The Use of Megavitamin Treatment in Children with Learning Disabilities

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Children with severe reading and spelling difficulties were given megavitamin treatment. Progress in psycholinguistic ability and the presence of soft neurological signs and perceptual dysfunction symptoms were compared with dyslexic children given no treatment. Although no differences between the groups in reading and spelling ability could be detected after the treatment period, children receiving megadoses of vitamins C, B3, pantothenic acid, and B6, (plus a high-protein low-carbohydrate diet) did show a reduction in hyperkinesis, sleep disturbance, and nystagmus, as well as in some perceptual dysfunction symptoms. Improvements in some basic language skills were also noted.

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Before discussing the results of the study it seems opportune to describe the complex meaning of the term, learning disability. The term is used in a very broad sense—it includes all learning problems due to organic or nonorganic abnormalities or dysfunctions. Some organic bases for such difficulties include: cerebral palsy, mental deficiency (retardation), cortical blindness or deafness, or epilepsy.

Usually a distinction is made between organic and functional abnormality. It is obvious that every organic abnormality carries with it some abnormal functions. The term "functional" refers to an abnormal performance for which a pathophysiological basis has not yet been determined. Children with impairment of functional abnormal performance are more numerous than those suffering from mental deficiencies or cerebral palsy. Estimates of the extent of functional difficulties in the general school population vary between 5 percent to 22 percent depending on the degree of learning dysfunctions.

Every affected child is in some way different from every other. But all have in common poor school performance. Some also show behavior problems at home and at school with hyperactivity as the most frequent complaint. This involves a tendency to become over-stimulated and overactive. Behavior is often inappropriate, hectic, and disorganized. It is as if the child cannot control his movements. Impulsiveness, short attention span, marked distractibility, lability of mood, antisocial behavior are present in various degrees.

Neurological examinations are often unrevealing. Usually no abnormalities as to cranial nerves, motor and sensory functions, and reflexes are found. The speech and expressive language abilities of these children is usually normal. However soft, neurological signs are frequently found in these children. These include: difficulties in keeping balance when hopping on one foot, swaying of the body when the eyes are closed, nystagmus —jumping of the eyeball when fixing an object, perceptual dysfunctions, poor visual or auditory discriminations, lack of motor-coordination, poor sequential auditory or visual memory, confusing right and left.

Because of the soft neurological signs in the absence of neurological pathology these cases have been referred to as "minimal brain damage," or "minimal cerebral dysfunctions," or "special educational difficulties" (Paine, 1965).

In 1972, a psychiatrist, A. Cott, reported that he successfully treated 500 children who suffered various degrees of learning disability with megadoses of ascorbic acid (vitamin C), niacinamide (vitamin B3), Pyridoxine (vitamin B6), and calcium pantothenate. Following Abram Hoffer's (1962) medical treatment program in treating schizophrenic patients with megadoses of vitamins, A. Cott reasoned that it may also be of value to the learning disabled child.

In 1973 Dr. Glen Green presented and published a paper on subclinical pellagra in children and adults. He found perceptual and motor impairment leading to learning disabilities to be related to vitamin B3 —niacin deficiency or even niacin dependency.

The difference between a deficiency and dependency is that in the condition of a niacin deficiency the patient suffers symptoms of subclinical pellagra because of a diet deficient in vitamin B3. An individual's need for vitamin B3 varies with age, lifestyle, physical condition, and diet. Thus the recommended daily intake varies from 5 mg/day for infants to 18 mg/day during pregnancy, and 20 mg/day for boys aged 14 to 18 years. In general men require more vitamin B3 than do women, with 15-18 mg/day and 13-15 mg/day respectively (Goodman and Gilman, 1970).

In the case of a vitamin B3 dependency the body's needs for the vitamin are so great that the best diet cannot meet them and the individual requires a daily megadose. As in the case of schizophrenia, A. Hoffer diagnoses these individuals as suffering a vitamin B3 dependency if they react positively to the megadoses of vitamins.

Glen Green (1970) reported the successful treatment of a 10-year-old with Orthomolecular therapy. The child showed symptoms which would be considered under the heading of general learning disability: "specific dyslexia." Although the term "dyslexia" is reserved for cases with diagnosed brain damage, the term "specific dyslexia" implies that no organic or convincing neurological signs are present (Paine, 1965). The child shows a marked deficiency in reading and spelling in spite of a normal intelligence and normal willingness to learn! The symptoms of a child with specific dyslexia are reversals, omissions, substitutions of letters, visual and/or auditory lack in discriminations of letters, forms, and/or sounds.

Hoffer has reported that children with hyperkinetic symptoms given vitamins B6 and B3 improve considerably.

Pyridoxine has been found to control convulsions (Hunt et al., 1954) and daily seizures. Considering that hyperactivity in children is associated with possible "minimal brain damage" and recalling the description of symptoms such as overstimulation, lack of motor-control, then it seems reasonable to assume that Pyridoxine in combination with niacin may, indeed, control hyperactivity. There are about 20 metabolic defects known, and it may well be that hyperactivity is related to one of them not yet discovered.

HYPOTHESIS

Since the statements made by A. Cott and G. Green regarding a relationship between a vitamin dependency and learning disabilities were based on essentially clinical evidence, it seemed that a controlled study using objective psychometric information was in order. To this end, the hypothesis to be tested was whether children diagnosed as having specific dyslexic symptoms3 with or without hyperactivity[4] or behavioral symptoms would show significant changes in their academic skills or behavior under the vitamin treatment plus a high-protein low-carbohydrate diet recommended by A. Hoffer, A. Cott, and G. Green.

METHODOLOGY

Subjects

All subjects were school-age children who were experiencing extreme difficulty in reading and spelling, with or without other behavioral problems. They were referred either by their doctor, the school, or were self-referred. The **experimental** group included children whose parents were willing to try vitamin treatment. The experimental group was matched with a control group comparable in sex, age, I.Q., and degree of specific dyslexia and behavioral problems. Most parents of control group

3 Dyslexia is reserved for diagnosed brain damage. Specific dyslexia implies no convincing evidence of neurological impairment.

4 Hyperactivity was defined as a limited ability to sit still, to concentrate, and to show age-appropriate attention. children were interested in the treatment. Subjects in both groups came from middle-income families.

Experimental Group

The group included 19 males and five females who were tested four times over a mean period of 1.1 years (range = 9 months to 1.5 years).

For this group, the mean age at the first test session was 10.10 years (range = 7.5 - 14.9 years). At the fourth session, the mean age was 12.1 years (range = 8.7 -16.1).

Intelligence quotients (I.Q.), as calculated with the performance section of the WISC, ranged from 74 - 128 (mean = 103.9). It included six children with I.Q.'s less than 90 and 10 children with I.Q.'s greater than 110 points.

Within this group, six children were adopted, seven mothers reported complications of pregnancy or birth, one child was premature, and one child suffered from a severe digestive disturbance for her first two years.

Medication

Administration of the megadoses of vitamins was supervised by the subject's doctor. According to the prescription given by practitioners5 experienced in Orthomolecular medicine, the following dosages of vitamins were given on a daily basis: 3 g ascorbic acid, 3 g niacinamide, 250 mg Pyridoxine, and 250 mg pantothenic acid. A high-protein low-carbohydrate diet was followed in conjunction with the vitamins.

The vitamins were introduced to the subjects gradually. For the first two weeks of treatment 1.5 g of ascorbic acid and niacinamide were given as well as 250 mg of Pyridoxine and pantothenic acid. Then for one week the dosages of ascorbic acid and niacinamide were raised to 2 g per day. After that time period the doses were again increased to the full dosage mentioned above. The

[5] Special thanks for advice to B. Kowalson, M.D., D. F. Besant, M.D., and T. S. Cha, M.D.

children were particularly observed for side effects during this period.

At the conclusion of the study a similar gradual reduction in vitamin intake was followed. The children were seen by their doctors regularly during and shortly after the treatment period.

Control Group

Nine children acted as a control group to determine the extent of changes in performance that result from developmental factors and test experience. They were given neither vitamins nor a special diet to follow. This group of six males and three females was tested twice over a five-month period.

The ages at the first test period ranged from 7.11 to 11.8 years (mean = 9.10 years).

WISC performance I.Q.'s for this group ranged from 92-121 points (mean = 104.6). None had scores less than 90, and two had I.Q.'s above 110. In this group two children were adopted and three mothers experienced complications of pregnancy or birth.

Because of limited funds and the approaching summer holidays the observation period for the control group was shorter than that for the experimental group. This fact was taken into account in the descriptive statistical evaluation. The shorter observation period for the control group was felt to be justified since it was hypothesized that a minimum time period of two to six months was necessary for the vitamin-treated children before any objective changes in academic or behavioral symptoms could be effective and be measured. which included words that children with specific dyslexia have particular difficulty spelling; 4. a test of "soft" neurological signs including left-right orientation, hand tremor, balance, kinesthetic perception, and detection of gross abnormal eye movements (Vazuka, 1968); 5. and four subtests of the Illinois Test of Psycholinguistic Ability (Kirk et al., 1968, visual closure, visual sequential memory, auditory closure, and auditory sequential memory).

Parents were given a questionnaire to determine the developmental history of the child and to outline whatever behavioral difficulties the child has experienced at home and at school. The Glen Green Perceptual Dysfunction Questionnaire was also given to the parent to be filled out at home with the child. For this questionnaire, possible symptoms were divided according to modality.

At a subsequent test session the child was given all the above tests with the exception of the WISC. Parents were given the Glen Green Questionnaire for the child to fill out as well as a questionnaire to determine the extent of behavioral difficulties that the child was experiencing.

Children in the experimental group were seen at least four times with approximately a three-month interval between test sessions. Children in the control group were seen twice over a five-month interval.

Statistical Evaluation

Because of the small number of subjects, no inferential statistics were applied to the data to compare experimental and control groups; descriptive statistics were used.

RESULTS

When describing the test results the reader is reminded that the time of observation for the control group was only five months long as compared to an average 1.1-year observation period of the experimental group.

Reading

The only area in which no significant changes were observed was in reading and spelling levels. Both groups had the same distribution of poor readers. The experimental group was two and a half grades behind in reading level, the control group was one grade behind. The control group was one year younger (age 9 years, 10 months) as compared to the experimental average group age (age 10 years 11 months and 10 years 10 months). The experimental group did not exceed the control group in reading abilities.

Spelling

The spelling test used for this study was given also to a normal third-grade school group (n = 41). The normal group spelled 93 percent of the words correctly. Before megavitamin treatment the experimental group spelled 76 percent correctly and after 1.1 years later 81 percent correctly. This is comparable to the control group spelling 61 percent correctly and after five months 66 percent correctly. Thus no differences in spelling levels were established.

TABLE 1

ITPA Changes in Raw Scores for each Subject

	Vis.Clos.	**Vis . Mem.**	**Aud. Clos.**	**Aud. Mem.**
	%	%	%	%
% raw score improvement				
Exp. (5-10 points)	**18**	**61**	**22**	**18**
{ >11 points)	**70**	**22**	**30**	**43**
Total	**88**	**83**	**52**	**61**
Control (3-5 points)* (>6 points)	**29 14**	**25 25**	**0 37**	**11 22**
Total	**43**	**50**	**37**	**33**
% deterioration in raw score Exp. (>5 points) Control (> 3 points)	**0 14**	**0 22**	**4 13**	**4 44**

" Approximately half of the number of points compared with the experimental group because of half of the observed time period.

TABLE 2

ITPA
Differences-between Average Raw Scores
at First and Last Test Session for
Experimental and Control Groups

Difference between 1st and 2nd Test	**Experimental**	**Control**
Visual Closure	11.6	4.0
Visual Memory	7.7	2.2 '
Auditory Closure	6.8	3.0
Auditory Memory	8.4	-1.1

ITPA

Increases in raw scores were most evident in the experimental group (see Table 1). For all four subtests, more than half of the experimental group showed at least a five-point gain. In general, however, gains were greatest in the visual modality for both groups. The most striking comparison here was the extent of deterioration in raw score in control group children and the minimal number of experimental group children who declined in raw score.

The extent of improvement in the experimental group can be seen in Table 2. On each subtest, the experimental children at first scored, on the average, slightly lower than control group children. This is particularly noteworthy since the experimental children were slightly older than those not receiving the vitamin treatment.

By the end of the study period the average score for experimental children on all the subtests was higher than those of the control group. Thus, not only did most children gain in score, but those receiving the megavitamins actually surpassed those who did not get this treatment.

General Behavioral Symptoms and Soft Neurological Signs

Table 3 indicates the percentages of subjects in each group who showed such symptoms or signs. For both groups, a high percentage of subjects had kinesthetic dysperceptions, difficulty following a moving object only with the eyes, hand tremor, left-right disorientation, and sleep disturbance at the beginning of the study. More children receiving the megavitamin treatment experienced hyperactivity symptoms prior to therapy. On the average, a similar proportion of both experimental and control groups indicated symptoms initially, at the start of the study.

In contrast, children receiving the megavitamins showed, on the average, almost **twice** as much improvement as the children who received no particular treatment. Sixty percent of the treated children and only 34 percent of the control children showed a reduction of symptoms.

Initial symptoms and the extent of improvement was also examined according to the age of the subjects. The groups were divided according to whether the subjects were less than or

TABLE 3

General Symptoms and Soft Neurological Signs
Percentages of Subjects Showing Symptom at First
Test and Percentages of Subjects Showing Improvement

	N = 23	N = 9		
	% showing symptom at first test		% improved of those initially showing symptom	
Symptom or Sign	**Exp.**	**Cont.**	**Exp.**	**Cont.**
Kinesthetic Dysperception	**96**	100	**41**	**67**
Eye skipping	**91**	**89**	**62**	**13**
Hand tremor	**78**	**67**	**33**	**33**
Left-right disorientation	**61**	**67**	**57**	**67**
Balance difficulties	**13**	**0**	100	-
Hyperactivity	**78**	**33**	**78**	**0**
Enuresis	**26**	**44**	**50**	**50**
Sleep disturbance	**78**	**78**	**61**	**14**
Means	65.1[c]	59.8%	60.3%	34.9%

greater than 11.0 years old at the midpoint of the experiment. Although symptoms were seen in both age groups, they were more prevalent in the younger subjects. Experimental subjects less than 11 years had the most symptoms, on the average. Balance difficulties were seen only in the younger children. Regardless of age, experimental subjects showed a larger reduction in symptoms than control children. Thus, age was not a limiting factor for responding to megavitamin treatment.

Glen Green Questionnaire Normative Data

Glen Green Questionnaire, filled out prior to treatment by children in the experimental group, was compared with the responses of 8, 9, and 10 year-old
children attending regular classes. For each question, the frequency of responses that indicated the presence of a symptom was compared between the groups; a chi square formula was used for this.

Table 4 indicates that only 11 questions differentiated the two groups of children ($p < .05$). Even so, the average percentages of subjects reporting symptoms in a given modality indicated that, in general, the dyslexic children reported more symptoms (Table 5).

Experimental Data

At the beginning of the study, many subjects in the experimental group and in the control group reported only a minimal number of symptoms. Somatic and auditory complaints were observed

TABLE 4 GLEN GREEN QUESTIONNAIRE

Questions Indicating a Significant Difference[1] in Frequency of Response Between the Experimental Group and a Normal Group Aged 8, 9, 10 Years
Exp. N = 24 Normal N = 58

** 10. Do the words seem backwards when you read? e.g., saw-was
** 12. Does your mind go blank when you read?
** 13. Do the lines move together or get mixed up when you read?
** 14. Do the words seem to disappear when you read?
** 18. Do vou sometimes think you can see animals when there are none there?
** 30. Do you think you hear voices talking or yelling when there is no one there?
** 34. Do some things seem to feel different now than before when you touch them?
* 38. Can you tell where your hands are when your eyes are closed? ** 46. When you walk does the ground seem to move ahead of you?
* 64. Do you sometimes wet the bed? 90. Do you feel that people watch you more than they used to?

t: significance was determined with an x2 test
*: p<.05 **:
p<01

TABLE 5 GLEN GREEN QUESTIONNAIRE

Mean Percentage of Subjects Reporting Symptom According to Symptom Classification and Group

Type of Symptom	N = 24 Dyslexic %	N = 58 Normal %
Visual	35.5	25.4
Auditory	43.5	39.6
Tactile	27.4	24.4
Taste	25.1	34.5
Physical	40.7	37.9

most frequently in both groups: 48 percent in the experimental and 44 percent in the control group.

It is interesting to note that the control group showed more increases in symptoms from the beginning to the end of the study; this was true for every modality. Only a minimal number of experimental children showed increases in the tactual and taste modalities, and none increased in visual symptoms.

The extent of change in the number of symptoms reported over the course of the study is evident in Table 6. Here, the scores for each group at the beginning of the study was compared with those at the end of the study using the t-test for correlated samples statistic. A significant ($p < .05$) decrease in number of symptoms was reported in the experimental group for the visual, auditory, tactual, and physical modalities. None of the score changes for the control group was significant.

DISCUSSION

The major hypothesis of this study, that learning difficulties relating to specific dyslexia could be alleviated by megavitamin therapy, was not supported. But behavioral improvements attributable to this treatment were observed for certain types of symptoms. In contrast, reading and spelling skills, whose mastery is somewhat dependent on practice, were not substantially influenced by megavitamin therapy. It seems unlikely that children handicapped by perceptual memory or hyperkinetic symptoms for most of their academic lives would suddenly be able to read and spell once some of these symptoms subsided. Perhaps observation of the children over a longer time period or intense remedial reading instruction in conjunction with the treatment would have yielded more positive results in this area as well.

Reduction in hyperactivity, eye skipping, and sleep disturbances among children taking the vitamins was a noteworthy experimental outcome. Reduction in hyperkinetic symptoms may, however, be a function of a number of variables in addition to megavitamin treatment. For example, the high-protein low-carbohydrate diet could have contributed to this effect. It is known that hyperactivity may also be a symptom of various food allergies (e.g., sugar, wheat, milk, meat, Speer, 1963). Thus, the diet alone may have alleviated this symptom. More research is needed for the establishment of a differential treatment program. Tentatively, however, the results suggest that megavitamin treatment in combination with the high-protein low-carbohydrate diet may be used instead of Ritalin or similar drugs often prescribed to control hyperkinetic problems in children.

Although the significance of the Glen Green Perceptual Dysfunction Questionnaire is not completely clear, it was still noteworthy to find a significant reduc-

TABLE 6 GLEN GREEN QUESTIONNAIRE

t Values* for Comparison of Scores for First and Last Test and Mean Percentage of Symptoms According to Group and Modality

	Visual		Auditory		Tactual		Taste		Physical	
Experimental Mean	27.0	10.7	35.3	20.6	18.6	4.6	19.1	9.9	34.7	22.2
(22 df)	4.23+		3.55+		3.88+		1.76		2.64	
Control Mean	22.6	20.7	28.3	28.2	9.4	8.0	5.3	12.9	32.3	36.0
(8df)	0.41		0.01		0.32		1.32		0.45	

* based on t-tesf for correlated scores + p<.01 +. p<.05'

tion in symptoms only in the experimental group. This finding would presumably reflect the fact that such symptoms are a function of a subclinical deficiency possibly based on a specific vitamin or diet dependency. It is interesting to observe that any reduction in perceptual dysfunctional symptoms occurred without any relationship to the initial appearance or disappearance of other difficulties (e.g., hyperactivity, academic progress).

Note that with the exception of one case, none of the parents nor children had complaints as to dysperceptions when interviewed. Only when the specific questions of the Glen Green Questionnaire were answered were such dysperceptions brought to light. There had been no hypothesis set forth by the investigators as to possible relations of dysperceptions with specific dyslexia. In fact it was a great surprise to find that dyslexic and normal children have such considerable dysperceptions. Thus it must be assumed that dysperceptions are more frequent and probably within the normal experience range than one would have expected in a normal sample.

Note that even though dyslexics and normals experience similar dysperceptual experiences, the groups may differ in degree of intensity of such experience. Differences in performance between experimental and control children on some ITPA subtests were encouraging. Improved concentration ability may explain why the experimental group showed more progress on the auditory memory subtest of the ITPA.[6] It was also of interest to note that more children in the control group showed declines in ITPA subtest scores than did children receiving vitamin therapy.

6 This test specifically requires attention and concentration.

SUMMARY AND CONCLUSIONS

Children with severe reading and spelling difficulties were given megavitamin treatment. Their progress in the psycholinguistic ability, the presence of soft neurological signs and perceptual dysfunction symptoms were compared with dyslexic children given no treatment. Although no differences between the groups in reading and spelling ability could be detected after the treatment period, children receiving megadoses of vitamins C, B3, pantothenic acid, and B6 (plus a high-protein low-carbohydrate diet) did show a reduction in hyperkinesis, sleep disturbance, and nystagmus, as well as in some perceptual dysfunction symptoms. Improvements in some basic language skills as measured by the ITPA were also noted.

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