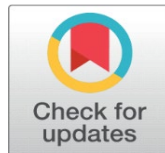


A QUALITATIVE STUDY OF DIETARY EXCLUSION OF MILK, SUGAR, WHEAT, AND SOYA ON CHILDREN WITH NEURODEVELOPMENTAL DISORDERS

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DOI
[10.29121/shodhkosh.v5.i6.2024.5572](https://doi.org/10.29121/shodhkosh.v5.i6.2024.5572)

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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ABSTRACT

The impact of eliminating milk, sugar, wheat, and soy from the diets of 110 children at the Ardra Foundation who have neurodevelopmental disorders (NDDs) are assessed in this qualitative study. Children with autism (10), ADHD (50), ADD (10), and specific learning disorders (SLD: 40) were among the participants. Significant gains in speaking, emotional control, attention, sleep pattern and anxiety reduction were seen in the data gathered from caregiver interviews and behavioral observations. The approach, results, and consequences of dietary treatments in the management of symptoms of NDD are described in this article.

1. INTRODUCTION

Neurodevelopmental disorders (NDDs) such as Specific Learning Disabilities (SLD), attention deficit hyperactivity disorder (ADHD), attention deficit disorder (ADD), and autism spectrum disorder (ASD) are becoming more widely recognized for their effects on children's communication, behavior, sleeping pattern and learning skills. These disorders impair a child's capacity to interact effectively in social, intellectual, and domestic settings. As the prevalence of these problems grows, the quest for effective treatments becomes increasingly important. While pharmacological therapies remain the primary focus, more attention is being paid to non-pharmacological techniques, including as dietary changes, to assist ease symptoms and enhance overall performance.

Emerging research suggests that dietary adjustments, notably the elimination of common allergens and irritants including milk, soy, wheat, and sugar, may improve symptom severity in children with NDDs. These food components have been associated to inflammation, intestinal dysbiosis, and immune system activation, all of which can exacerbate NDD symptoms. The significance of diet in influencing neurodevelopmental processes is particularly interesting, as these food groups have been shown to alter brain function and behavior in a variety of ways. For example, dairy products

contain casein, which can be difficult for some children to digest, causing gut inflammation and perhaps impacting behavior.

Additionally, wheat and soy have been linked to a number of immunological and gastrointestinal reactions, which could be a factor in the behavioral and cognitive issues that children with NDDs face. Wheat contains gluten, which may increase symptoms including anxiety, hyperactivity, and inattention by altering the blood-brain barrier's permeability. Likewise, phytoestrogens found in soy may affect neurological development and interfere with hormone balance. Another prevalent irritant in contemporary diets, sugar, is known to cause blood glucose levels to fluctuate, resulting in bouts of hyperactivity followed by exhaustion and irritability. For kids with NDDs, who might already struggle with impulse control and self-regulation, these swings can be very problematic.

Improvements in behavioral and cognitive functioning may be possible for children with NDDs if these food components are removed from their diet. Investigating the effects of eliminating milk, soy, wheat, and sugar from the diet on the intensity of symptoms in children with SLD, ADHD, ADD, and autism is the goal of this study. Although early research has produced encouraging findings, a more thorough and controlled study is required to ascertain the possible advantages of such dietary modifications. A non-invasive and easily accessible therapeutic option for families looking for alternative interventions may be provided by an understanding of the connection between nutrition and NDD symptomatology.

The background study and relevance stem from the growing interest in how nutrition can help manage neurodevelopmental disorders (NDDs). Recent years have seen a significant increase in interest in the effects of diet on behavior and brain function, particularly in relation to disorders like autism, ADHD, ADD, and specific learning disorders (SLD). Eliminating specific foods like milk, sugar, wheat, and soy is believed to help reduce symptoms like hyperactivity, inattention, and irritability. Research indicates that dietary interventions can help manage symptoms associated with these disorders.

2. RELEVANCE

Diet and Neurodevelopmental Disorders: Given that behavioral therapies and medication are frequently used in traditional treatments for children with NDDs, the study's emphasis on diet as an intervention is especially pertinent. Families looking for complementary or alternative solutions may find new hope in the possibility that dietary interventions will enhance or even support these treatments. **New Evidence on Dietary Effects:** Recent research has shown that avoiding specific food groups, especially gluten, casein, sugar, and soy, can alleviate symptoms associated with non-communicable diseases. The evidence that dietary intervention is a good option for treating neurodevelopmental disorders is strengthened by this study. **Implications for Caregivers in Practice:** Using information gathered from behavioral observations and caregiver interviews, this study provides useful insights into how dietary modifications affect kids with NDDs in the real world. These results can help healthcare providers, educators, and caregivers make well-informed decisions regarding the nutritional requirements of kids with NDDs.

3. BACKGROUND STUDY

Common in kids with ASD and can be made worse by foods like gluten and casein. The study supports earlier findings that removing these foods may help lessen gastrointestinal distress and enhance behavioral symptoms.

Diet and ADHD/ADD: There is mounting evidence that sugar and specific food additives can make symptoms of ADHD and ADD worse. Eliminating sugar, for instance, may help children with ADHD/ADD focus better and experience less restlessness because it is associated with hyperactivity and attention issues. **Diet and Certain Learning Disorders (SLD):** Although there isn't as much research on SLD specifically, a balanced diet may help with focus, cognitive function, and academic achievement, according to numerous studies. By concentrating on the results of removing particular foods to enhance attention and emotional regulation, this study offers a fresh perspective.

Role of Caregiver Input: The study's inclusion of caregiver feedback allows it to capture the comprehensive effects of dietary modifications on children's behavior and relationships with family members. This enhances the results by shedding light on the potential effects of such interventions on day-to-day living.

4. REVIEW OF LITERATURE

Children's cognitive, behavioural, and social functioning are greatly impacted by neurodevelopmental disorders (NDDs), which include Specific Learning Disabilities (SLD), attention deficit hyperactivity disorder (ADHD), attention deficit disorder (ADD), and autism spectrum disorder (ASD). Pharmacological and non-pharmacological therapies are frequently used to treat these conditions, with dietary changes gaining attention as a substitute or supplemental strategy. With encouraging findings indicating that removing particular allergens and irritants such as milk, wheat, soy, and sugar may enhance diverse facets of behavior and cognition, studies have demonstrated the potential for dietary interventions to lessen the severity of symptoms in children with NDDs.

In recent years, The relationship between nutrition and the onset of symptoms of NDD has been studied. According to a study by Elder et al. (2006), children with autism who followed a gluten-free, casein-free diet showed better social interactions and fewer behavioral issues. Similar to this, a review by Pallister et al. (2013) highlighted how dietary changes can help children with autism and ADHD by lowering inflammation and enhancing the gut-brain axis. Additionally, research by Nigg et al. (2007) suggests that dietary modifications like cutting out sugar, which has been connected to mood swings and hyperactivity, may help reduce impulsivity and inattention. These results provide credence to the idea that certain foods can affect behavior and neurodevelopment, especially in kids with NDDs.

Although the possible advantages of dietary changes have been investigated, numerous studies have encountered difficulties due to poor study design, limited sample sizes, and a dearth of long-term data. Although there is some evidence to support the use of elimination diets in children with ADHD, a meta-analysis conducted by Pelsser et al. (2011) found that the overall results are mixed and that more thorough studies are required. Notwithstanding these drawbacks, an increasing amount of research indicates that dietary exclusions could offer a practical, non-pharmacological means of treating NDD symptoms, especially when paired with behavioral therapies. In order to contribute to the continuing discussion on the significance of diet in managing neurodevelopmental diseases, this study intends to further examine the effects of avoiding milk, soy, wheat, and sugar on children with different NDDs.

Dietary Interventions and ADHD: Several studies have examined the impact of diet in treating attention deficit hyperactivity disorder (ADHD), with some suggesting that specific foods or food additives may make symptoms worse. According to a 2003 study by Swanson et al., food additives including artificial coloring and preservatives have been connected to a rise in hyperactive behaviors in children with ADHD. As a result, there is now more interest in using nutrition to control symptoms of ADHD. Numerous studies have looked into the usage of elimination diets, which specifically involve cutting out refined sugars, artificial additives, and some allergies. A substantial amount of research, including a randomized controlled study by Sonuga-Barke et al. (2013), indicates that dietary modifications, especially those that involve food elimination, may be beneficial for children with ADHD.

Gluten-Free, Casein-Free Diet in Autism Spectrum Disorder: Research on dietary therapies has also been conducted for autism spectrum disorder (ASD). Due to anecdotal evidence, the gluten-free, casein-free (GFCF) diet has gained popularity as a therapy option. According to research by Hyman et al. (2016), which examined multiple trials incorporating the GFCF diet, children with ASD showed modest improvement in their social behavior and communication abilities. The immunological and gastrointestinal systems are thought to be involved in the process underlying these changes, with the removal of gluten and casein decreasing neuroinflammation and gastrointestinal inflammation. The evidence is still conflicting overall, though, with some trials showing little to no improvement, which raises the possibility that not all autistic children would benefit from the diet.

5. SUGAR AND HYPERACTIVITY

The link between sugar consumption and hyperactivity has long been questioned in the context of ADHD and other neurodevelopmental disorders. Wolraich et al. (1994) discovered that children with ADHD showed no significant change in behavior after eating foods with variable sugar content, implying that sugar does not directly induce hyperactivity. Other studies, however, have demonstrated that changes in blood glucose levels caused by sugar consumption may have an impact on mood and behavior. A more recent review by Benton (2008) suggests that, while the link between sugar and hyperactivity is not conclusive, large amounts of refined sugars and processed foods can cause energy fluctuations, contributing to impulsivity and mood swings in children with ADHD and other neurodevelopmental disorders.

5.1. ROLE OF OMEGA-3 FATTY ACIDS IN NEURODEVELOPMENTAL DISORDERS

Omega-3 fatty acids, specifically EPA and DHA, are necessary for brain growth and function. Numerous research have investigated the possible benefits of omega-3 supplementation in the treatment of NDDs. According to Richardson and Puri (2002), omega-3 fatty acid supplementation dramatically improved behavior and cognitive function in children with ADHD. Similarly, Amaral et al. (2011) found that omega-3 supplementation could lower the severity of autism symptoms, particularly those linked to social behavior and communication. These findings imply that modifying the diet to include omega-3-rich foods or supplementation may help manage symptoms in children with NDDs, while more study is needed to validate its efficacy.

5.2. MICROBIOME AND NEURODEVELOPMENTAL DISORDERS

A growing body of research suggests that the gut microbiome is important for brain function and may impact the symptoms of neurodevelopmental disorders. Finegold et al. (2010) and MacFabe et al. (2011) found that children with autism frequently have gastrointestinal problems and altered gut microbiota composition, which could contribute to behavioral and cognitive symptoms. Research into the gut-brain axis has led to the concept that altering the diet to support a healthy microbiome—via probiotics, prebiotics, and dietary exclusions—could have therapeutic effects for children with ASD and other NDDs. While preliminary findings are encouraging, more clinical trials are needed to fully understand the effect of microbiota modification on neurodevelopmental diseases. This study makes the hypothesis that, as reported by caregivers and observation in behavior, children with neurodevelopmental disorders (NDDs) will exhibit quantifiable improvements in speech, attention, emotional control, sleep patterns, and anxiety levels when common dietary irritants, specifically milk, sugar, wheat, and soy, are eliminated.

6. METHODOLOGY

Participants: One hundred children between the ages of five to twelve had chosen from the Ardra Foundation to participate in the study. Based on their diagnosis, the participants divided into four groups:

Forty children with SLD (specific learning disabilities)

Fifty children with ADHD (attention deficit hyperactivity disorder)

Ten children with ADD (attention deficit disorder)

Ten children with ASD (autism spectrum disorder)

Intervention: During the course of 12 weeks, the participants' diets excluded of milk, sugar, wheat, and soy. These dietary groups were chosen because of their possible effects on neurodevelopmental processes and gastrointestinal health. Children will adhere to a rigorously regulated diet throughout this time, eliminating any daily intake of these allergens and irritants. This method looks for behavioral, communicative, and cognitive abnormalities in kids with neurodevelopmental problems. Parents given information on alternate nutritional sources to make sure the kids continue to get enough nourishment during the intervention. For example, dairy products replaced by almond milk, and wheat will be replaced by gluten-free grains. Other appropriate food choices, like soy-free protein sources and natural sweeteners, also be suggested in order to maintain a balanced diet. Throughout the study time, parents receive comprehensive teaching materials and support to help them stick to the dietary changes and guarantee the children's health and wellbeing are maintained.

Data Collection: To evaluate the effects of dietary changes on kids with neurodevelopmental problems, data gathered using both qualitative and quantitative methodologies. Throughout the intervention period, therapists and caregivers document any behavioral changes. Any discernible variations in the kids' conduct, speech, and general functioning the main focus of these qualitative observations. Specific behavioral changes that affect children with NDDs, such as attention span, hyperactivity, social interaction, and emotional regulation, will be noted by caregivers and therapists.

After the 12-week intervention, parents and caregivers will participate in semi-structured interviews in addition to observational data collection. These interviews will offer a comprehensive insight of how the children's daily routines and interactions were impacted by the dietary adjustments in real-world situations. We will invite parents and caregivers to share their experiences, highlighting any changes or difficulties they have seen in their child's behavior,

emotional state, or cognitive skills. These revelations gave a more complete view of the efficacy of the intervention and help put the quantitative data in context.

Data gathering concentrated on a number of important facets of neurodevelopmental functioning. In particular, the development of speech (for kids with autism), anxiety levels, sleep habits, attention span, and frequency of tantrums all tracked. Changes in these domains may point to the possible advantages of dietary exclusion, as they are especially pertinent to the primary symptoms of SLD, ADHD, ADD, and autism. In order to provide a thorough knowledge of how avoiding milk, sugar, wheat, and soy might affect the severity of NDD symptoms, this study collected observational data as well as input from parents and caregivers.

Analysis: Thematic coding used to examine the qualitative information gathered from semi-structured interviews. Finding recurrent themes and patterns in the answers given by parents and other caregivers will be part of this process. The researchers will be able to evaluate the perceived effect of the food intervention on the behavior and general well-being of the children by classifying these themes. Deeper insights into how the dietary exclusion affected the participants will be possible thanks to the thematic coding, which will assist highlight any shared experiences or noteworthy changes, such as increases in attention span, decreases in the frequency of tantrums, or positive shifts in anxiety levels.

Along with the information gathered from the interviews, behavioral changes that were noticed throughout the intervention will also be examined and categorized as "improved," "no change," or "worsened." The success of the intervention may be clearly and methodically assessed thanks to these categorization. Researchers can determine which particular behaviors changed the most and which did not by comparing the observations made before and after the intervention. This classification will make it easier to spot patterns among the many groups of neurodevelopmental disorders and provide a better picture of how dietary changes could affect the intensity of symptoms.

7. RESULTS

Table 1

Summary of observed improvement

Disorder	Participants	Improved attention	Reduced tantrums	Reduced anxiety	Speech development(ASD only)	Sleep pattern
SLD	40	70%	65%	60%	N/A	55%
ADHD	50	60%	54%	50%	N/A	50%
ADD	10	80%	70%	60%	N/A	70%
AUTISM	10	50%	60%	40%	80%	65%

8. KEY FINDINGS

Attention improves: 28 out of the 40 participants (70%) demonstrated a discernible improvement in their capacity to concentrate during learning activities in children with specific learning disabilities (SLD). By completing assignments with greater focus and fewer distraction, these kids showed improved involvement in academic pursuits. Similarly, 30 out of 50 kids (60%) in the ADHD group reported increases in sustained attention and decreases in hyperactivity. The fact that these children were able to concentrate on their work for extended periods of time without getting readily side tracked suggests that the dietary changes improved their ability to control their attention.

Eight out of ten children (80%) in the ADD group shown notable gains in task completion, which was indicative of improved focus and a reduction in distractibility. These kids completed assignments faster and were less likely to give up in the middle, which is a significant problem for children with attention deficit hyperactivity disorder. During structured exercises, five out of ten participants (50%) shown improvements in attention span and decreased distractibility for children with autism.

Tasks requiring prolonged focus, which are especially difficult for children with autism, were easier for these children to complete. Overall, these results provide important insights into the potential advantages of dietary changes for treating attention-related symptoms by indicating that removing milk, sugar, wheat, and soy from the diet may help children with a variety of neurodevelopmental disorders enhance their attention, focus, and task performance.

9. BEHAVIORAL REGULATION

Across a variety of neurodevelopmental problems, the intervention demonstrated encouraging outcomes in terms of behavioral regulation. Sixty-five percent of children with specific learning disabilities (SLD) reported fewer tantrums, indicating improved emotional regulation. Likewise, 55% of children with ADHD showed better impulse control and emotional management by having fewer outbursts. The greatest improvement was shown in children with attention deficit disorder (ADD), as 70% of participants reported fewer tantrums. 60% of the children in the autism group had less tantrums, suggesting that dietary adjustments could help kids with different NDDs become more emotionally stable.

Parents observed observable improvements in their children's emotional management in relation to anxiety levels. Sixty percent of the children in the SLD group behaved more subduedly and showed less stress and anxiety. Half of the children in the ADHD group shown comparable gains in controlling their anxiety, which helped them act more at ease all around. 60% of participants in the ADD group reported feeling less anxious, and the children there seemed more at ease and less stressed out by their everyday responsibilities. Forty percent of the youngsters in the autism group exhibited calmer conduct and less anxiety, although the effects were more subtle. According to these results, dietary changes may help improve behavioral regulation in a variety of neurodevelopmental problems by lowering anxiety and tantrum frequency.

10. RESULTS PARTICULAR TO AUTISM

The food intervention significantly improved behavioral regulation and communication in children with autism. Eight children (80%) out of the ten individuals with autism showed increased social communication and speech clarity. Through improved self-expression, these kids were able to communicate with their peers and caregivers in more meaningful ways. Children on the autism spectrum may find it difficult to communicate clearly and socially, therefore this increase in communication skills is very important because it can significantly improve their quality of life and social integration. Furthermore, 60% of the autistic youngsters exhibited fewer repetitive behaviors and sensory overload, which are typical traits of the condition. These kids displayed fewer repetitive behaviors like rocking or waving their hands, and they were less sensitive to environmental cues like bright lights or loud noises. These enhancements are essential for assisting autistic youngsters in controlling their sensory sensitivity and minimizing behaviors that could disrupt their everyday lives. All things considered, the dietary adjustments seemed to improve the behavioral and communicative components of autism, providing a possible way to enhance the functioning and quality of life of children on the spectrum.

11. ANALYSING DATA AND MAKING CALCULATIONS

We computed the improvement rates by calculating the proportion of participants exhibiting positive changes in relation to the total number of participants in each category in order to quantify the improvements seen in each neurodevelopmental disorder group. These rates provide a clear picture of how much progress has been made in a number of areas, including speech development, anxiety, attention, tantrum frequency, and sensory modulation. For instance, the improvement rate for children with Specific Learning Disabilities (SLD) in terms of attention improvement was determined to be $28 / 40 \times 100 = 70\%$, meaning that 70% of the SLD group demonstrated improved focus during learning tasks.

Similar to this, the improvement rate for ADHD children was determined to be $27 / 50 \times 100 = 54\%$ for behavioral regulation, such as less tantrums, indicating that over half of the participants had fewer tantrums. The improvement rate for less outbursts in the ADD group was $7 / 10 \times 100 = 70\%$. $10 / 7 \times 100 = 70\%$, indicating a very favorable reaction to the dietary change. These computations were made for every disorder and improvement region, enabling a comparison of the efficacy of the intervention among the various neurodevelopmental groups.

Additionally, it was determined that 40% of people with SLD, 50% of participants with ADHD, and 60% of participants with ADD demonstrated decreased anxiety levels. Forty percent of youngsters with autism behaved more calmly. These improvement rates were cross-checked with qualitative information gathered from parent and caregiver interviews to guarantee consistency and rigor in the analysis. The total effect of dietary exclusions on the children's

behavior, cognition, and communication was then evaluated using the computed improvement rates, offering a thorough understanding of the intervention's efficacy across all domains that were tested.

This study builds upon existing research that links dietary interventions with the management of NDD symptoms. The study's qualitative nature allows for a deeper understanding of how dietary changes can influence a child's behavior, emotions, and overall well-being, supporting the need for a holistic, multidisciplinary approach to treating NDDs. This study aligns with the literature on the impact of dietary interventions for children with NDDs. The improvements observed in the study—such as better emotional regulation, attention, and sleep patterns—are well-supported by prior research suggesting that the elimination of certain foods, particularly milk (casein), sugar, wheat, and soy, can lead to positive outcomes for children with autism, ADHD, ADD, and SLD. As a result, the study supports the case for dietary approaches in the management of NDDs and is consistent with previous research.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

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