



## How Much Caffeine is in Your Cup?

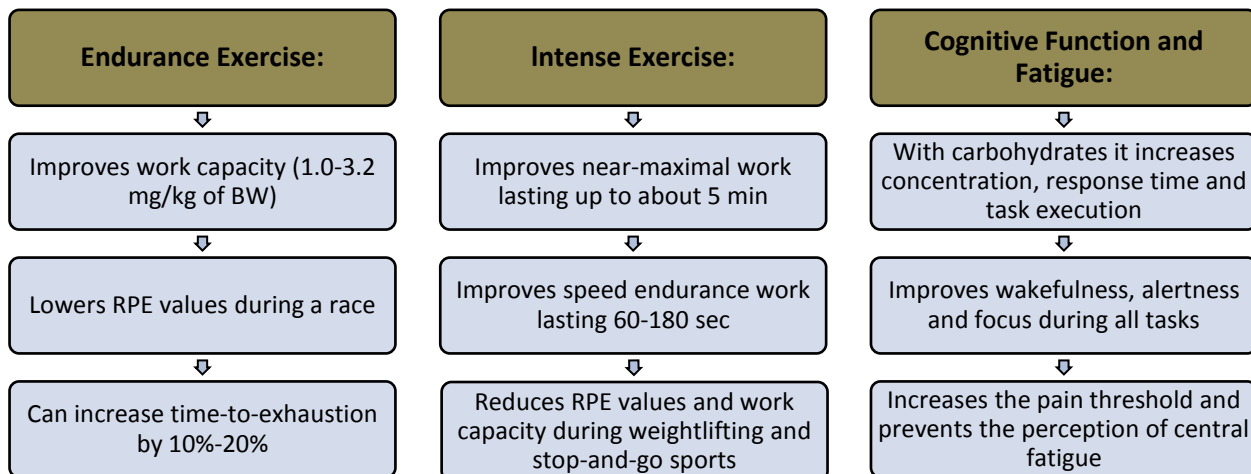
Human caffeine consumption is by no means novel, dating back almost 5,000 years - but today's on-the-go society certainly thrives on the stimulant. From waking up to making it through the 2 pm work drag to pre-exercise readiness and late-night study alertness, caffeine does indeed provide a number of health and performance benefits. Caffeine can deliver consumers a cognitive and physical edge during the rigors of a long and demanding day. It originates naturally in over 60 species of plants including coffee beans, tea leaves, cocoa beans and kola nuts. When consumed with carbohydrates it can improve concentration, response speed and the performance of complex cognitive tasks - making it a desirable compound for most busy individuals from business leaders to world-class athletes alike.

The timing and quantity of caffeine ingestion should be strategically considered to reap the greatest benefits while limiting the potential side-effects of overconsumption. Up to 400 mg of caffeine per day appears to be safe for most healthy adults. This is roughly the amount found in four cups of brewed coffee, 10 cans of cola, or two "energy shot" drinks (depending on the brand). Research shows 3-9 mg per kg of body weight (BW) taken 30-90 minutes before training provides optimal performance benefits. Around 2-6 mg per kg of BW may be useful for limiting ergolytic effects among those who are sensitive to the compound. It is also suggested to avoid caffeine consumption after 4:00 pm (after 1:00 pm if sensitive) as its systemic half-life ranges from 5-6 hours. Late afternoon/evening intake can potentially result in insomnia and consequently poor recovery during the following day. This can result in excess caffeine intake to compensate for the sleep deprivation... sometimes resulting in a negative feedback loop.

The following figure summarizes the performance benefits associated with caffeine. They are significant; which sheds light on why most athletes and exercise enthusiasts consume it to support the physical demands of their training regimen. Overall, caffeine is proven to:

- 1) exert useful physiological effects during most types of training and sports
- 2) lower the rate of perceived exertion (RPE) during exercise
- 3) increase cognitive functioning

Interestingly, benefits for single-effort sports (e.g., shot-put, long jump) or supra-maximal work (e.g., one maximal sprint) are still unclear.



The above benefits are understood to be provided by:

- An increase in lipolysis which can spare glycogen
- An increase in the excitability of muscle fibers (especially type II)
- The stimulation of neurotransmitters and hormones which optimize neural function and reduce the perception of fatigue

On the other hand, various negative side-effects can be experienced with overconsumption such as digestive distress, headaches, tachycardia, insomnia, anxiety, irritability, muscle tremor, psychomotor agitations (e.g., eye twitch) and elevated blood pressure. Contrary to common belief, there does not appear to be an additional risk for dehydration when caffeine is consumed in moderation. However, if one regularly or acutely consumes a toxic level of caffeine it can promote vomiting, seizures, ulcers (long-term use) or even death due to cardiovascular complications. 500-600mg/day is categorized as “heavy use” but can be handled by most healthy adults, while >700mg/day is generally considered the upper limit for ingestion - depending on age, medical history and sensitivity or tolerance. Children are recommended to limit their daily use to 45mg/day while adolescents or teenagers should not surpass 100mg/day.

The data in the following tables can be used to get an idea of how much caffeine one **really** consumes to strategize appropriate intake based on training needs, age, health issues (e.g., trouble sleeping) and relative sensitivity. Remember, research shows 3-9 mg per kg of BW taken 30-90 minutes before training can be optimal for those with tolerance; 2-6 mg per kg of BW can be used by many with higher sensitivity. Adequate intake all depends on specific need as endurance exercise shows improvements

with intake as low as 1.0 mg per kg of BW. Considering these factors, one can take their body weight in pounds and divide the value by 2.2 to get their BW in kg. From here, simple math can determine the mg of caffeine consumed per kg of BW - to try to get within the optimal concentration range. As one can easily see, it would be prudent to consume energy drinks or shots with caution.

Example: 200mg coffee consumed by a person who is 80kg ---  $200\text{mg} \div 80\text{kg} = 2.5\text{mg/kg}$  of body weight

#### ***Select Coffee Beverages for Comparison***

<b>Name</b>	<b>Fluid Ounces</b>	<b>Caffeine (mg)</b>	<b>Mg per fluid ounce</b>
Coffee (brewed)	8	163 (can vary)	~20.4 (can vary)
Dunkin Donuts Brewed Coffee	14	210	15
Starbucks Cold Brew Coffee	16	200	12.5
K-Cup Coffee	8	120	15
Caffe Mocha	12	152	~12.7
Cappuccino (double shot)	12	154	~12.8
Espresso	1.5	77	~51.3
Black Insomnia Coffee	12	702	~58.5

#### ***Select Sodas for Comparison***

<b>Name</b>	<b>Fluid Ounces</b>	<b>Caffeine (mg)</b>	<b>Mg per fluid ounce</b>
Barq's Root Beer	12	22	~1.8
Diet Coke	12	46	~3.8
Diet Pepsi	12	34	~2.8
Dr. Pepper	12	41	~3.4
Mello Yello	12	51	~4.2
Mountain Dew	12	54	~4.5
Mr. Pibb	12	40	~3.3
RC Cola	12	43	~3.6
Sprite or 7-up	12	0	0

#### ***Select Energy Drinks Pre-Workout Drinks for Comparison***

<b>Name</b>	<b>Fluid Ounces</b>	<b>Caffeine (mg)</b>	<b>Mg per fluid ounce</b>
Amp Energy Drink	16	142	~8.9
BANG Energy Drink	16	300	~18.8
Crave Energy Drink	16	160	10.0
Crystal Light Energy	16	60	~3.8
Monster Energy Drink	16	160	10.0
Mountain Dew Kickstart	16	92	~5.8
NOS Energy Drink	16	160	10.0
Red Bull	8.46	80	~9.5
Redline Energy Drink	8	250	~31.2
Rockstar Pure Zero Energy Drink	16	240	15.0
V8 Fusion Energy Drink	8	80	10.0
Venom Black Mamba	16	160	10.0
VitaminWater Energy Drink	11.5	80	~7.0
XS Energy Drink	8.4	83	~9.9

### ***Select Energy Shots for Comparison***

<b>Name</b>	<b>Fluid Ounces</b>	<b>Caffeine (mg)</b>	<b>Mg per fluid ounce</b>
5 Hour Energy Shot	2	200	100.0
10 Hour Energy Shot	1.93	422	~218.7
Hydroxycut Instant Shot	2	200	100.0
NoDoz Energy Shot	1.89	115	~60.8
Redline Power Rush	2.5	350	140.0
Rockstar Energy Shot	2.5	200	80.0

### ***Select Teas for Comparison***

<b>Name</b>	<b>Fluid Ounces</b>	<b>Caffeine (mg)</b>	<b>Mg per fluid ounce</b>
Chai Tea	8	50	~6.2
Black Tea	8	42	~5.2
Green Tea	8	25	~3.1
Herbal Tea	8	0	0
Jasmine Tea	8	25	~3.1
Oolong Tea	8	37	~4.6
White Tea	8	28	~3.5
Yellow Tea	8	33	~4.1

Again, the above information can be quite useful among exercise professionals for educating their clients or athletes on selecting appropriate caffeinated beverages. Consuming the right amount of caffeine with proper timing in relation to training sessions can provide significant performance benefits, while excess consumption can lead to various negative repercussions and sympathetic nervous system fatigue.