evaluate chronic diarrhea beyond first phase investigations and early successful management of the case.

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REFERENCES

1. Bhatia MS, Khandpal M, Srivastava S, Kohli GS. Intractable psychogenic sneezing: Two case reports. Indian Pediatr 2004; 41: 503-505.
2. Wyllie R. Recurrent Abdominal pain of childhood. *In:* Behnnan RE. Kliegman RM, Jenso HB, editors. 17th edn. Nelson Textbook of Pediatrics. Reed Elseiver India Pvt Ltd: 2004; p 1821- 1822.
3. Ohta T, Shinelo T, Kojima K. Irritable bowl syndrome in children. Nippon Rinsho, 1992; 50: 2728 (Absiract available from: URL: http: / /www.pubmed.com/). Accessed May 24, 2004.
4. Sperling M. Psychogenic diarrhea and phobia in a 6½-year–old girl; workshop, 1952. Am J Orthopsychiatry 1952; 22: 838-848.

Natural Antioxidant Therapy for Patients with Hemolytic Anemia

We read with interest the article by Marwaha, *et al*.(1) on the use of wheat grass juice (WGJ) to reduce transfusion requirements in patients with thalassemia major. We applaud the authors for their efforts in this innovative pilot study, and wish to speculate on possible mechanisms of action that may be considered in the event the authors or others wish to pursue this line of investigation.

First, likely recognizing that all statistically significant results may not be clinically significant, the authors chose a clinical albeit arbitrary endpoint to evaluate the success of the WGJ therapy to decrease transfusion requirements in the study patients. Using their definition of success (>25% reduction of blood transfused compared to the pre-WGJ period), they reasoned that 50% of the patients responded to the WGJ therapy. Using the data they provided in the table in the paper, we performed relevant statistical analyses on the entire cohort to evaluate the effects of WGJ on the total amount of blood transfused and the mean interval between transfusions. We found that WGJ therapy decreased the total volume of blood transfused and increased the intervals between blood transfusions of the entire study cohort (*Table I*). More importantly, the blood transfusion requirements and intervals between transfusions of the post-WGJ therapy

TABLE I–*Effect of WGJ Therapy on Blood Transfusion Requirements.*

	Pre-WGJ therapy *	Post-WGJ therapy *	p value §
Interval between transfusions (days)	22.4 (22.4, 17.5 - 27.5)	26.35 (28.7, 20.7 - 42.2)	0.001
Blood Transfusion (g/kg/year)	255 (242.6, 156 - 306)	188 (187.5, 91 - 291)	0.001

(N = 16, * Median, Mean, Minimum - Maximum; § Wilcoxon signed-rank test).

period demonstrated negative and positive relation-ships respectively to the duration of WGJ therapy (Pearson's correlation co-efficient of 0.560, P <0.05 and 0.627, P <0.01, res-pectively). These analyses suggest that not only is WGJ therapy effective, but also that the benefit is related to the duration of WGJ therapy. Second, as the authors chose not to speculate on the mechanism of the beneficial action of the WGJ therapy on their transfusion dependent patients, we would like to propose a testable hypothesis for consideration to facilitate future studies in this area. Historically, the beneficial effects of WGJ therapy have been attributed to its rich nutritional content that include antioxidant vitamins (C&E) and bio-flavenoids(2). We speculate that the effects of the WGJ therapy may be due to the action of natural antioxidants on red blood cell (RBC) antioxidant function, and corresponding effects on cellular enzyme function and membrane integrity. This thought is supported by studies that show decreased antioxidant capacities of RBCs of patients with thalassemia(3) as well as beneficial effects on RBC life-span by supplementation of antioxidants in vivo in other hemolytic disorders(4). Although, in this study, the authors did not measure RBC life-span, the greater interval between blood transfusions following institution of WGJ therapy suggests that RBC life-span was increased. Inter-estingly, the authors noted that the response to WGJ therapy took some months (the "neutral period"); this may suggest that the natural antioxidants contained in the WGJ are better able to prevent cellular injury than to repair RBC enzymes/membranes once damaged. Hence, RBCs, once damaged, would be cleared from the circulation by the reticulo-endothelial system as they would prior to the onset of the WGJ therapy, but newly formed RBCs would not be damaged and have a longer life-span. This antioxidant hypothesis can be easily tested by measuring indices of RBC antioxidant capacity previously noted to be abnormal in patients with thalassemia(3) in study subjects currently on WGJ therapy and matched control patients not consuming WGJ. Studies of RBC life-span may be attempted, but are more complex and are not likely to yield more information than the interval between blood transfusions already noted. Such an antioxidant mechanism of action of WGJ was also cited by Ben-Arye *et al* to explain the beneficial effects of WGJ therapy in patients with ulcerative colitis(2). While clinical trials are currently underway to find suitable blood substitutes for patients needing blood transfusions, they may not be readily available in developing countries nor would they be preferable to natural therapies aimed at preserving a patient's own RBCs. Indeed, WGJ and other nutritional therapies may be considered as adjuvants to drug therapy. Using nutritional therapy to augment a patient's antioxidant defenses in an effort to decrease morbidity and mortality has similarly been advocated in other more dreaded diseases such as cancer(5).

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REFERENCES

1. Marawaha RK, Bansal D, Kaur S, Trehan A. Wheat grass juice reduces transfusion requirement in patients with thalassemia major: a pilot study. Indian Pediatr 2004; 41: 716-720.
2. Ben-Arye E, Goldin E, Wengrower D, Stamper A, Kohn R, Berry E. Wheat grass juice in the

treatment of active distal ulcerative colitis: a randomized double-blind placebo-controlled trial. Scand J Gastroenterol 2002; 37: 444-449.

3. Chan AC, Chow CK, Chiu D. Interaction of antioxidants and their implication in Genetic Anemia. Proc Soc Exp Biol Med 1999; 222: 274-282.
4. Hafez M, Amar ES, Zedan M, Hammad H, Sorour AH, el-Desouky ES, Gamil N. Improved erythrocyte survival with combined vitamin E and selenium therapy in children with glucose-6-phosphate dehydrogenase deficiency and mild chronic hemolysis. J Pediatr 1986; 108: 558-561.
5. Donaldson M. Nutrition and cancer: A review of the evidence for an anti-cancer diet. Nutrition Journal 2004; 3: 19.

Reply

Fernandes and Donovon have performed statistical analysis on the entire cohort to provide evidence for success of the therapy. Statistical analysis of our data had shown similar significant results. The 'hard core' clinical evidence was convincing but the small sample size reminded us of the adage that all statistically significant results might not be clinically significant. It is heartening to know that Fernandes and Donovon have endorsed our 'clinically significant' observations, as statistically significant as well.

Fernandes and Donovon have applied Pearson's correlation to demonstrate that response is related to the duration of wheat grass juice therapy. This would have been done by comparing interval between blood transfusion and the total amount of the blood transfused among patients with wheat grass juice for varying periods. In an extension of this analysis, a further recourse can be to compare annual requirement of blood in an individual patient on wheat grass juice, and to look for evidence of increasing benefit as the duration of consumption increases. This would be more meaningful, than the comparison of benefit between different patients. We had not provided yearly data on each patient and instead given mean values of the entire duration of the pre and post wheat grass juice therapy period. This would have precluded the critics from performing temporal statistics in each patient. One must, however, remember that bias is likely to creep in with a large number of treatment defaulters. The patients who benefited initially are more likely to be compliant in the long run.

The hypothesis that an anti-oxidant mechanism may beresponsible for the beneficial effects of wheat grass juice therapy is worthy of further evaluation. Augmented antioxidant capacity of red cells may be true not only for newly formed cells, but for the transfused red cells as well.

Most of our thalassemics, consuming wheat grass juice, reported non-specific well-being, improved appetite and reduced musculo-skeletal aches and pains. These effects may be attributed to the antioxidant activity of wheat grass juice.

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