

Effectiveness of Dietary Regulation and Increased Physical Activity in Reducing the Risk of Type 2 Diabetes for Adult School

Al Azhar Muhammad¹, Amira Son See Abubakar², Ridwan Yamko³, Muliana⁴, Anwar Mallongi^{5*}, Wahyuni Salewe⁶

^{1,2,3,4} Student Program Studies Doctor Knowledge Health Public, Faculty Health Community, Hasanuddin University, Indonesia

^{1,2,3,4} Program Studies Doctor Knowledge Health Public, Faculty Health Public, Hasanuddin University, Indonesia

⁵ Environmental Health Department, Faculty of Public Health, Hasanuddin University, Indonesia

⁶ Hasanuddin University, Tamalanrea, Makassar, Indonesia

*Corresponding Author: rawnaenvi@gmail.com

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ABSTRACT

Cases of diabetes mellitus in children are increasing, the cause is lifestyle. Which No Healthy, consumption food Ready serving, tall glucose and obesity. Effort preventive measures must be taken done through various activity especially in school. Wrong One effort preventive through diet and physical activity management to prevent the risk of type 2 diabetes in the future. To analyze the effectiveness of dietary management and increasing physical activity in reducing the risk of type 2 diabetes in school children. The method used is a literature review. Data collection was carried out through a search of the online database Pubmed. The keywords used in the article search were "Effectiveness of Dietary Regulation in Children" school" and "Effectiveness of Improving activity physical fitness of school children in reducing the risk of diabetes". Inclusion criteria for quantitative and qualitative research types, population The target is Effectiveness Arrangement diet and Improvement Effectiveness physical activity of school children with parameters of reducing the risk of diabetes, published period 2020-2025 in Language English And article form original, full text And open access. Criteria exclusion is an article that is not relevant to the topic of discussion, is not experimental, uses experimental animals and literature studies. The combination of implementing dietary management and increasing physical activity can lower blood glucose levels by uptake of glucose stored in muscles. Dietary management can lower blood glucose. Physical activity through exercise has been shown to increase insulin sensitivity, and dietary management has been shown to be more effective in lowering blood glucose levels. Arrangement diet And improvement activity physique capable lower risk DM Type 2 in school children

Keywords: Arrangement diet, activity physique, DM Type 2, School children

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia caused by impaired insulin secretion and/or action. This can lead to: disturbance on organ eye, kidney, nerve, heart, and vessels blood (Harreiter & Roden, 2023). Diabetes mellitus is classified into five types, including: Type 1 Diabetes (Type 2 DM) 1), Diabetes Type 2 (DM Type 2), Diabetes Gestational (GDM), Diabetes Other (Secondary) and Monogenic Diabetes. Of the several types of diabetes, the most common cases are type 2 DM. The global prevalence of type 2 DM covers 90-95% of all diabetes cases and is burden financing health Which significant. Matter This Because

diabetes Keep going become one of the leading causes of morbidity and mortality worldwide (Medicina et al., 2023).

One of the causes of type 2 DM in children is obesity, obesity in children is problem health global Which the more increase. Reason occurrence obesity in children Because pattern eat that bad And lack of activity physical (Givaudan et al., 2020). Dietary changes such as caloric restriction have been shown to affect gut microbiota and colonization resistance, both of which play a crucial role in maintaining a healthy microbiota balance and preventing pathogen colonization. Caloric restriction is a dietary approach. Which known own Lots benefit health, like decline risk disease metabolic, one of which is type 2 DM (Schwartzberg et al., 2021).

According to data from the Global Burden of Disease (GBD) 2000-2019, the prevalence of metabolic diseases among young adults has increased significantly. significant, with type 2 diabetes being one of the biggest problems. Risk factors contributing to this increase include unhealthy lifestyles, obesity, and lack of physical activity. Furthermore, according to (Schechter et al., 2022), more from 30% individual Which own diabetes more risky experiencing heart disease and kidney disease. The worsening condition of patients is caused by type 2 diabetes accompanied by hypertension, dyslipidemia, and obesity (Schechter et al., 2022). A significant increase in individuals with type 2 diabetes is projected to reach 693 million adults worldwide by 2045. The main risk factors contributing to type 2 diabetes include obesity, lifestyle, and genetic predisposition (Medicina et al., 2023). The contribution of risk factors such as obesity, unhealthy diet, lack of physical activity, and genetics leads to an increase in mortality from diabetes (Guzman- & Carrillo-, 2022). A study Which involving 1.4 million person mature in Israel find that 10.1% suffer Type 2 DM shows that a large percentage of DM sufferers indicates a substantial high burden (Schechter et al., 2022).

Effectiveness activity physique can reduce risk diabetes in circles child school. Activities physique in a way regular very important For guard heavy body Which Healthy and improve sensitivity insulin Which is factor key in prevention diabetes. The importance of physical activity as a strategy for health promotion (Rock et al., 2020). Regular exercise help guard heavy body Which Healthy, Which very important Because obesity is a factor risk Which significant For diabetes. Activity physique increase ability the body to use insulin effectively, reducing the risk of developing type 2 diabetes. Guidelines American Diabetes Association recommend initiative level public For creating an environment that encourages physical activity among children (Rock et al., 2020). An environment that felt safe And can done in a way structured And regular is environment school. Based on the impact caused by diabetes mellitus, especially Type 2 DM

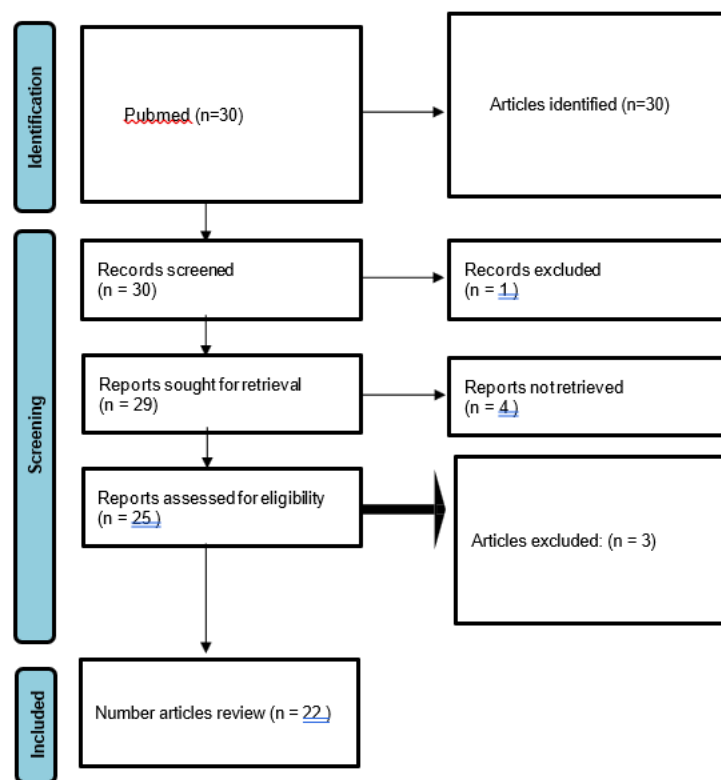
2 which has the highest percentage. The impact can range from diabetes complications to... with cost substantial Which very big, so required effort promotional And preventive measures are carried out as early as possible, especially during childhood. Children's activities are more often carried out at school, besides that schools have learning programs and activities that can be arranged to implement physical activity and diet management for school children. For this reason, research based on literature studies is needed which aims to analyze the effectiveness of changes. diet And improvement activity physique For lower risk diabetes type 2 on school children.

MATERIAL METHOD

The method used in writing this article is a literature review by searching for research journal sources obtained from the online database PubMed, which provides journal articles in PDF format. The topic of this research is the effectiveness of change. diet And improvement activity physique For lower risk diabetes type 2 on school children. Search source literature in the form of article study Which started from year 2020 until the year 2025.

There are 30 articles that meet the inclusion criteria, namely: 1) quantitative and qualitative research types. qualitative And study other Which relevant; 2) population target is diet And activity physique For lower risk DM type 2 on child school; 3) published between year 2020- 2025;

4) articles in English; and 5) articles in full text. The following word combinations were used in the search: "Effectiveness of Dietary Changes", AND "Increased physical activity" in reducing the ripple type 2 diabetes for adult school". Following diagram prism literature screening is presented in figure 1:



Picture 1. Prism Study Flow Diagram

RESULTS AND DISCUSSION

From results literature review on 23 article, writer get results effectiveness Dietary changes and increased physical activity in reducing the risk of type 2 diabetes in school children. Based on articles analyzed with themes such as "Effectiveness of dietary changes in reducing the risk of type 2 diabetes in school children", "Effectiveness of increased physical activity in reducing the risk of type 2 diabetes in school children", and "Effectiveness of dietary changes and increased physical activity in reducing the risk of type 2 diabetes in school children". Presented in the following table:

Table 1. Effectiveness change diet in lower DM risk Type 2 on child school

No.	Title	Design Studies	Results	Effectiveness	Source
1.	<i>Characterization the urban diet: development of an urbanized diet index</i>	<i>Observational Design</i>	This study developed an urban diet index that reflects eating habits of urban communities. This is directly related to the increase risk DM type 2.	Reducing the risk with dietary changes had a greater impact on urban diets that were rich in fat and low in fiber risk DM type 2	Cyr-Scully, A., et al. (2022). Nutrition Journal, 21(1), 55.

2	<i>Lay perceptions of diabetes mellitus and prevention costs and benefits among adults undiagnosed with the condition in Singapore</i>	<i>Qualitative Study</i>	Public perceptions of the costs and benefits of diabetes prevention indicate that knowledge and behavioral changes are very required For prevention.	Change diet more accepted as a risk prevention strategy for Type 2 DM	Hashim, J., et al. (2022). BMC Public Health, 22(1), 1582.
3	<i>Febuxostat does not delayed progression of carotid atherosclerosis in patients with asymptomatic hyperuricemia</i>	<i>Randomized Controlled Trial (RCT)</i>	Febuxostat does not slow down progression of carotid atherosclerosis in patients with hyperuricemia asymptomatic.	Change diet can contribute to the management of type 2 DM risk.	Tanaka, A., et al. (2020). PLoS Medicine, 17(4), e1003095.
4	<i>Effect of a high-fat Mediterranean diet on bodyweight and waist circumference: a prespecified secondary outcomes analysis of the PREDIMED randomized controlled trial</i>	<i>Randomized Controlled Trial" (RCT)</i>	The Mediterranean diet, rich in healthy fats, has been shown to reduce weight and waist circumference. Which significant in high-risk participants.	The Mediterranean diet is rich in healthy fats proven effective weight loss	Estruch, R., et al. (2019). The Lancet Diabetes & Endocrinology , 7(5), e6–e17.

Diet management plays an important role in reducing the risk of diabetes among children. school. Activity education And promotion habit Eat Which Healthy And maintain balanced diet. Research shows that dietary interventions can significantly impact metabolic health and weight management, which are important factors in diabetes prevention. Studies show that calorie restriction can improve health metabolism, although diet extreme can bother microbiota intestines, affecting absorption nutrition (Schwartzenberg et al., 2021). Management diet with Fasting that done during Ramadan show influence positive to control sugar blood and decline factor risk cardiovascular on sufferers diabetes type 2 (Almulhem et al., 2020). Other research also shows that regular and long-term dieting influences insulin expression, providing insight into the effect of diet on insulin metabolism (Anthony et al., 2024). Participating in school and implementing school-based nutrition education can empower children to make healthier food choices, thereby reducing the risk of diabetes (Rock et al., 2020).

Table 2. Effectiveness of increasing physical activity in reducing the risk of Type 2 DM in school children

No.	Title	Design Studies	Results	Effectiveness	Source
1	<i>Reducing the risk of Type 2 diabetes in HIV: a mixed-methods investigation of the STOP-Diabetes diet and physical activity intervention</i>	<i>Mixed Methods (Qualitative and Quantitative)</i>	STOP- Diabetes program reduces the risk of type 2 diabetes in HIV patients by increasing physical activity.	Physical activity has more impact on risk reduction compared to diet alone	Duncan, AD, et al. (2020). Diabetic Medicine, 37(10), 1705–1714.
2	<i>A culturally and linguistically adapted text- message Diabetes Prevention Program for Latinos</i>	Experimental	Program Text message-based diabetes prevention for the Latino community showed high acceptance And good initial effectiveness.	Increased physical activity show faster results on short-term prevention.	Formagini, T., et al. (2024). Translational Behavioral Medicine, 14(2), 138–147.
3	<i>Effectiveness of a Female Community Health Volunteer-Delivered Intervention in Reducing Blood Glucose Among Adults With Type 2 Diabetes</i>	Cluster Randomized Controlled Trial (Cluster RCT)	The intervention that provided by community health volunteers showed a decrease significant levels glucose blood	Physical activity plays a big role in lowering blood glucose levels.	Gyawali, B., et al. (2021). JAMA Network Open, 4(2), e2035799.

			in patients diabetes type 2.		
4	<i>Behavioral interventions to promote physical activity in a multiethnic population at high risk of diabetes: PROPELS three-arm RCT</i>	Three-arm Randomized Controlled Trial" (3-arm RCT)	Behavioral interventions that promoting physical activity in a multi-ethnic population in a high-risk area showed a reduced risk of type 2 diabetes.	Physical activity is more effective in reduce the risk of type 2 diabetes in high- risk populations	Khunti, K., et al. (2021). Health Technology Assessment, 25(77), 1–190.
5	<i>Identifying Behavior Change Techniques and Motivational Interviewing Techniques in Small Steps for Big Changes: A Community-Based Program for Adults at Risk for Type 2 Diabetes</i>	Community -based program evaluation	programs show improvement significant in reducing the risk of diabetes through change techniques behavioral and motivational interviewing.	Physical activity is more readily accepted in the community in reducing the overall risk of type 2 DM.	MacPherson, MM, et al. (2020). Canadian Journal of Diabetes, 44(8), 719–726.
6	<i>A Mediterranean Diet Rich in Extra-Virgin Olive Oil Is Associated with a Reduced Prevalence of Nonalcoholic Fatty Liver Disease</i>	Randomized Controlled Trial (RCT)	Diet Mediterranean rich in olive oil reduces prevalence of liver disease fatty non-alcoholic on individuals at cardiovascular risk tall.	Physical activity plays an important role in reducing the risk of metabolic diseases, including diabetes type 2,	Pinto, X., et al. (2019). The Journal of Nutrition, 149(11), 1920–1929.

Regular physical activity helps maintain a healthy weight by increasing energy expenditure. It helps maintain the calorie deficit necessary for weight loss or management, which is crucial because obesity is a major risk factor for diabetes. Exercise improves the body's ability to use energy. insulin in a way effective, reduce possibility develop resistance Insulin. Physical activity contributes to a better lipid profile and lowers blood pressure, further reducing the risk of diabetes (Rock et al., 2020) .

From sixth journal Which has reviewed in a way collective, show that activity Physical activity plays a role in reducing the risk of developing type 2 diabetes. This is in accordance with research which suggests that that activities physique capable reduce resistance insulin And lower blood sugar levels (Wiechert & Holzapfel, 2021). Behavioral approaches to obesity management can reduce risk diabetes type 2 with increase habit in do activity Another opinion states that lifestyle interventions in the prevention of type 2 diabetes in individuals with prediabetes show a significant reduction in the risk of type 2 diabetes, this is because physical activity plays an important role in increasing insulin sensitivity and reducing insulin resistance (Thipsawat, 2023).

Table 3. Analysis Decline Risk Diabetes Mellitus type 2 on child school

No.	Title	Method	Results	Source
1	<i>Effectiveness of digital health use the transtheoretical model to prevent or delay type 2 diabetes in impaired glucose tolerance patients</i>	Randomized Controlled Trial (RCT)	Dietary changes and physical activity both contribute to the prevention of type 2 diabetes, but digital programs that combine the two are more effective in preventing or delaying diabetes.	Alzeidan, R., et et al. (2019). BMC Public Health, 19(1), 1550.
2	<i>A culturally and linguistically adapted text-message Diabetes Prevention Program for Latinos</i>	Experimental	The results showed that the combination of the two was more effective in preventing diabetes than either. only change diet or physical activity.	Formagini, T., et al. (2024). Translational Behavioral Medicine, 14(2), 138–147.

3	<i>Biomarkers of insulin action during single soccer sessions before and after a 12-week training period in type 2 diabetes patients on a calorie-restricted diet</i>	<i>Experimental</i>	Activity physique during session Exercise has been shown to improve insulin sensitivity, although dietary changes have been shown to be more effective in lowering blood glucose levels.	De Sousa, M. V, et al. (2019). <i>Physiology & Behavior</i> , 209, 112618.
4	<i>Modification of cardiovascular disease risk by health behavior change following type 2 diabetes diagnosis</i>	<i>Experimental</i>	Dietary changes and physical activity together contribute to reducing the risk of cardiovascular disease in patients type 2 diabetes. Physical activity has a significant impact on heart health.	Estlin, A. F. L., et al. (2021). <i>Diabetic Medicine</i> , 38(10), e14646.
5	<i>Improving weight loss and cardiometabolic risk in black patients with diabetes or pre-diabetes: Rationale and protocol for a digital medicine hybrid type 1 implementation trial</i>	<i>Trial protocol design</i>	Diet and physical activity combined with a digital approach have greater effectiveness than either type of intervention alone.	Katzmarzyk, P. T., et al. (2025). <i>Contemporary Clinical Trials</i> , 149, 107806.
6	<i>Real-world effectiveness of digital and group-based lifestyle interventions as compared with usual care to reduce type 2 diabetes risk</i>	<i>Pragmatic randomized controlled trial</i>	The combination of dietary changes and physical activity through digital and group interventions is more effective than interventions involving only one or the other.	Lakka, TA, et al. (2023). <i>The Lancet Regional Health. Europe</i> , 24, 100527.
7	<i>Efficacy and Safety of Metformin and Atorvastatin Combination Therapy vs. Monotherapy with Either Drug in Type 2 Diabetes Mellitus and Dyslipidemia Patients</i>	<i>Double-blind randomized controlled trial</i>	Although metformin is effective In the management of type 2 DM, physical activity and diet still have a bigger role in the long term.	Lee, J.-E., et al. (2024). <i>Diabetes & Metabolism Journal</i> , 48(4), 730–739.
8	<i>Using intervention mapping approach to finding socio-cognitive determinants of diabetes preventive behaviors</i>	<i>Mapping-based intervention method</i>	Dietary changes and physical activity both have a significant impact on preventing type 2 diabetes, but social and cognitive Also play important role in the success of the intervention.	Mirzaei-Alavijeh, M., et al. (2019). <i>Journal of Preventive Medicine and Hygiene</i> , 60(3), E237–E242.
9	<i>Intensive multifactorial intervention improved renal impairment in short-duration type 2 diabetes</i>	<i>Randomized Controlled Trial (RCT)</i>	The combination of diet and physical activity in a multifactorial intervention is more effective in managing kidney complications compared with single treatment.	Shi, C., et al. (2020). <i>Journal of Diabetes and Its Complications</i> , 34(1), 107468.
10	<i>Effects of a Lifestyle Intervention to Prevent Deterioration in Glycemic Status Among South Asian Women With Recent Gestational Diabetes</i>	<i>Randomized Controlled Trial (RCT)</i>	Dietary changes and physical activity both play a role in preventing the development of type 2 diabetes, but the combination of the two is more effective in preventing the decline in glycemic status.	reservoir, N., et al. (2022). <i>JAMA Network Open</i> , 5(3), e220773.
11	<i>Effect of a family and interdisciplinary intervention to prevent T2D: randomized clinical trial</i>	<i>Randomized Controlled Trial (RCT)</i>	A healthy diet and physical activity accompanied by family support have shown significant impacts. more big in prevention of type 2 diabetes.	Vargas-Ortiz, K., et al. (2020). <i>BMC Public Health</i> , 20(1), 97.
12	<i>Rationale and design of the EMPA-ELDERLY trial: a randomized, double-blind, placebo-controlled, 52-week clinical trial</i>	<i>Double-blind randomized controlled trial</i>	Physical activity and diet are still needed as part of the management of type 2 diabetes in controlling blood glucose.	Yabe, D., et al. (2021). <i>BMJ Open</i> , 11(4), e045844.

From twelfth journal Which in review show that combination arrangement diet and increased physical activity have a significant impact on lowering and maintaining stable blood glucose levels, thereby minimizing the risk of developing type 2 diabetes. Higher levels of physical activity are closely associated with lower blood glucose levels, as physical activity helps metabolize glucose stored in muscles. Physical activity by doing walk foot, has proven lower level glucose blood with walk foot Three times a week for 20 minutes. Weight loss through dietary changes contributes to improved blood glucose control. Dietary regulation has been shown to effectively lower blood glucose levels, especially in individuals with hyperglycemia and diabetes.

Physical activity performed during exercise sessions has been shown to increase insulin sensitivity, on the side other change diet proven more effective in lower level glucose blood (de Sousa et al., 2019). Dietary changes and physical activity together contribute to reducing the risk of cardiovascular disease in patients with type 2 diabetes

(Estlin et al., 2021). Other research shows that a healthy diet and physical activity, accompanied by family support, have a greater impact on preventing type 2 diabetes (Vargas-Ortiz et al., 2020).

In general, this literature review shows that dietary management and increased physical activity can reduce and stabilize blood glucose levels. Stable blood glucose levels will reduce the risk of diabetes mellitus and prevent other complications caused by diabetes itself. diet And activity physique can applied in order or environment school especially on child. School can apply program education health comprehensive which informs students about diabetes, its risk factors, and prevention strategies. Increasing health knowledge and behavior among school children effectively influences choice style life (Ameneh et al., 2023). Activity school Which structured This regulation is easier to implement. Limiting consumption of unhealthy foods and implementing a daily physical activity routine from the beginning of school will have a significant impact, aiming to reduce the risk of Type 2 DM in the future. Findings This very important as base to implement and support school Healthy in preventing Type 2 DM in school children.

CONCLUSION

Effectiveness arrangement diet And activity physique can reduce risk diabetes in among school children. Regular physical activity is very important for maintaining a healthy weight and increase sensitivity insulin Which is factor key in prevention diabetes in the future. Schools are educational institutions that can have a big influence on child school. With apply program education health comprehensive program that informs students about diabetes, its risk factors, and prevention strategies. Improving health knowledge and behaviors among schoolchildren effectively influences lifestyle choices.

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