

Library Watch on caffeine

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Perception of simulated driving performance after sleep restriction and caffeine

Biggs SN; Smith A; Dorrian J; Reid K; Dawson D; van den Heuvel C. *Journal of Psychosomatic Research* 63(6):573-577, 2007. (32 refs.)

Objective: As feelings of alertness are reported to be highly correlated with performance perception, the objective of this study was to determine whether caffeine, a common countermeasure to driver sleepiness, affected a sleepy driver's ability to monitor his or her simulated driving performance. Methods: Twelve healthy young adults (six males, six females) participated in three counterbalanced, blinded, daytime conditions: control [9 h time in bed (TIB)], 100 mg caffeine (4 h TIB), and placebo (4 h TIB). Driving performance was measured through lane drift on a series of 30-min simulated driving sessions. Subjective sleepiness and perception of driving performance were measured at 5-min intervals during driving sessions via the Karolinska Sleepiness Scale and a corresponding perception scale. Results: Sleep restriction had a significant detrimental effect on driving performance and subjective measures. Caffeine resulted in significant improvements across all measures. Subjective measures were found to be significantly correlated after sleep restriction and prior to caffeine. Correlations between actual and perceived performance were nonsignificant across all conditions. Conclusions: The strong correlation between subjective measures supports the postulation that sleepiness is used as a cue for performance prediction when sleep restricted. The relationship between perceived and actual performance after fatigue countermeasures remains inconclusive. Further research, addressing limitations, is needed. Copyright 2007, Elsevier Science.

Nutrition for distance events

Burke LM; Millet GE; Tarnopolsky MA. *Journal of Sports Sciences* 25(Supplement 1):S29-S38, 2007. (76 refs.)

The goal of training is to prepare the distance athlete to perform at his or her best during major competitions. Whatever the event, nutrition plays a major role in the achievement of various factors that

will see a runner or walker take the starting line in the best possible form. Everyday eating patterns must supply fuel and nutrients needed to optimize their performance during training sessions and to recover quickly afterwards. Carbohydrate and fluid intake before, during, and after a workout may help to reduce fatigue and enhance performance. Recovery eating should also consider issues for adaptation and the immune system that may involve intakes of protein and some micronutrients. Race preparation strategies should include preparation of adequate fuel stores, including carbohydrate loading for prolonged events such as the marathon or 50-km walk. Fluid and carbohydrate intake during races lasting an hour or more should also be considered. Sports foods and supplements of value to distance athletes include sports drinks and liquid meal supplements to allow nutrition goals to be achieved when normal foods are not practical. While caffeine is an ergogenic aid of possible value to distance athletes, most other supplements are of minimal benefit. Copyright 2007, Taylor & Francis.

Coffee, caffeine, and coronary heart disease

Cornelis MC; El-Soheemy A. *Current Opinion in Clinical Nutrition and Metabolic Care* 10(6):745-751, 2007. (62 refs.)

Diterpenes present in unfiltered coffee and caffeine each appear to increase risk of coronary heart disease. A lower risk of coronary heart disease among moderate coffee drinkers might be due to antioxidants found in coffee. Copyright 2007, Lippincott, Williams & Wilkins.

Pharmacological and psychological effects of caffeine ingestion in 40-km cycling performance

Foad AJ; Beedie CJ; Coleman DA. *Medicine and Science in Sports and Exercise* 40(1):158-165, 2008. (27 refs.)

Aim: To explore the psychological and pharmacological effects of caffeine in laboratory cycling performance. Method: Fourteen male competitive cyclists performed 14 40-km time trials (eight experimental interspersed with six baseline). The experimental phase consisted of two trials for each of four experimental conditions: informed caffeine/

received caffeine, informed no treatment/received caffeine, informed caffeine/received placebo, and informed no treatment/received no treatment. Conditions were nonrandomized. ANOVA was used to estimate main effects and interactions for mean values of power, heart rate, blood lactate, and maximal oxygen uptake. Probabilistic inferences for mean power were based on a smallest worthwhile change of 1.5%. Results: Relative to baseline, a very likely beneficial main effect of receiving caffeine (3.5%; 95% confidence interval 1.5 to 5.5%), and a possibly beneficial main effect of being informed of caffeine (0.7%; -0.7 to 2.1%) were observed. A substantial interaction between belief and pharmacology indicated that caffeine exerted effect on performance in conditions when subjects were informed that they had not ingested it, whereas belief exerted a greater influence on performance in the absence of caffeine (2.6%; -0.7 to 5.9%). A possibly harmful negative placebo (nocebo) effect was observed when subjects were correctly informed that they had ingested no caffeine (-1.9%; -4.1 to 0.3%). No clinically significant changes relative to baseline were observed in mean heart rate. Clear and substantial increases in blood lactate were evident after receipt of caffeine. Data for mean oxygen uptake were unclear. Conclusion: Our data support the ergogenic efficacy of caffeine but suggest that both positive and negative expectations impact performance. Copyright 2008, Lippincott, Williams & Wilkins.

Death by chocolate: A fatal problem for an inquisitive wild parrot

Gartrell BD; Reid C. *New Zealand Veterinary Journal* 55(3): 149-151, 2007. (18 refs.)

CASE HISTORY: An adult male kea (*Nestor notabilis*) in good body condition was found dead at Aoraki/Mt Cook Village, in the Southern Alps of New Zealand. The bird had previously been involved in behavioural tests of problem-solving ability. **CLINICAL AND PATHOLOGICAL FINDINGS:** The bird had substantial subcutaneous and abdominal reserves of fat. The crop contained 20 g of what appeared to be dark chocolate; a conservative estimate of the dose of methylxanthines ingested by the bird was 250 mg/kg theobromine, 20 mg/kg caffeine and 3 mg/kg theophylline. Histopathological examination revealed acute degenerative changes to hepatocytes, renal tubules, and cerebrocortical neurons. **DIAGNOSIS:** Acute combination methylxanthine toxicity after opportunistic ingestion of chocolate. **CLINICAL RELEVANCE:** This is the first report of the pathological findings of methylxanthine toxicity in a wild parrot, and illustrates the need to ensure that kea

are protected from the toxic by-products of human habitation, and the difficulties in ensuring this against a neophilic, inquisitive and innovative parrot. Copyright 2007, New Zealand Veterinary Association.

Does caffeine modulate verbal working memory processes? An fMRI study

Koppelstaetter F; Poeppel TD; Siedentopf CM; Ischebeck A; Verius M; Haala I. *Neuroimage* 39(1): 492-499, 2008. (51 refs.)

To assess the effect of caffeine on the functional MRI signal during a 2-back verbal working memory task, we examined blood oxygenation level-dependent regional brain activity in 15 healthy right-handed males. The subjects, all moderate caffeine consumers, underwent two scanning sessions on a 1.5-T MR-Scanner separated by a 24- to 48-h interval. Each participant received either placebo or 100 mg caffeine 20 min prior to the performance of the working memory task in blinded crossover fashion. The study was implemented as a blocked-design. Analysis was performed using SPM2. In both conditions, the characteristic working memory network of frontoparietal cortical activation including the precuneus and the anterior cingulate could be shown. In comparison to placebo, caffeine caused an increased response in the bilateral medial frontopolar cortex (BA 10), extending to the right anterior cingulate cortex (BA 32). These results suggest that caffeine modulates neuronal activity as evidenced by fMRI signal changes in a network of brain areas associated with executive and attentional functions during working memory processes. Copyright 2008, Academic Press.

Assessing caffeine as an emerging environmental concern using conventional approaches

Moore MT, Greenway SL; Farris JL; Guerra B. *Archives of Environmental Contamination and Toxicology* 54(1): 31-35, 2008. (22 refs.)

Organic wastewater contaminants, including pharmaceuticals, caffeine, and nicotine, have received increased scrutiny because of their detection in water bodies receiving wastewater discharge. Despite recent measurement in United States streams, caffeine's effect on freshwater organisms is not well documented. The present study measured caffeine's lethal and sublethal effects on the freshwater species, *Ceriodaphnia dubia*, *Pimephales promelas*, and *Chironomus dilutus*. These organisms, which are used in standard testing or effluent monitoring, were exposed to aqueous caffeine solutions under static exposure for 48 hours and daily renewed static exposure for 7 days. Averaged responses of 48-hour acute end points indicated that *C. dubia* was more sensitive to caffeine exposures (LC50

= 60 mg/L) than either *P. promelas* (LC50 = 100 mg/L) or *C. dubia* (LC50 = 1,230 mg/L). Exposure-response slopes confirmed these findings (3% mortality/mg/L for *C. dubia*; 0.5% mortality/mg/L for *P. promelas*; and 0.07% mortality/mg/L for *C. dubia*). Comparative 7-day responses between *C. dubia* and *P. promelas* (LC50 = 46 and 55 mg/L, respectively) were more similar than the broad range of acute values. Sublethal effects measured for caffeine exposure included impaired *C. dubia* reproduction (IC50 = 44 mg/L) and inhibited *P. promelas* growth (IC50 = 71 mg/L). According to the results of this study, combined with earlier studies reporting environmental concentrations and product half-lives, caffeine should pose negligible risk for most aquatic vertebrate and invertebrate organisms. Copyright 2008, Springer.

Timing of blood pressure measurement related to caffeine consumption

Mort JR; Kruse HR. *Annals of Pharmacotherapy* 42(1): 105-110, 2008. (21 refs.)

OBJECTIVE: To determine whether patients should wait 30 minutes after caffeine consumption to have their blood pressure measured. **DATA SOURCES:** Literature was obtained by searching MEDLINE (1980-September 2007), International Pharmaceutical Abstracts (1980-September 2007), and the Cochrane Database of Systematic Reviews (1994-September 2007). Search terms included caffeine and blood pressure. Literature was also obtained from citations in relevant articles. **STUDY SELECTION AND DATA EXTRACTION:** Articles that examined caffeine's acute effect on blood pressure were reviewed, with additional focus on caffeine tolerance and hypertensive status. **DATA SYNTHESIS:** Caffeine appears to affect blood pressure through adenosine receptor inhibition and an increased release of select neurotransmitters. Caffeine levels peak 30-120 minutes after oral intake and caffeine's half-life is 3-6 hours. The effect of caffeine on blood pressure has been examined for decades, with variable results depending on factors such as population examined (eg, hypertensive status, physical stressors, age) and study design (eg, acute effects, chronic ingestion, retrospective epidemiologic review). Caffeine tolerance diminishes the acute effect of caffeine on blood pressure, and hypertensive individuals are more susceptible to blood pressure changes. Reviews of caffeine's acute effect on blood pressure indicate changes of 3-15 mm Hg systolic and 4-13 mm Hg diastolic. Typically, blood pressure changes occur within 30 minutes, peak in 1-2 hours, and may persist for more than 4 hours. **CONCLUSIONS:** Having a patient abstain from caffeine for 30 minutes prior to

blood pressure monitoring is not adequate to avoid caffeine's potential effects. An alternative approach to blood pressure monitoring would be to ask the patient about recent caffeine consumption and interpret the blood pressure reading based on this information. In addition, healthcare practitioners should provide education regarding caffeine's effects. Copyright 2008, Harvey Whitney Books.

Association between coffee consumption and risk of hypertension

Palatini P; Dorigatti F; Santonastaso M; Cozzio S; Biasion T; Garavelli G. *Annals of Medicine* 39(7): 545-553, 2007. (44 refs.)

Background. The longitudinal relationship between coffee use and hypertension is not well known. **Aim.** We did a prospective study to investigate if there is a temporal relationship between coffee consumption and development of sustained hypertension. **thod.** We assessed 1107 white subjects with elevated blood pressure who were followed up for 6.4 years. Coffee intake and other life-style factors were ascertained from regularly administered questionnaires. Incident physician-diagnosed hypertension was the outcome measure. **Results:** During the follow-up, 561 subjects developed sustained hypertension, whereas 546 subjects did not meet the criteria for treatment. Coffee drinkers developed sustained hypertension more frequently than abstainers (53.1% versus 43.9%, $P=0.007$). The incidence of hypertension did not differ between moderate and heavy coffee drinkers. Kaplan-Meier analysis confirmed that sustained hypertension was developed more frequently by coffee drinkers compared with nondrinkers ($P < 0.001$). The adjusted relative risk of hypertension was greater in both categories of coffee drinking than in abstainers (hazard ratio, 95% confidence limit (CL)=1.24, 1.06-1.44). The risk of hypertension associated with coffee drinking increased gradually with increasing level of alcohol use (adjusted P for interaction= 0.005). **Conclusions.** In subjects screened for stage I hypertension a nonlinear association was found between coffee consumption and development of sustained hypertension. Copyright 2007, Taylor & Francis.

Ageing and nocturnal driving: Better with coffee or a nap? A randomized study

Sagaspe P; Taillard J; Chaumet G; Moore N; Bioulac B; Philip P. *Sleep* 30(12):1808-1813, 2007. (40 refs.)

Study Objective: To test the effects of coffee and napping on nocturnal driving in young and middle-aged participants. **Design:** A cup of coffee (200 mg of caffeine), a placebo (decaffeinated coffee, 15 mg of caffeine), or a 30-minute nap were tested. Participants

drove 125 highway miles between 18:00 and 19:30 and between 02:00 and 03:30 after coffee, placebo, or a nap. Setting: Sleep laboratory and open French highway. Participants: Twelve young (range, 20-25 years) and 12 middle-aged participants (range, 40-50 years). Measurements: Inappropriate line crossings, self-perceived fatigue and sleepiness, and polysomnographic recordings were analyzed. Results: Compared to daytime, after placebo the number of inappropriate line crossings was significantly increased (2 versus 73 for young participants, $P < 0.01$ and 0 versus 76 for the middle-aged participants, $P < 0.05$). Both coffee and napping reduced the risk of inappropriate line crossings, compared with placebo, in young participants (respectively, by three-quarters, incidence rate ratios [IRR] = 0.26 95% confidence interval [CI], 0.09-0.74, $P < 0.05$ and by two thirds, IRR = 0.34 95% CI, 0.20-0.58, $P < 0.001$) and in middle-aged participants (respectively by nine tenths, IRR = 0.1195% CI, 0.05-0.21, $P < 0.001$ and by one fifth, IRR = 0.77 95% CI, 0.63-0.95, $P < 0.05$). A significant interaction between age and condition (IRR = 2.27 95% CI, 1.28-4.16 $P < 0.01$) showed that napping led to fewer inappropriate line crossings in younger participants than in middle-aged participants. During napping, young participants slept more ($P < 0.01$) and had more delta sleep ($P < 0.05$) than middle-aged participants. Self-perceived sleepiness and fatigue did not differ in both age groups, but coffee improved sleepiness ($P < 0.05$), whereas napping did not. Conclusions: Coffee significantly improves performance in young and middle-aged participants. Napping is more efficient in younger than in older participants. Countermeasures to sleepiness should be adapted according to the age of drivers. Copyright 2007, American Academy of Sleep Medicine.

Caffeine and miscarriage risk

Savitz D; Chan RL; Herring AH; Howards PP; Hartmann KE. *Epidemiology* 19(1):55-62, 2008. (24 refs.)

Background: Coffee and caffeine have been inconsistently found to be associated with increased risk of clinical miscarriage—a potentially important association given the high prevalence of exposure. Methods: Women were recruited before or early in pregnancy and interviewed regarding sources of caffeine, including assessment of changes over the perinatal period. We identified 2407 clinically-recognized pregnancies resulting in 258 pregnancy

losses. We examined the relationship of coffee and caffeine intake with clinically-recognized pregnancy loss prior to 20 weeks' completed gestation, using a discrete-time continuation ratio logistic survival model. Results: Coffee and caffeine consumption at all 3 time points were unrelated to total miscarriage risk and the risk of loss after the interview. Reported exposure at the time of the interview was associated with increased risk among those with losses before the interview. Conclusions: There is little indication of possible harmful effects of caffeine on miscarriage risk within the range of coffee and caffeine consumption reported, with a suggested reporting bias among women with losses before the interview. The results may reflect exposure misclassification and unmeasured heterogeneity of pregnancy losses. Copyright 2008, Lippincott, Williams & Wilkins.

Effects of caffeine on physiological responses to exercise: Boys versus men

Turley KR; DeSisso T; Gerst JW. *Pediatric Exercise Science* 19(4):481-492, 2007. (47 refs.)

We compared the influence of caffeine on physiological responses to exercise between boys and men. Fifty-two participants (26 boys and 26 men) participated in a double blind, randomized, double crossover study. Each participant received the caffeinated (5 mg/kg) drink (CAF) and placebo (PL) twice each on 4 separate days. One hour after drink consumption preexercise heart rate (HR) and blood pressure (BP) were measured. Then while the participants rode stationary cycle ergometers at two different exercise intensities, HR, BP, and oxygen consumption (VO₂) were measured. Blood pressure was not significantly affected by CAF, although on average it was always higher in boys for diastolic BP (3 mmHg) and systolic BP (3-4 mmHg) and men for diastolic BP (2-3 mmHg) and systolic BP (1-6 mmHg) both at rest and during exercise. HR was significantly ($p < .05$) lower at rest, 25W and 50W in CAF versus PL in boys, with no change in adults. During exercise, VO₂ and respiratory exchange ratio (RER) were not different in CAF versus PL in either group. In conclusion, metabolism is not affected by a moderate caffeine dose in children or adults. The same dose has a similar effect on BP in both groups. The effect on HR was different, however, with a significant ($p < .05$) lowering in children in CAF versus PL, with no adult effects. Copyright 2007, Human Kinetics Publishing.