

Library Watch on caffeine

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Tea and health: Preventive and therapeutic usefulness in the elderly?

Bolling BW; Chen CYO; Blumberg JB. *Current Opinion in Clinical Nutrition and Metabolic Care* 12(1): 42-48, 2009. (82 refs.)

Purpose of review: To update the growing literature suggesting that tea and its constituent flavonoids are inversely related to the risk of chronic diseases common among the elderly. Recent findings: Results are provided from recent observational studies and clinical trials on the relationship of tea and tea catechins to body weight control and energy metabolism, impaired glucose tolerance and diabetes, cardiovascular disease, bone mineral density, cognitive function and neurodegenerative disease, and cancer. The evidence for the efficacy and potency of tea and tea extracts in benefiting these outcomes ranges from compelling for cardiovascular disease to equivocal at best for some forms of cancer. Summary: Although randomized clinical trials of tea have generally been of short duration and with small sample sizes, together with experimental and epidemiological studies, the totality of the data suggests a role for tea in health promotion as a beverage absent in calories and rich in phytochemicals. Further research is warranted on the putative benefits of tea and the potential for synergy among its constituent flavonoidS, L-theanine, and caffeine. Copyright 2009, Lippincott, Williams & Wilkins.

Caffeinated energy drinks: A growing problem. (review).

Reissig CJ; Strain EC; Griffiths RR. *Drug and Alcohol Dependence* 99(1-3): 1-10, 2009. (96 refs.)

Since the introduction of Red Bull in Austria in 1987 and in the United States in 1997, the energy drink market has grown exponentially. Hundreds of different brands are now marketed, with caffeine content ranging from a modest 50 mg to an alarming 505 mg per can or bottle. Regulation of energy drinks, including content labeling and health warnings differs across countries, with some of the most lax regulatory requirements in the U.S. The absence of regulatory oversight has resulted in aggressive marketing of energy drinks, targeted primarily toward young males. for psychoactive, performance enhancing and stimulant drug effects. There are increasing reports of caffeine intoxication from energy drinks, and it seems

likely that problems with caffeine dependence and withdrawal will also increase. In children and adolescents who are not habitual caffeine users, vulnerability to caffeine intoxication may be markedly increased due to all absence of pharmacological tolerance. Genetic factors may also contribute to an individual's vulnerability to caffeine-related disorders including caffeine intoxication, dependence, and withdrawal. The combined use of caffeine and alcohol is increasing sharply, and studies suggest that such combined use may increase the rate of alcohol-related injury. Several studies suggest that energy drinks may serve as a gateway to other forms of drug dependence. Regulatory implications concerning labeling and advertising, and the clinical implications for children and adolescents are discussed. Copyright 2009, Elsevier Science.

Semen quality according to prenatal coffee and present caffeine exposure: two decades of follow-up of a pregnancy cohort.

Ramlau-Hansen CH; Thulstrup AM; Bonde JP; Olsen J; Bech BH. *Human Reproduction* 23(12): 2799-2805, 2008. (41 refs.)

A few studies have investigated the association between male caffeine consumption in adult life and semen quality with conflicting results, but so far no studies have explored the effect of prenatal coffee exposure. We studied the association between prenatal coffee and current caffeine exposure and semen quality and levels of reproductive hormones. From a Danish pregnancy cohort established in 1984-1987, 347 sons out of 5109 were selected for a follow-up study conducted 2005-2006. Semen and blood samples were analyzed for conventional semen characteristics and reproductive hormones and were related to information on maternal coffee consumption during pregnancy and present caffeine consumption. Data were available for 343 men. There was a tendency toward decreasing crude median semen volume ($P = 0.06$) and adjusted mean testosterone ($P = 0.06$) and inhibin B ($P = 0.09$) concentrations with increasing maternal coffee consumption during pregnancy. Sons of mothers drinking 4-7 cups/day had lower testosterone levels than sons of mothers drinking 0-3 cups/day ($P = 0.04$). Current male caffeine intake was associated with increasing testosterone levels ($P =$

0.007). Men with a high caffeine intake had similar to 14% higher concentration of testosterone than those with a low caffeine intake ($P = 0.008$). The results observed in this study are only tentative, but they do not exclude a small to moderate effect of prenatal coffee exposure on semen volume and levels of reproductive hormones. Present adult caffeine intake did not show any clear associations with semen quality, but high caffeine intake was associated with a higher testosterone concentration. Copyright 2008, Oxford University Press.

Caffeine improves physical and cognitive performance during exhaustive exercise.

Hogervorst E; Bandelow S; Schmitt J; Jentjens R; Oliveira M; Allgrove J; Carter T; Gleeson M.

Medicine and Science in Sports and Exercise 40(10): 1841-1851, 2008. (33 refs.)

Caffeine is thought to act as a central stimulant and to have effects on physical, cognitive, and psychomotor functioning. Purpose: To examine the effects of ingesting a performance bar, containing caffeine, before and during cycling exercise on physical and cognitive performance. Methods: Twenty-four well-trained cyclists consumed the products [a performance bar containing 45 g of carbohydrate and 100 mg of caffeine (CAF), all isocaloric noncaffeine performance bar (CHO), or 300 ml of placebo beverage (BEV)] immediately before performing a 2.5-h exercise at 60% ($\dot{V}O_{2max}$) followed by a time to exhaustion trial (T2EX) at 75% ($\dot{V}O_{2max}$). Additional products were taken after 55 and 115 min of exercise. Cognitive function measures (computerized Stroop and Rapid Visual Information Processing tests) were performed before exercise and while cycling after 70 and 140 min of exercise and again 5 min after completing the T2EX ride. Results: Participants were significantly faster after CAF when compared with CHO on both the computerized complex information processing tests, particularly after 140 min and after the T2EX ride ($P < 0.001$). On the BEV trial, performance was significantly slower than after both other treatments ($P < 0.0001$). There were no speed-accuracy tradeoffs ($P > 0.10$). T2EX was longer after CAF consumption compared with both CHO and BEV trials ($P < 0.05$), and T2EX was longer after CHO than after BEV ($P < 0.05$). No differences were found in the ratings of perceived exertion, mean heart rate, and relative exercise intensity ($\dot{V}O_{2max}$); $P > 0.05$. Conclusion: Caffeine in a performance bar can improve endurance performance and complex cognitive ability during and after exercise. These effects may be salient for sports performance in which

concentration plays a major role. Copyright 2008, Lippincott, Williams & Wilkins.

Fourteen well-described caffeine withdrawal symptoms factor into three clusters.

Ozsungur S; Brenner D; El-Sohemy A.

Psychopharmacology 201(4): 541-548, 2009. (35 refs)
Abrupt cessation of caffeine often results in several withdrawal symptoms among habitual caffeine consumers. The objective of the study was to determine whether caffeine withdrawal symptoms co-exist as clusters in some individuals. Withdrawal symptoms and caffeine intake were assessed for men ($n=126$) and women ($n=369$), aged 20-29, using a caffeine habits questionnaire and a semi-quantitative food frequency questionnaire, respectively. Principal components factor analysis was used to identify common underlying factors among 14 well-described caffeine withdrawal symptoms. Odds ratios (OR) and 95% confidence intervals (CI) were calculated to determine if the likelihood of reporting a withdrawal factor was associated with habitual caffeine consumption. The 14 withdrawal symptoms were grouped into three factors termed "fatigue and headache", "dysphoric mood", and "flu-like somatic". The likelihood of reporting the fatigue and headache and dysphoric mood factors increased with higher levels of habitual caffeine consumption. Compared to < 100 mg/day of caffeine, the ORs (95% CI) of reporting the fatigue and headache factor with a habitual intake of 100-200 mg/day and > 200 mg/day were 1.97 (1.21, 3.21) and 4.44 (2.50, 7.86), respectively. The corresponding ORs (95% CI) for the dysphoric mood factor were 1.55 (0.96, 2.52) and 3.34 (1.99, 5.60). The 14 well-described caffeine withdrawal symptoms factor into three clusters, suggesting the existence of three distinct underlying mechanisms of caffeine withdrawal. Increasing habitual caffeine consumption is associated with an increased likelihood of reporting the fatigue and headache and dysphoric mood symptoms, but not the flu-like somatic symptoms. Copyright 2009, Springer.

Caffeine and sports performance.

Burke LM. *Applied Physiology, Nutrition and Metabolism* 33(6): 1319-1334, 2008. (60 refs.)

Athletes are among the groups of people who are interested in the effects of caffeine on endurance and exercise capacity. Although many studies have investigated the effect of caffeine ingestion on exercise, not all are suited to draw conclusions regarding caffeine and sports performance. Characteristics of studies that can better explore the issues of athletes include the use of well-trained

subjects, conditions that reflect actual practices in sport, and exercise protocols that simulate real-life events. There is a scarcity of field-based studies and investigations involving elite performers. Researchers are encouraged to use statistical analyses that consider the magnitude of changes, and to establish whether these are meaningful to the outcome of sport. The available literature that follows such guidelines suggests that performance benefits can be seen with moderate amounts (similar to 3 mg.kg⁻¹ body mass) of caffeine. Furthermore, these benefits are likely to occur across a range of sports, including endurance events, stop-and-go events (e. g., team and racquet sports), and sports involving sustained high-intensity activity lasting from 1-60 min (e. g., swimming, rowing, and middle and distance running races). The direct effects on single events involving strength and power, such as lifts, throws, and sprints, are unclear. Further studies are needed to better elucidate the range of protocols (timing and amount of doses) that produce benefits and the range of sports to which these may apply. Individual responses, the politics of sport, and the effects of caffeine on other goals, such as sleep, hydration, and refuelling, also need to be considered. Copyright 2008, National Research Council of Canada.

Effect of caffeine on the neuromuscular system. Potential as an ergogenic aid.

Tarnopolsky MA. *Applied Physiology, Nutrition and Metabolism* 33(6): 1284-1289, 2008. (64 refs.)

The ergogenic effect of caffeine on endurance exercise performance is multifactorial; however, there is evidence for an effect on both the central nervous system and the excitation-contraction coupling of skeletal muscle. The increase in exercise performance seen following intracerebroventricular caffeine injection in rats provides strong evidence for a central ergogenic effect. The central ergogenic effect is not likely related to the ability of caffeine to promote wakefulness, but could be due to an increase in the pain and effort perception threshold. There is no evidence that caffeine alters peripheral nerve conduction velocity or neuromuscular transmission, and 1 study showed that motor unit synchronization was not altered by caffeine. Studies have also shown that caffeine can have a direct effect on skeletal muscle that could be ergogenic. For example, patients with high cervical spinal cord lesions showed improvements in stimulated contractile force during cycling, in spite of the fact that they have no peripheral pain input and no sympathetic nervous system response. Two studies have found a potentiation of force production during submaximal stimulation intensities, and 1 found that the M-wave amplitude was not altered by caffeine.

Together, these studies suggest that caffeine can enhance contractile force during submaximal contractions by potentiating calcium release from the ryanodine receptor, not by altering sarcoplasmic excitability. Furthermore, the potentiation of force during submaximal electrical stimulation is identical in habitual and nonhabitual caffeine consumers. In summary, the ergogenic effects of caffeine during endurance activity are mediated partly by enhanced contractile force and partly by a reduction in perceived exertion, possibly through a blunting of effort and (or) pain. Copyright 2008, National Research Council of Canada.

Coffee consumption, genetic susceptibility and bladder cancer risk.

Villanueva CM; Silverman DT; Murta-Nascimento C; Malats N; Garcia-Closas M; Castro F et al. *Cancer Causes & Control* 20(1): 121-127, 2009. (21 refs.)
We evaluated the bladder cancer risk associated with coffee consumption in a case-control study in Spain and examined the gene-environment interactions for genetic variants of caffeine-metabolizing enzymes. The analyses included 1,136 incident cases with urothelial carcinoma of the urinary bladder and 1,138 controls. Odds ratios (OR) and 95% confidence intervals (CI) were adjusted for area, age, gender, amount of cigarette smoking, and years since quitting among former smokers. The OR (95% CI) for ever consumed coffee was 1.25 (0.95-1.64). For consumers of 1, 2, 3, and 4 or more cups/day relative to never drinkers, OR were, respectively, 1.24 (0.92-1.66), 1.11 (95% CI 0.82-1.51), 1.57 (1.13-2.19), and 1.27 (0.88-1.81). Coffee consumption was higher in smokers compared to never smokers. The OR for drinking at least 4 cups/day was 1.13 (0.61-2.09) in current smokers, 1.57 (0.86-2.90) in former smokers, and 1.23 (0.55-2.76) in never smokers. Gene-coffee interactions evaluated in NAT2, CYP1A2, and CYP2E1-02 and CYP1A1 were not identified after adjusting for multiple testing. We observed a modest increased bladder cancer risk among coffee drinkers that may, in part, be explained by residual confounding by smoking. The findings from the gene-coffee interactions need replication in further studies. Copyright 2009, Springer.

The effect of caffeine, green tea and tyrosine on thermogenesis and energy intake.

Belza A; Toubro S; Astrup A. *European Journal of Clinical Nutrition* 63(1): 57-64, 2009. (47 refs.)

Objectives: To investigate the effect of three different food ingredients tyrosine, green tea extract (GTE) and caffeine on resting metabolic rate and haemodynamics, and on ad libitum energy intake (EI) and appetite.

Methods: Twelve healthy, normal weight men (age: 23.7 +/- 72.6 years, mean +/- s.d.) participated in a four-way crossover, randomized, placebo-controlled, double-blind study. Treatments were administered as tablets of 500 mg GTE, 400 mg tyrosine, 50 mg caffeine, or placebo, and were separated by 43-day washout. The acute thermogenic response was measured in a ventilated hood system for 4 h following ingestion. Blood pressure, heart rate (HR), and subjective appetite sensations were assessed hourly and ad libitum EI 4 h post-dose. Results: Caffeine induced a thermogenic response of 6% above baseline value (72 +/- 25 kJ per 4 h, mean +/- s.e.) compared to placebo ($P < 0.0001$). The thermogenic responses to GTE and tyrosine were not significantly different from placebo. Tyrosine tended to increase 4-h respiratory quotient by 1% compared to placebo (0.01 +/- 0.005, $P = 0.05$). Ad libitum EI was not significantly different between treatments but was reduced by 8% (-403 +/- 183 kJ), 8% (-400 +/- 335 kJ) and 3% (-151 +/- 377 kJ) compared to placebo after intake of tyrosine, GTE and caffeine, respectively. No significant difference in haemodynamics was observed between treatments. Conclusions: Only caffeine was thermogenic in the given dose and caused no haemodynamic side effects. The sample size was probably too small to detect any appetite suppressant properties of the treatments. Further investigations are required. Copyright 2009, Nature Publishing.

Nicotine dependence vs. daily smoking as a meaningful variable. (review).

Martinez-Ortega JM; Jurado D; Gurpegui M. *Progress in Neuro-Psychopharmacology & Biological Psychiatry* 32(8): 1972-1977, 2008. (50 refs.)
Objective: As an indication of potential psychopathology, our aim was to compare, in a non-psychiatric sample, the variables associated to daily smoking with those associated to nicotine dependence. We also compared dependent and non-dependent smokers on these variables and on the age of onset of daily smoking (AODS). Method: A sample of 290 persons aged 18 or older, recruited in a family medical clinic, were interviewed to inquire about their tobacco, caffeine, alcohol, and illegal drugs consumption, and on their practice of physical exercise. Psychiatric morbidity was assessed with the General Health Questionnaire (GHQ-28) and defined by a score > 6 . They also were questioned on their use of psychotropic medication and previous suicide attempt. The smokers answered the Fagerstrom Test for Nicotine Dependence (FTND) and the question on their age of onset of daily smoking (AODS). Results: In comparison with non-dependent smoking, nicotine

dependence was associated with current use of psychotropic medication, psychiatric morbidity, previous suicide attempt, and earlier AODS. Logistic regression analyses showed that nicotine dependence was associated with antecedents of suicide attempt and primary or lower education as well as with high caffeine use and the regular use of illegal drugs; in contrast, daily smoking showed a significant association with high caffeine use, the regular use of illegal drugs and lack of physical exercise. Conclusions: In terms of psychopathology or behavioral disturbance-particularly attempting suicide-nicotine dependence adds significant information as opposed to the simple daily smoking, with important implications in clinical and epidemiological psychiatric studies. Copyright 2008, Elsevier Science.

Dissociations between motor timing, motor coordination, and time perception after the administration of alcohol or caffeine.

Terry P; Dumas M; Desai R; Wing A. *Psychopharmacology* 202(4): 719-729, 2009. (66 refs.)

The objectives of the study are to test the effects of alcohol and caffeine on the explicit timing involved in tapping with the implicit timing observed in the coordinated picking up of an object, and with the temporal discrimination. Participants in the "alcohol" experiment ($N = 16$) received placebo, "low" (0.12 g/kg or 0.14 g/kg for women/men, respectively) or "high" (0.37 g/kg or 0.42 g/kg, respectively) doses of alcohol, and those in the "caffeine" experiment ($N = 16$) received placebo, 200 or 400 mg caffeine. Time production variability was measured by repetitive tapping of specified intervals, and sources of variance attributable to central timer processes and peripheral motor implementation were dissociated. The explicit timing in tapping was compared with the implicit timing in the coordinated picking up of an object. Time perception was measured as discrimination thresholds for intervals of similar duration. Drug effects on reaction time were also measured. For tapping, alcohol significantly increased timer variability, but not motor variability; it did not affect coordination timing in the grip-lift task. Conversely, for time perception, the low dose of alcohol improved temporal discrimination. Caffeine produced no effects on any of the timing tasks, despite significantly reducing reaction times. The effects of alcohol argue against a common clock process underlying time interval perception and production in the range below 1 s. In contrast to reaction time measures, time perception and time production appear relatively insensitive to caffeine. Copyright 2009, Springer.