(RESEARCH ARTICLE)

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The Impact of educational intervention on knowledge about diabetes mellitus among Indonesian high school students

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Abstract

Background: Diabetes mellitus (DM) is a state of hyperglycemia caused by a variety of factors. Increasing population understanding and awareness of DM will improve community health outcomes. Direct public education and mass media campaigns can significantly raise public awareness of DM and its complications. Until recently, knowledge about DM is still not fully understood, especially in student population. We aimed to measure the extent of knowledge level about DM with pre-test and post-test in Indonesian students.

Methods: This interventional non-randomized longitudinal study was held in Alif Laam Miim Islamic Boarding School Surabaya. An intervention was provided by giving education about diabetes mellitus through offline seminars, handbook, and interactive discussion with the experts. Pre- and post-test questionnaires with a close-ended question were given before and after intervention. Statistical analysis was performed using SPSS using the wilcoxon test.

Result: This study consisted of 95 students with the mean age of 14.94 ± 1.44 years. Around 16.84% of the participants had a family history of DM. After knowledge intervention, there was a significant difference between pre- and post-test score (p = 0.00), with the mean score being 36.90 ± 1.64 and 65.21 ± 1.26 respectively. There were positive changes in almost all answers regarding diabetes general knowledge, diabetes signs and symptoms, and diabetes management in the school (p < 0.05).

Conclusion: There was an improvement about diabetes mellitus knowledge in Indonesia's high school students after giving an educational intervention.

Keywords: Diabetes Mellitus; Educational Intervention; Knowledge; Children; Adolescents

1. Introduction

Diabetes mellitus (DM) is a state of hyperglycemia caused by a variety of factors and defined by persistently elevated blood glucose levels. T1DM is a condition of insulin insufficiency coupled with autoimmune death of functioning beta cells, a process initiated in genetically vulnerable hosts by environmental stressors. Obesity with insulin resistance has uncovered genetic abnormalities in the control of insulin synthesis and secretion; the prevalence of T2DM is increasing in minority communities and correlates with obesity. Lifestyle change and weight loss remain the cornerstones of

prevention and treatment for these individuals [1]. Increasing population understanding and awareness of diabetes mellitus will improve community health outcomes. Patients must have a deeper awareness of DM to manage their lifestyles and drug use to receive the most significant benefits and postpone the start of long-term complications. Providing psychological and dietary support and assisting the family of diabetic patients in adjusting to the essential lifestyle adjustments requires education. Diabetes mellitus risk factors classify as either changeable or immutable. Modifiable risk factors include high-fat diets, inactivity, a high body mass index (BMI), blood pressure that is over 140/90, metabolic syndrome, and elevated plasma triglyceride levels. Age (over 40 years) and a family history of type 2 diabetes are non-modifiable risk factors [2]. Our data indicate that diabetic patients in The Gambia are generally unaware of this fact. This conclusion is consistent with Muninarayana et al., who observed that fifty percent of diabetic patients in Tamaka Kolar (India) were unaware of their condition [3]. Kenya reported the same findings [4].

Diabetes mellitus is a chronic metabolic disease that is difficult to treat because of its diverse etiology, societal risk factors, and genetic, behavioral, and environmental predispositions. Although it is linked to serious problems, early detection and treatment can stop or slow the emergence of those complications. The significant rise in the prevalence of childhood and teenage obesity worldwide indicates the increased risk for comorbidities. The frequency of T2DM diagnoses in children has considerably grown, even though that T2DM is frequently diagnosed in adults [5]. Children who are obese are much more likely to experience negative health consequences, such as physical and mental problems. Internalizing and externalizing disorders, ADHD, body image problems, a lower quality of life, low self-esteem, social exclusion, and prejudice are some of the psychosocial consequences of obesity [6].

However, a terrible lifestyle is cause for alarm. Direct public education and mass media campaigns can significantly raise public awareness of diabetes mellitus (DM) and its complications, according to the results of a Chennai-based study involving multiple prevention, awareness, counseling, and evaluation strategies. We would also suggest improving public motivation by emphasizing the importance of prompt screening and follow-up to prevent problems [7]. Until recently, knowledge about diabetes mellitus, from risk factors to handling it correctly, is still not fully understood, especially in the student population. Therefore, we aimed to measure the extent of knowledge level with pre-test and post-test in Indonesian students.

2. Material and methods

This interventional non-randomized study (pre- and post-intervention) was held in Alif Laam Miim Islamic Boarding School Surabaya, to evaluate the effectiveness of health education in improving students' knowledge about diabetes mellitus. An intervention was provided by giving education about diabetes mellitus through offline seminars and discussion with the experts to promote diabetes education. A handbook with a topic focused on general information about diabetes mellitus was also given to participants. Pre- and post-test questionnaires with the same questions were given before and after intervention. Questionnaire used was divided into four sections; Section A collects demographic data of the participants including age, gender, ethnic, and history of family with DM, Section B contained 6 questions regarding diabetes general knowledge, Section C had 6 questions of diabetes signs and symptoms, and Section D contained 7 questions of diabetes mellitus management. The question used in the questionnaire was modified from previous literature [8]. The questionnaire used a closed-ended question with a single word answer as "yes", "no" and "don't know". A "don't know" answer was further considered wrong. Each answer was scored as correct or wrong, allocating 1 point for every correct answer and 0 point for every wrong answer. Ethical clearance was obtained from the Faculty of Medicine Health Research and Ethics Committee with ethical clearance number 139/EC/KEPK/FKUA/2022.

This study used a consecutive sampling conducting all 8th-9th grade students in Alif Laam Miim Islamic Boarding School Surabaya. The inclusion criteria were students with ability to communicate and willingness to be a respondent. Students who refused to participate in this study were excluded. Data was entered in and statistical analysis was performed using SPSS version 17. The categorical variables were expressed as mean ± standard deviation, and frequency (percentage). Comparison of pre-and post-intervention questionnaire was analyzed with Wilcoxon test with a significance level $p < 0,05$.

3. Results and discussion

3.1. Subject's characteristic

A total of 95 subjects consisted of Indonesian students already completed this study. There was 42 males and 53 females' students, with the mean age of 14.94 ± 1.44 years. Based on school grade, 52 (54.7%) subjects were junior high school

students and 43 (45.3%) were in high school students. About 16.84% of the participants had a family history of DM. The demographic characteristic of the subjects was shown in table 1.

Table 1 Demographic Characteristics of subjects

Variables	Results (n = 95)
Age (years)	14.94 ± 1.44
Sex	
Male	42 (44.21)
Female	53 (55.79)
Maternal Ethnic	
Javanese	82 (86.32)
Madura	10 (10.53)
Other	3 (3.16)
History of family with DM	
Yes	16 (16.84)
No	79 (83.16)

DM, Diabetes Mellitus

3.2. Pre- and post- intervention knowledge assessment

Table 2 Average of pre- and post-intervention scores

	Pre-Test	Post-Test	Description	p value
Mean score	36.90 ± 1.64	65.21 ± 1.26	Improved	0.00

Table 3 Diabetes general knowledge of students

Question	Pre-intervention			Post-intervemtion			Wilcoxon test (*p value*)
	Correct	Wrong	Mean score	Correct	Wrong	Mean score	
Can children and adolescents have diabetes?	75 (78.95)	20 (21.05)	78.95 ± 4.20	95 (100.0)	0 (0.0)	100 ± 0.00	0.00
Is diabetes contagious from one person to another?	76 (80.0)	19 (20.0)	80.00 ± 4.13	80 (84.21)	15 (15.79)	84.21 ± 3.76	0.43
Is there a cure for diabetes?	11 (11.58)	84 (88.42)	11.58 ± 3.30	85 (89.47)	10 (10.53)	89.47 ± 3.17	0.00
Is there a treatment for diabetes?	81 (85.26)	14 (14.74)	85.26 ± 3.66	86 (90.53)	9 (9.47)	90.53 ± 3.02	0.23
Can the person who has diabetes eat sweets?	22 (23.16)	73 (76.84)	23.16 ± 4.35	60 (63.16)	35 (36.84)	63.16 ± 4.98	0.00
Can the blood sugar lever get to low in person with diabetes?	51 (53.68)	44 (46.32)	53.68 ± 5.14	81 (85.26)	14 (14.74)	85.26 ± 3.66	0.00

Knowledge was assessed using three sets of questionnaires related to the general knowledge, sign & symptom, and management of DM. All of the students completed the post-test questionnaire right after education intervention. The mean score was significantly difference between pre- and post-test (p = 0.00), with the mean score was 36.90 ± 1.64 and 65.21 ± 1.26 respectively. The positive change of pre- and post-test score of each section of the questionnaire was

shown in table 3, table 4, and table 5. There were positive changes in the general knowledge, with the highest mean differences in the answer regarding cure of diabetes (p = 0.00). After the intervention, almost all students (98.95%) know that pee urgency is one of the signs of diabetes. Regarding the section about diabetes management in the schools, there were positive changes and significant differences about almost all the answers except for the need of candy in case of emergency (p = 1.00).

Table 4 Diabetes sign and symptom recognition by students

Question	Pre-intervention			Post-intervemtion			Wilcoxon test (*p value)*
	Correct	Wrong	Mean score	Correct	Wrong	Mean score	
Can a student with diabetes may need to leave the classroom several times to pee?	35 (36. 84)	60 (63.16)	36.84 ± 4.98	94 (98.95)	1 (1.05)	98.95 ± 1.05	0.00
Can a student with diabetes suddenly feel headache?	1 (1.05)	94 (98.95)	1.05 ± 1.05	30 (31.58)	65 (68.42)	31.58 ± 4.79	0.00
Can a student with diabetes suddenly be very irritability?	22 (23,16)	73 (76.84)	23.16 ± 4.35	30 (31.58)	65 (68.42)	31.57 ± 4.79	0.17
Can a student with diabetes suddenly have blurry vision?	10 (10.53)	85 (89.47)	10.53 ± 3.17	9 (9.47)	86 (90.53)	9.47 ± 3.02	0.81
Can a student with diabetes pass out suddenly?	37 (38.95)	58 (61.05)	38.95 ± 5.03	62 (65.26)	33 (34.74)	65.26 ± 4.91	0.00
Can a student with diabetes be very sleepy during class?	32 (33.68)	63 (66.32)	33.68 ± 4.87	80 (84.21)	15 (15.79)	84.21 ± 3.76	0.00

Table 5 Diabetes management in the school of students

Question	Pre-intervention			Post-intervemtion			Wilcoxon test (*p value)*
	Correct	Wrong	Mean score	Correct	Wrong	Mean score	
Can a student with diabetes need to have a different snack than the other students?	18 (18.95)	77 (81,05)	18.95 ± 4.04	34 (35.79)	61 (64.21)	35.79 ± 4.94	0.01
Can a student with diabetes dance, jump, and run?	59 (62.11)	36 (37.89)	62.11 ± 5.00	87 (91.58)	8 (8.42)	91.58 ± 2.86	0.00
Can a student with diabetes have a snack with others (in the same place and at the same time?)	60 (63.16)	35 (36.84)	63.16 ± 4.98	85 (89.47)	10 (10.53)	89.47 ± 3.17	0.00
From time to time, does the student with diabetes have to prick hid finger to check his diabetes?	38 (40.00)	57 (60.00)	40.00 ± 5.05	81 (85.26)	14 (14.74)	85.26 ± 3.66	0.00
Does the student have to always have candies with him in case he feels bad?	9 (9.47)	86 (90.53)	9.47 ± 3.02	9 (9.47)	86 (90.53)	9.47 ± 3.02	1.00
Can a student with diabetes may need an insulin shot in the school?	29 (30.53)	66 (69.47)	30.53 ± 4.75	79 (83.16)	6 (16.84)	83.16 ± 3.86	0.00
Can a student with diabetes may need to eat in different times than his classmates?	14 (14.74)	81 (85.26)	14.74 ± 3.66	34 (35.79)	61 (64.21)	35.79 ± 4.94	0.00

4. Discussion

This study assessed the effectiveness of health education on the knowledge of students about diabetes mellitus. Before intervention, all students had relatively low levels of general knowledge about diabetes, as can be seen from the low mean score of the pretest result (36.90 ± 1.64). Intervention programs given in this population in the form of offline seminar, booklets, and interactive discussion effectively increased the general knowledge of students about diabetes (p = 0.00). Children with diabetes had a complex aspect of treatment because it involved many aspects, including a safe and supportive environment in the school [9]. Promoting health education known as an essential intervention in preventing non-communicable disease [10]. School-based health education is a potent way to embrace healthy behaviors for prevention against non-communicable disease, such as diabetes mellitus [11].

According to the literature available worldwide, diabetes educational intervention proves beneficial in managing diabetes with several good consequences. This study reveals that the student's knowledge of signs and symptoms was still relatively minimal during the pre-intervention. After the post-intervention in the form of offline seminars, booklets, and interactive discussions, there was an increase in the mean score (p = 0.00). Research in Bangladesh also proves that groups with higher education produce better knowledge about diabetes. In contrast, lower socioeconomic groups tend to have a poorer ability to prevent and control diabetes [12]. The Brazilian study also promoted health education in public schools and evaluated the effectiveness of diabetes interventions in the school environment. This study led to essential changes in the knowledge and perceptions of students, with significant changes related to hypoglycemia and sugar intake by people with diabetes [8].

This study reveals that most students still misinterpret the treatment and physical activity applied to diabetic patients. Numerous studies have demonstrated that children and teenagers with T1DM experience shame and embarrassment when administering insulin and checking their blood sugar levels, both inside and outside of schools. Since numerous daily doses of insulin have long been an effective T1DM treatment, it is typically necessary to apply at least one dosage at school, particularly before meals [8].. Patients with diabetes who did physical activities and exercise got better results. This knowledge aids in the effective treatment of diabetes.

The limitation of this study was the small population size and it was only conducted in one school. The impact of health education was assessed right after the intervention given, so it might not reflect a real long outcome. We also couldn't assess if this intervention would have an actual impact on changing a student's behavior. Further studies with bigger data comes from various schools needed to assess the impact of health education on the long-term effect after giving health intervention on different time series.

5. Conclusion

This study showed that knowledge about diabetes mellitus in high school students in Indonesia is still lacking. Education and interactive discussions was effective in increasing the student's general knowledge, especially about sign and symptoms and the important of treatment about diabetes mellitus.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Statement of ethical approval

This study was approved by the Faculty of Medicine Health Research and Ethics Committee with ethical clearance number 139/EC/KEPK/FKUA/2022.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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