

# My First Medical Writing

## SECTION EDITOR



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### Editorial

As always, this section brings you the best of EMWA's rising stars. This time, I had the pleasure to work with Sofia Urner on her article about the scientific pros and cons of coffee.

Sofia obtained a PhD in biology and has

extensive experience in biomedical research, mainly in cardiovascular biology and diabetic complications. During her career as a scientist, she has worked in different countries (Germany, USA, Australia), authored several scientific publications, and successfully applied for grants.

Following her passion for medical communications, she is now a freelance scientific and medical writer.

Grab your favourite cup of coffee and enjoy the read!

Evguenia

## Good or bad – how does coffee influence our health?

**F**irst thing in the morning. Every day. Usually black but sometimes with milk. This is how I drink my coffee. And I love it. It is not only because of the taste and the energy kick but also because of the time I dedicate to myself and my coffee. I am sure coffee drinkers know exactly what I mean. But what is the actual magic of coffee? And how does coffee affect our health? Let's have a look at what science is saying.

### The magic of coffee

Coffee is one of the most consumed drinks worldwide. It is obtained by brewing roasted seeds of the plant genus *Coffea*. The two most popular and commonly used species for coffee production are *Coffea arabica* (Arabica coffee) and *Coffea canephora* (Robusta coffee). The actual coffee beans are the seeds located in the red berries of the coffee plant. It takes 7 to 11 months for the berries to ripen before the coffee beans can be harvested, dried, and processed into coffee.

Coffee contains more than 1000 chemical substances, including various bioactive components with beneficial effects at the cellular and physiological levels. These include, but are not limited to, stimulatory, antioxidant, and anti-inflammatory effects.<sup>1-3</sup>

The most famous and probably the most studied ingredient in coffee is the alkaloid caffeine. The plant uses caffeine as a toxic defence

strategy against pests like insects. Luckily, caffeine does not have the same effect on humans, so we can fully enjoy its positive properties. The most prevalent effect of caffeine relates to its structural similarity with the endogenous molecule adenosine. Adenosine acts by binding to specific adenosine receptors in the brain. These receptors slow down neural activity and make us feel tired and sleepy. Caffeine acts as an antagonist of adenosine receptors, which means it can bind to them with a similar affinity, blocking their signalling and promoting alertness and wakefulness.<sup>2</sup> Thus, the energising effect of coffee is indeed related to caffeine.

These effects occur shortly after the consumption of coffee. Generally, caffeine is absorbed by our stomach and small intestine within 30-45 minutes, and its blood concentration peaks shortly after. It is then metabolised

in the liver by the cytochrome P450 oxidase enzyme system, which breaks it down to paraxanthine (84%), theobromine (12%), and theophylline (4%). These caffeine metabolites also directly impact physiological processes, such as stimulating fat metabolism, increasing urine volume, and relaxing smooth muscles.<sup>1</sup> In healthy adults, the half-life time of caffeine, which is the time it takes to reduce its

plasma concentration by 50%, is approximately three to four hours, but can vary widely. For example, under specific hormonal influences like

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pregnancy, caffeine has a half-life time of nine to 11 hours.<sup>1,2</sup> This highlights the variety of immediate and delayed effects coffee has on our body, from boosting energy levels within minutes to longer-term metabolic adaptations lasting several hours.

Although it sometimes seems that caffeine alone is the star of coffee, other bioactive substances also significantly contribute to its magic. These include other alkaloids (like trigonelline), polyphenols (like chlorogenic acid), or diterpenes (like cafestol and kahweol). These substances provide antioxidant, anticancerogenic, and anti-inflammatory properties. They are neuroprotective, contribute to anti-diabetic effects, and are antimicrobial.<sup>3</sup> Furthermore, coffee is rich in vitamin B3, magnesium, and potassium, thus delivering precious micronutrients to the body.<sup>2</sup>

### Coffee dogmas

Different dogmas about coffee contribute to the debate on whether coffee is harmful to our health or not. But are these dogmas based on scientific facts? Let's have a look at two common ones:

#### Does coffee raise blood pressure?

Hypertension, or increased blood pressure,

affects more than 30% of adults and is a risk factor for severe health complications, such as heart attack, stroke, or kidney failure.<sup>4</sup> The bioactive components in coffee directly or indirectly affect blood pressure regulation. Caffeine alone influences blood pressure via several mechanisms. It stimulates the narrowing of blood vessels, activates the sympathetic nervous system, and controls the water and electrolyte levels in the body.<sup>5</sup> Due to these mechanisms, blood pressure increases shortly after caffeine consumption. However, coffee also contains substances with blood-pressure-lowering effects, such as chlorogenic acid or trigonelline, which may compensate for the pro-hypertensive actions of caffeine.<sup>6</sup> Several studies have tried to clarify whether a direct correlation exists between coffee consumption and blood pressure. Although the conclusions on the effects of drinking up to three cups of coffee per day are conflicting, with studies showing beneficial, neutral, or negative outcomes,<sup>7-9</sup> drinking more than three cups of coffee daily is mainly associated with a reduced risk of hypertension.<sup>7,10,11</sup> This suggests even protective effects on cardiovascular health. However, it should be highlighted that these effects have been observed in habitual coffee consumers, while non-regular coffee drinkers are more likely to have increased blood pressure after drinking coffee.<sup>6</sup> A possible explanation for this is that habitual coffee drinkers become tolerant to caffeine, thus diminishing its effects on blood pressure. Also, regular coffee consumption has been shown to positively change the gut microbiota, such as by increasing *Bacteroides*, associated with lower blood pressure.<sup>6,12</sup> In general, several factors influence the risk of hypertension, and coffee consumption is only one of many variables, such as age, lifestyle, and genetics.

#### **Does coffee consumption lead to irregular heartbeat?**

Caffeine can affect the heartbeat by increasing catecholamine (adrenaline and noradrenaline) levels in the blood, leading to an increased heart rate.<sup>13</sup> Therefore, caffeine has a reputation for stimulating irregular heartbeat, also called arrhythmia. However, a meta-analysis of several studies failed to find an association between coffee consumption and an increased risk of arrhythmia.<sup>14</sup> Furthermore, studies show that habitual drinking of one to three cups of coffee daily can even reduce the risk of arrhythmia, with each additional cup further lowering the risk.<sup>15-17</sup>



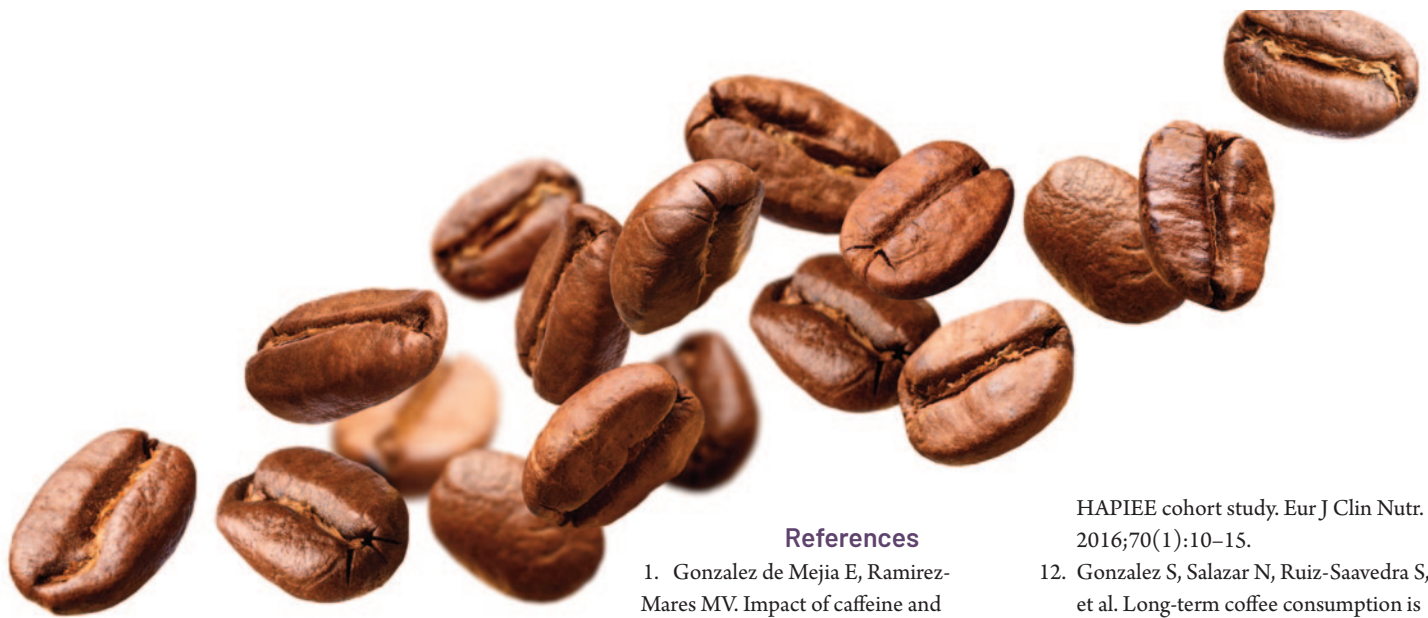
#### **The facts – coffee and mortality**

Because coffee has such a wide range of physiological effects, both negative and positive impacts of coffee on health can be found if looking at specific health aspects. For example, coffee has been associated with increased blood cholesterol levels, lower bone density, or increased risk of spontaneous abortion in pregnant women.<sup>1</sup> On the other hand, coffee has also been shown to decrease the risk of Parkinson's and Alzheimer's disease, prevent certain cancers, or reduce the risk of developing type 2 diabetes mellitus.<sup>1</sup> Therefore, a more holistic approach may be required to answer the complex question of whether coffee is harming or improving our health in the long term.

In this regard, many extensive studies have

analysed the association between coffee consumption and mortality, considering and adjusting for relevant lifestyle factors, such as smoking, physical activity, or alcohol consumption, and primarily suggest positive effects of coffee. A recent study with over 460,000 UK Biobank participants and a follow-up time of approximately 11 years showed that consuming half to three cups of coffee per day lowers the risk of all-cause mortality, death due to cardiovascular events, and incident stroke events.<sup>18</sup> Another study, including over 520,000 participants from 10 European countries with a mean follow-up time of approximately 16 years, concluded that consuming three or more cups of coffee daily is associated with lower all-cause mortality.<sup>19</sup> These positive effects of coffee consumption on





## References

mortality have been confirmed in another recent study including around 170,000 Korean individuals over a follow-up time of approximately nine years.<sup>20</sup> Strikingly, drinking decaffeinated coffee has similar health benefits, suggesting that the positive effects of coffee are not exclusively due to caffeine.<sup>18</sup>

### Long live the coffee drinker!

Let's get back to our initial question – is coffee good or bad for our health? According to recent research, coffee consumption seems mainly beneficial. In individuals without underlying health conditions, the complex health-supporting properties of coffee likely outweigh potential health risks. Knowing this, we can enjoy our daily coffee – or two. However, as with everything in life, it is probably all about balance in the end.



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