Asia Pacific J Clin Nutr (1998) 7(2): 196–197

Short communication

The fatty acid status of rural school children with helminth infections

HY Tichelaar MSc, CM Smuts PhD, ME van Stuijvenberg MSc, M Faber MNutr and AJS Benadé DSc

National Research Programme for Nutritional Intervention of the Medical Research Council, Tygerberg, South Africa

Intestinal helminth infections may reduce nutrient availability and thereby impair cognitive growth and other functions. Certain nutrients such as fatty acids may also modulate inflammation and the immune response and, thus, the severity of helminth infection. Fatty acid status may, therefore, both be affected by and affect helminth infection. Rural school-children in South Africa with a 35% helminth infestation rate were assessed for serum total fatty acid status. With hookworm, a higher percentage total n-3 fatty acids were found with functional implications.

Key words: South Africa, helminth, fatty acids, school children.

Helminth infections are implicated in the aetiology of poor school performance.[1] Infected children also have a high rate of absenteeism.[2] School-age children of communities with low socio-economic status in developing countries frequently present with very high levels of helminth infections that may cause cognitive deficits. Although light loads of helminth infections are unlikely to measurably impair cognition, a large body of evidence indicates that moderate to heavy loads of roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*) and hookworm (*Ancylostoma duodenale* or *Necator americanus*) are most likely to cause impairment.[1] Regular mass deworming is necessary in highly endemic areas as intestinal parasites compete with their host for nutrients and/or impair absorption and cause loss of nutrients by haemorrhage.[3] Helminth infections elicit an immune response by releasing cytokines,[1] which can be modulated by certain fatty acids to control inflammation.[4] Interactions between the nervous and immune systems influence behaviour.[5] The effect of helminth infections on the plasma fatty acid status of human beings remains unknown.

Correspondence address: Mr HY Tichelaar, National Research Programme for Nutritional Intervention, PO Box 19070, Tygerberg, 7505, South Africa.
Tel: 27 21 938 0409; Fax: 27 21 938 0321
E-mail: htichela@eagle.mrc.ac.za

Table 1. Comparison of serum total fatty acids (%) from rural school children without and with worm infections

Fatty acids		No worms (n = 76)		Roundworm (*Ascaris lumbricoides*) (n = 19)		Whipworm (*Trichuris trichiura*) (n = 64)		Hookworm (*Necator americanus*) (n = 10)	
14:0	(myristic acid)	0.60	(0.28)	0.60	(0.19)	0.63	(0.26)	0.58	(0.17)
16:0	(palmitic acid)	21.87	(2.43)	22.34	(2.40)	22.07	(2.13)	21.06	(1.93)
16:1ω7	(palmitoleic acid)	1.70	(0.96)	1.74	(0.79)	1.73	(0.98)	1.57	(0.91)
18:0	(stearic acid)	8.62	(0.91)	8.64	(0.81)	8.60	(0.71)	8.51	(1.00)
18:1ω9	(oleic acid)	17.49	(2.26)	17.44	(2.43)	17.75	(2.65)	17.64	(2.67)
18:2ω6	(linoleic acid)	35.27	(4.59)	33.99	(4.43)	34.42	(4.37)	34.94	(5.00)
18:3ω6	(gamma-linolenic acid)	0.53	(0.19)	0.54	(0.21)	0.52	(0.19)	0.40[a]	(0.12)
18:3ω3	(α-linolenic acid)	0.33	(0.15)	0.36	(0.16)	0.43[b]	(0.22)	0.55[a]	(0.34)
20:3ω9	(eicosatrienoic acid)	0.45	(0.17)	0.45	(0.11)	0.42	(0.10)	0.47	(0.10)
20:3ω6	(dihomo-gammalinolenic acid)	1.67	(0.35)	1.88[a]	(0.35)	1.63	(0.40)	1.90	(0.42)
20:4ω6	(arachidonic acid)	8.53	(1.53)	8.83	(1.21)	8.77	(1.57)	8.84	(0.80)
20:5ω3	(eicosapentaenoic acid)	0.26	(0.14)	0.27	(0.09)	0.26	(0.11)	0.34	(0.19)
22:4ω6	(docosatetraenoic acid)	0.55	(0.13)	0.62	(0.16)	0.55	(0.17)	0.63	(0.17)
22:5ω3	(docosapentaenoic acid)	0.37	(0.09)	0.39	(0.11)	0.39	(0.12)	0.45[a]	(0.11)
22:6ω3	(docosahexaenoic acid)	1.77	(0.50)	1.92	(0.59)	1.84	(0.48)	2.13[a]	(0.40)
∑ ω6		46.54	(4.62)	45.86	(4.54)	45.89	(4.69)	46.71	(4.56)
∑ ω3		2.73	(0.64)	2.93	(0.66)	2.92	(0.67)	3.46[b]	(0.64)

Mean ± SD. Significantly different from no worms: [a] $P < 0.05$; [b] $P < 0.01$.

We retrospectively analysed the serum total fatty acid status of children with and without helminth infection. African primary school children, aged 6–14 years, of a rural low-socio-economic community were screened for helminth infections during a cross-sectional survey. Written informed parenteral consent was obtained from 253 children for blood and stool sampling. The study was approved by the Medical Research Council's ethics committee, the Department of Education, the school principal and the local community leaders. A 35% prevalence of helminth infections was observed. The most common helminths were roundworm (n = 19), whipworm (n = 64) and hookworm (n = 10). Lipids were extracted from serum with chloroform/methanol (2/1; v/v) with butylated hydroxytoluene as antioxidant and total serum fatty acids were subjected to gas-liquid chromatographic analysis with DB-225 (J&W Scientific, Falsom, CA, USA) fused silica columns. Serum total fatty acids of children with specific worm infections were compared with those without worm infections (Table 1) using a Wilcoxon two-sample test. Children with roundworm infections had higher levels of 20:3ω6. A similar trend was also noted in the fatty acids of children with hookworm infections. Higher levels of 18:3ω3 were seen in children with whipworm and hookworm infections. Children with hookworm infections had higher Σ ω3 fatty acids, mainly 18:3ω3, 22:5ω3 and 22:6ω3, with concomitant lower levels of 18:3ω6 than children without worm infections.

This study suggests that specific worm infections may affect fatty acid metabolism of children. Further investigations are recommended because of the anti-inflammatory and immunoregulating properties of specific fatty acids such as 20:3ω6[4] which offer stimulating possibilities to find relationships between intestinal parasite infections and school performance.

The fatty acid status of rural school children with helminth infections

HY Tichelaar, CM Smuts, ME van Stuijvenberg, M Faber and AJS Benadé

Asia Pacific Journal of Clinical Nutrition (1998) Volume 7, Number 2: 196–197

农村学龄儿童蠕虫病患者体内的脂肪酸状态

摘要

肠道蠕虫感染可减低营养素的利用从而影响机体的生长和其它功能。某些营养素象脂肪酸可能调节感染与免疫反应以及蠕虫感染的严重性。因此体内脂肪酸的状态和蠕虫感染 相互影响。南非农村学龄儿童蠕虫感染率高达35%。在这些蠕虫感染儿童进行的血清脂肪酸组成测定表明: 钩虫病患者 总n-3脂肪酸的百分比偏高, 同时有功能性的损伤。

References

1. Watkins WE, Pollitt E. 'Stupidity or worms': do intestinal worms impair mental performance? Psychol Bull 1997; 121: 171–191.
2. Raj SM, Sein KT, Anuar AK, Mustaffa BE. Effect of intestinal helminthiasis on school attendance by early primary schoolchildren. Transact Royal Soc Trop Med Hyg 1997; 91: 131–132.
3. Fincham JE, Evans AC, Woodroof CW, Seager JR, Benadé AJS, Appleton CC. Feed the children, not the parasites — an essential part of primary health care in South Africa. S Afr Med J 1996; 86: 647–649.
4. Zurier RB. Fatty acids, inflammation and immune responses. Prostaglandins Leukot Essent Fatty Acids 1993; 48: 57–62.
5. Ader R, Cohen N, Felten D. Psychoneuroimmunology: interactions between the nervous system and the immune system. Lancet 1995; 345: 99–103.