

Supplementary Data

The Effects of Multivitamins on Cognitive Performance: A Systematic Review and Meta-Analysis

Natalie A. Grima^{a,*}, Matthew P. Pase^b, Helen Macpherson^b and Andrew Pipingas^b

^a*Faculty of Medicine, Nursing and Health Sciences, Monash University, Clayton, Australia*

^b*Centre for Human Psychopharmacology, Swinburne University of Technology, Hawthorn, Australia*

Handling Associate Editor: Thomas Shea

Accepted 20 December 2011

*Correspondence to: Natalie A. Grima, Faculty of Medicine Nursing and Health Sciences, Monash University, Building 17, Level 4, Clayton Campus, 3800 Clayton, Australia. E-mail: Nataliegrima@gmail.com.

Supplementary Table 1
Multivitamin constituents of studies included in review

1st Author/year	Intervention characteristics
Chan 2010 [1]	Folic acid (400 µg), Vit B12 (6 µg), Vit E (30 IU), S-adenosylmethionine (400 mg), N-acetyl cysteine (600 mg), Acetyl-L-carnitine (500 mg)
Cockle 2000 [2]	Vit A palmitate (3334 IU), B12 (0.03 mg), C (600 mg), thiamine mononitrate (14 mg), riboflavin (16 mg), pyridoxine (22 mg), dl-alpha-tocopherol acetate (100 mg), folic acid (4 mg), d-biotin (2 mg) and nicotinamide (180 mg)
Gariballa 2007 [3]	Nutrition supplement providing 100% of the reference nutrient intakes of Vit A, C, D, E, B1, B2, B6, B12, folic acid, nicin, biotin, pantothenic acid, potassium, magnesium, calcium, phosphorous, chloride, iron, zinc, iodine, copper, manganese and selenium
Haskell 2010 [4]	Vit A (0.8 mg), B1 (4.2 mg), B2 (4.8 mg), Nicotinamide (54 mg), Pantothenic acid (18 mg), B6 (6 mg), Biotin (0.45 mg), Folic acid (0.6 mg), B12 (0.003 mg), C (180 mg), D3 (5 mg), E (10 mg), K1 (30 mg), Calcium (120 mg), Phosphorus (126 mg), Chromium (.025 mg), Copper (0.9 mg), Fluoride (1.5 mg), Iodine (0.075 mg), Iron (8 mg), Magnesium (45 mg), Manganese (1.8 mg), Molybdenum (0.045 mg), Selenium (0.055 mg), Zinc (8 mg)
Kang 2009 [5]	Vit E (600 IU), C (500 mg), beta carotene (50 mg)
Kennedy 2010 [6]	Vit B1 (15 mg), B2 (15 mg), B6 (10 mg), B12 (10 mcg), C (500 mg), biotin (150 mcg), folic acid (400 mcg), nicotinamide (50 mg), pantothenic acid (23 mg), calcium (100 mg), magnesium (100 mg), zinc (10 mg)
McNeill 2007 [7]	Vit A (800 Ug), Vit C (60 mg), Vit D (5 ug), Vit E (10 mg), thiamine (1.4 mg), riboflavin (1.6 mg), niacin (1 ug), pantothenic acid (6 mg), pyridoxine (2 mg), Vit B12 (1 ug), folic acid (200 ug), iron (14 mg), iodine (150 ug), copper (0.75 mg), zinc (15 mg), manganese (1 mg)
Smith 1999 [8]	Beta carotene (12 mg), alpha-tocopherol (400 mg), ascorbic acid (500 mg)
Summers 2010 [9]	Alpha lipoic acid 90 mg, d-alpha tocopherol (240 IU), Ascorbic acid (300 mg), A vitamin palmitate (4,500 IU), Beta carotene (9,000 IU), Bioflavonoid lemon (90 mg), Boron citrate (60 µg), Co-enzyme Q10 (36 mg), Copper gluconate (75 µg), DMAE (67.5 mg), Eleutherococcus senticosus (90 mg), Folic acid (720 µg), Gingko biloba (90 mg), Ginseng with 10% ginsenosides (90 mg), glutathione (120 mg), Gotu kola (120 mg), Grape seed extract (210 mg), L-lysine (180 mg), Magnesium citrate (48 mg), Manganese citrate (3 mg), L-methionine (180 mg), Methylcobalamin (720 µg), Nicotinamide (24 mg), Pantothenate <i>d-calcium</i> (60 mg), Papain (9 mg), Phosphatidylcholine (480 mg), Phosphatidylserine (30 mg), Pyridoxine HCl (18 mg), Pyridoxal-5-phosphate (3.6 mg), Riboflavin-5-Phosphate (6 mg), L-selenomethionine (60 µg), Taurine (90 mg), Thiamine (24 mg), Tocotrienols mixed (186 mg), Zinc citrate (18 mg)
Wouters- Wesseling 2005 [10]	Sodium (80 mg), Potassium (550 mg), Chloride (40 mg), Calcium (400 mg), Phosphorus (400 mg), Magnesium (100 mg), Iron (9 mg), Zinc (18 mg), Copper (3 mg), Manganese (4 mg), Fluoride (75 lg), Molybdenum (40 lg), Selenium (85 lg), Chromium (35 lg); Iodine (150 lg), Vit A (240 lg), Carotenoids (3 mg), Vit D (13 lg), Vit E (70 mg), Vit K (80 lg), Vit C (250 mg), Vit B1 (1.9 mg), Vit B2 (1.9 mg), Vit B6 (2.5 mg), Vit B12 (5.3 lg), Niacin (14 mg NE), Pantothenic acid (4.5 mg), Folate (480 lg), Biotin (70 lg), Coenzyme Q10 (3 mg), Flavonoids (19 mg)

Vit = Vitamin.

REFERENCES

- [1] Chan A, Remington R, Kotyla E, Lepore A, Zemianek J, Shea TB (2010) A Vitamin/nutriceutical formulation improves Memory and cognitive performance in community-dwelling adults without dementia. *J Nutr Health Aging* **14**, 224-230.
- [2] Cockle SM, Haller J, Kimber S, Dawe RA, Hindmarch I (2000) The influence of multivitamins on cognitive function and mood in the elderly. *Aging Ment Health* **4**, 339-353.
- [3] Gariballa S, Forster S (2007) Effects of dietary supplements on depressive symptoms in older patients: A randomised double-blind placebo-controlled trial. *Clin Nutr* **26**, 545-551.
- [4] Haskell CF, Robertson B, Jones E, Forster J, Jones R, Wilde A, Maggini S, Kennedy DO (2010) Effects of a multi-vitamin/mineral supplement on cognitive function and fatigue during extended multi-tasking. *Hum Psychopharm* **25**, 448-461.
- [5] Kang JH, Cook NR, Manson JE, Buring JE, Albert CM, Grodstein F (2009) Vitamin E, Vitamin C, Beta carotene, and cognitive function among women with or at risk of cardiovascular disease: The women's antioxidant and cardiovascular study. *Circulation* **119**, 2772-2780.
- [6] Kennedy DO, Veasey R, Watson A, Dodd F, Jones E, Maggini S, Haskell CF (2010) Effects of high-dose B vitamin complex with vitamin C and minerals on subjective mood and performance in healthy males. *Psychopharmacology* **211**, 55-68.
- [7] McNeill G, Avenell A, Campbell MK, Cook JA, Hannaford PC, Kilonzo MM, Milne AC, Ramsay CR, Seymour DG, Stephen AI, Vale LD (2007) Effect of multivitamin and multimineral supplementation on cognitive function in men and women aged 65 years and over: A randomised controlled trial. *Nutr J* **6**, 10-15.
- [8] Smith A, Clark R, Nutt D, Haller J, Hayward S, Perry K (1999) Anti-oxidant vitamins and mental performance of the elderly. *Hum Psychopharm* **14**, 459-471.
- [9] Summers WK, Martin RL, Cunningham M, Deboynnton VL, Marsh GM (2010) Complex antioxidant blend improves memory in community-dwelling seniors. *J Alzheimers Dis* **19**, 429-439.
- [10] Wouters-Wesseling W, Wagenaar LW, Rozendaal M, Deijen JB, De Groot LC, Bindels JG, Van Staveren WA (2005) Effect of an enriched drink on cognitive function in frail elderly persons. *J Geront - A Bio Sci Med Sci* **60**, 265-270.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Chan 2010	+	+	+	-	?	+	+
Cockle 2000	+	?	+	+	+	+	+
Gariballa 2007	+	+	+	+	+	+	+
Haskell 2010	+	+	+	+	+	+	+
Kang 2009	+	?	?	+	+	+	+
Kennedy 2010	+	+	+	+	+	+	-
McNeil 2007	+	+	+	+	+	+	+
Smith 1999	+	?	?	?	?	+	+
Summers 2010	+	+	+	+	+	-	+
Wouters-Wesseling 2005	+	?	+	+	+	+	+

Supplementary Figure 1. Risk of bias assessment of studies included in review. + = low risk of bias; - = high risk of bias; ? = unclear risk of bias.