



Effect of an Educational Program on the Level of Knowledge of Primary School teachers about ADHD

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ABSTRACT

Background: Attention deficit hyperactivity disorder (ADHD) can severely harm academic achievement. Teachers are expected to be the first to observe behavioral abnormalities indicative of ADHD. **Objective:** to evaluate the efficacy of an educational program in improving the knowledge about ADHD among primary schoolteachers. **Method:** An interventional pre-post study was conducted in one primary school (Zagazig, Egypt) from August 2023 to March 2024. After a pre-test, schoolteachers were given two-day educational intervention about ADHD in the form of lectures and discussion. A post-test was conducted three months after the intervention to assess teachers' retained knowledge regarding ADH. The Arabic version of the Knowledge of Attention Deficit Disorder Scale (KADDS) was used to assess teachers' knowledge about ADHD. **Results** Thirty-six schoolteachers were included in the current study. Most of schoolteachers were 40 years or older (58.3%) and the majority (94.4%) were females. Most schoolteachers were college graduates (94.4%) and have work experience of 10 years or longer (83.3%). KADDS scores significantly increased from an average of 14.25 ± 3.77 in pre-intervention phase to an average of 24.80 ± 4.38 in the post-intervention phase ($p < 0.001$), with 74.0% post-intervention improvement. The significant improvement was evident in the three ADHD knowledge aspects; general information, symptoms and diagnosis, and treatment, with post-intervention improvements of 73.6%, 57.5% and 95.0%, respectively. **Conclusion:** Educational interventions have proven beneficial in improving the knowledge of primary schoolteachers about ADHD. If teachers are equipped with sufficient knowledge about the disorder, they can play significant roles in detecting, referring, and managing the disorder.

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INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) can severely harm academic achievement.¹ Teachers are expected to be the first to recognise and diagnose ADHD since they spend much time with students and know how they act in the classroom.² Teachers' role is essential in the early detection of ADHD due to their tendency to identify behavioural problems before others.³ Furthermore, the most well-researched and widely used non-pharmacological treatment for ADHD in preschoolers and primary school students is Behavioral Parent-and-Teacher training (BPT).⁴ To restore stability to school

performance, non-pharmacological educational interventions are necessary for students with ADHD. Teachers must thus be aware of ADHD to recognise symptoms and act upon them as soon as they arise, apart from their role in behavioral therapy, which is regarded as one of the main recommendations for treating ADHD besides medication therapy.⁵ Despite all the evidence above emphasising teachers' role in detecting and treating ADHD, unfortunately, evidence on teachers' knowledge about ADHD shows a lack of knowledge about the disorder. A systematic review of studies measuring teachers'

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understanding of ADHD revealed that knowledge scores ranged widely for symptoms, behaviors, prognosis, and therapy. They also highlighted the importance of teachers educating students about ADHD as a critical component in increasing knowledge levels.⁶

According to a recent meta-analysis, teacher training interventions for ADHD improve teachers' knowledge of ADHD and their capacity to engage effectively with children who display behaviors like those of ADHD. The study indicates that these interventions significantly impact teachers' understanding of ADHD.⁷ The objective of the current study was to evaluate the efficacy of an educational program in improving the knowledge about ADHD among primary schoolteachers.

METHODS

An interventional pre-post study was conducted on 36 primary school teachers in Al-Shahid Ibrahim El-Haddad primary school in Shiba (one of the rural Zagazig West educational districts) from August 2023 to March 2024. After a pre-test, schoolteachers were given two-day educational intervention about ADHD in the form of lectures and discussion. A post-test was conducted three months after the intervention to assess teachers' retained knowledge regarding ADH.

The sample size was estimated according to a previous study (Awadalla et al., 2016), the teachers' pre-intervention inadequate knowledge is 17.9%, and the post-intervention knowledge is 69.2%. With a confidence level of 95% and 80% study power, the sample size was 36, using the OpenEpi program.⁸

A representative sample of eight primary schools was drawn from the Zagazig region. The multistage random sampling technique was used in this stage. Zagazig region was divided into two educational districts: Zagazig East and West. Two rural and two urban schools were selected. Then from them Al-Shahid Ibrahim El-Haddad Primary School was selected by simple random sampling technique.

Data collection: Two questionnaires were used in the current study. (1) Socio-demographic characteristics questionnaire, which involved eight questions regarding Age, gender, residence, marital status, educational level, length of work experience, previous attendance of conventions or workshops about ADHD, and previous experience teaching ADHD children. (2) The Arabic version of the Knowledge of Attention Deficit Disorder Scale (KADDS),⁹ a tool developed to assess teachers'

Table 1: Socio-demographic characteristics of the studied teachers (N=36)

	N	%
Age (years)		
<40	15	41.7
≥40	21	58.3
Sex		
Male	2	5.6
Female	34	94.4
Residence		
Rural	20	55.6
Urban	16	44.4
Education level		
Graduate degree	34	94.4
Post-graduate degree	2	5.6
Marital status		
Married	30	83.3
Others (Single -Divorced- widow)	6	16.7
Years of experience		
<10	6	16.7
≥10	30	83.3
Previous dealing with ADHD children		
	33	91.7

knowledge about ADHD. KADDS is a 36-item questionnaire divided into three parts: The first part includes 15 questions concerning general information about ADHD, the second part involves nine questions about symptoms and diagnosis of the disorder, and the third part comprises 12 questions about the treatment of the disorder. KADDS demonstrates good reliability; KADDS Cronbach's alpha value was 0.76, and in our study, it was 0.71; an adequate validity (content validity by experts in ADHD and educational psychology reviewed the items to ensure they comprehensively covered the domain of knowledge about ADHD. Construct validity was tested through factor analysis, which helps determine whether the questionnaire items cluster together in a way that aligns with theoretical constructs of knowledge about ADHD).¹⁰

Intervention: The educational program was conducted over two consecutive days. During this, lectures were given to the participating teachers using teaching aids, such as PowerPoint presentations and educational videos. Brochures were given to the participants to facilitate the educational process, and some of the brochures were left at the school library -upon teachers' request- as a source of information about ADHD. The educational program provided information about the prevalence, causes, types, and symptoms of ADHD that affect academic performance. All those procedures enforced teacher's knowledge.

Table 2: Correct answers of schoolteachers about general knowledge (Prevalence, Nature) of ADHD before and after the intervention (N=36)

Variable		Pre-intervention N (%)	post-intervention N (%)	P-value
Prevalence	ADHD occurs in 15% of school-age children.	4 (11.1)	17 (47.2)	0.004*
	The prevalence of ADHD in males and females is equivalent.	16 (44.4)	25 (69.4)	0.021*
Nature	ADHD children are more compliant with fathers than with mothers.	22 (61.1)	29 (80.6)	0.096
	ADHD is more common in the 1 st degree biological relatives.	15 (41.7)	36 (100)	<0.001*
	In children less than 4, the problem behaviours of ADHD children are different from non-ADHD children.	2 (5.6)	8 (22.2)	0.070
	ADHD is more distinguishable in a classroom.	28 (77.8)	33 (91.7)	0.227
	ADHD children evidence poor school performance.	23 (63.9)	29 (80.6)	0.359
	Non-ADHD children from chaotic homes often show ADHD.	21 (58.3)	31 (86.1)	0.022*

* Statistically significant ($p < 0.05$), using McNemar test.

Table 3: Correct answers of schoolteachers about general knowledge (Onset, Progress) of ADHD before and after the intervention (N=36)

Variable		Pre-intervention N (%)	post-intervention N (%)	P-value
Onset	An adult can be diagnosed with ADHD.	13 (36.1)	21 (58.3)	0.096
Nature	Symptoms of depression are more frequent in ADHD children.	12 (33.3)	30 (83.3)	<0.001*
	Most ADHD children “outgrow” their symptoms by puberty.	10 (27.8)	17 (47.2)	0.143
	If an ADHD child demonstrates sustained attention to fun activities, that child can also sustain attention for studying.	11 (30.6)	14 (38.9)	0.388
	Diagnosis of ADHD makes a child eligible for special education.	9 (25)	26 (72.2)	<0.001*
	ADHD children experience more problems in novel situations.	3 (8.3)	8 (22.2)	0.125
	Physical features can be identified when diagnosing ADHD.	8 (22.2)	18 (50)	0.031*

* Statistically significant ($p < 0.05$), using McNemar test.

The program also involved improving the capacity of schoolteachers in early detection and classroom management of ADHD; information about a diagnosis, diagnostic criteria, and, most importantly, teachers’ role in diagnosis was provided, in addition to information about treatment modalities, especially behavioral, educational intervention and teachers’ role in treatment.

Statistical analysis: It included coding, entry, sorting, and data analysis. The collected data were summarized and presented using suitable tables. Categorical variables are presented as numbers and percentages. Statistical significance was evaluated using the paired t-test to measure the association

between paired continuous variables, and the McNemar test was used to assess statistical significance for paired proportions of dichotomous variables. The percentage of improvement was calculated as (post-intervention mean score - pre-intervention mean score)/pre-intervention mean score*100. A p-value of $\leq .05$ was considered statistically significant. Statistical analyses were conducted using SPSS version 22.

RESULTS

Thirty-six teachers participated in an educational intervention program. Most of the participants (58.3%) are 40 years or older. 34 (94.4%) of the participants are females. Rural residents

Table 4: Correct answers of schoolteachers about symptoms and diagnosis of ADHD before and after the intervention (N=36)

	Variable	Pre-intervention	Post-intervention	P-value
Symptoms	ADHD children are distracted by extraneous stimuli.	26 (72.2)	36 (100)	<0.001*
	ADHD children are physically cruel to other people.	10 (27.8)	26 (72.2)	<0.001*
	ADHD children often squirm in their seats.	29 (80.6)	36 (100)	<0.001*
	ADHD children commonly have inflated self-esteem.	11 (30.6)	22 (61.1)	0.031*
	ADHD has two clusters of symptoms: inattention and hyperactivity/impulsivity.	21 (58.3)	36 (100)	<0.001*
	ADHD children have difficulties organising tasks.	25 (69.4)	36 (100)	<0.001*
	ADHD children have a history of stealing or destroying things.	13 (36.1)	21 (58.3)	0.210
Diagnosis	To be diagnosed with ADHD, symptoms must present at age <7.	11 (30.6)	27 (75)	<0.001*
	To be diagnosed with ADHD, symptoms must be exhibited in two or more settings.	28 (77.8)	34 (94.4)	0.109

* Statistically significant ($p < 0.05$), using McNemar test.

Table 5: Correct answers of schoolteachers about pharmacological treatment of ADHD before and after the intervention (N=36)

	Variable	Pre-intervention N (%)	Post-intervention N (%)	P-value
	Antidepressant drugs are effective in reducing symptoms.	7 (19.4)	27 (75)	<0.001*
	When treatment is terminated, symptoms rarely return.	9 (25)	13 (36.1)	0.344
	Side effects of stimulants are insomnia and appetite reduction.	11 (30.6)	31 (86.1)	<0.001*
	In severe cases, medication is used before behaviour modification.	13 (36.1)	30 (83.3)	<0.001*
	Stimulant drugs are the most common drugs used in ADHD.	5 (13.9)	21 (58.3)	<0.001*

* Statistically significant ($p < 0.05$), using McNemar test.

represented 55.6% of the participants. Most of the participants were married, 83.3%. Graduated participants represented 94.4%. Most of the participants, 83.3%, have work experience of 10 years or longer. Most of the studied teachers (91.7%) have previous experience teaching ADHD children, as shown in Table 1.

Regarding knowledge about prevalence, the role of heredity, the role of gender and the role of the home environment per cent of correct answers in post-intervention increased to 47.2%, 69.4%, 100% and 86.1%, respectively, with a significant increase in the studied participants' knowledge (P-values < 0.05), as shown in Table 2.

Regarding depression symptoms in ADHD children, eligibility for placement in special education, and the presence of diagnostic physical features in ADHD children, participants' correct answers were increased to 83.3%, 72.2% and 50% post-intervention, respectively, with a statistically significant increase in correct answers to questions about (P-values < .05) as shown in Table 3.

Regarding participants' knowledge about symptoms and diagnosis of ADHD after the intervention, there was a statistically significant improvement post-intervention (P-values < .05). Except for two questions (a question about stealing history in ADHD children and another question about the necessity of symptoms occurrence in 2 settings for diagnosis (P-value > .05) as shown in Table 4

Regarding participants' knowledge about pharmacological treatment of ADHD, there was a statistically significant improvement post-intervention except for one question (about symptoms recurrence after the termination of medications (P-value > .05) as shown in Table 5.

Regarding the non-pharmacological treatment of ADHD, there was a statistically significant increase in correct answers to all questions [post-intervention, except for two questions (about behavioral and electroconvulsive therapy), as shown in Table 6.

Table 6: Correct answers of schoolteachers about non-pharmacological treatment of ADHD before and after the intervention (N=36)

Variable	Pre-intervention N (%)	Post-intervention N (%)	P-value
ADHD is largely the result of ineffective parenting skills.	12 (33.3)	20 (55.6)	0.035*
Parent/teacher training is effective when combined with medication	28 (77.8)	36 (100)	<0.001*
Individual psychotherapy is sufficient for the treatment of ADHD.	13 (36.1)	24 (66.7)	0.004*
Reducing sugar/ additives is effective in reducing symptoms.	5 (13.9)	15 (41.7)	0.049*
Behavioural/Psychological interventions focus on inattention.	5 (13.9)	9 (25)	0.508
Electroconvulsive Therapy is effective in severe cases.	12 (33.3)	17 (47.2)	0.227
Treatment that focuses on punishment is the most effective.	22 (61.1)	34 (94.4)	0.002*

* Statistically significant ($p < 0.05$), using McNemar test.

Table 7: Pre- versus post-intervention KADDS scores values among studied participants

Knowledge aspects	Maximum items score	Pre-Intervention score	Post-intervention score	Percentage of improvement	P-value
Total score	36	14.25 ± 3.77	24.80 ± 4.38	74.07%	<0.001*
General information	15	5.47±1.52	9.5±2.53	73.60%	<0.001*
Symptoms and diagnosis	9	4.83 ±1.87	7.61±1.20	57.47%	<0.001*
Treatment	12	3.94 ±1.91	7.69±1.72	95.07%	<0.001*

KADDS, The Arabic version of the Knowledge of Attention Deficit Disorder Scale. Values were expressed as mean and standard deviation.* Statistically significant ($p < 0.05$), using paired t-test.

KADDS scores significantly increased from an average of 14.25±3.77 in pre-intervention phase to an average of 24.80±4.38 in the post-intervention phase ($p < 0.001$), with 74.0% post-intervention improvement. The significant improvement was evident in the three ADHD knowledge aspects; general information, symptoms and diagnosis, and treatment, with post-intervention improvements of 73.6%, 57.5% and 95.0%, respectively, as shown in Table 7.

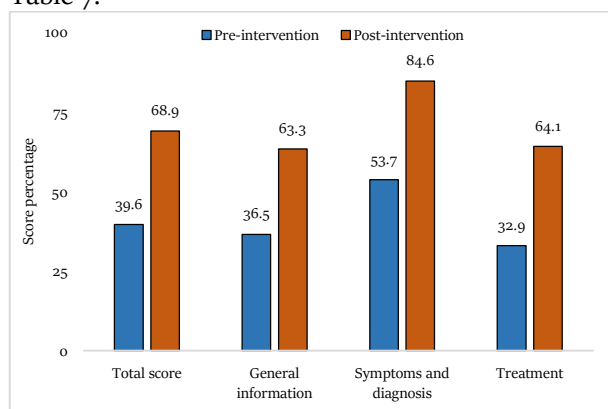


Figure 1: Pre- versus post-intervention KADDS scores percentages among studied participants

Figure 1 shows the percentage of participants' correct answers on the KADDS and the three KADDS subscales before and after the intervention. There was an increase in participants' knowledge of all aspects of ADHD. Overall, the correct answers increased from 39.6% before the intervention to 68.9% after. Teachers' knowledge of general information about ADHD also shows an increase from 36.5% before the intervention to 63.3% after the intervention. Similarly, symptoms and diagnosis of the disorder increased from 53.7% before the intervention to 84.6% after the intervention. Likewise, knowledge about the treatment of ADHD shows a rise from 32.9% before the intervention to 64.1% after the intervention.

DISCUSSION

ADHD has a significant negative impact on academic achievement. In addition, children with ADHD who perform academically below grade level may experience lifelong consequences such as poor career advancement, poor social and relationship skills, poor mental health, and criminal behavior.¹¹ Thus, ADHD is challenging for both the teachers and the children themselves. A teacher is a significant

person in recognizing ADHD problems and requesting referrals to clinical assessment at schools; primary school teachers play an essential role in assessing children's behaviors and can be the first ones to identify children with ADHD.¹²

Results of the current study revealed that teachers' knowledge about various aspects of ADHD was improved after the implementation of an educational intervention program, as reflected in a highly statistically significant increase (P value <0.001) in post-intervention total KADDS scores, as well as the three ADHD knowledge aspects: general information, symptoms & diagnosis, and treatment in comparison to pre-intervention scores. Post-interventional mean KADDS score showed a statistically significant increase, rising from 14.25 ± 3.8 to 24.8 ± 4.4 , with 74% improvement retained three months following the intervention.

The findings of the present study are consistent with the results reported by a survey conducted on primary school teachers in Australia¹³ in which the mean KADDS score was increased from pre-interventional 17.4 ± 7 to post-interventional 29.8 ± 4.2 with 71.2% improvement retained one month after the intervention, although their post-interventional mean KADDS was higher, in fact; the results of the current study could be considered better than the mentioned study; owing to the nearly equal improvement and most importantly retained knowledge even after longer time of post-intervention assessment. However, this result is higher than that of a similar study carried out in the United States,¹⁴ where the overall KADDS mean score increased from 20.2 ± 10 to 27.5 ± 7.2 , indicating only a 36.5% improvement, which can be attributed to the short training that was used in the study of interest, which consisted of a 45-minute online training session. The current study's results are also greater than those of Brazilian research on primary school teachers¹⁵, where the mean score improved by just 16% from 14.94 ± 2.5 before the intervention to 17.36 ± 1.9 after it. The educational intervention's brief length could explain the Brazilian study's poorer findings, which were restricted to a single, three-and-a-half-hour session.

As the present research revealed, there was a considerable rise in the study participants' knowledge about various aspects of ADHD. The percentage of participants who knew that inheritance contributes to the aetiology of ADHD increased from 41.7% before the intervention to 100% following it, indicating an improvement in

their general knowledge of the illness. This is greater than Aguiar and his colleagues,¹⁵ who stated that 93% of participants knew about the role of heredity after the intervention, compared to 54% before. Also, the percentage of participants who understood that ADHD students are easily distracted by extraneous stimuli increased from 72.2% before the intervention to 100% after the intervention, indicating an improvement in the study participants' knowledge regarding symptoms of ADHD. This better result also outperforms Aguiar and his colleagues,¹⁵ who found that post-interventional knowledge of this symptom was 97.3% and pre-interventional knowledge was 78.4%. As previously indicated, the shortened intervention time may cause inferior outcomes in the referred study. Conversely, the percentage of teachers who recognized that cutting back on sugar and additives doesn't lessen symptoms went from 13.9% before the intervention to 41.7% after it, indicating that the intervention also increased the teachers' knowledge about treating ADHD. This outcome, however, is less than that of¹⁵ who found that post-interventional knowledge was 95% and pre-interventional knowledge was 59%. This may be because a greater proportion of female teachers participated in this study and have ingrained notions that sugar causes hyperactivity.

The overall percentage of correct responses on the KADDS increased from 39.6% to 68.90%, but the correct responses for each question ranged from 22.2% to 100%. This is lower than the results of a previous national study conducted in Mansoura, where the percentage of correct responses ranged from 69.2% to 94.9%.¹⁶ Additionally, the percentage of correct responses for each subscale was lower than in the mentioned study, possibly because the post-test was administered immediately after the intervention. In contrast, the current study's findings were determined three months later. These findings were consistent with a Saudi Arabian study that found that participants in the educational intervention group had significantly increased their knowledge about ADHD immediately after the intervention. Then, these knowledge benefits tapered off over three months, but they were still greater than those in the control group.¹⁷

As demonstrated, teachers' knowledge about ADHD remained much greater than their baseline levels three months after the intervention. Teachers may see children with ADHD less negatively now that they are more knowledgeable about the disease.

Lack of knowledge may cause teachers to neglect to implement good teaching techniques, which could have worsening effects. Teachers who were not trained to help a student with ADHD may also be under more stress and may penalize their students more frequently, which can be detrimental to their self-esteem.

In contrast to other studies where training was restricted to a single lecture,¹⁸ educational interventions in the current research were offered in two lectures spread over two consecutive days. This two-day training was more effective in enhancing teachers' knowledge. By spreading the intervention over two days, the teachers could absorb and process the knowledge from the first day and still have time to prepare questions for the second day's discussion. The study's knowledge development results were also better than those of previous research in which three instructors conducted the intervention¹⁵ or over several days.¹⁹ Our intervention used resources already accessible in the school, took less time, and only needed one tutor.

Although the study's findings show a considerable gain in participants' knowledge regarding ADHD, the current study was limited. For example, the intervention did not include interactive activities like role-playing, which could have led to even better results. Another limitation is that we should have evaluated the intervention's perceived acceptability, practicality, or long-term impacts. Moreover, the small sample size and a short follow-up period were other limitations. There were no control group as the focus on to evaluate the effectiveness of the educational program. It is recommended that future studies to consider these issues, especially how knowledge may influence teachers' attitudes toward afflicted students.

CONCLUSIONS

Educational interventions have proven beneficial in improving primary school teachers' knowledge about ADHD. If teachers are equipped with sufficient knowledge about the disorder, they can play significant roles in detecting, referring, and managing the disorder.

Ethical Consideration

Approvals from Education Directorate at El-Sharkia Governorate and Zagazig West educational district, an approval from Institutional Review Board (IRB) for medical research ethics, Zagazig University, Faculty of Medicine (ZU-IRB) were obtained

(Approval No. ZU-IRB 10049), the purpose and nature of the study were explained to the school's principal and school teachers to ensure their cooperation and informed consent was obtained from school teachers before any participant was enrolled in the study.

Availability of data and materials: All data generated or analyzed during this study are included in this published article. The materials and any of the plants used in the current study are available from the corresponding author upon reasonable request.

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