Effect of a Health Education Package Regarding Feingold Diet on Knowledge and Attitude among Caregivers of Children with Attention Deficit Hyperactivity Disorder

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Abstract

Attention-deficit hyperactivity disorder (ADHD) is a common mental disorder among children and represents a significant public health concern. Recent evidence underscored the potential effect of elimination diets, such as the Feingold diet. Family caregivers often have limited knowledge and misconceptions regarding such dietary interventions. **Aim:** This study aimed to evaluate the effect of implementing a health education package about a Feingold diet on knowledge and attitudes among caregivers of children with ADHD. **Methods:** A quasi-experimental one-group pre-test/post-test study design was used, involving 53 caregivers of ADHD children in Mansoura city. Data were collected on the socio-demographic characteristics of caregivers, and their knowledge and attitude regarding the Feingold diet. **Results:** Statistically significant differences were observed between pre- and post-test scores of caregivers` knowledge regarding the Feingold diet ($p < 0.001$), with an improvement in their total score level from an unsatisfactory level among 60.4% of them in pretest to a satisfactory level among 94.4% in posttest, with a high effect size. A significant difference was detected between caregivers' attitudes pre- and post-test ($p < 0.001$). More than half of them (56.6%) had a neutral attitude level in pretest, compared to a very positive level among 60.4% of them in posttest. **Conclusion & Recommendations:** The health educational package improved caregivers` knowledge and attitude regarding the Feingold diet, with a significant positive correlation. It is recommended to conduct an ongoing dietary educational program for caregivers to enhance their awareness, which will be reflected in their decisions regarding the Feingold diet practices.

Keywords: Attention Deficit Hyperactivity Disorder, Attitude, Caregivers, Children, Feingold Diet, Health education package & Knowledge.

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a severe neurodevelopmental disorder characterized by persistent patterns of inattention, hyperactivity, and impulsivity that significantly affect an individual's functioning and development, which typically manifest before age 12 (**Song et al., 2021)**. It occurs in 5% to 7% of school-age children worldwide, affecting school performance, interpersonal relationships, and occupational functioning **(Danielson et al., 2018)**. The etiology of ADHD suggests a complex interplay of genetic, neurological, and environmental factors. Neuroimaging research revealed structural and functional variations in brain areas responsible for attention and behavioral control, including the prefrontal cortex, basal ganglia, and cerebellum, in individuals with ADHD **(Howard et al., 2019; Arber & Costa, 2022).**

A comprehensive intervention strategy for ADHD often involves behavioral therapies, educational support, and dietary modifications **(Nigg et al., 2012)**. Various dietary approaches have been explored for managing ADHD symptoms in children, one of which is the Feingold Diet. This diet is a nutrition system that emphasizes the elimination of artificial additives, preservatives, and certain foods that may exacerbate hyperactivity. The Feingold Diet encourages a whole-foods approach, promoting fresh fruits, vegetables, and unprocessed foods while avoiding sugar and artificial colorings. Research suggests that some children may respond positively to these dietary changes, experiencing reduced ADHD symptoms **(Feingold, 1975)**.

Caregivers play a crucial role in supporting children with ADHD. Well-informed caregivers have greater potential to apply effective management strategies. Evidence demonstrates that providers who receive specific training in ADHD and its management are more likely to use evidence-based practices more successfully, resulting in better behavioral outcomes for children **(Barkley, 2015)**. Health education entails systematic dissemination of information and skills that allow individuals and communities to make informed decisions, advocate for their children's needs, gain insight into ADHD complexities, and implement consistent routines, ultimately improving behavioral and emotional well-being **(Norris et al., 2019; Hoffmann et al., 2018)**. Tailored health education packages can provide information and practical support to caregivers, enhancing their confidence and ability to manage their children. Thus, intensive health education is crucial for caregiver awareness and promoting effective ADHD dietary management approaches **(Sun et al., 2020)**.

Changing caregivers' attitudes toward dietary management for children with ADHD is crucial for the effective implementation of nutritional interventions. A positive change in perception can enhance adherence to dietary changes. Teaching parents and other caregivers how diet affects behavior and cognitive function encourages them to follow nutritional recommendations, increases their participation in meal preparation, and eventually improves the outcomes for their children **(Havighurst et al., 2016)**. Additionally, empowering caregivers enhances children's behavioral and emotional outcomes while reducing family stress and uncertainty, contributing to a healthier society **(Wang et al., 2020)**. For this reason, it was necessary in this study to empower caregivers with the health education package to employ successful dietary interventions and improve public health outcomes.

Significance of the study

Most research prioritize pharmacological intervention as the primary therapeutic approach. Despite the growing concerns regarding medication side effects, dietary strategies such as the Feingold diet remain underexplored and underutilized. Notably, even when such dietary interventions do not produce substantial improvements, they pose minimal risk and are unlikely to cause harm. This highlights the importance of giving greater attention to safe, non-pharmacological options that may complement or, in some cases, reduce reliance on medication. Caregivers often lack reliable information about dietary interventions, which can hinder adoption. A structured health education program providing accurate information that can positively influence caregivers' knowledge, attitudes, and increase their adherence to the diet.

Aim of the study

This study aimed to evaluate the effect of a health education package regarding a Feingold diet on the knowledge and attitudes of caregivers of children with ADHD in Mansoura City.

Study hypothesis:

H1: A health education package about the Feingold diet will improve the level of knowledge of caregivers of children with ADHD immediately after implementation.

H2: A health education package about the Feingold diet will improve the level of attitude of caregivers of children with ADHD immediately and after twelve weeks of implementation.

Subjects and method

Study design

A quasi-experimental one-group pre-test/ post-test study design was used to fulfill the aim of this study. This design is an empirical one that allows measurement of the knowledge and attitude of caregivers before the health education intervention and then again after the intervention to assess any changes **(Creswell, 2014)**.

Study setting

The study was conducted in two settings in Mansoura city, namely, a child and adolescent psychiatric outpatient clinic affiliated with Mansoura University Hospital, and Zaid Child Psychiatric Private Clinic.

Participants

Family caregivers who fulfilled the following inclusion criteria were recruited for this study:

1. Caregivers with different age groups and both genders.
2. Primary caregivers of ADHD children (aged 5-12 years), who were diagnosed and confirmed by a healthcare professional.
3. Provided informed consent to participate in the study.
4. Those who can read and understand the educational materials provided.

Exclusion criteria:

1. Caregivers with significant cognitive or psychological impairments that may affect their ability to understand or implement the Feingold diet.
2. Care givers of children who were treated with salicylate (aspirin)

Sample size and sampling technique

The sample size was determined by analyzing the power of the test using **Cohen's (1992)** G*Power, based on the parameters of **Faheim, Abdalla, & Akl (2022)** for testing the two-tailed hypothesis with a power of 0.90 and an alpha error of 0.05, effect size type (Cohen's d). With an estimated effect size value of 0.5, the sample size required is 44 caregivers and their children with ADHD. To accommodate potential attrition, the sample size is increased by 20%. Therefore, the total sample size needed is 53.

Study tools

The researcher developed three tools for data collection after reviewing the relevant literature, as follows:

Tool (I): Self-administered structured questionnaire about socio-demographic data for primary caregivers and their ADHD children's

The researcher developed this tool, which consisted of two parts as follows:

Part (1): Assessment of sociodemographic data of primary caregivers, such as age, sex, and kin relationship to the ADHD children.

Part (2): Assessment of sociodemographic data of ADHD children, such as age, sex, number of additional disabilities, and health conditions.

Tool (II): Self-administered structured questionnaire, about caregivers` knowledge regarding the Feingold diet

The researcher developed this tool to measure caregivers' knowledge regarding the Feingold diet. It consisted of 17 questions related to such topics as the purpose of the Feingold diet, its phases, types of restricted foods, permissible foods and discouraged products, potential children's health outcomes and behavior, and favorable cooking methods.

For each correct answer, a score of 1 was given, and an incorrect answer or a missing answer was scored 0. The sum of these scores was calculated to produce the "total knowledge score," which was categorized based on the mean score of the pretest, as unsatisfactory knowledge was below the mean score of the pretest, and satisfactory knowledge was above the mean score of the pretest.

Tool III: Self-administered caregivers` Attitude Scale regarding the Feingold diet.

The researcher developed this tool to assess the level of attitudes of caregivers of children with ADHD regarding the Feingold diet. It consisted of 13 statements that required a response on a 5-point Likert scale, with 5 response options: **Strongly Disagree** = 1 point; **Disagree** = 2 points; **Neutral** = 3 points; **Agree** = 4 points; **Strongly Agree** = 5 points. The Total attitude score was calculated by summing the points of all response items. The possible scores ranged from a Minimum Possible Score: 13(if all responses are "Strongly Disagree") and a Maximum Possible Score: 65 (if all responses are "Strongly Agree").

Interpretation of Scores

- **13-26**: **Very Negative Attitude** towards the Feingold Diet
- **27-40**: **Neutral Attitude** towards the Feingold Diet
- **41-54**: **Positive Attitude** towards the Feingold Diet

- **55-65**: **Very Positive Attitude** towards the Feingold Diet

Ethical consideration

Written initial approval was obtained from the Research Ethics Committee, Faculty of Nursing, Mansoura University (Reference No. P.0815). An official letter clarifying the purpose of the study was obtained from the Dean of the Faculty of Nursing, Mansoura University, and submitted to the head of the child and adolescent psychiatric outpatient clinic affiliated with Mansoura University Hospital, and Zaid Private Clinic. Each caregiver was provided with a written informed consent form after being informed about the study's purpose and procedures. They were assured that their participation involved no physical, social, or psychological risks and that they could withdraw from the study at any time during data collection. To maintain confidentiality and anonymity, each participant was assigned a unique code number used only for data analysis. No incentives or rewards were offered to participants for completing the questionnaire.

Validity and reliability

The researchers developed the questionnaires following a comprehensive literature review to guarantee validity. To evaluate content validity, these were then evaluated by a panel of five academic experts, two professors in community health nursing and three in psychiatric health nursing. According to the panel's feedback concerning the material's appropriateness and the phrases' clarity, only minor revisions were made to the self-administered questionnaire, the caregivers' knowledge-related questionnaire, and the attitude scale toward the Feingold diet. After that, a translator with expertise in medical texts and research translated the questionnaire into Arabic. Subsequently, the Arabic version was back-translated into English to ensure accuracy, and the translation was examined in comparison with the original text by the same team. Any minor discrepancies detected between the original and back-translated versions were resolved through group consensus.

Pilot study

A pilot study was a preliminary study conducted on 10% (6 caregivers). to evaluate the clarity and completeness of the tools and to estimate the time needed to complete the questionnaire. The results showed that no refinement or adjustments were needed, so the subject was included in the main sample. Approximately, it took 15-20 minutes to complete the structured questionnaire.

The internal consistency of the developed tools as an attitude scale was tested using Cronbach's alpha coefficient, and it showed excellent reliability (0.95).

Fieldwork

The fieldwork was carried out in eight months, from the beginning of March to November 2022, through four phases:

Phase I: Assessment phase: Data collection for the study took place over one month, beginning in early March 2022. The researchers visited the study setting three days a week, from 9 AM to 2 PM, throughout the designated period. During these visits, the researcher met with the caregivers. explained the study's purpose and procedures and introduced the data collection tools. Caregivers then completed the sociodemographic, knowledge questionnaires, and attitude scale as part of a pre-test assessment of their baseline knowledge and attitudes.

Phase II: Planning phase: The researchers prepared the health education package based on the knowledge gaps that were found in the baseline data, reviewing relevant literature, and utilizing the Feingold handbook, which was based on the Feingold Association-recommended diet. This package included a dietary educational booklet and brochures. **The dietary educational booklet** was adapted to suit the caregivers' culture and the dietary context. It consisted of three main sections: The first section covered general knowledge about the Feingold diet, including its definition, purpose, phases, a list of restricted and allowed foods, and non-food items. The second section involved a description of the Feingold dietary recipes. This section provides a variety of meal ideas using healthy

homemade alternatives for breakfast, lunch, dinner, and snack options. It offers detailed information about food ingredients and cooking methods that align with the diet`s goals, which exclude artificial colors and preservatives. The third section illustrated a printable food diary template to track food intake and symptoms. **Brochures** were the second material used. It provided a concise and summarized message about the Feingold diet, highlighting tips about the goal, phases, restricted and allowed foods. The educational package content was then reviewed by six experts, three in community health nursing, two in public health and health education. The final version of the educational package was developed based on feedback and recommendations from these experts. It consisted of theoretical sessions to be implemented over four weeks. Focusing on ensuring that the caregivers understand the key concepts of the Feingold diet.

Phase III: Implementation phase: This phase aimed to apply the health educational package to the caregivers of children with ADHD, which lasted for three months, starting from the end of April to the end of July 2022. It was carried out after obtaining approvals and contact with the study settings. It was implemented in small groups of caregivers (5-10 / group) to facilitate participation and active discussion. Three educational sessions were conducted, each lasting about 45-60 minutes, with a one-week interval between sessions until the end of the predetermined period. The sessions were held in a quiet room in the study setting equipped with visual and audio aids. Teaching strategies included interactive discussion, PowerPoint presentation, printed educational materials (dietary educational booklet and brochures), and showing examples related to meal recipes and explaining the dietary diary template. A post-test was conducted immediately after finishing the sessions to assess the changes in caregivers' knowledge level regarding the Feign gold diet for children with ADHD, while the changes in their attitude level about the same diet were assessed once after 12 weeks.

The first session included an orientation about the program's goal and objectives, with a brief explanation of basic knowledge about ADHD definition, symptoms, and harmful dietary elements such as artificial colors and sugar. The second session included an introduction to the Feingold diet definition, principles, phases, allowed, and restricted foods. The third session included information about the variety of recipes with descriptions of ingredients and steps of cooking, and explained a diary template and how to fill it to trace children`s meals and symptoms. Each session began with a review and feedback on the previous session and an overview of the new session's aim and objectives. At the end of each session, the researchers briefed the caregivers on the objectives of the upcoming session, answered questions, and facilitated a discussion period. Further details of the group training program are provided in Table 1. Furthermore, to guarantee efficient follow-up and lower dropout rates, a WhatsApp group was created for study participants.

Phase IV: Evaluation phase: This phase was carried out immediately to assess changes in caregivers` knowledge level, and after 12 weeks to assess changes in caregivers' attitude level. The researchers asked the participants to complete the same questionnaire about knowledge; attitude used in the pre-test to evaluate the effect of the educational package by comparing the difference between pre- and post-test scores.

Table (1): The sessions of a health educational package were as follows.

Session	Subject	Time duration (minutes)
1st	**Introduction** **Welcome and introduction**: Brief overview ADHD **Icebreaker activity**: Engage participants by asking about their current knowledge and attitude toward ADHD **Understanding of ADHD** - Definition of ADHD - Symptoms - harmful dietary elements - essential nutrients that support brain function	45-60 minutes
2nd	**Introduction** **Welcome and introduction**: Brief overview of the educational package and the objective of the session **Icebreaker activity**: Engage participants by asking about their current knowledge and attitude regarding dietary intervention for ADHD children. **Understanding and attitude towards the Feingold diet** - What is the Feingold diet - Phases of implementation. - The children's behavioral changes based on the Feingold diet - principles and a list of allowed and restricted foods - Common misconception regarding the Feingold diet	45-60 minutes
3rd	**Introduction** **Welcome and introduction**: Brief overview of the educational package and the objective of the session **Icebreaker activity**: Engage participants by asking about their current knowledge and attitude regarding dietary intervention for ADHD children and examples of meals. **Understanding and attitude towards the Feingold diet** - The Feingold diet` recipes - Descriptions of ingredients - Steps of cooking	45-60

Statistical analysis:

Data were coded and analyzed using the Statistical Package for the Social Sciences version 21.0 (SPSS Inc., Chicago, IL). Descriptive analyses using numerical summaries, including measures of central tendency and dispersion, were performed on the research data to describe the sample characteristics. For determining normality, the Kolmogorov-Smirnov test was used. A paired t-test was used to test the research hypotheses, and Cohen's d was used to measure the effect size of the program. Additionally, the Pearson correlation coefficient was used to measure the linear relationship between the knowledge and attitude scores. Inferential statistics, such as Chi-square and McNemar's test, were used to indicate independence between the study variables. The significance level was set at 5%.

Result

Table 2 illustrates caregivers' socio-demographic characteristics. 69.8% of the caregivers who filled out the questionnaire and participated in the study were mothers. 49.1% of them were between 25 and 35 years old, and 32.1% were 35 to less than 45 years old, with a mean age of 35.24±6.13. It was also found that 66% had secondary education and 69.8% were married. Regarding their occupation, 58.5% were not working or were housewives. About residence, 52.8% resided in urban areas. Furthermore, the monthly income for 79.2% of them was not enough, and they did not have previous information about the ADHD diet.

Table 3 shows the caregivers correct responses to knowledge questions regarding the Feingold diet before and after the implementation of the educational program. Before the program, only a small percentage of caregivers correctly answered questions related to the goal, objectives, symptoms, duration,

prohibited foods, recommended foods and drinks, key features of the Feingold diet, and the effects of the Feingold diet on the child. Compared to the post-test results, there were marked improvements, with higher percentages of correct responses reported regarding recommended foods (98.1%), prohibited foods and drinks (96.2%), and the effects of the Feingold diet (94.3%). These differences between pre- and post-test results were statistically significant ($p < 0.001$).

The total score of the caregivers' knowledge studied regarding the Feingold diet before and after the educational program implementation is illustrated in **Table 4**. At the baseline survey, 60.4% of the studied caregivers had an unsatisfactory level of knowledge, with a mean score of 5.18±2.65. Compared to the post-test results, the level of caregivers' knowledge improved to a satisfactory level among 94.4% of the study sample with a mean score of 15.77±3.43. It is also noted from the same table that the Paired t-test indicated highly significant differences with a high effect size between the means of the total caregivers' knowledge score toward the Feingold diet throughout the two educational program phases ($t=16.14$, $P\leq0.001$, $d=3.45$).

Table 5 shows the caregivers' attitudes regarding using the Feingold diet before and after the implementation of the educational program. At baseline assessment, a large percentage of caregivers reported a neutral attitude related to all attitude statements except for difficulty in preparing meals (71.7%), improving my child's behavior (84.9%), requiring a lot of planning (66%), reading food labels to maintain the Feingold Diet (84.9%), and potential health benefits (52.8%) where they reported disagree responses. Compared to the post-test results, there were marked enhancements as all caregivers reported agree to strongly agree responses on the attitude scale. These differences between pre- and post-test results were statistically significant ($p < 0.001$).

The total score level of the studied caregivers' attitude regarding the Feingold diet before and after the educational program implementation is illustrated in **Table 6**. At the baseline survey, 56.6% of the studied caregivers had a Neutral Attitude, with a mean score of 37.83 ± 5.67. Compared to the post-test results, the level of caregivers' attitude improved to a very positive level among 60.4% of the study sample with a mean score of 55.07 ± 3.33. Additionally, the paired t-test reported highly significant differences with a huge effect size between the means of the total caregivers' attitude score toward the Feingold diet before and after the educational program ($t = 18.39$, $P \leq 0.001$, $d = 3.71$).

Table 7 presents the strength and direction of the relationship between the total caregivers' knowledge and attitude scores regarding the Feingold diet before and after the implementation of the educational program. The table shows that there was an insignificant relationship between the total caregivers' knowledge and attitude scores regarding the Feingold diet before the program implementation. However, a significant positive moderate relationship was detected between them ($P<0.001$) after implementing the program.

Table (2): Caregivers' Socio-demographic characteristics (n=53)

Items	No.	%
Filled by:		
The mother	37	69.8
Sister	16	30.2
Age (In years)		
<25	3	5.7
25- <35	26	49.1
35-<45	17	32.1
≥45	7	13.2
Mean (SD)	**35.24(6.13)**	
Educational level		
Secondary	35	66.0
University	18	34.0
Occupation		
Governmental employee	11	20.8
Not working/housewife	31	58.5
Free work	11	20.8
Marital status		
Single	16	30.2
Married	37	69.8
Residence		
Urban	28	52.8
Rural	25	47.2
Family income		
Not Enough	42	79.2
Enough	11	20.8
Previous information about ADHD diet		
No	42	79.2
Yes	11	20.8

Table (3): Distribution of the studied caregivers correct knowledge regarding the Feingold diet before and after the program implementation. (n=53)

Items	Pre-Test N=53		Post-test N=53		Significance test
	No.	%	No.	%	
The primary goal of the Feingold diet is to improve behavior and learning in children with ADHD and autism	14	26.4	49	92.5	$X^2_{MC} = 47.93$ *P ≤ 0.001
The Feingold diet primarily eliminates artificial additives and preservatives	17	32.1	48	90.6	$X^2_{MC} = 38.22$ *P ≤ 0.001
One of the symptoms that the Feingold diet can help alleviate is hyperactivity	19	35.8	51	96.2	$X^2_{MC} = 43.07$ *P ≤ 0.001
The initial elimination phase of the Feingold diet is typically recommended to last for three week	16	30.2	49	92.5	$X^2_{MC} = 43.31$ *P ≤ 0.001
A food that is prohibited on the Feingold diet is processed snacks that contain artificial colors	17	32.1	51	96.2	$X^2_{MC} = 47.42$ *P ≤ 0.001
The Feingold diet discourages the use of artificial colors	16	30.2	50	94.3	$X^2_{MC} = 46.41$ *P ≤ 0.001
The Feingold diet encourages the consumption of organic whole foods	21	39.6	52	98.1	$X^2_{MC} = 42.28$ *P ≤ 0.001
A key feature of the Feingold diet is its focus on natural ingredients	21	39.6	50	94.3	$X^2_{MC} = 35.87$ *P ≤ 0.001
After completing the elimination phase of the Feingold diet, certain foods should be gradually reintroduced	16	30.2	50	94.3	X^2_{MC} =46.41 *P ≤ 0.001
A drink that is permissible on the Feingold diet is home-made fruit juice	14	26.4	51	96.2	$X^2_{MC} = 54.45$ *P ≤ 0.001
The Feingold diet is based on the premise that certain food additives can cause behavioral problems	14	26.4	51	96.2	$X^2_{MC} = 54.45$ *P ≤ 0.001
The Feingold diet does not include packaged foods that contain preservatives	20	37.7	49	92.5	X^2_{MC} =34.91 *P ≤ 0.001
Before starting the Feingold diet, it is recommended to consult a health professional	17	32.1	50	94.3	$X^2_{MC} = 44.17$ *P ≤ 0.001
While following the Feingold diet, it is important to monitor the child's behavior	14	26.4	49	92.5	X^2_{MC} =47.93 *P ≤ 0.001
One potential outcome of successful adherence to the Feingold diet is better academic performance	9	17.0	51	96.2	X^2_{MC} =67.74 *P ≤ 0.001
During the reintroduction phase, any behavioral changes linked to specific foods should be carefully noted	13	24.5	50	94.3	$X^2_{MC} = 53.56$ *P ≤ 0.001
The Feingold diet encourages cooking methods such as baking and steaming	17	32.1	50	94.3	$X^2_{MC} = 44.17$ *P ≤ 0.001

Table (4): Caregivers' total score level of knowledge regarding the Feingold diet before and after program implementation. (n=53)

Items	Pre-Test N=53		Post-test N=53		Significance tests
	No.	%	No.	%	
Total knowledge score=(17)					
Unsatisfactory	32	60.4	3	5.6	χ^2=35.87, * p ≤ 0.001
Satisfactory	21	39.6	50	94.4	
Mean (SD)	5.18(2.65)		15.77(3.43)		t=16.14, * p ≤ 0.001 d =3.45

χ2: Chi square test, t: Paired t-test, d: Cohen's D (effect size of t test),*P<0.05 significant

Table (5): Distribution of the studied caregivers' attitude regarding the Feingold diet before, and after the program implementation (n=53)

Items	Pre-Test				Post-test N=53			Significance test
	Disagree	Neutral	Agree	Strongly Agree	Neutral	Agree	Strongly Agree	
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
The primary goal of the Feingold Diet is to eliminate certain food additives.	14(26.4)	33(62.3)	6(11.3)	0(0.0)	4(7.5)	31(58.5)	18(34)	χ^2=71.62,* p ≤ 0.001
I believe the Feingold Diet benefits my child's health	0(0.0)	34(64.2)	8(15.1)	11(20.8)	0(0.0)	12(22.6)	41(77.4)	χ^2=52.10,* p ≤ 0.001
I feel very supportive of using the Feingold Diet for my child with ADHD	10(18.9)	28(52.8)	15(28.3)	0(0.0)	0(0.0)	36(67.9)	17(32.1)	χ^2=74.12,* p ≤ 0.001
I find it difficult to prepare meals that adhere to the Feingold Diet	38(71.7)	0(0.0)	15(28.3)	0(0.0)	5(9.4)	31(58.5)	17(32.1)	χ^2=65.56,* p ≤ 0.001
Following the Feingold Diet will improve my child's behavior	45(84.9)	8(15.1)	0(0.0)	0(0.0)	0(0.0)	36(67.9)	17(32.1)	χ^2=106.00,* p ≤ 0.001
I believe that the Feingold Diet requires a lot of planning	35(66)	18(34)	0(0.0)	0(0.0)	0(0.0)	35(66)	18(34)	χ^2=106.00,* p ≤ 0.001
I feel comfortable reading food labels to maintain the Feingold Diet	45(84.9)	0(0.0)	8(15.1)	0(0.0)	0(0.0)	37(69.8)	16(30.2)	χ^2=84.66,* p ≤ 0.001
Identifying safe foods is a challenge when starting the Feingold Diet.	20(37.7)	25(47.2)	8(15.1)	0(0.0)	0(0.0)	37(69.8)	16(30.2)	χ^2=24.98,* p ≤ 0.001
The Feingold Diet feels too restrictive for my family.	0(0.0)	45(84.9)	8(15.1)	0(0.0)	0(0.0)	36(67.9)	17(32.1)	χ^2=79.81,* p ≤ 0.001
I believe the Feingold Diet can help improve my child's communication skills.	20(37.7)	18(34)	15(28.3)	0(0.0)	0(0.0)	36(67.9)	17(32.1)	χ^2=63.64,* p ≤ 0.001
The Feingold Diet has a positive impact on my child's overall diet.	20(37.7)	8(15.1)	25(47.2)	0(0.0)	0(0.0)	38(71.7)	15(28.3)	χ^2=42.76,* p ≤ 0.001
I think more community support is needed for families following the Feingold Diet.	10(18.9)	28(52.8)	15(28.3)	0(0.0)	0(0.0)	40(75.5)	13(24.5)	χ^2=62.36,* p ≤ 0.001
The potential health benefits are the most important factor for me when deciding to implement the Feingold Diet.	28(52.8)	25(47.2)	0(0.0)	0(0.0)	0(0.0)	39(73.6)	14(26.4)	χ^2=106.00,* p ≤ 0.001

Table (6): Caregivers' total score level of attitude about the Feingold diet before, and after the program implementation. (n=53)

Items	Pre-Test N=53		Post-test N=53		Significance tests
	No.	%	No.	%	
Total attitude score=(65)					
Very Negative Attitude	0	00	0	00	χ^2=62.09, * p ≤ 0.001
Neutral Attitude	30	56.6	0	00	
Positive Attitude	23	43.4	21	39.6	
Very Positive Attitude	0	00	32	60.4	
Mean (SD)	37.83(5.67)		55.07(3.33)		t=18.39, * p ≤ 0.001 d =3.71

χ2: Chi square test, t: Paired t-test, d: Cohen's D (effect size of t test),*P<0.05 significant.

Table (7): Correlation between the total caregivers' level of knowledge and attitude regarding the Feingold diet before, and after the program implementation. (n=53)

Item	*Total knowledge score*			
	Pre-Test N=68		Post-test N=68	
	r	*P*	*r*	*P*
Total attitude score	**0.216**	0.121	**0.512**	≤ 0.001**

***Correlation is significant at the 0.05 level.**
****Correlation is significant at the 0.01 level***

Discussion

Attention Deficit Hyperactivity Disorder (ADHD) is a common childhood condition that affects children's development. It is characterized by inattention, hyperactivity, and impulsiveness. As concerns about medication side effects grow, more people are looking into other management methods **(Posner, Polanczyk, & Sonuga-Barke, 2020)**. One option is a dietary regimen that removes artificial additives and certain types of foods believed to worsen hyperactive behavior **(Office of Environmental Health Hazard Assessment (OEHHA), 2020)**. One of these diets is the Feingold diet. The effectiveness of this diet relies heavily on caregivers' knowledge and attitudes, as they must implement it consistently **(Yaseen et al., 2020)**.

Despite the growing global interest in non-drug management for ADHD, there is still a significant gap in research on dietary management **(Breda et al., 2022)**, especially tailored diets for ADHD **(Nimmo-Smith et al., 2020)**. Additionally, there are scarce interventional studies about the effect of structured educational modalities on caregivers' understanding and acceptance of ADHD tailored diets **(Pinto et al., 2022)**. Therefore, this study seeks to address this gap by evaluating the effect of a health education package regarding the Feingold diet on knowledge and attitude among caregivers of children with attention-deficit hyperactivity disorder (ADHD).

This study's aim aligns with the Egyptian study by **Abdallah, Soliman, and Abd El-kader (2019)** that was implemented in Dakahlia governorate, Egypt, and investigated the combined effect of language training and the Feingold diet intervention. The study reported significant improvements in caregivers' knowledge and practice regarding receptive language and the Feingold diet.

The study findings showed that most caregivers of children with ADHD were mothers. This result is consistent with earlier studies **(Faheim et al., 2022)**, which found that mothers are typically the primary caregivers and are most involved in raising children, especially those with special health needs. Nearly half of the participants were aged between 25 and 35 years old, with a mean age of 35.24 ± 6.13 years. This suggests that most caregivers were in their early to mid-adulthood, a period typically associated with active parenting and the ability to participate in health

education activities. This result is in line with a recent study by **Si, Ma, and Zhang (2020)** in China, which examined factors affecting parenting stress among Chinese families with children diagnosed with ADHD and reported that parents had an average age of 36.56 ± 5.2 years.

The findings of the current study showed significant enhancements in caregivers' knowledge about the Feingold diet after implementing the educational package. Before the implementation, caregivers had a limited understanding of the diet's goals, objectives, duration, recommended foods, prohibited foods, and its overall effect on children with ADHD. This conclusion is due to the limited availability of a tailored educational program about suitable diet regimens for ADHD children.

This result agrees with earlier research that pointed out caregivers often lack knowledge about the dietary management of ADHD **(Bosch et al., 2020)** as the most available educational resources mainly focus on medication and behavior treatments **(Mechler, Banaschewski, Hohmann, & Häge, 2022; Nimmo-Smith et al., 2020)**

In summary, the educational intervention significantly improved caregivers' understanding of the Feingold diet. This included knowledge about appropriate and restricted foods as well as the overall therapeutic effects of the diet. The large effect size highlights the program's strong impact on knowledge gain. These results support existing evidence that structured, tailored education effectively fills caregivers' knowledge gaps. It also strengthens evidence-based caregiving practices and helps manage children with ADHD by improving understanding of the relationship between diet and behavior **(Faheim, Abdalla, & Akl, 2022; Pinto et al., 2022).**

The attitude results indicated a marked enhancement in the caregivers' attitudes toward the Feingold diet following the educational package. At baseline, a large percentage of caregivers held a "Neutral" attitude, which improved to a "Very Positive" level after implementing the intervention. Additionally, the results reported a substantial effect size of the targeted educational package on the caregiver's attitude toward the Feingold diet.

The shift from a neutral attitude to a very positive attitude suggests that initially, caregivers may have been unsure or ambivalent about the Feingold diet, but once educated, they perceived the relevance of the diet, and they felt more confident in the effect of the diet on the children's ADHD symptoms. In contrast to the current study by **Pelsser et al. (2011)**, who studied the relationship between restricted diet and the behaviors of ADHD children and found that a restricted elimination diet did not definitively prove a consistent parental attitude.

After implementing the program, a significant positive correlation was detected between caregivers' knowledge and attitude scores. This indicates that as caregivers learned more about the Feingold diet, their attitudes improved. The strength and direction of this relationship suggest that greater knowledge leads to a change in attitude. This is consistent with accepted behavioral change theories such as the Knowledge-Attitude-Practice (KAP) model and the Health Belief Model (HBM). These models argue that better knowledge increases perceived benefits and self-confidence, leading to more positive attitudes toward the desired health behavior **(Glanz, Rimer, & Viswanath, 2015)**.

In conclusion, the educational intervention successfully improved caregivers' knowledge and attitudes about the Feingold diet. This suggests that organized, research-based health education can help raise awareness of safe, complementary ADHD treatments. Ongoing follow-up is recommended to determine if the increased knowledge leads to long-term adherence and better outcomes for children.

Conclusion

The present study concluded that the research hypotheses are supported and that a health education package about the Feingold diet has been highly effective in enhancing caregivers' knowledge and attitudes toward the recommended dietary management for children with ADHD. Furthermore, although caregivers' knowledge and attitudes toward the Feingold diet were initially unrelated, the educational program fostered a significant positive

correlation between them, suggesting improved coherence between what caregivers know and how they feel about the diet.

Recommendation

1. A regular Feingold dietary educational program should be conducted for caregivers of children with ADHD to enhance their knowledge and attitudes for a long period of follow-up.
2. Future studies should examine the long-term effects of dietary education programs on caregivers' practices and children's behavioral outcomes.
3. Develop easy-to-use educational materials (brochures, videos, or mobile apps) to maintain parents' involvement and compliance with the Feingold diet`s instructions.

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Conflict of interest

The authors state that there are no conflicts of interest.

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