PROCEEDINGS OF AIPKIND
SCIENTIFIC MEETING 2025
Publisher : Asosiasi Pendidikan Kebidanan Indonesia (AIPKIND)
http://proceeding.journal-aipkind.or.id

The Association Between Obesity and the Risk of Prediabetes Among Adolescents

Herlianty[*1], Evi Sridahrianti[2], Yanti Mustarin[3], Syaiful Bachri[4]

[1,2,3,4] *Sekolah Tinggi Ilmu Kesehatan Gunung Sari*
Corresponding author: bidanerly@gmail.com

ABSTRACT

Background: adolescents who are overweight or obese have an increased risk of developing prediabetes, which can be prevented through healthy lifestyle changes, particularly those related to body weight management. Healthy weight loss achieved through a balanced diet and regular exercise can improve insulin sensitivity, reduce the risk of prediabetes, and enhance overall health.
Purpose: to determine the relationship between obesity and the incidence of prediabetes among adolescents at SMP Negeri 3 Makassar.
Methods: this study employed a quantitative approach with a cross-sectional design. The sample consisted of 34 respondents, selected using total sampling. Data collection was conducted from September 5 to October 5, 2025. The instruments used included a scale to measure body weight, a tape measure for height, a calculator to determine BMI, a glucometer to assess fasting blood glucose levels, and an observation sheet for recording examination results and respondent data. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 26.0, with the chi-square test applied for statistical analysis.
Results: among the respondents, 23.5% were classified as obese, while 76.5% were not obese. Additionally, 14.7% were identified as prediabetic, and 85.3% were not prediabetic. The analysis yielded a p-value of 0.000, indicating a statistically significant relationship ($p < 0.05$).
Conclusion: the study concluded that there is a significant relationship between obesity and the incidence of prediabetes among adolescents at SMP Negeri 3 Makassar.

Keywords: *Obesity; overweight; prediabetes; insulin sensitivity; balanced diet*

PROCEEDINGS OF AIPKIND
SCIENTIFIC MEETING 2025
Publisher : Asosiasi Pendidikan Kebidanan Indonesia (AIPKIND)
http://proceeding.journal-aipkind.or.id

BACKGROUND

The variation in body weight among adolescents today can be influenced by various factors, including lifestyle, diet, physical activity, genetic factors, and social and cultural environments (Agung et al., 2022). Adolescent body weight can vary from one individual to another. Some adolescents experience issues with being overweight (obesity), while others struggle with being underweight. Childhood obesity is considered one of the most serious global public health challenges of the 21st century. Children with obesity are at high risk for prediabetes, dyslipidaemias, hypertension, non-alcoholic fatty liverdisease and obstructive sleep apnoea and are more likely to stay obese into adulthood and to develop associated comorbidities at a younger age (Liu et al., 2024).

Obesity is a multifactorial nutritional disorder resulting from the interaction between genetic and environmental factors, manifested through an imbalance in dietary patterns, eating behaviors, physical activity, and lifestyle changes (Hsieh et al., 2023). Some adolescents experience underweight issues due to poor diet, lack of physical activity, or health factors, leading to malnutrition and growth problems. Conversely, obesity involves excessive fat or energy imbalance. Obesity rates among adolescents have risen recently, driven by unhealthy eating, high-calorie fast food and sugary drinks, and sedentary lifestyles linked to excessive technology use (Czubaj et al., 2025). In response, many countries and health organizations promote healthy lifestyles, balanced diets, and physical activity. Studies indicate that weight gain increases diabetes risk (World Health Organization, 2021).

Prediabetes is a condition in which a person's blood sugar level is higher than normal but not yet high enough to be classified as diabetes. Prediabetes can serve as an important warning sign for the risk of future diabetes. Body weight and being overweight are closely associated with the risk of prediabetes, especially among adolescents (Wood et al., 2024). Cases of increased body weight continue to rise and have contributed to the emergence of prediabetes among adolescents. According to the International Diabetes Federation (IDF) 2021, impaired glucose tolerance a key indicator of prediabetes affected approximately 9.1% of the global adult population, equivalent to 464 million individuals. Although specific data for adolescents aged 13–15 years is limited, the rising trend of youth-onset type 2 diabetes suggests that prediabetes may be increasingly prevalent in younger age groups (Magliano et al., 2021). By the year 2045, this prevalence is projected to rise to 8.3%, or about 587 million people. Based on IDF data from 2017, the highest prevalence of prediabetes was found in North America and the Caribbean, affecting approximately 54.4 million people, or around 15.4% of the population in that region. In South and Central America, the prevalence was around 32.5 million people (10.0%). Meanwhile, in Southeast Asia, the figure was about 29.1 million (3.0%), and in Europe, approximately 360 million people or 5.5%. Therefore, body weight and excess weight are considered major contributing factors to prediabetes.

The incidence of prediabetes continues to increase and may develop into Diabetes Mellitus (DM) if not prevented early. Currently, there is a surge in prediabetes prevalence

PROCEEDINGS OF AIPKIND
SCIENTIFIC MEETING 2025
Publisher : Asosiasi Pendidikan Kebidanan Indonesia (AIPKIND)
http://proceeding.journal-aipkind.or.id

driven by unhealthy lifestyles, particularly among adolescents. There is a need for education related to prediabetes screening and motivation for adolescents to reduce sedentary behavior (Ikatan Dokter Anak Indonesia (IDAI), 2019).

Given the tremendous toll that lifestyle factors such as obesity, physical inactivity, and smoking have on the health of patients with diabetes, ongoing and energetic efforts are needed to address and change the societal determinants at the root of these problems (Syukri et al., 2021). According to the Basic Health Research Riskesdas, (2019), the prevalence of prediabetes in Indonesia is relatively high, at approximately 10.2%, which means around 24 million Indonesians are living with prediabetes. Prediabetes serves as an early warning before the onset of diabetes, and once it is identified, that is the critical time to make lifestyle changes before it progresses to diabetes. The prevalence of overweight and obese adolescents aged 13–15 in Indonesia is 20%, while for adolescents aged 16–18, the rate is 13.6%. The prevalence of overweight adolescents in Indonesia has increased compared to 2013, with the 13–15 age group rising by 0.4% and the 16–18 age group increasing by 2.2%.

South Sulawesi ranks sixth among Indonesian provinces for obesity prevalence, with a rate of 19.1%. Meanwhile, the obesity prevalence in Makassar City is 24.05%, the highest in South Sulawesi and higher than the provincial average of 19.1% (Magliano et al., 2021). Based on initial data collection conducted directly on June 7, 2025, the total number of students at SMP Negeri 3 Makassar is 1,191, of which 34 students were identified as obese.

Previous studies have shown that significant weight loss can occur with appropriate interventions, including dietary modifications, increased physical activity, behavioral therapy, and, in some cases, pharmacological treatment. Several factors may contribute to obesity, including genetic factors, environmental influences, dietary habits, and physical activity. Foods high in sugar content can alter hormonal and biochemical functions in the body, which trigger weight gain. This includes hormones like leptin and ghrelin, which regulate appetite and control fat-burning processes in the body (Yeung, A. Y. Tadi, 2023).

Adolescents who are overweight or obese are at greater risk of developing prediabetes, which can be prevented through healthy lifestyle changes—particularly those related to body weight. By losing weight in a healthy manner through a balanced diet and regular exercise, insulin sensitivity can improve, the risk of prediabetes can be reduced, and overall health can be enhanced. Therefore, this issue has prompted the researcher to conduct a study on the relationship between obesity and the incidence of prediabetes among adolescents at SMP Negeri 3 Makassar.

PROCEEDINGS OF AIPKIND
SCIENTIFIC MEETING 2025
Publisher : Asosiasi Pendidikan Kebidanan Indonesia (AIPKIND)
http://proceeding.journal-aipkind.or.id

OBJECTIVE

To analyze the association between obesity, as measured by Body Mass Index (BMI), and the incidence of prediabetes, as indicated by fasting blood glucose (FBG) levels, among adolescents at SMP Negeri 3 Makassar.

METHODS

This study employed a quantitative approach with an analytic survey design using a cross-sectional method. The aim of the research was to examine the relationship between obesity and the incidence of prediabetes among adolescents at SMP Negeri 3 Makassar. The study was conducted from September 5 to October 5, 2025, at SMP Negeri 3 Makassar.

The population consisted of all students at the school, totaling 34 individuals, all of whom were included in the sample using a total sampling technique. The independent variable was obesity, determined using Body Mass Index (BMI), with obesity classified as BMI ≥ 23 and non-obesity as BMI between 18.5–22.9. The dependent variable was prediabetes, defined based on fasting blood glucose (FBG) levels: respondents were categorized as prediabetic if their FBG levels were between 100–125 mg/dL, and non-prediabetic if below 100 mg/dL, in accordance with the American Diabetes Association criteria (Elsayed et al., 2023). Both variables were measured using an ordinal scale.Research instruments included a weighing scale and measuring tape to assess weight and height, and a glucometer to measure fasting blood glucose. Primary data were obtained through structured questionnaires and direct observation, while secondary data were collected from school records

Data processing included editing, coding, and tabulation. Data analysis was conducted using SPSS version 26, with univariate analysis to describe frequency distributions, and bivariate analysis using the Chi-Square test ($\alpha = 0.05$) to assess the relationship between obesity and prediabetes. A result was considered statistically significant if the *p-value* was less than 0.05. Ethical approval for this study was obtained from the Health Research Ethics Committee, with reference number 6081/UN4.14.1/TP.01.02/2025. All participants and their legal guardians provided informed consent prior to participation in the study.

PROCEEDINGS OF AIPKIND
SCIENTIFIC MEETING 2025
Publisher : Asosiasi Pendidikan Kebidanan Indonesia (AIPKIND)
http://proceeding.journal-aipkind.or.id

RESULTS

Univariate Analysis

Table 1. Sociodemographic Characteristics of Respondents (n=34)

Characteristic	Category	Frequency (n)	Percentage (%)
Age	13 years	13	38.2
	14 years	16	47.1
	15 years	5	14.7
Gender	Male	21	61.8
	Female	13	38.2
Religion	Islam	31	91.2
	Christian	3	8.8
Parental Education	Elementary School	20	58.8
	Junior High School	4	11.8
	Senior High School	8	23.5
	Bachelor's Degree	2	5.9
Parental Occupation	Homemaker	19	55.9
	Entrepreneur	7	20.6
	Laborer	4	11.8
	Civil Servant	1	2.9
	Military	1	2.9
	Employee	2	5.9
Living With	Parents	28	82.4
	Grandmother	3	8.8
	Aunt	3	8.8
History of Hypertension	No	34	100.0
History of High Cholesterol	No	34	100.0
Smoking	No	34	100.0
Depression	No	34	100.0
Alcohol Consumption	No	34	100.0
Physical Activity	Yes	34	100.0
Exercise Frequency	Once a week	17	50.0
	Rarely	12	35.3
	Twice every three weeks	5	14.7
Family History of Diabetes Mellitus	Yes	23	67.6
	No	11	32.4

PROCEEDINGS OF AIPKIND
SCIENTIFIC MEETING 2025
Publisher : Asosiasi Pendidikan Kebidanan Indonesia (AIPKIND)
http://proceeding.journal-aipkind.or.id

Table 2. Distribution of Respondents by Obesity Status Based on BMI

Status	N	%
Obese	8	23.5
Non-Obese	26	76.5
Total	**34**	**100.0**

Based on the table, 76.5% of respondents were not obese and 23.5% of respondents were obese.

Table 3. Distribution of Respondents Based on Prediabetic

Status	N	%
Prediabetic	5	14.7
Non-Prediabetic	29	85.3
Total	**34**	**100.0**

Based on the table, 14.7% of respondents were prediabetic and 85.3% of respondents were non-prediabetic.

Bivariate Analysis

Table 3. Relationship between Obesity and the incidence of Prediabetic at SMP Negeri 3, Makassar

	Cases of Prediabetic						
	Prediabetic		**Non-Prediabetic**		**Total**		**P value**
	n	**%**	**N**	**%**	**n**	**%**	
Obese	3	37.5	5	62.5	8	**100.**	
Non- Obese	2	7.7	24	92.3	26	**100.**	0.000
Total	**5**	**23.5**	**29**	**76.5**	**34**	**100**	

According to the table above, all 8 respondents classified as obese (100.0%) consisted of 3 individuals (37.5%) who had prediabetes and 5 individuals (62.5%) who did not. Among the non-obese respondents, 2 individuals (7.7%) were found to have prediabetes, while 24 individuals (92.3%) were not prediabetic. Statistical analysis using the Chi-Square test with a significance level of $\alpha = 0.05$ ($p < \alpha$) yielded a p-value of 0.000. Since the p-value is less than

PROCEEDINGS OF AIPKIND
SCIENTIFIC MEETING 2025
Publisher : Asosiasi Pendidikan Kebidanan Indonesia (AIPKIND)
http://proceeding.journal-aipkind.or.id

0.05, and the correlation coefficient was found to be 0.835, it can be concluded that the alternative hypothesis (Ha) is accepted, and the null hypothesis (Ho) is rejected. This indicates a statistically significant relationship between obesity and the incidence of prediabetes among students at SMP Negeri 3 Makassar, with a very strong correlation strength**.**

DISCUSSION

The results of the Chi-Square test showed a p-value of 0.000, which is less than the significance level $\alpha = 0.05$, indicating that the alternative hypothesis (Ha) is accepted and the null hypothesis (Ho) is rejected. This confirms that there is a significant relationship between obesity and the incidence of prediabetes at SMP Negeri 3 Kota Makassar. The Chi-Square test also yielded a correlation coefficient (r) of 0.835, indicating a very strong relationship between obesity and prediabetes incidence among students at SMP Negeri 3 Makassar.

Based on the findings of this study, although all respondents reported engaging in physical activity, more than half exercised only once a week or less. This indicates that insufficient physical activity may be a contributing factor to the incidence of obesity and prediabetes, in addition to an unbalanced diet. Lin et al., (2020) stated that adolescents who are overweight or obese are commonly influenced by unhealthy lifestyle factors, such as excessive intake of macronutrients and frequent consumption of fast food. In this study, although all respondents reported engaging in physical activity, more than half exercised only once a week or less, indicating a low frequency of physical activity. Adolescents are more likely to experience weight gain during this stage due to increased energy demands required for supporting growth and development.

This study aligns with the findings of Noviriana et al., (2025) which demonstrated that dietary patterns are significantly associated with blood glucose levels in patients with Type 2 Diabetes Mellitus. Their research reported that the majority of respondents had moderately healthy eating habits (60.9%), while 39.1% had good dietary patterns. Statistical analysis revealed a strong relationship between dietary habits and blood glucose levels, with a p-value of 0.000 ($p < 0.05$) and an odds ratio of 9.250, indicating that diet is the most dominant factor influencing blood glucose levels.

This study also found that a portion of respondents were obese, and this condition was strongly associated with the occurrence of prediabetes. The findings indicate that obesity significantly contributes to the risk of developing prediabetes. Typically, obesity is assessed using Body Mass Index (BMI), which reflects overall body fat mass. Prediabetes is a known risk factor for type 2 diabetes and may lead to long-term complications such as cardiovascular disease. The underlying mechanism of prediabetes involves insulin resistance, which may occur in muscle, liver, and adipose tissues. Contributing factors to insulin resistance include genetics, obesity, gender, and lifestyle.

The results of this study suggest that a higher BMI is associated with elevated fasting blood glucose levels. Body Mass Index (BMI) is a commonly used measure to estimate body

PROCEEDINGS OF AIPKIND
SCIENTIFIC MEETING 2025
Publisher : Asosiasi Pendidikan Kebidanan Indonesia (AIPKIND)
http://proceeding.journal-aipkind.or.id

fat by comparing a person's weight to their height. A higher BMI indicates a greater likelihood of obesity. BMI is widely used to classify weight status, ranging from underweight, normal weight, overweight, to obesity. A high BMI reflects excess fat accumulation, which can increase the risk of health problems, including prediabetes, which states that risk factors for type 2 diabetes include overweight/obesity, lifestyle changes from traditional to Western patterns, overeating, and sedentary behavior (Abdulai et al., 2019). However, there were 5 respondents (62.5%) who were obese but did not have prediabetes, which may be due to their fasting blood glucose levels still being within the normal range (around 86 mg/dL). This could explain the absence of prediabetes. These findings are supported by research from Widuri, which found no significant relationship between BMI and fasting blood glucose levels. It was further explained that body fat distribution and quantity do not always reflect metabolic processes in the body (Oktariza et al., 2021).

Furthermore, the study showed that 26 respondents (85.3%) were not obese, and among them, 2 respondents (7.7%) were prediabetic. Based on the physical activity data, some adolescent respondents reported low exercise frequency, which may contribute to impaired insulin release and hyperglycemia. Physical activity plays a critical role in blood glucose utilization. During physical activity, muscles contract to produce movement, which involves the breakdown of stored glucose in muscles into energy. This energy is then used by muscles to perform activity. Glucose use in muscles during activity occurs independently of insulin, which helps in lowering blood glucose levels (Hohberg et al., 2025).

These findings are also supported by research conducted by Syukri et al., (2021), which reported a positive relationship between physical activity and prediabetes. Their study showed that the majority of prediabetic respondents had low levels of physical activity. The current study also found that male respondents were more likely to experience prediabetes compared to female respondents. Similarly, the study by Jeon et al. found that the prevalence of prediabetes was higher among males (14.4%) than females (10.4%)

Additionally, 92.3% of the respondents were neither obese nor prediabetic, which may be related to having a normal Body Mass Index (BMI). However, since specific data on their dietary patterns and physical activity intensity were not collected in detail, no conclusions can be drawn regarding the exact factors contributing to their health status.

This study provides valuable insight into the relationship between obesity and prediabetes among adolescents, particularly in a school-based setting where early detection is crucial. The use of objective measurements, such as BMI and fasting blood glucose levels, strengthens the validity of the findings. However, the study also has several limitations. The sample size was relatively small and limited to a single school, which may affect the generalizability of the results. In addition, physical activity data were self-reported and may be subject to bias. Future research with a larger and more diverse population is recommended.

PROCEEDINGS OF AIPKIND
SCIENTIFIC MEETING 2025
Publisher : Asosiasi Pendidikan Kebidanan Indonesia (AIPKIND)
http://proceeding.journal-aipkind.or.id

CONCLUSION

A significant relationship was found between obesity and the incidence of prediabetes among adolescents at SMP Negeri 3 Makassar. Among the respondents, 76.5% were classified as non-obese, while 23.5% were classified as obese. The prevalence of prediabetes among the respondents was 14.7%, whereas 85.3% were non-prediabetic. These findings suggest that obesity may be a contributing factor to the development of prediabetes in this population.
Based on these results, it is recommended that educational institutions implement routine health screening programs, including assessments of body mass index (BMI) and fasting blood glucose (FBG), to facilitate early identification of students at risk. Furthermore, health promotion initiatives emphasizing nutritional education and physical activity should be incorporated into the school curriculum to mitigate the risk of obesity and subsequent metabolic disorders. It is also suggested that future studies involve larger and more heterogeneous adolescent populations to enhance the generalizability of the findings and to explore additional risk factors associated with prediabetes.

ACKNOWLEDGMENTS

The researcher would like to express sincere gratitude to Stikes Gunung Sari Makassar and heartfelt thanks to the participants, teachers, and staff at SMP Negeri 3 Makassar for their cooperation and participation in encouraging the students to be respondents in this study.

REFERENCES

Abdulai, T., Li, Y., Zhang, H., Tu, R., Liu, X., Zhang, L., Dong, X., Li, R., Wang, Y., & Wang, C. (2019). Prevalence of impaired fasting glucose, type 2 diabetes and associated risk factors in undiagnosed Chinese rural population: The Henan Rural Cohort Study. *BMJ Open*, *9*(8), 1–9. https://doi.org/10.1136/bmjopen-2019-029628

Agung, F. H., Sekartini, R., Sudarsono, N. C., Hendarto, A., Dhamayanti, M., Werdhani, R. A., & Sawyer, S. M. (2022). The barriers of home environments for obesity prevention in Indonesian adolescents. *BMC Public Health*, *22*(1), 1–10. https://doi.org/10.1186/s12889-022-14669-6

Czubaj, N., Szymańska, M., Nowak, B., & Grajek, M. (2025). The Impact of Social Media on Body Image Perception in Young People. *Nutrients* , *17*(9). https://doi.org/10.3390/nu17091455

Elsayed, N. A., Aleppo, G., Aroda, V. R., Bannuru, R. R., Brown, F. M., Bruemmer, D., Collins, B. S., Hilliard, M. E., Isaacs, D., Johnson, E. L., Kahan, S., Khunti, K., Kosiborod, M., Leon, J., Lyons, S. K., Murdock, L., Perry, M. Lou, Prahalad, P., Pratley, R. E., … Gabbay, R. A. (2023). 2. Classification and Diagnosis of Diabetes: Standards of Care in Diabetes—2023. *Diabetes Care*, *46*(January), S19–S40. https://doi.org/10.2337/dc23-S002

Hohberg, V., Lichtenstein, E., Kreppke, J. N., Zanitti, C., Streckmann, F., Gerber, M., & Faude,

PROCEEDINGS OF AIPKIND
SCIENTIFIC MEETING 2025
Publisher : Asosiasi Pendidikan Kebidanan Indonesia (AIPKIND)
http://proceeding.journal-aipkind.or.id

O. (2025). Effects of Lifestyle Interventions to Promote Physical Activity on Physical Activity and Glycated Hemoglobin in Patients with Type 2 Diabetes: a Systematic Review and Meta-Analysis. *Sports Medicine*, *55*(5), 1165–1181. https://doi.org/10.1007/s40279-025-02184-8

Hsieh, P. P., Sindhu, F. C., Dewi, M. R., & Sidhiarta, I. G. L. (2023). Hubungan antara durasi tidur dengan kejadian obesitas pada anak: sebuah tinjauan sistematis. *Intisari Sains Medis*, *14*(1), 229–236. https://doi.org/10.15562/ism.v14i1.1303

Ikatan Dokter Anak Indonesia (IDAI). (2019). Pedoman Pengelolaan Diabetes Mellitus pada Anak dan Remaja. https://www.idai.or.id

Lin, X., Yang, T., Zhang, X., & Wei, W. (2020). Lifestyle intervention to prevent gestational diabetes mellitus and adverse maternal outcomes among pregnant women at high risk for gestational diabetes mellitus. *Journal of International Medical Research*, *48*(12). https://doi.org/10.1177/0300060520979130

Liu, R., Figueroa, R., Brink, H. Vanden, Vorland, C. J., Auckburally, S., Johnson, L., Garay, J., Brown, T., Simon, S., & Ells, L. (2024). The efficacy of sleep lifestyle interventions for the management of overweight or obesity in children: a systematic review and meta-analysis. *BMC Public Health*, *24*(1), 1–18. https://doi.org/10.1186/s12889-024-17708-6

Magliano, D., Edward, B., Beverley, B., & Barengo, N. (2021). International Diabetes Federation. In *Diabetes Research and Clinical Practice* (Vol. 102, Issue 2). https://doi.org/10.1016/j.diabres.2013.10.013

Noviriana, A., Firdaus, S., Studi, P., Keperawatan, M., Banjarmasin, P. K., Banjarmasin, M., Banjarmasin, K., & Selatan, P. K. (2025). Analisis Hubungan Pola Makan , Aktivitas Fisik dan Tingkat Stres Dengan Kadar Glukosa Darah pada Pasien Diabetes Melitus Tipe 2 di RSUD Sultan Suriansyah Banjarmasin. *Jurnal Penelitian Dan Pengabdian Masyarakat Indonesia*, *4*(1), 408–420.

Oktariza, R. T., Kalanjati, V. P., & Tirthaningsih, N. W. (2021). Body Mass Index, Waist-Hip Ratio and Fasting Blood Glucose Levels amongst the University Students. *Folia Medica Indonesiana*, *57*(1), 53. https://doi.org/10.20473/fmi.v57i1.14661

Riskesdas. (2019). Riset Kesehatan Dasar 2019: Prevalensi prediabetes di Indonesia.

Syukri, M., Debbie, N., & Intan, P. S. (2021). Kejadian Prediabetes pada Kelompok Usia Dewasa di Kota Jambi. *Kodifikasia : Jurnal Penelitian Islam, Vol 15, No. 01 (2021), 133-158*, *15*(01), 133–158.

Wood, M., Bando, H., & Ebe, K. (2024). Standards of Care in Diabetes 2025: Diabetes-Associated Autoantibodies. *SunText Review of Endocrine Care*, *4*(1), 2024–2026. https://doi.org/10.51737/2771-5469.2024.024

World Health Organization. (2021). Diabetes. https://www.who.int/news-room/fact-sheets/detail/diabetes

Yeung, A. Y. Tadi, P. (2023). Physiology, obesity neurohormonal appetite and satiety control. In StatPearls. https://www.ncbi.nlm.nih.gov/books/NBK555906%0A