

# Flax Seeds Supplementation on Children with Autism

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**Abstract:** ***Background:** Autism is described through delay as well as deviance within multiple sections of progress, such as impaired social interaction and communication. As there is a surge in the incidence of autism in India and lack of information is available on the role of diets, the **Objective** is to assess effectiveness of a diet free from casein and gluten and also supplementation of a snack with omega-3-fatty acids on autistic children. **Study Design:** An experimental study design was employed with purposive random sampling. Group 1-gluten-free, casein-free diet along with supplementation of omega 3 in the form of a snack with flax seeds and group 2-control group. A DSM-IV adapted questionnaire was applied to assess the level of autistic features, before and after the intervention. **Results:** A significant difference ( $p<0.01$ ) was observed in the social interaction and communication of the autistic children of group 1. As for behavior pattern, significant difference ( $p<0.05$ ) was observed. **Conclusion:** Implementation of a strict casein, gluten-free diet, along with omega-3-fatty acid supplementation showed remarkable improvements in the life of autistic children, indicating that supplementation would lay foundation for a diet that can greatly benefit the condition.*

**Keywords:** Omega- 3, flaxseeds, autism, casein- free, gluten- free

## 1. Introduction

The Autism Society of America, 2007<sup>1</sup> definition includes the inability of the child in the first few years that is usually observed as complexity of neuro- degenerative disorder mainly the central nervous system, impaired interaction socially and skills with regard to communication abilities is involved.

Nutritional therapy and modifications in diet could be one of the alternate therapies of management. 70-80 percent of people with autism have elevated levels of opioid peptides in the urine which aggravate autistic features<sup>2</sup>. These peptides originate from improperly digested proteins mainly from casein and gluten. So a diet which excludes casein and gluten can help in reducing the autistic symptoms<sup>3</sup>. Gluten in grains such as wheat, oats, rye and barley and casein in milk and milk products are one of the most significant launchers of the destructive reaction. In recent years, many studies have reported that fatty-acids deficiencies or imbalances are linked with childhood neurological disorders. Various studies have also proven that autistic children do have lesser content of omega- 3 in the body.

Children with autism suffer from various feeding problems which decrease their dietary intake and lead to deficiency conditions. Supplementation of the snack rich in omega – 3 can bring about tremendous changes. Thus, in addition to a gluten-free casein-free diet, omega-3 supplementation is important. Therefore, this study attempts to find efficacy of flax seeds supplementation on children with Autism and how to improve their health.

## 2. Materials and Methods

The experimental study design used is the pre and post test with control group using purposive random sampling technique. The universe to be studied was the special schools situated in Chennai. Out of the total number of differently-abled children studying there, 20 autistic children were selected for the supplementation program by means of an interview schedule, which comprised of questions related to age, level of autistic features, feeding problems and other associated disorders.

### 2.1 Sample size

An age-matched and gender-matched control group was included for the study. All autistic children ( 20 experimental and 20- control) aged 3- 6 years of both genders and children willing to participate in the study after obtaining parent's consent were included in the study. Autistic children with associated chronic disease and deficiency conditions and children not willing to participate in the study were exclude. The Duration of study was for 3 months with a Supplementation period of 45 days

### 2.1.1 Tools for Data Collection

#### 1) Interview schedule

The interview schedule consisted of questions related to: Age, Gender, Type of marriage and Obstetric History, Anthropometric measurements such as height, weight, Gomez, MAC, TSF, MAMC, Clinical Evaluation, Associated disorders such as Down's syndrome, ADHD, developmental delay, compulsive disorder, indigestion , Feeding problems like spitting, food refusal, choking, dysphagia and Cognitive functions

2) **Questionnaire adapted from DSM-IV diagnostic criteria for Autism**

The Diagnostic and Statistical Manual for mental disorders<sup>6</sup> consists of distinctive features of autism and it is used as a tool to assess the level of severity of the autistic symptoms. The questionnaire provides details about the social interaction, communication level and behavior pattern of the child.

3) **Three day Record and Food frequency questionnaire** pertaining to gluten and casein rich foods

4) **Food diaries and Activity note** to monitor the food intake and behavioral pattern during the follow-up period.

2.1.2 Experimental Procedure

1) **Analysis of flax seeds:** Flax seeds which are used as the main source of omega-3-fatty acids were analyzed in a nutrient analysis lab to estimate their omega 3 content. 100g of flax seeds contained 25g of omega-3-fatty acids.

2) **Formulation of the supplement:** Based on the omega 3 content, the product was formulated using desiccated coconut, groundnuts, honey and the ingredients were made into rolls which were easy for the children to consume without any wastage.

3) **Nutrient content of the supplement:** energy- 201kcal; proteins-6g; calcium-83mg; omega-3-fatty acids- 2.5g.

A written informed consent was obtained from the parents of the selected autistic children. The interview schedule and DSM-IV questionnaire was then administered to the parents so as to find out the features of autism in these children. A counseling session was then carried out among the parents and this was followed by the supplementation. The children were then followed-up by means of a food diary and activity diary on a weekly basis, which was maintained by the parents.

After the forty-five days of follow-up, a re-evaluation of the level of autistic features was carried out using the DSM-IV questionnaire. The various statistical analysis used were 't' test and paired 't' test.

3. Results and Discussion

Table 1: Age wise, Gender classification of experimental group and control group

Variables	Group 1		Group 2		Total	
Age (yrs)	N	%	N	%	N	%
3	2	10	1	5	3	7
4	4	20	5	25	9	23
5	10	50	10	50	20	50
6	4	20	4	20	8	20
<b>Total</b>	<b>20</b>	<b>100</b>	<b>20</b>	<b>100</b>	<b>40</b>	<b>100</b>
<b>Gender</b>						
<b>Male</b>	<b>11</b>	<b>55</b>	<b>13</b>	<b>65</b>	<b>24</b>	<b>60</b>
<b>Female</b>	<b>9</b>	<b>45</b>	<b>7</b>	<b>35</b>	<b>16</b>	<b>40</b>
<b>Total</b>	<b>20</b>	<b>100</b>	<b>20</b>	<b>100</b>	<b>40</b>	<b>100</b>

Table 1 shows the gender classification, age classification of experimental and control groups. The age range in group 1 was from three to six years, with a percentage ranging from seven to fifty. A similar trend was noted in group 2, which is the control group. This shows that there was an age-match control among all the groups and this type of distribution is essential to obtain unbiased results. While considering the gender distribution, again similar trends were observed among the two groups, showing that there was a gender-matched control.

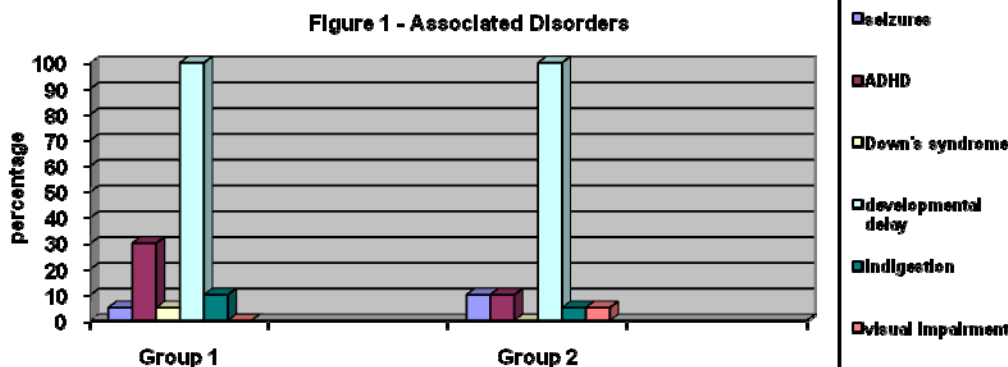


Figure 1: Associated Disorders in the total subjects

Autistics tend to suffer from a number of other associated disorders. Hundred percent of developmental delay was seen in both the groups. This is due to the compromised brain development which affects autistics. The next most prevalent disorder seen was Attention Deficit Hyperactive Disorder. This condition tends to aggravate autistic features by increasing the hyperactivity levels. Down's syndrome is usually not a common manifestation in autistic children since both disorders have completely different features. The other disorders that were also present among the total samples were visual impairment and indigestion.

Table 2: Anthropometric measurements and level of significance in groups 1 and 2, before supplementation

Parameters	Groups	N	Mean ±SD	't' value
Weight	1	20	16.20±4.07	0.000 <sup>NS</sup>
	2	20	16.20±3.27	
MAC	1	20	151.80±12.37	1.085 <sup>NS</sup>
	2	20	155.80±11.05	
TSF	1	20	8.10±1.86	0.0607 <sup>NS</sup>
	2	20	8.45±1.43	
%MAMC	1	20	93.35±9.59	1.080 <sup>NS</sup>
	2	20	96.50±8.83	

NS – Not Significant Group 1- Experimental group, Group-2- Control group.

Table 2 represents the anthropometric measurements of groups 1 and 2. There was not much disparity in the weight, stores of somatic fats and proteins between the autistic children from the supplementation and the control groups. Therefore it is concluded that all the forty samples were of equal nutritional status during the initial assessment.

**Table 3:** Evaluation of DSM-IV before supplementation and counseling:

Autistic features	Groups	N	Mean ±SD	't' value
Social interaction	1	20	4.20±2.26	0.687 <sup>NS</sup>
	2	20	3.70±2.34	
Communication	1	20	4.15±2.25	0.759 <sup>NS</sup>
	2	20	4.65±1.89	
Behavior pattern	1	20	8.15±2.03	2.269*
	2	20	6.60±2.28	

NS – Not Significant \* - 5% significant level

The Diagnostic and Statistical Manual for mental disorders, which was formulated by the American Psychiatric Association, 2002, was used to assess the level of autistic features such as social interaction, communication and behavior pattern in all the forty autistic children, before the supplementation. Table 3 shows that there was no significant difference in the social interaction and communication. But a five percent significant difference was noted in the behavior pattern. This difference can be attributed to the degree of training and forms of therapy that were given in the different schools.

**Table 4:** Effect of flaxseeds supplementation on autistic features in group- 1

Autistic features	N	Before Mean ± SD	After Mean ±SD	't' value
Social interaction	20	4.20±2.26	8.45±2.11	8.745**
Communication		4.15±2.25	7.60±2.50	9.242**
Behavior pattern		8.15±2.033	9.10±1.77	2.454*

\* - 5% significant level \*\* - 1% significant level

Using the DSM-IV questionnaire, a re-evaluation of the level of autistic features was carried after the forty-five days of supplementation. The minimum score from the questionnaire was zero and maximum was twelve. From table 4, it is seen that the mean score for level of social interaction of the twenty autistic children, prior to supplementation was 4.20±2.26 and after intervention an increase to 8.45±2.11 was noted. The changes in social interaction involved facial expression, eye contact, sharing of enjoyment and emotional needs. An increase in the level of communication was also observed, with a mean score of 4.15±2.25, to 7.60±2.50, these were significant at one percent level. Communication involved development of spoken language, ability to sustain conversation and level of comprehension. As for the behavior pattern, which includes mood changes, level of hyperactivity, sleep pattern and repetitive mannerisms, a five percent significant difference was seen after the supplementation. It is thus concluded that omega 3 had beneficial properties on the level of autistic features.

**Table 5:** Type of changes seen in autistic children after supplementation

Changes	N= 20	percentage
Decreased Hyperactivity	14	70
Improved Eye-contact	7	35
Improved Sleep pattern	6	30
Regular Bowel movement	20	100
Increased Appetite	20	100
Increased Concentration	3	15
Increased Socialization	4	20
Decreased Mood changes	3	15
Decreased stereotypic behavior	2	10

Table 5 shows the different types of changes in autistic features that were seen after the forty-five days of supplementation. Hundred percent improvements in bowel movement and appetite were noted. This is attributed to the high fibre content (10g of flax seeds provides 3-4g of fibre) of flax seed, which helps in stabilizing bowel movement. The next feature that showed great improvement is hyperactivity, with seventy percent of children displaying a decrease in hyperactivity level. A better sleep pattern was also reported for thirty percent of the children. Mothers said that the children had eight to ten hours of peaceful sleep, which thereby made the children more cheerful. Thirty-five percent showed great improvements in eye-contact and twenty percent of the autistic children had better socialization.

**Table 6:** Effect of supplementation on weight

Weight	Mean ± SD (kg)	't' value
Before	16.20±4.07	7.345**
After	17.91±3.70	

\*\* - 1% significant level

Table 6 represents the difference in weight among the autistic children from group 1, before and after supplementation. Prior to supplementation, the mean weight among the children was 16.20±4.07kgs. After the forty-five days of supplementation, the mean weight had increased to 17.91±3.70. There was therefore a mean weight gain of 1.71kg. Based on the growth table suggested by Prevention of persistent health disorders and promotion of health, 2000<sup>7</sup>, average growth rate for children aged three to six is two kilograms per year. Since the average weight gain among the autistic children over a period of forty-five days is 1.71kg, this implies that the supplementation has contributed to some amount of weight gain in the otherwise underweight children.

**Table 7:** Autistic features of children in control group

Autistic features	N	Before Mean ± SD	After Mean ±SD	't' value
Social interaction	20	3.70±2.34	3.70±2.34	NS
Communication		4.65±1.89	4.65±1.89	
Behavior pattern		6.60±2.28	6.60±2.28	

NS – not significant

Table 7 shows the level of autistic features of the children from the control group, before and after the forty-five days of supplementation. No significant difference was observed

since the scores remained the same. It is thus concluded that autistic children who are not given appropriate dietary intervention will not be able to show rapid changes in autistic features, thereby making nutritional counseling and dietary modifications mandatory in the treatment of autism.

**Table 8:** Evaluation of DSM-IV and significant level between groups 1 and 2 after supplementation

Autistic features	Experimental group Mean $\pm$ SD	Control group Mean $\pm$ SD	't' value
Social interaction	8.45 $\pm$ 2.11	3.70 $\pm$ 2.34	6.733**
Communication	7.60 $\pm$ 2.50	4.65 $\pm$ 1.89	4.201**
Behavior pattern	9.10 $\pm$ 1.77	6.60 $\pm$ 2.28	3.870**

\*\* - 1% significant level

Table 8 shows the comparison of autistic features among the children of experimental and control group. A significant difference at one percent level was observed after the supplementation period. While the scores for improvements in autistic features increased in group 1, scores of group 2 showed no changes. It is thus concluded that maintaining autistic children on a gluten-free, casein-free diet, with omega 3 has beneficial effects on the level of autistic features.

#### 4. Summary and Conclusion

Based on the level of changes seen after the forty-five days of intervention and follow-up, it is concluded that maintaining autistic children on a diet strictly exclusive of gluten and casein can help in decreasing the level of autistic features. Nevertheless, omega-3-fatty acids rich foods should also be given as it aids in better and faster improvements in autistic features and it also increases cognitive functions.. The current study therefore shows that if autistic children are maintained on omega-3-fatty acids, there are greater chances of reducing features of autism faster, thereby promoting healthy growth and development

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