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Reduced behavioural and learning problems in children with specific learning difficulties after supplementation with highly unsaturated fatty acids: a randomised double-blind placebo-controlled trial

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ABSTRACT

Introduction: There is evidence that relative deficiency in certain highly unsaturated fatty acids (HUFA) may underlie some of the behavioural and learning problems associated with Attention-Deficit / Hyperactivity Disorder (ADHD). Fatty acid abnormalities are also implicated in developmental dyslexia, which often co-occurs with ADHD. Here, effects of supplementation with HUFA on behavioural and learning problems were studied in children with specific learning difficulties (mainly dyslexia) who also showed features associated with ADHD.

Method: Subjects were children aged 8-12 years at a special school. With ethics and education committee approval, 41 children and their parents gave informed written consent to random double-blind allocation to either a HUFA supplement (1) or placebo for 12 weeks followed by one-way crossover (placebo to active) for a further 12 weeks. At each time-point the CPRS-L (2) was used to assess a range of behavioural and learning problems.

Results: At baseline the groups did not differ, but at 12 weeks mean scores for attentional problems and general behaviour problems were significantly lower for HUFA (n=15) than placebo (n=14). Paired t-tests showed significant improvements from baseline on 6/14 scales for active treatment, none for placebo. Group differences in change scores all favoured HUFA, with 3/14 reaching conventional significance levels. Over the next 12 weeks significant improvements were then seen in the crossover group for 9/14 scales (n=12), while children continuing HUFA (n=12) maintained earlier symptom reductions.

Conclusion: These results strongly suggest that HUFA may help to reduce behavioural and learning problems in some children, but the replicability, specificity, extent and durability of these effects require further investigation.

(1) Efalex™ (Efamol Ltd, UK)
(2) C.K.Conners (1997) Conners' Parent Rating Scales - Revised. NY: Multi-Health Systems Inc.

INTRODUCTION

BACKGROUND

- Certain highly unsaturated fatty acids (HUFA) of the omega-3 and omega-6 series are essential for normal brain development and function.[1-4]
- Unless these fatty acids are provided directly in the diet, they must be synthesised from simpler 'essential fatty acids' (EFA).
- Some individuals may have difficulties in synthesising HUFA from EFA owing to dietary, lifestyle or constitutional factors.[5] Problems incorporating HUFA into cell membranes, and/or excessive membrane breakdown can also contribute to HUFA deficiency.[6]
- There is a high clinical overlap between attention-deficit / hyperactivity disorder (ADHD) and dyslexia.[7]
- Relative deficiencies of HUFA have been implicated in both conditions.[8-28]

Evidence suggesting HUFA deficiencies in dyslexia and ADHD

ADHD	DYSLEXIA
• ADHD children show clinical signs of fatty acid deficiency	• Dyslexic children and adults show clinical signs of fatty acid deficiency
• Blood biochemical studies show reduced plasma levels of HUFA	• Brain imaging has shown abnormal membrane lipid turnover in dyslexic adults
• Fatty acid deficiency (on clinical signs or blood measures) relates to learning and behaviour problems	• Fatty acid deficiency signs relate to severity of dyslexic difficulties, and to other dyslexic symptoms
• Case reports and some controlled studies suggest possible benefits from fatty acid treatment	• Case reports and open studies have indicated possible benefits from fatty acid treatment

- The existing evidence suggests a mild abnormality of fatty acid metabolism in some individuals with dyslexia and ADHD that may be amenable to correction through diet.[8-28]

AIM OF THIS STUDY

- To find out if behavioural and learning problems associated with attention-deficit / hyperactivity disorder (ADHD) and dyslexia can be reduced by dietary supplementation with highly unsaturated fatty acids (HUFA).

SUBJECTS AND METHODS

SUBJECTS

- 41 children aged 8-11 years (35 male, 6 female) from a special school who showed both specific learning difficulties and features of ADHD.[1]

STUDY DESIGN AND MEASURES

- A randomised double-blind placebo-controlled trial. Children were allocated to parallel groups (HUFA versus placebo)* for 3 months. There was then a one-way treatment crossover (placebo to HUFA) for a further 3 months. (see Table 1 for details).
- Behavioural and learning problems were assessed at baseline, 3 months and 6 months using the Conners' Parent Rating Scales (CPRS-L, 1997).

[1] *All had specific reading difficulties, and scored above the population average on all three scales from the CPRS_L assessing DSM-IV ADHD features.*

* HUFA supplement: 480mg DHA, 96mg GLA, 42mg AA, 80mg Vitamin E, 8mg Thyme oil. Placebo: identical-looking capsules of olive oil.

Conners' Parent Rating Scales (CPRS-L, 1997).

CPRS-L Sub-scales

Oppositional	- *breaks rules, problems with authority*
Cognitive Problems	- *concentration / organisational problems*
Hyperactivity	- *abnormally restless and impulsive behaviour*
Anxious-shy	- *excessive worries and fears, oversensitive*
Perfectionism	- *sets high goals, obsessive about work*
Social Problems	- *emotionally distant from peers*
Psychosomatic	- *reports atypical amounts of aches and pains*

CPRS-L Global scales

Conners' ADHD Index	- *identifies children 'at risk' for ADHD*
Conners' Restless-Impulsive	- *atypical restlessness, impulsivity, hyperactivity*
Conners' Emotional Lability	- *unusually prone to mood swings, emotionality*
Conners' Global Index	- *hyperactivity, general behaviour problems*
DSM Inattention	- *corresponds to DSM Inattentive-type ADHD*
DSM Hyperactive-Impulsive	- *corresponds to DSM Hyperactive-type ADHD*
DSM Global Total	- *corresponds to DSM Combined-type ADHD*

RESULTS

0-3 MONTHS: PARALLEL GROUPS - HUFA vs PLACEBO

Between-group comparisons[⊥]

- There were no group differences before treatment. Mean scores on most scales were around one standard deviation above population norms.
- After 3 months, the HUFA treated-group scored significantly lower on:
  - Conners Index *(General behavioural problems)*
  - DSM Inattention
- All change scores favoured HUFA over placebo, with significantly greater reductions for:
  - Anxious / Shy
  - Cognitive problems *(Inattention, memory and organisation problems)*
  - Conners' Index *(General behavioural problems)*

[⊥] *Mann-Whitney, two-tailed*

Within-group comparisons[*]

- HUFA: significant improvements over baseline on:
  - Anxious / Shy
  - Psychosomatic symptoms
  - Cognitive Problems
  - Conners' Global Total
  - DSM Inattention
  - DSM Total ADHD
- PLACEBO: no improvements over baseline
  - significant deterioration on Conners' Index

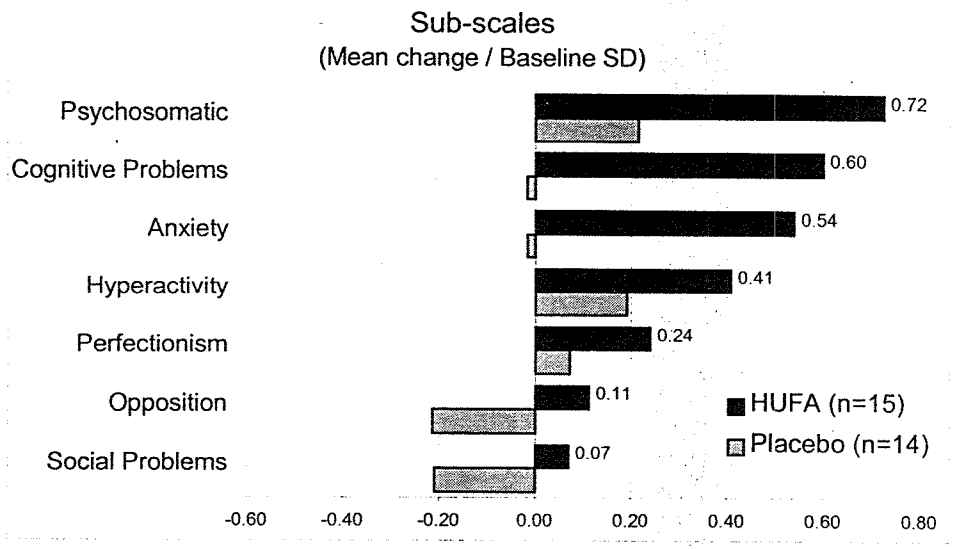
[*] *Paired t-test*

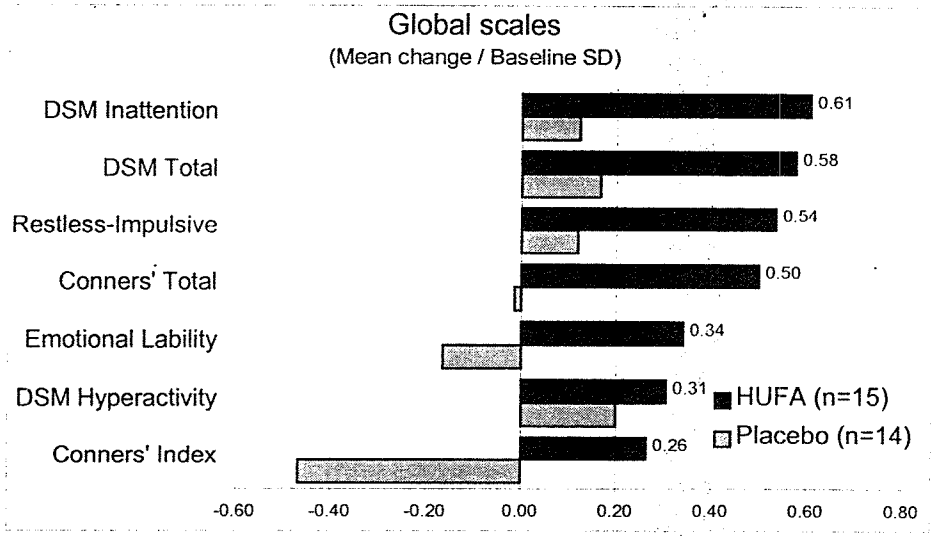
3-6 MONTHS: ONE WAY CROSSOVER (PLACEBO TO HUFA)

- Children given placebo treatment showed no improvement on any ADHD measures in the first 3 months
- However, when these same children crossed over to HUFA treatment for the next 3 months, significant improvements were seen on 9/14 ADHD scales.[*]
  - Anxious / Shy
  - Hyperactivity
  - Conners' Index
  - Conners' Restless-Impulsive
  - Conners' Emotional Lability
  - Conners' Global Total
  - DSM Inattention
  - DSM Hyperactive
  - DSM Total ADHD
- Children who continued with HUFA treatment maintained or improved on their earlier symptom reductions.
- At 6 months, mean scores did not differ between groups and were within the normal range on all ADHD measures.

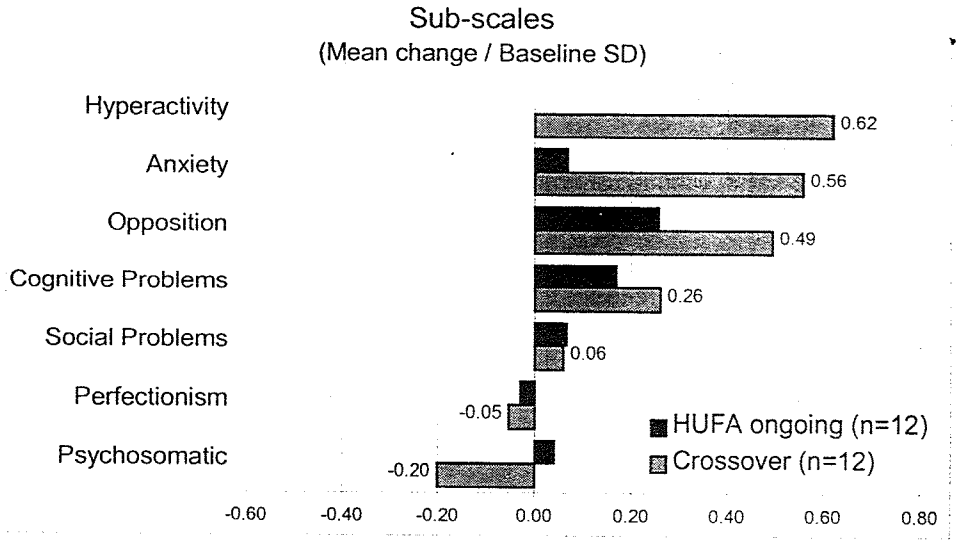
[*] *Paired t-test*

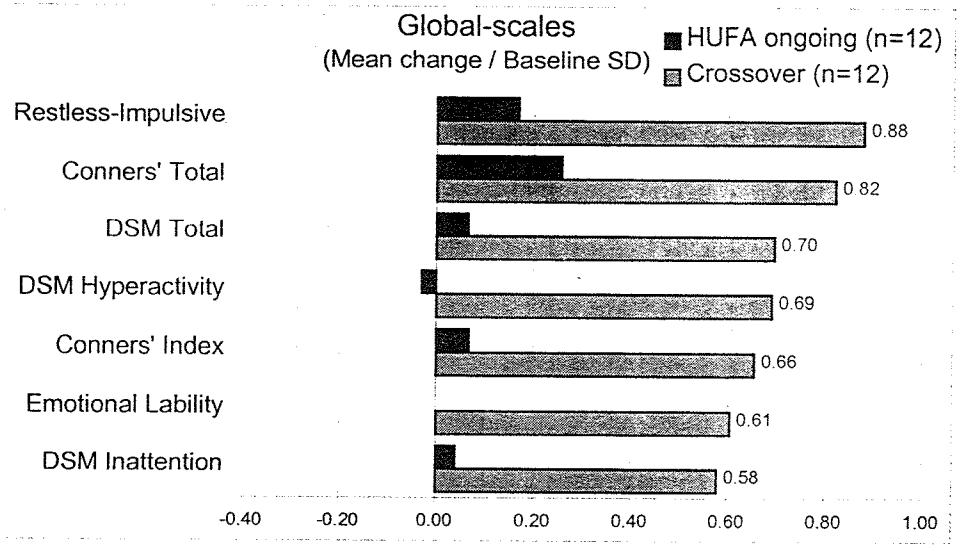
Treatment Effect Sizes: 0-3 months

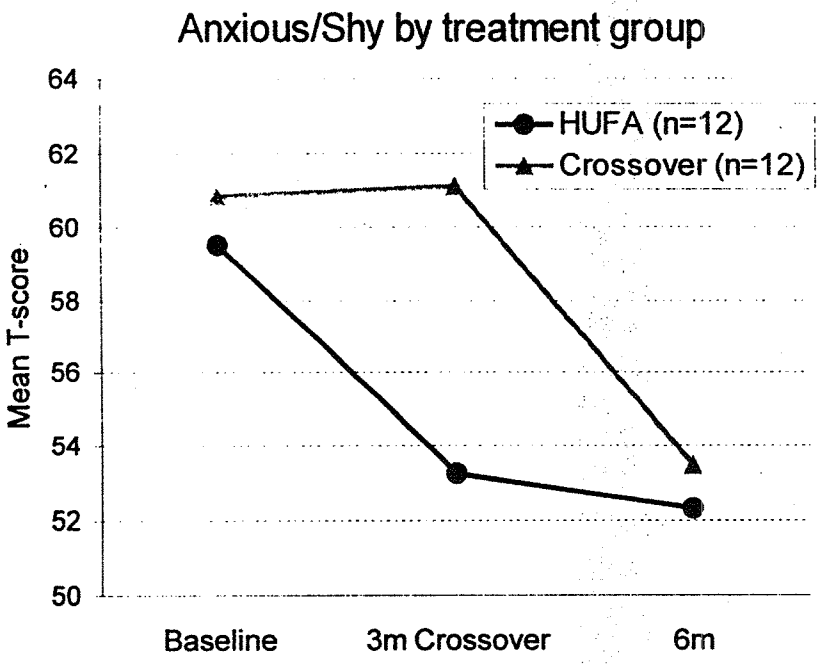


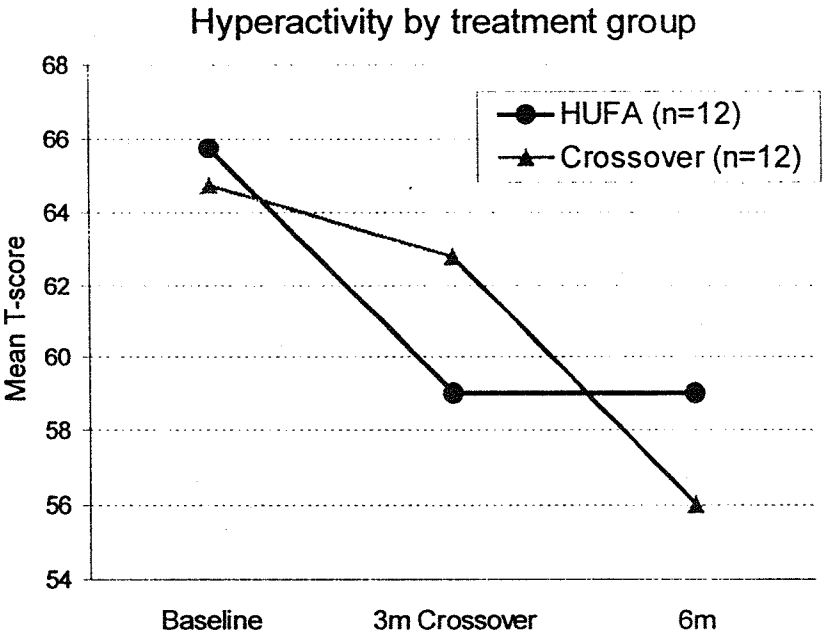


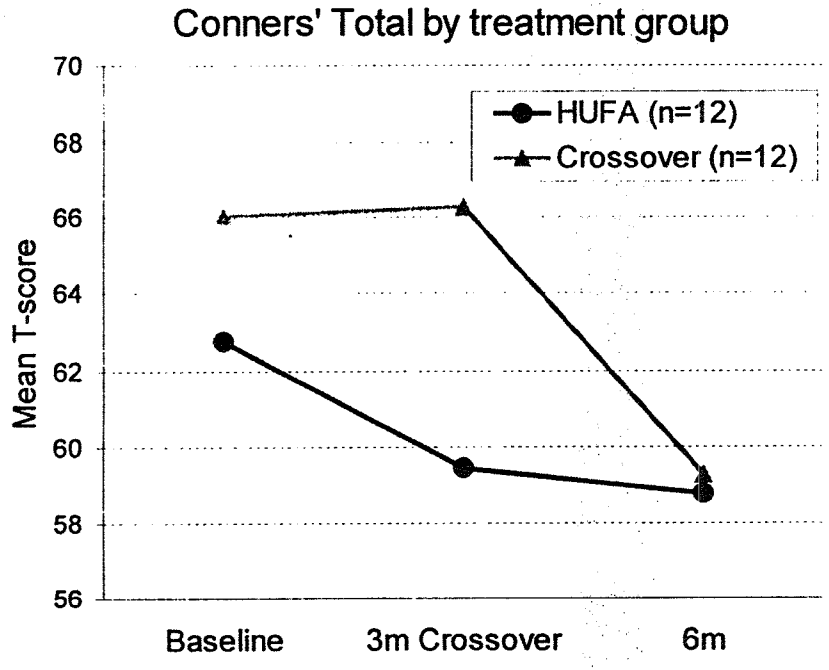
Treatment Effect Sizes: 3-6 months

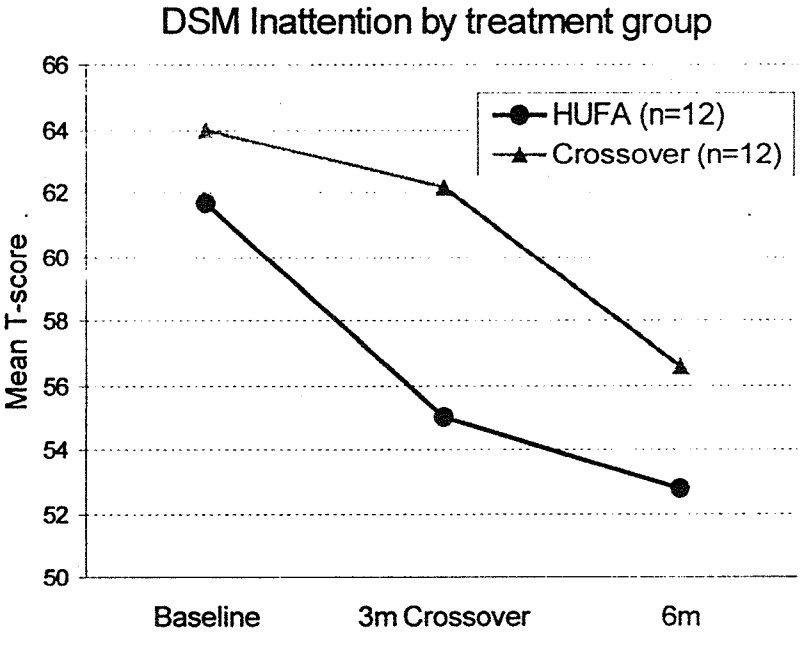





Anxious/Shy by treatment group
Mean T-score
64
62
60
58
56
54
52
50
HUFA (n=12)
Crossover (n=12)
Baseline
3m Crossover
6m


Hyperactivity by treatment group
Mean T-score
68
66
64
62
60
58
56
54
HUFA (n=12)
Crossover (n=12)
Baseline
3m Crossover
6m


Conners' Total by treatment group
Mean T-score
70
68
66
64
62
60
58
56
HUFA (n=12)
Crossover (n=12)
Baseline
3m Crossover
6m


DSM Inattention by treatment group
Mean T-score
66
64
62
60
58
56
54
52
50
HUFA (n=12)
Crossover (n=12)
Baseline
3m Crossover
6m

SUMMARY

- A randomised double-blind placebo-controlled trial was conducted to determine whether HUFA supplementation could reduce ADHD symptoms in children with specific learning difficulties (dyslexia).
- HUFA treatment was found to be significantly better than placebo treatment in reducing a wide range of behavioural and learning problems in these children.
- A very strong crossover effect was seen when the placebo group switched to active treatment, reinforcing results from the parallel group study.

CONCLUSIONS

- These findings constitute further evidence that mild abnormalities of fatty acid metabolism can contribute to behavioural and learning problems in dyslexia and ADHD.
- These results also provide convincing evidence that HUFA treatment can help in the management of these conditions.
- Larger studies are now needed, preferably with additional measures, to replicate and extend these initial findings.

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