HYPERACTIVITY AND PHYSICAL ANOMALIES*

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Hyperactivity is a common behavioural syndrome which has long been a major problem for parents, teachers and clinicians. The most prominent trait is excessive motor activity in inappropriate situations. Recently investigators have revealed that hyperactive children also show major deficits in attentional processes, frustration-tolerance and impulse control (4).

The etiology of hyperactivity remains uncertain and although some investigators assume environmental factors to be the principal contributors (14) most prefer physiological explanations (1, 4). Within the physiological realm a frequently cited cause is neurological damage of one type or another, thought to be due to a reportedly high number of pre-natal and para-natal birth complications (6, 10). Some investigators also suggest that these children have a high frequency of borderline or abnormal EEG tracings (1). However, studies using control groups have failed to support either of these claims (7). Furthermore, a large number of hyperactive children lack the neurological and electroencephalographic signs which would substantiate a diagnosis of brain damage (11).

The possibility that they suffer some sort of biochemical deficit, passed on genetically, has been suggested (5, 10), and a critical deficit of norepinephrine is postulated.

Waldrop and her associates (11-13) have lent further credence to a physiological explanation for hyperactivity by showing that these children have more physical anomalies than normal children. In fact, in a recently published paper (8) significant correlation between dopamine-beta-hydroxylase (the final enzyme in the biosynthesis of norepinephrine) and physical anomalies was demonstrated.†

The present study is basically a replication of Waldrop and Goering's work (12), but there are some differences between the two studies. Waldrop and Goering chose their hyperactive subjects by asking teachers to select three children in the class "who seemed to be constantly on the move". The control group was made up of three children whom the teacher felt were "in the normal range of behaviour, being neither hyperactive nor lethargic". It is apparent then that the hyperactive and control subjects were not carefully matched groups, and attempts were made to ensure equivalence between groups by matching hyperactive and control children.

These authors also reported that there was a significant positive correlation between the number of anomalies and the

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†This study was uncovered only after the present experiment had been completed.

degree of hyperactivity, and this was based on the school principal's rank ordering of the severity of hyperactivity and the number of anomalies evident in the subjects. In the present study attributes of hyperactive children were ranked more objectively, based on a well-validated rating scale for hyperactivity (2, 3).

Method

Subjects

Forty-eight male elementary school children, twenty-four hyperactives and twenty-four controls, all from the Chomedey School Board in Montreal took part. The two groups were matched for age and Peabody Picture Vocabulary Test IQ — all had to have an IQ of 80 or above.

Prior to the study teachers and principals were given a brief verbal description of the symptoms characteristic of hyperactive children which focused mainly on three traits — overactivity, short attention span and impulsivity. The teachers were then asked to fill out Conners' behaviour rating scale (2). Those children whose average score on the Hyperactivity factor of the scale was 1.5 or greater were considered candidates for the hyperactive sample. A further selection was based on a parental report (by telephone) of the child's behaviour at home. For the child to be included his hyperactivity had to be chronic and present since early childhood. Excluded from the sample were those who showed definite signs of brain damage, epilepsy or psychosis. None were taking psychotropic medication and all were living at home with at least one parent.

Each teacher of a hyperactive child was asked to go to the class register and choose the next male child on the list who was of approximately the same age and intelligence as the experimental subject. Children with a history of brain damage, epilepsy, psychosis or severe behaviour problems were not acceptable. Subsequently, the teacher was required to fill out Conners' behaviour rating scale on the control child. None of the control children were taking psychotropic medication and all were living at home with at least one parent.

Rating Scales and Apparatus

Conners has developed a widely used rating scale for teachers, which has a scale of 39 items factor analysed to give five factors: Conduct Problem: Inattentive-Passive; Tension-Anxiety; Hyperactivity; Sociability. The teacher is told to observe the child in question for a few days and then to check the appropriate box for each item. The score for each factor is based on the mean score on items within the factor (a four point scale, 0-3 is used). The scale has been used extensively to assess the effectiveness of psychotropic medication with hyperactive children, and has been shown to be sensitive to drug effects (9).

Procedure

All children were seen individually during regular school hours. To eliminate bias the examiner (F.L.) was not told which children were hyperactive and which were control. The examiner also scored and analysed all data. A second examiner made independent judgements on the existence of anomalies in 10 of the 48 subjects so that a reliability estimate might be obtained.

Physical anomalies were tabulated on the basis of a total anomaly score and a weighted anomaly score — the weighting of a score depends on the degree to which the anomaly deviates from the normal. The method of examination for anomalies and the full scoring procedure is too lengthy to be included in the present report but may be found in Waldrop and Halverson (11).

Results

As indicated in Table I there was not a significant difference between the hyperactive and control group in age or IQ, but hyperactives were scored higher than controls on all factors of Conners' scale — see Table II.

A Pearson correlation coefficient of .82 ($p < .001$) was obtained from the two independent judgements as to the occurrence of the anomalies, while the coefficient of the weighted scores was .88 ($p < .001$).

Waldrop and Goering found a correlation of .86 between the frequency of anomalies and the weighted score, and thus used only the weighted score when analysing their data for this study. The Pearson correlation coefficent between the total score and weighted score in the present study was also high ($r = .88$, $p < .01$), and therefore only the weighted score was used in the data analyses. The weighted scores ranged from 0 to 9 with a mean of 4 for the hyperactive sample, while in the control group they ranged from 0–8 with a mean of 2.89. The

TABLE I

MEANS AND STANDARD DEVIATIONS OF AGE AND IQ FOR HYPERACTIVE AND CONTROL SUBJECTS

	Hyperactive	Normal Controls
Age (in months)	110.96[1] (23.65)[1]	112.4* (22.84)
Peabody Picture Vocabulary Test IQ	104.52 (10.8)	104.56** (12.2)

[1]Standard deviations are in parenthesis
*t=.24, df=46, p<.05
**t=.01, df=46, p<.05

difference between the means was significant ($t = 2.19$, $df = 47$, $p < .05$).

The correlation between the Hyperactivity factor and physical anomalies was not significant ($r = .054$, $p < .05$).

Discussion

These data support previous findings that hyperactive children have more physical anomalies than normal children, but they do not support previous findings suggesting significant correlations between anomalies and the degree of hyperactivity. This discrepancy may be attributed to differences in subject groups. In future it would be beneficial to utilize a well-validated rating scale, such as Conners', in order to compare populations under study.

Nevertheless, the findings do support the hypothesis that there is a physiological component to the hyperactive syndrome which may be either genetically determined or a result of abnormalities in fetal development. Further research might investigate the diagnostic and predictive potential of these anomalies as they relate to various treatment methods.

Summary

Hyperactive elementary school boys were matched for age and IQ to a group of normal control children, and the frequency of minor physical anomalies in each group was recorded. Although hyperactives had more of these anomalies than the control children there was not a significant correlation between the degree of hyperactivity and the frequency of anomalies.

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TABLE II

MEAN FACTOR SCORES OF HYPERACTIVES AND CONTROLS ON CONNERS' RATING SCALE FOR Teachers

Factors		Hyperactives	Controls	T-Values	df	2-tail probability
I	Conduct Problems	1.50	.14	12.3	46	.001
II	Inattentive-Passive	1.48	.43	7.4	46	.001
III	Tension-Anxiety	.88	.49	2.8	46	.005
IV	Hyperactivity	2.13	.42	15.9	46	.001
V	Sociability	.82	.12	4.9	46	.001

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Résume

On a fait une comparaison entre des garçons de niveau scolaire élémentaire hyperactifs de même âge que des enfants normaux, et possédant le même "I.Q." La fréquence des anomalies physiques ont été relevées dans les deux cas. Même si les enfants hyperactifs avaient plus d'anomalies que les autres, il n'existe pas de relation entre les différences niveaux d'hyperactivité et la fréquence des anomalies.

Time to me this truth has taught
('Tis a treasure worth revealing),
More offend from want of thought
Than from any want of feeling.

Want of Thought

Charles Swain
1801-1874