Parental Education on Hidden Sugars: A Preventive Strategy Against Childhood Diabetes

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Abstract.

The increasing incidence of type 2 diabetes in children is a growing public health concern, often linked to excessive consumption of sugar-rich, energy-dense foods. Many of these contain hidden sugars not easily recognized by consumers. As children are especially drawn to sweet tastes, early dietary habits can significantly impact long-term health. Parental knowledge is essential in guiding healthier food choices and preventing early exposure to diabetes risk. This study aimed to enhance parental awareness of dietary sugar intake and its potential role in childhood diabetes. Methods:A quasi-experimental pre-test–post-test design was used to evaluate the effectiveness of a health education intervention. The program included a structured lecture and interactive discussion focusing on hidden sugars and diabetes risk. Knowledge was measured using a validated questionnaire administered before and after the intervention. Data were analyzed using paired t-tests and correlation analysis.Results: The mean knowledge score increased from 7.87 ± 2.03 to 9.65 ± 1.38 ($p < 0.001$; 99% CI), reflecting a 22.54% improvement. The intervention significantly enhanced parental understanding of hidden sugars.Conclusions: The educational intervention effectively increased parental knowledge regarding hidden sugars and diabetes risk in children. Similar health education programs should be implemented at the community and school levels to support broader diabetes prevention efforts in children.

Keyword: *Type 2 diabetes; consumption of sugar-rich and children.*

I. INTRODUCTION

The burden of diabetes mellitus (DM) among children and adolescents in Indonesia is rising, especially for type 1 diabetes mellitus (T1DM), though exact incidence remains under-documented. Recent registry data from the Indonesian Pediatric Society report a steady increase in diagnosed cases, with the majority concentrated in Java, while under-diagnosis persists in rural areas.Alongside T1DM, early markers of metabolic risk are becoming more visible in the younger population. A 2024 study among adolescents in a Surabaya boarding school found that 10.3% had elevated fasting blood glucose levels (≥100 mg/dL), indicating early dysglycemia [1]. In parallel, obesity—a key risk factor for type 2 diabetes—is strongly associated with sugar consumption in Indonesian youth. A recent study showed that over 75% of urban adolescents consumed sugar-sweetened beverages or sugary snacks at least three times per week, and those consuming more than ~30 g of added sugar per day were significantly more likely to be overweight or obese [2].Environmental and social determinants further amplify these risks. Adolescents from families with lower socioeconomic status or limited health literacy were more likely to consume SSBs frequently and had higher body mass index (BMI) compared with peers from more health-conscious households [2].

This pattern is reinforced by widespread marketing and easy access to sugary drinks and snacks in urban environments, shaping adolescents' dietary choices.Globally, the rise of youth diabetes has been linked to a nutrition transition, where traditional diets are replaced by energy-dense, highly processed foods. Indonesia mirrors this trend, with a sharp increase in availability of packaged sugary drinks, often marketed directly to children and adolescents [3]. The World Health Organization (WHO) has highlighted that reducing sugar intake is among the most effective interventions to prevent childhood obesity and associated metabolic disorders [4]. Without targeted efforts, Indonesia risks following the trajectory of other middle-income countries experiencing a surge in type 2 DM among adolescents.Given these findings—rising T1DM

case numbers, 10% prevalence of impaired fasting glucose in adolescents, and high levels of SSB consumption linked to obesity—early public health interventions are urgently needed.

Recommended strategies include public education for children and caregivers, adoption of healthy eating behaviors from early life, early screening for abnormal glucose levels, and policy initiatives such as clear sugar labeling, regulation of sugary product marketing, and fiscal measures like excise taxes on sweetened beverages [3], [5]. These integrated measures are expected not only to reduce excessive sugar consumption but also to alleviate the long-term burden of non-communicable diseases (NCDs) in Indonesia's next generation.This study aims to raise public awareness—particularly among children and their caregivers—about the risks posed by high sugar consumption in children, promote healthy dietary patterns early, and advocate for early screening (e.g., blood glucose testing) to detect DM risk. In light of current findings, policy measures such as sugar content labeling, regulation of SSB marketing, and possibly excise taxes on sweetened beverages are urgently needed to stem this growing public health issue.

II. METHODS

2.1.Study design and participants

This study employed a cross-sectional design. Participants were recruited using a consecutive sampling technique, in which all eligible individuals who attended Nuri during the study period were invited to participate. Participation was voluntary, and written informed consent was obtained from all respondents prior to data collection.

2.2.Intervention procedures

The intervention consisted of a structured health education program delivered through lectures and group discussions. The sessions were designed to provide knowledge related to the study objectives and to encourage active participation from respondents. To assess the effectiveness of this educational approach, participants completed a pre-test before the intervention and a post-test immediately afterward. The tests were designed to evaluate changes in knowledge and understanding following the educational activities.

2.3.Participant flow

A total of 31 individuals were initially approached for participation. Of these, 31 met the eligibility criteria and consented to join the study. All consenting participants completed the pre-test and attended the educational sessions. After the intervention, 31 participants completed the post-test. No participants withdrew from the study during the intervention period.

2.4. Data analysis

Data were analyzed using the paired t-test to compare pre-test and post-test scores. Results were expressed as percentages and mean values. Statistical significance was set at a 99% confidence interval ($p < 0.01$), indicating that observed differences between pre- and post-test scores were considered highly reliable.

III. RESULT AND DISCUSSION

Studies on increasing knowledge to prevent diabetes mellitus usually focus on the importance of diabetes prevention in adults. Whereas efforts to prevent diabetes in children are still rarely undertaken. This study was conducted in the Sempu Wonokerto area, which actively engages in children's health check-ups, but has never conducted a study on parents' knowledge of hidden sugars in food that could potentially trigger diabetes in children. This study was participated in by parents with children and also by the Nuri Sempu Wonokerto cadres. The description of the participants in this study is as shown in Table 1 below.This study demonstrated that a brief educational intervention focusing on hidden sugars significantly increased parents' knowledge regarding diabetes prevention in children. The mean knowledge score improved from 7.87 ± 2.03 at pretest to 9.65 ± 1.38 at posttest, representing a 22.54% increase. These findings highlight the potential of community-based health education programs in enhancing parental awareness of risk factors for diabetes mellitus, particularly those related to hidden sugars in common snacks and fruits.

Table 1. Characteristic of participant (n = 31)

		= 31	Percentage
Gender	Male	5	16.13
	Female	26	83.87
Education	Elementary school	2	6.45
	Midle School	1	3.22
	High school	28	90.32
Occupies	House wife	18	58.00
	Teacher of pre school	1	3.22
	Student	10	32.25
	Others	2	6.45
Age (years old)	20-25	12	38.71
	26-30	5	16.13
	31-35	8	25.81
	36-40	2	6.45
	41-45	0	0.00
	46-50	1	3.22
	51-55	2	6.45
	56-60	1	3.22

About 16.13% of the study's participants are male, despite the gender being dominating among females. The majority of participants, who vary in age from 20 to 25 and 31 to 35, are still rather young. This aligns with cognitive research showing that younger adults often have better information processing and memory retention compared to older groups [6]. People in the local neighborhood often start families and have kids between the ages of 20 and 35. High school is the highest level of education for most of them. Housewives are their primary occupation, followed by being students. Moreover, enthusiasm expressed during group discussions may have facilitated higher engagement and comprehension. Similar improvements in knowledge following educational interventions have been documented across different age groups, including adolescents and middle-aged adults [7], [8], [9].Meanwhile the mean of pretest score was 7.87 ± 2.03 and the post test was 9.65±1.38. This value includes knowledge about the diabetic, including diabetic category, snack and fruit with high glucose. There was an increase in knowledge of 22.54 % or 1.77 points. The t test between pre and post test is 0.000161505 , with a CI level of 99%. The distribution of pre post test results is in Figure 1.

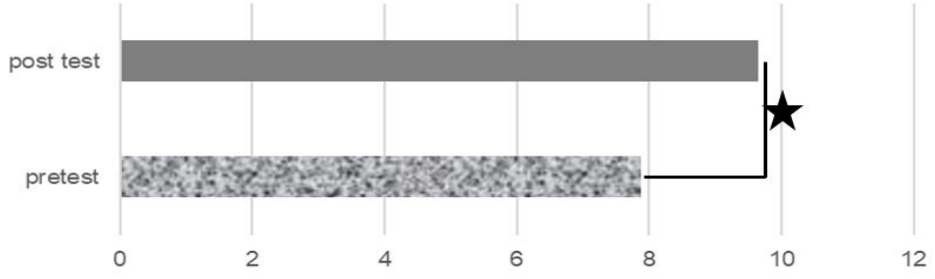

Fig 1. Pre and post test scores of participants, with an average increase of 1.77 points equal with 22.54%. Sign star mean significant difference between pre and post test. The average of pre test was 7.87 ± 2.03 and the post test was 9.65±1.38

It can be seen that there are participants who already understand about diabetic diseases such as trigger or risk factor become Diabetes mellitus, how to protect the children from Diabetes mellitus also kind of snack with high glucose like sweet cake, candy and also fruit with high glucose such as sawo (*Manilkara zapota*) water melon, durian and so on. These all snack also fruit should be limited to consume such as donut,

some sweet. The knowledge of the participants increased, with a total of 22.54 %. The existence of an increase after counseling and discussion is also found in previous activities both increasing knowledge for middle-aged, adolescents and the elderly [7], [8], [9]. The lecture on hidden glucose can be absorbed by the participants. The participants' average age, which ranges between 20 and 35, indicates that they are still extremely vulnerable to learning new things.

They also participate actively in conversations and attend lectures with a lot of enthusiasm. Perhaps since this is a novel subject for them and they are really concerned about their kids' health, particularly to prevent them from being exposed to Diabetes Mellitus disease. Importantly, this study addresses a gap in diabetes prevention research, which often targets adults or children directly, while parental knowledge — particularly about hidden sugars — receives less attention. Previous studies suggest that parents frequently underestimate the role of added and hidden sugars in children's diets [10]. Jústiz et al. [11] also reported that both parents and children often have incomplete knowledge of sugar intake recommendations, which correlates with higher actual sugar consumption. The present findings therefore provide important context from an Indonesian setting, where dietary practices and commonly consumed snacks may differ from Western populations. Table 2 shown the chi square test between some variable. Some variable did not interfere one another but any show the interfere. The significant correlation between variable express by $p< 0.05$.

Table 2. The chi square test between value of Pre-test, Post-test, age, occupation also education level of participant.

		Edu	Occupation	Pretest	Posttest
Age	Pearson chi square	48.714[a1]	46.674[a2]	99.768[a3]	53.457[a4]
	Asymp. Sig. (2-sided)	.001	.002	.042	.534
Edu	Pearson chi square		2.735[a5]	31.677[a6]	1.484[a7]
	Asymp. Sig. (2-sided)		.603	.000	.476
Occupies	Pearson chi square			2.327[a8]	9.498[a9]
	Asymp. Sig. (2-sided)			.312	.147

Noted :

a1.35 cells (97.2%) have expected count less than 5. The minimum expected count is .03
a2.36 cells (100.0%) have expected count less than 5. The minimum expected count is .06.
a3.48 cells (100.0%) have expected count less than 5. The minimum expected count is .03.
a4.23 cells (95.8%) have expected count less than 5. The minimum expected count is .19.
a5.7 cells (77.8%) have expected count less than 5. The minimum expected count is .06.
a6.10 cells (83.3%) have expected count less than 5. The minimum expected count is .03.
a7. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .19.
a8. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .39.
a9. 9 cells (75.0%) have expected count less than 5. The minimum expected count is .06.

Based on table 2, there is a significant correlation between the age and education, age and occupation ($p=0.001$ and $p=0.002$) also Education and pre-test. The participant with highest education in High school with age 20-25, Their condition is that they are strong young women, their brains are still capable of working hard, and their memory power is still strong. Enthusiasm further enhances their focus, allowing the information obtained to be absorbed well. It is commonly known that after the age of 40, the brain's weight and volume decline at a rate of about 5% per ten years **[7]**. Ages 20-35 are a good reproductive age for women, so most of them give birth and raise children during this period. Mothers, as housewives who generally do not have helpers (maid), handle household chores themselves, as well as the care and supervision of children, because they are still in a growth and development phase that requires their mothers. This age also the best time to deliver offspring **[8], [9], [12]**. Education and pre test seem significant correlation due to the high variation of basal knowledge about the hidden glucose as trigger to diabetes mellitus to children among the participant. These mean many participants had no good information about the topic. As shown in post-test, after lecture, there were no significant correlation between education and post-test. It meant the similar knowledge about the topic on all participant after lecturing. Lecturing or knowledge transfer is important to increase the people knowledge **[13], [14]**.

The good performance while teaching can also influence participants' attention or focus on the subject, which facilitates understanding.on lecturing also important to influence the attention of participant **[13], [14], [15]**. Despite the knowledge gains observed, several limitations must be acknowledged. First, the sample size (n = 31) was small and predominantly female, which may limit generalizability. Statistical analyses such as Chi-square were compromised by small expected cell counts, reducing the robustness of subgroup correlations. Second, the study measured only short-term knowledge acquisition. Knowledge does not necessarily translate into behavior change, as highlighted by Hübner et al. (2024), who found that parental feeding practices — including modeling, structuring the food environment, and autonomy support — strongly influence children's sugar consumption **[16]**.

Without assessing whether parents subsequently reduced hidden sugar provision at home, the practical impact of the intervention remains uncertain. Third, potential test-retest or social desirability bias may have contributed to improved posttest scores.Nevertheless, the intervention appears to have equalized knowledge across education levels, as no significant correlation was found between education and posttest scores. This suggests that well-structured health education, even when delivered via simple lectures and discussions, can be effective across diverse educational backgrounds. Prior studies have shown that interactive and culturally tailored approaches may further enhance knowledge retention and behavioral change **[16], [17]**.Future studies should therefore consider larger, more diverse samples, validated instruments for measuring knowledge of hidden sugars, and the inclusion of behavioral outcomes such as changes in children's dietary patterns. Long-term follow-up would also clarify whether knowledge gains persist and translate into healthier practices. Additionally, integrating practical activities such as food label reading, snack demonstrations, or participatory workshops may help parents apply knowledge to daily decision-making **[10]**.

IV. CONCLUSIONS

This study confirms that targeted parental education on hidden sugars can significantly increase knowledge in a community setting. While knowledge is insufficient to ensure behavior change, it is an essential foundation for effective diabetes prevention in children. Embedding such interventions within routine activities offers a promising pathway for improving family health literacy and reducing the risk of future diabetes in vulnerable populations.The lecture on hidden glucose on parents with children increase the knowledge of participant. The increasing point of knowledge were 22,4% was significant than before doing lecture.

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