevant information.

Several authors report improved information processing after caffeine consumption. The benefit seems mainly due to improved input processing, both in terms of increased speed as well as increased amount of information processed. (Lorist et al. 1994., Smith et al. 1999., Ruijter et al. 1999) One aspect which was noticeably improved is the selection of relevant information (Lorist et al. 1994., Ruijter et al. 2000) as well as the encoding of new information, (Smith et al. 1999) and possibly more profound information processing. (Ruijter et al. 2000)

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All these benefits are extremely useful in everyday life where we face a continuous flood of all kinds of information, which need to be quickly sorted for their relevance to us.

We've all enjoyed a coffee break as refreshment, but also because it can improve our mood. Taking a break and enjoying talking to family, friends or work colleagues is an important part of our daily routine. Part of the benefit of taking a break has been shown to be linked to the effect of caffeine on the brain and the positive impact on mood. Studies reported increased contentedness, lower anxiety, more self-confidence and higher motivation to tasks after consumption of the equivalent of 1 cup of caffeinated coffee. (Fredholm et al. 1999; Quinlan et al. 2000., Lieberman 2001., Smith et al. 2004., Casas et al 2004., Van Gelder et al. 2007., Ritchie et al. 2007)

In summary, research bears out what most people experience everyday. A delicious cup of caffeinated coffee improves mental alertness and helps us perform our everyday tasks with greater focus and attention and helps reduce tiredness. Moderate coffee consumption is therefore a satisfying way of helping us cope with the demands we experience in our daily lives.

### **Early Morning**

A cup of coffee first thing in the morning is one of the most popular ways of starting the day, and the caffeine in that first cup of coffee can make you feel more alert and ready to face the challenges of the day ahead. That cup of coffee can also contribute to our daily fluid intake and help keep us hydrated which is essential for health and well-being. (Ganio 2007)

We all know what it is like to get back to our desks or other work places after lunch and to suddenly feel lethargic. Its not just your imagination, you are experiencing what is commonly called 'the post lunch dip', which is actually nothing to do with lunch at all. The bodies "circadian rhythm" (often known as our body clock) has high and lows throughout the day and night, and one of the lows is around 2.00pm; hence the 'post lunch dip'. A cup or two of coffee is not just an excuse to put off the task in hand! The caffeine in your coffee helps to restore levels of alertness, improving performance and mood, just what we all need to get through the second half of the working day. (Smith et al.1990., Ruxton 2008)

At some stage in most people's lives we are required to take a long car journey which can cause tiredness. Several studies have shown that the caffeine in one or two cups of coffee and a short 15 minute nap are the most effective counter measures to alleviate driver fatigue. (Horne et al. 1996., Philip 2006., Sagaspe et al. 2007., Anund et al. 2008) Advice given by road traffic organisations to tired drivers is to pull over, have one or two cups of coffee or other caffeine containing beverages and a short nap before continuing your journey feeling refreshed and alert.

## Jet Lag

Jet lag happens when we disrupt the normal “circadian” rhythms that help us wake up in the morning and go to sleep at night. Flying across different time zones, whether on business travel or on holiday, plays havoc with these normal “circadian” rhythms, so anything that we can do to minimise the impact is well worth considering. One of the easiest, and most effective, things we can do is to drink a cup of coffee when we reach our destination. ‘Caffeine is a stimulant that is widely used to maintain alertness’ (Waterhouse et al. 2007). The caffeine will increase our alertness and enable us to keep going through the day, and as coffee is an important source of fluid in the diet this will also help to re-hydrate us after our journey.

Many people compare the effects of shift work to permanent “jet-lag” but without the benefits of a holiday to look forward to at the end of it! In fact, moving from a day to night shift has a similar effect on the body to taking a flight across eight time zones. People are not naturally nocturnal animals. A person’s normal body rhythm involves sleeping at night. If this rhythm is ignored this could have implications for health, safety and efficiency. Studies have shown that the caffeine in a cup or two of coffee can combat symptoms experienced by many night shift workers, such as the tendency to be less attentive and being slower in making responses. (Boivin et al. 2007., Smith et al. 1993) Military personnel who are frequently required to undertake sustained operations that do not permit regular sleep and rest patterns also experience the benefits of increased alertness from caffeine. It has been shown that caffeine maintained both vigilance and physical performance during sustained operations that required periods of overnight wakefulness and restricted opportunities for sleep during the day. (McLellan et al. 2007)

## Conclusion

Coffee is one of life’s pleasures – enjoyed by billions of people around the world every day. It is clear that for the majority of healthy adults coffee can be enjoyed in moderation (4 to 5 regular size cups a day) helping maintain important body fluid levels as well as increasing alertness; and keeping us going throughout the day.

## Frequently Asked Questions

**Q: Is it true that the caffeine in coffee can help increase levels of alertness and attentiveness?** A: Yes. Many well-conducted studies demonstrate the effects of caffeine in coffee and other beverages and increased alertness.

**Q: Can drinking coffee lead to better work performance?** A: Yes. As the caffeine in coffee helps enhance alertness and attentiveness, this can lead to better performance at work.

**Q: What about mood, I have read somewhere that caffeine improves mood, is this true?** A: Yes. Caffeine impacts positively on alertness and performance, and this in turn can help elevate overall mood.

**Q. Is the post lunch dip a true phenomenon? If so does coffee help?** A. Our bodies experience/have what is known as a 'circadian rhythm', often referred to as our body clock. The circadian rhythm goes through highs and lows throughout the day, and one of the lows is in the early afternoon – this has been called the 'post-lunch dip' though in actual fact has nothing to do with lunch. The caffeine in a cup or two of coffee is sufficient to increase your levels of alertness and by doing so to keep you going through the afternoon.

**Q: Is it true that coffee can reduce driver tiredness?**

A: It is well documented that a couple of cups of coffee and a short nap are the most effective method of alleviating driver fatigue. Many road accidents occur as a result of a driver falling asleep at the wheel so yes, coffee may be improve road safety. Road safety organisations advise drivers to pull over, drink one or two cups of strong coffee and take a 15 minute nap.

**Q. Will coffee help me 'recover' from jet lag?**

A. Following a long plane journey, the caffeine in one or two cups of coffee can help you to remain awake/alert when you reach your destination until it is time for bed. Coffee is also a good source of fluid so it will help keep you hydrated which will also ease the feelings associated with jet lag.

**Q. I don't understand how coffee can be stimulating, as I often enjoy relaxing with a cup of coffee?**

A. Both are true. The effect of coffee depends on several things. When you are not quite awake, as may happen when you are getting up in the morning, the caffeine in coffee will raise your level of alertness. When you are already alert and active, it may over stimulate you and in some cases, the body responds to that state by dampening down its own metabolism. That would explain why coffee might relax you. The other relaxing effect of coffee is the psychological effects resulting from giving your body and mind a "treat" by having a coffee break.

**Q. I don't drink coffee for the effects of caffeine. I just like it for its warmth, taste and flavour?**

A. Most people drink coffee primarily because they enjoy the warmth, the aroma and the taste of a nice cup of coffee. The stimulating effect is usually a much appreciated plus. At times when the stimulating effect is not desirable, decaffeinated coffee is an enjoyable alternative beverage

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