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Eskimo 3 Kids fish oil supplement for children: Bio availability, consumer accept and effect – a pilot study with 113 children for 4 months.

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Abstract:
Learning disorder, hyperactivity, recurrent infections, eczema, behaviour problems and ADHD are an increasing problem among children, contemporary with a decrease of oily fish consumption.
Aim was to examine dietary intakes of nutrients in relation to symptoms possibly related to essential fatty acid deficiency and to examine consumer accept, bio availability, and self reported effect of 4 months intake of Eskimo 3 kids, 5 ml/d, in children.
This was an open label pilot study of four month duration, with participation of 113 children, mean age 7.5 y (range 1-15 y).
Looking at the different groups of children, it was clear that the less oily fish and/or oil supplements the children ingested before the intervention, the more likely they were to have minor health problems at baseline. The more minor health problems at baseline the better effect did the children have of the fish oil supplement.
Up to 21.1% reported improvements in their condition over the 4 month period with respect to recurrent colds (p=0.003), upper respiratory infections (p=0.03), dry skin generalized (p=0.01), dry skin localized (p=0.003), Sebaceous pimples (p=0.02), diarrhoea/loose stool (p=0.05) and memory (p=0.03).
Intake of a stable fish-oil and plant-oil combination, improved infection tendency and relieved symptoms possibly related to essential fatty acid deficiency, thus being of potential relevance for children with low intake of oily fish, or with symptoms of essential fatty acids deficiency.

Introduction

Previous research have demonstrated that certain health problems in children i.e. hyperactivity, learning disorders, eczema and infection tendency improves when supplemented with essential fatty acids. (Nagakura 2000; Kidd 2000; Stevens 1996; Richardson 2000; Burgess 2000). EPA and DHA are two important omega-3 fatty acids necessary for the development of the child. A newly developed Scandinavian essential oil supplement was to be researched. It contains both n-3 (fish oil), n-6 and n-9 (rapeseed oil) as well as vitamin D and E. (Saldeen 1997)
Children need several types of fatty acids to develop optimally (Innis 2000; Willatts 2000; Willatts 1998; Birch 2000; Heird 2001; Forsyth 2001; Makrides 2000). The brain and eye tissue consist of approximately 30% fatty acids like eicosapentaenoic acid (EPA) (Neuringer 1986). Essential fatty acids are major structural components of membrane phospholipids and influence membrane fluidity and ion transport across the cell membranes. (Neuringer 1985; Tinoco 1982) EFAs serve as precursors to substrates in the biosynthesis of eicosanoids, which mediate a wide variety of functions in every cell in the body. De novo synthesis of n-3 and n-6 fatty acids does not occur in humans, thus they must be obtained from the diet.
Humans have increased the size of the brain threefold over time. An interesting theory is that it is due to a diet based on freshly caught fish and shellfish, where the fish-oils may be the crucial factor for the development of the human brain. In East Africa the fatty acids pattern in the local fish are closer to the fatty acids pattern in the human brain than any other foodstuff (Broadhurst LL, 1998).
During the last many decades the general diet and lifestyle in Scandinavian has changed from large consumptions of oily fish with salmon and herrings being a stable diet for the working class. Presently common diets are poorer in oily fish and the nutritional value may not necessarily meet the children's need for essential fatty acids. (Saldeen 1998). It is therefore of interest to evaluate the intake of a 3 d diet record related to symptoms in children and to investigate if supplementary intake of fish oil improves self reported health.

Materials and methods

Subjects
Subjects were recruited through our clinic and a network of therapists in a 6 month period in the spring and summer 2001. Inclusion criteria were age between 1-16 years, both healthy children,

children with minor symptoms and children with medically diagnosed health problems. Other treatments (both alternative and conventional), diet and use of food supplements were held stable, in the 4 month trial period.
Subjects and their parents were informed written and orally and signed informed consent.
The study was approved by the Regional Ethical Committee for Copenhagen and Fredriksberg, Denmark, as part of a general approval for pilot studies in the institute (J. no 07-00-044/02) and The Danish Data Protection Agency J. no. 2004-41-4321

Research design and treatment
Open-label pilot study, with a before and after registration of indicators of physical and somatic symptoms and mental performance; dry skin/hair, recurrent colds, upper respiratory and ear infections, asthma and other lung problems, intestinal disorders, eczema, memory, hyperactivity, concentration and learning problems.
Intervention was intake of 1 large teaspoon of oil (5 ml) daily for 4 months, each containing EPA 410 mg, DHA 280 mg, Ω-6 510 mg, Ω-9 1400 mg, D-vitamin 5 mcg and Pufanox, a mix of natural antioxidants. The oil has added tutti-frutti flavour and can be taken on its own or mixed with juice or food.

Data collection and measurements
Data about health, diet, somatic and disease symptoms, mood, memory, learning problems and behaviour, was completed through a structured interview and questionnaires at baseline and after 4 months and a 3 day food consumption recorded at baseline. On a random sub group, blood samples were taken for establishing the bio-availability of the product.
Registration on self (parent) reported health were on a registration form with predefined classification in five scores: 1 = never, 2 = <1 x ½ year, 3 = < 1 x month, 4 = 1-3 x month, 5 = always. This applied for questions about physical performance, physical and somatic symptoms. Questions about mental health and learning performance were classified in five scores as: 1 = never, 2 = < 1 x month, 3 = 1-4 x month, 4 = 2-4 x week, 5 = always.
Subjects were supplied with Eskimo 3 Kids oil for four months at baseline. We also requested the parents and children to use their own words to describe any difference they noticed during the 4 month and write it on the questionnaires at the final interview.

Fatty acid analysis
Four millilitres of venous blood was drawn from 16 subjects both at baseline and at the final interview. The blood was then centrifuged at 1400 x *g* for 20 min and plasma reserved for fatty acid analysis; plasma samples were stored in glass vials at – 20 °C.
For the determination of phospholipid fatty acids, plasma lipids were extracted with chloroform/methanol. The phospholipids were then separated by thin-layer chromatography and after transmethylation, the fatty acid methyl esters were separated by gas-liquid chromatography. The results are given as area percentage of all 22 fatty acids detected.

Dietary intake
The completion of a 3-d diet records was explained in detail to parents and children. These records were analysed by computer for macro and micro components with the software program Dankost 3000 based on the Danish Veterinary and Food administration database (Dansk Catering Center A/S, Denmark), to detect any difference in dietary intake between three groups of children; basically healthy children, parent diagnosed children and doctor diagnosed children, that might account for any difference in minor health symptoms related to EFA deficiency between the three groups.

Statistical analysis
Statistical analyses were performed with PC SAS, version 8.2 (SAS Institute, Inc, Cary, NC, USA). Descriptive statistics include means and t- test for normally distributed data, frequency counts, table-analysis and chi-square- tests for proportions.
Changes over time in symptoms were analysed by subtracting the start score from 4 month and recode the 5 categories in two or three: better, and unchanged/worse. To determine if changes over time were more likely to be better than worse McNemar's test for paired dichotomous variables were used. All tests were considered significant at the 5 percent level.

Results
Subjects
Table 1
In this open pilot study, 113 children aged 1-15 y, mean age 7.5 years participated. 62 children were 1-7 y and 51 children were 8-15 y, 53 boys and 60 girls. After each subject agreed to participate, the child with or without parents, depending on age, were interviewed in the clinic. (Table 1)
The group of healthy normal functioning children consisted of 38 (33.6%), the group of children with parent diagnosed problems; hyperactivity concentration problems, eczema, dry skin, learning disorders, food sensitivities of 47 (41,6%) and the group of doctor diagnosed children with epilepsy, allergies, hyperactivity, asthma, damp, brain damage (from foetal life) of 28 (24,8%). Additional baseline characteristics are shown in table 1, which also demonstrates that there were no differences between the group with compliance at or above 80 % compared to that group with compliance below 80%.

Dietary intakes at baseline
Table 2
The three day food-composition data (table 2) showed significant differences between the three groups of children with respect to percent of energy from carbohydrates ($p<0.05$) and fat, ($p<0.05$), the parent diagnosed group receiving less energy from fat and more energy from carbohydrates. The parent diagnosed group of children had a lower intake of fatty acids both saturated C10_1 ($p<0.05$), mono unsaturated C20_1_11 ($p<0.05$), C22_1_11 ($p<0.05$), C24_1_9 ($p<0.05$), polyunsaturated C20_5_3 EPA (0.002), C22_5_3 ($p<0.006$), C22_6_3 ($p<0.005$) and cholesterol ($p<0.005$),
Also intake of the vitamins D ($p<0.02$) and B12 ($p<0.05$) were lower in the parent diagnosed group than in the other groups. As fish is the main source of vitamin D, apart from skin exposure to the sun in the summer, children low in fish intake can obtain their daily level of D-vitamin (5 mcg) necessary to insure an optimal bone formation through 5 ml Eskimo 3 Kids daily.
In comparing the average intake of nutrients in the 3d-diet record to the Nordic Nutrition Recommendation for children, revealed differences between the recommended and the recorded intake. Energy composition were within normal ranges, but calcium, iodine, selenium, vitamin D and niacin were lower than the recommendation, magnesium, iron, zinc, riboflavin, and folate were just under recommendation with copper, ascorbic acid, and the vitamins B-6, thiamine, at level or above the recommended. All vitamins and minerals were analysed, but only Vitamin D and B-12 showed significant difference between the groups.
Generally for most micronutrients the parent diagnosed group showed a smaller consumption, both in fatty acids but also in micro nutrients. It is important to take notice of such a large group of otherwise normal children is currently being insufficient in essential nutrients, either by eating too little food or by choosing food with too little nutritional value and thereby promoting a less than optimal health.
On the background of the food-composition data that revealed diets that were very insufficient in respect to various micro nutrients and EFA, we informed the parents and children on how to optimise their daily diet at the final interview.

Note: The food-composition data are not always complete in respect of the individual nutrient intake, the ingestion of multivitamin-mineral or EFA supplements are not added to the 3-d food-composition data.

Consumer accept of oil intake
Compliance was registered by measurement of left over oil.
Intake >80% of the oil: 59 children = 52.2%
Intake 40-80% of the oil: 29 children = 25.7%
Intake <40% of the oil: 25 children = 22.1%
Compliance in the different age groups:
1-7 years: 70% (43 children) ingested 40-100% of their allocated oil, the remaining 30% (19 children) ingested < 40% of the oil.
8-15 years: 88% (45 children) ingested 40-100% of their allocated oil, the remaining 12% (6 children) ingested < 40% of the oil.

54 children (49%) preferred the oil on a spoon.
34 children (30.9) mixed the oil with juice/food.
13 children (11.9) found different ways to take the oil.
12 children (10.6%) didn't take the oil.

Bio-availability
Analysis of blood plasma content of essential fatty acids from a random subgroup of 16 children, showed a significant increase of n-3 fatty acids at 56% ($p<0,001$) ranging from a decrease of 17% in a child who had not taken the oil supplement, to an increase in the other children up to 131% in a child who had not eaten fish in many years. Both EPA and DHA increased respectably by 138% (±- 58%- +558%, $p<0,001$) and 50% (±- 1,5%- +109%, $p<0,001$), respectively.

Tolerance, side effects and completion of the study
Participants were requested to call if any unexpected events occurred and intervention was stopped for a few days until complaints had cleared and then restarted to clarify if the complaints were caused by the intervention. Three cases of loose stool occurred, all of which ceased within one week of cessation with the product and recurred after restart. Two cases of small eczema-like spots were reported; both ceased within 1-2 weeks of cessation and did not recur after restart.

96 children completed the study, 3 children dropped out after the first interview, 2 due to a dislike of the oil and one child who moved far away. The remaining 14 children had completed very few questions on the questionnaires. These children did not differ from the rest with respect to age, sex etc.

Self (parent) reported effect of the supplement
Table 3A and 3B
Overall up to 21.1% of the subjects reported improvements for the physical symptoms: Recurrent colds ($p=0.0027$), throat infections ($p=0.0325$), dry skin general ($p=0.0126$), dry skin local ($p=0.0027$), sebaceous pimples ($p=0.0201$), diarrhoea/loose stool ($p=0.0455$) and on mental symptoms up to 14.5% reported improvements: Memory ($p=0.0253$).
No significant differences were seen for dry hair, recurrent earache, generalized eczema, eczema localized, constipation, hyperactivity, literal concentration, physical concentration, learning difficulty in Danish and learning difficulty in Math ($p=0.0956$), very few children suffered from these symptoms making lack of power a problem. Table 3B shows the number and percentage of

children with symptoms in the three health groups at baseline. The generally healthy group of children can act as a form of control group for the other two groups, both in respect to symptoms at the outset and at their diet. When comparing table 3B with the 3 d-diet in table 2, the large group of children with symptoms at the outset is the same as the group receiving the smallest amount of EFA through the diet and thus would benefit from a diet richer in EFA or as supplements. The large amount of children with memory problems in the healthy group of children may reflect the parents exaggerated expectations on behalf of bright children.

Stratified in the three groups
Table 4A and 4B
Stratifying subjects on basis of start score, into those scoring medium or below (scores either score 1,2,3 or 3,4,5 in the questionnaire, depending on the type of question) and those scoring good or above (scores 4,5 or 1,2), revealed that the group of children with parent or doctor diagnosed problems had a lower intake of oily fish and oil supplements and had a larger percentage of the type of symptoms that may be associated with essential fatty acid deficiency (dry hair, dry skin, dry spots and sebaceous pimples), compared to the healthy group of children. The largest consumption of oily fish and oil supplements were seen in the healthy group.
12.6%, (range 5.3-26.3%) of the healthy group, 21.3% (17-29.8%) of the parent diagnosed group and 25% (range 21.4-46.4%) of the doctor diagnosed group reported these possibly essential fatty acid deficiency related symptoms at the start. Compliance > 40 percent of the oil, was almost 18% higher in the healthy group, compared to the two other groups. All groups reported improvements for these four symptoms.

Additional remarks
The parents provided many positive responses, both at the small questionnaire half way through the study and at the final interview:
Eczema and dry skin had improved, many found it easier to comb their hair and infection frequency (ear, nose, throat) were less, first we thought it was mostly due to the study terminated in the summer, but looking closer at the figures it had mainly effected the children taking >40% of the oil and not those taking less or nothing at all.
The oil seemed to have a regulatory effect on both constipation and diarrhoea.

In children suffering from eczema we found that the group who didn't eat oily fish regularly or took oil capsules (58 children) 13 children started out with eczema and 12 (92.3%) reported positive effect. In the group of children regularly consuming oily fish or taking EFA capsules (39 children) 6 children started out with eczema and 3 (50%) reported a positive effect.

Discussion
A wide variety of fish-oil supplements target at adults and their health problems are currently on the market, some of these have been evaluated scientifically on children's health and behaviour problems. This pilot study is a first attempt to describe the degree and magnitude of effect of a newly developed children friendly, combined fish and plant oil supplement on the Scandinavian market.
As a pilot study this work has several shortcomings, first and foremost the lack of a control group from the outset. Many of the subjects were fairly healthy, with a group of children basically healthy, a group of children with parent diagnosed symptoms and a group of children with doctor diagnosed symptoms. Previous studies of children has aimed at a much more narrow group of children with similar specific problems i.e. behaviour (Stevens 1995) which gives a clearer picture of symptoms in which fish-oil supplementing can be beneficial.

As such, a reasonable expectation would be a general lack of increased well-being, health and behaviour over time, as children in the Scandinavian countries in general are well fed, there are no starvation – nevertheless a significant proportion reported improvements on several items, mainly in the parent and doctor diagnosed groups where the lowest intake of oily fish and oil supplements occurred. Due to the lack of a control group we have been conservative in estimating the effect by using the McNemar's test that omits the unchanged group and test the probability for getting better against that for getting worse. On several items (recurrent colds ($p=0.0027$), throat infections ($p=0.0325$), dry skin general ($p=0.0126$), dry skin local ($p=0.0027$), sebaceous pimples ($p=0.0201$), diarrhoea/loose stool ($p=0.0455$) and memory ($p=0.0253$)) findings were significant, thus it is unlikely they should have occurred at random.

Another shortcoming is the lack of using a validated questionnaire for the assessments of symptoms and parameters of IQ and learning capability in connection with possible EFA deficiency. No validated questionnaire we could find covered all the different aspects we wanted to evaluate.

The third shortcoming is the lack of measuring other parameters of interest to explain the perceived effects, changes in symptoms and improvement of general health and behaviour, i.e. immune status, neurotransmitter imbalances and food-sensitivities, it was not possible due to lack of funding and should be attempted in a subsequent study.

Conclusion

Intake of a combined fish and plant oil, Eskimo 3 Kids improved infection tendency, skin condition, bowel irregularities and memory systematically in this open pilot study, thus being important for relieving symptoms associated with EFA deficiency.
Today's view on oily fish as a healthy food is constantly under threat, as the amount of toxic metals and chemicals like mercury, dioxin, PCB and other health threatening elements are discovered in more and more species and in amounts that prevent especially larger older fish from being a safe source of EFA (Le Grand P), as a safe alternative fish oil supplements should be offered to children who does not have their need for EFA fulfilled by their food intake.

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The sponsor and supplier of the study approved of the study protocol, but had no role in data analysis, data interpretation or writing of the report.

Contributors

Vivi Krabbe Logan wrote the protocol with contributions from Eva Lydeking-Olsen. Vivi Krabbe Logan interviewed subjects, Helge Lydeking-Olsen performed the blood samples and Tom Saldeen analysed them for EFAs. Vivi Krabbe Logan performed the statistical analysis and wrote the report with contributions from Eva Lydeking-Olsen.

Conflict of interest statement

None of the authors are affiliated with Anjo A/S

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Table 1.
Baseline characteristics of participants.

	All n = 113	Compliance ≥80% n = 59	Compliance < 80% n = 54	P-value
Age (Years)[1])	7.5 ± 3.9	7.7 ± 4,1	7.3 ± 3,7	0.53
Sex:				
Girls, n (%)	60 (53.1)	33 (55.9)	27 (50.0)	
Boys, n (%)	53 (46.9)	26 (44.1)	27 (50.0)	
Height, m[1])	1.27 ± 0.24	1.28 ± 0.25	1.26 ± 0.23	0.71
Weight, kg[1])	29.42 ± 13.85	30.95 ± 14.76	27.78 ± 12.71	0.22
Proportion:				
Pre-school, n (%)[2])	62 (54.9)	32 (54.2)	30 (55.6)	
School, n (%)[3])	51 (45.1)	27 (45.8)	24 (44.4)	
No health prob. n (%)	38 (33.6)	25 (42.4)	13 (24.1)	
Self-reported prob. n (%)*[1])	47 (41.6)	20 (33.9)	27 (50.0)	
Diagnosed prob. n (%)*[2])	28 (24.8)	14 (23.7)	14 (25.9)	

[1]) Data are mean±SD (Age group 1-15 years) at study entry.
[2]) Age 1±6 y.
[3]) Age 7±15 Y.
*[1])Intolerance, recurrent infections, bronchitis, eczema, learning difficulties, hyperactivity, behavoir problems
*[2]) Epilepsy 2, eczema 8, asthma 10, allergy 6, drug/alcohol abuse (from foetal life) 2, damp/brain damage (from foetal life) 3, migraine 1, hyperactivity 2. Some of the children had 2 diagnoses.

Table 2 Food-composition data from 3-d diet records in healthy subjects, parent diagnosed subjects and doctor diagnosed subjects.

Nutrients	Healthy (n = 38)	Parent diagnosed[1]) (n = 47)	Doctor diagnosed[2]) (n = 28)	Anova P - value
Energy (kJ)	7360±1554	7359 ± 1415	7537 ± 1583	0.875
Protein (% of energy)	13.8 ± 1.6	13.5 ± 1.9	13.8 ± 2.0	0.728
Carbohydrates (% of energy)	59.0 ± 4.2	61.1 ± 5.9*	57.8 ± 4.5	0.029
Fat (% of energy)	27.2 ± 3.9	25.4 ± 5.8*	28.4 ± 4.9	0.045
Cholesterol (mg)	224 ± 141	192 ± 108*	219 ± 191	0.005
Saturated fatty acids (g)	17.5 ± 4.6	15.6 ± 6.3	16.9 ± 5.5	0.127
C10_1 (mg)	425 ± 201	336 ± 260	341 ± 259	0.054
Monounsaturated fatty acids (g)	16.4 ± 4.8	15.3 ± 6.6	17.3 ± 6.7	0.089
C14_1n_5 (mg)	197 ± 105	143 ± 095	186 ± 148	0.081
C20_1_11 (mg)	490 ± 302	325 ± 224*	459 ± 350	0.026
C22_1_11 (mg)	136 ± 236	29 ± 72*	133 ± 264	0.025
C24_1_9 (mg)	15 ± 22	5 ± 10*	14 ± 23	0.047
Polyunsaturated fatty acids (g)	8.1 ± 2.7	7.7 ± 2.5	8.1 ± 3.3	0.725
C18_2n_6 LA (mg)	6640±2334	6460 ± 2110	6646 ± 2629	0.922
C20_4n_6 AA (mg)	27 ± 26	27 ± 29	26 ± 31	0.927
C18_4_3 (mg)	34 ± 60	10 ± 27	35 ± 69	0.057
C20_5n_3 EPA (mg)	87 ± 115	26 ± 40*	77 ± 92	0.002
C22_5_3 (mg)	38 ± 29	23 ± 16*	40 ± 27	0.006
C22_6n_3 DHA (mg)	241 ± 281	94 ± 104*	214 ± 232	0.005
Vitamin D (mcg)	1.8 ± 1.6	1.0 ± 0.7*	1.9 ± 1.8	0.012
Vitamin B-12 (mcg)	3.6 ± 1.7	2.4 ± 1.5*	3.4 ± 1.3	0.027

Data are mean ± SD

[1])Intolerance, recurrent infections, bronchitis, eczema, learning difficulties, hyperactivity, behaviour problems.

[2]) Epilepsy, eczema, asthma, allergy, drug/alcohol abuse (from foetal life), damp/brain damage (from foetal life), migraine, hyperactivity.

* significantly different from the two other groups.

Table 3A
Self/parent reported effects on physical and mental problems after 4 months intake of Eskimo 3 Kids. (n = 113)

Symptoms	n	Worse, n (%)	Unchanged, n (%)	Better, n (%)	P- value*
Physical:					
Dry hair	96	7 (7.3)	80 (83.3)	9 (9,4)	0.6171
Recurrent colds	95	5 (5.3)	70 (73.6)	20 (21.1)	0.0027
Recurrent ear ache	96	2 (2.1)	91 (94.8)	3 (3.1)	0.6547
Throat infections	96	3 (3.1)	82 (85.4)	11 (11.5)	0.0325
Eczema in general	93	2 (2.2)	87 (93.5)	4 (4.3)	0.4142
Eczema local	96	6 (6.2)	81 (84.4)	9 (9.4)	0.4386
Dry skin in general	93	2 (2.2)	80 (86.0)	11 (11.8)	0.0126
Dry skin local	95	2 (2.1)	79 (83.2)	14 (14.7)	0.0027
Sebaceous pimples	94	3 (3.2)	79 (84.0)	12 (12.8)	0.0201
Diarrhoea/loose stool	93	4 (4.3)	77 (82.8)	12 (12.9)	0.0455
Constipation	92	7 (7.6)	73 (79.4)	12 (13.0)	0.2513
Mental:					
Memory	90	0 (0.0)	85 (94.4)	5 (5.6)	0.0253
Hyperactivity	92	8 (8.7)	74 (80.4)	10 (10.9)	0.6374
Literal concentration	90	13 (14.4)	69 (76.7)	8 (8.9)	0.2752
Physical concentration	91	10 (11.0)	68 (74.7)	13 (14.3)	0.5316
Learning difficulty Danish	66	1 (1.5)	63 (95.5)	2 (3.0)	0.5637
Learning difficulty Math	62	2 (3.2)	53 (85.5)	7 (11.3)	0.0956

*McNemars test for paired dichotomous data.
The amount of worse children in hyperactivity, can reflect that many reported back after the summer holiday, where parents had been together with their children for weeks.
Low number in learning difficulty Danish/math is due to the question being irrelevant to pre-school children.

Table 3B

Number and % of children reporting symptoms at baseline in three groups

	Healthy children n=38 (%)	Parent diagnosed children n=47 (%)	Doctor diagnosed children n=28 (%)	ANOVA p-value
Dry hair	4 (10.5)	8 (17.0)	7 (25.0)	0.2086
Recurrent colds	14 (36.8)	27 (57.4)	18 (64.3)	0.111
Recurrent ear ache	1 (2.6)	3 (6.4)	1 (3.6)	0.7004
Throat infections	1 (2.6)	10 (21.3)	8 (28.6)	0.0373
Eczema in general	0 (0.0)	2 (4.2)	3 (10.7)	0.0659
Eczema local	1 (2.6)	13 (27.7)	10 (35.7)	0.0021
Dry skin in general	2 (5.3	8 (17.0)	6 (21.4)	0.0639
Dry skin local	4 (10.5)	14 (29.8)	13 (46.4)	0.001
Sebaceous pimples	10 (26.3)	12 (25.5)	7 (25.0)	0.8236
Diarrhoea/loose stool	8 (21.1)	21 (44.7)	13 (46.4)	0.0006
Constipation	6 (15.8)	10 (21.3)	10 (35.7)	0.018
Memory	7 (18.4)	3 (6.4)	3 (10.7)	0.5165
Hyperactivity	4 (10.5)	8 (17.0)	2 (7.1)	0.6115
Literal concentration	12 (31.6)	13 (27.7)	13 (46.4)	0.1529
Physical concentration	8 (21.1)	15 (31.9)	9 (32.1)	0.0686
Learning difficulty Danish	4 (10.5)	7 (14.9)	6 (21.4)	0.4476
Learning difficulty Math	5 (13.2)	4 (8.5)	8 (28.6)	0.0951

Table 4A

Symptoms often associated with possible fatty acid (EFA) deficiencies, EFA intake from supplements and consumption of oily fish in three groups of children. Healthy, parent diagnosed and doctor diagnosed health problems, at baseline. Based on parents/child self reporting

Total no.	Healthy n=38 (%)	Parent diagnosed problems*[1]) n=47 (%)	Doctor diagnosed problems*[2]) n=28 (%)	ANOVA P-value
Dry hair	4 (10.5)	8 (17.0)	7 (25.0)	0.2086
Dry skin	2 (5.3)	8 (17.0)	6 (21.4)	0.0639
Dry spots	4 (10.5)	14 (29,8)	13 (46.4)	0.001
Sebaceous pimples	10 (26.3)	14 (25.5)	7 (25.0)	0.8236
Oily fish[1])	15 (39.5)	10 (21.3)	7 (25.0)	0.2056
Oil supplement[2])	7 (18.4)	6 (12.8)	3 (10.7)	0.8966

[1]) Consumption > once a week

[2]) Both n-3 and n-6 supplements[1])

*[1])Food intolerance, recurrent infections, bronchitis, eczema, learning difficulties, hyperactivity, behaviour problems.

*[2]) Epilepsy, eczema, asthma, allergy, drug/alcohol abuse (from foetal life), damp/brain damage (from foetal life), migraine, hyperactivity.

Table 4B

Symptoms often associated with possible fatty acid (EFA) deficiencies.
No. of children reporting improvements after 4 month intervention, in three groups.
Based on parents/child self reporting

Total no.	Healthy n=38 (%)	Parent diagnosed problems*[1]) n=47 (%)	Doctor diagnosed problems*[2]) n=28 (%)	ANOVA P-value
Dry hair	3 (7.9)	8 (17.0)	3 (10.7)	0.8184
Dry skin	1 (2.6)	1 (2.1)	4 (14.3)	0.0189
Dry spots	0 (0.0)	7 (14.9)	7 (25.0)	0.0056
Sebaceous pimples	6 (15.8)	5 (10.6)	1 (3.5)	0.9513

*[1])Food intolerance, recurrent infections, bronchitis, eczema, learning difficulties, hyperactivity, behaviour problems.

*[2]) Epilepsy, eczema, asthma, allergy, drug/alcohol abuse (from foetal life), damp/brain damage (from foetal life), migraine, hyperactivity.