OPEN ACCESS

Review Article

An Extensive Meta-analysis of Prediabetes Prevalence on a Global Scale

`1.Anusuya .M , 2. Dr. Sumanth Kumar. B , 3. Dr. Vinitha Krishanan , 4. Dr. Thirumal 5. Dr. Sarah Monica Jane iD

1.Senior Dietitian SRM Institute of Medical Science and Hospital ;2. Professor of Biochemistry Meenakshi Medical College Hospital and Research Institute ; 3. Chief Dietician SRM Institute of Medical Science and Hospital ; 4. Assistant Professor and Assistant Register Meenakshi Academy of Higher Education and Research ; 5. Assistant Professor MOP College for Women's

Corresponding Author:anusuya94anu@gmail.com

Abstract:

Introduction

A metabolic condition known as prediabetes, this case can't fulfill the criteria for diabetes diagnosis and it is indicated by elevated blood glucose. This condition is characterized by elevated HbA1c (Glycated hemoglobin), Impaired glucose tolerance, and Impaired fasting glucose.Objective of this review is to analyze the effects of numerous variables, such as diet, age and lifestyle, about the occurrence of prediabetes worldwide.

Materials and Methods

We reviewed 41 research publications to analyze the prevalence of prediabetes globally by using online database like PubMed ,GoogleScholar was used to collect the relevant data. The article published between 2013 to 2023 was included in the study.Reviewed the effect of prediabetes prevalence among peoples by different categories such as age around 18-79, BMI, waist circumference, total cholesterol andhigh-density lipoprotein, hypertension. Importance of dietary schedule and physical activity was also reviewed.

Results

Globally 13,11,085 peoples were examined under age of 18-89 years. Prevalence of prediabetes over the world was reported as 22.8%. Meta analysis revealed the prevalence of prediabetes most predominantly in Iran with sample size less than 10,000 and India with sample size greater than 10,000. The reports stated that the prediabetic prevalence was increased among older adults due to the metabolic disorders with obesity and young population affected by the modification in the diet and lifestyle. Scientific results stated that the prevalence of prediabetes increases with the BMI, hypertension, high density lipoprotein cholesterol and waist size.

Conclusion

The frequency that prediabetes occurs is high and expanding global which increases the trouble of cardiovascular disease and diabetes. The main course of treatment or preventative measure for prediabetes is to adhere to and sustain a healthy diet and lifestyle.

Keywords:

 Prediabetes, Global burden, Meta-analysis, Obesity, Diabetes.

Review Article

Introduction

The term "prediabetes" defined as individuals exhibit greater than normal glucose levels but doesn't fulfill the requirements for a diabetes diagnosis. **(Selvin et al., 2013)** HbA1c, IFG, and IGT level ranging from 5.6-7.4% (39–47 mmol/mol) are indicative of prediabetes in patients. Prediabetes poses anincreased chance of diabetes and cardiovascular disease (CVD) development as opposed to being considered a separate clinical condition. Prediabetes is linked to obesity, particularly visceral or abdominal obesity, high blood pressure, and dyslipidemia, which is accompanied by higher values of triglycerides or high density lipoprotein cholesterol levels with lower values **(ADA, 2020).** When it comes to overweight or obese adolescents and children, Diabetes Type 1 can still the most frequent cause of paediatric diabetes, and the clinician should consider it regardless of the children's body mass index (BMI). Prediabetes act as a precursor to Type-2 Diabetes in these individuals. This is especially true for children under the age of ten and/or those who are in the prepubertal stage **(Magge et al., 2020)**

Complications of Prediabetes

The pediatric obesity epidemic has led to the concentration of several cardio-metabolic risk factors (CMRFs) in young people. The occurrence of three or more CMRFs is indicative of metabolic syndrome (MetS). In U.S, Out of the 5633 teenagers 16.1% were found to have pre-diabetes, 4.7% had IGT, 4.5% had high HbA1c, and 11.4% had IFG. The updated NCEP standards revealed that odds ratios (ORs) exhibited an increase in cases of pre-diabetes as the number of CMRFs increased, with corresponding 95% confidence intervals (CIs) of 1.32, 2.07, 2.52, and 5.41 respectively, when compared to adolescents without CMRFs. These findings suggest that there is a correlation between the aggregation of CMRFs and American teenagers exhibit a greater incidence of pre-diabetes **(Liu et al., 2021)** .The collaboration between prediabetes and the trouble of cardiac events and total cause of death was observed in a study involving 28,643 patients with heart failure. This was discovered that heart failure patients with prediabetes had a worse prognosis. The occurrence of prediabetes varied across a range of values 9.6% - 37.2% among the study population. The existence of prediabetes in patients suffering from heart failure was associated with higher rates of heart failure hospitalization, cardiovascular mortality and overall cause of death during a median follow-up of 2.3 years **(Mai et al., 2021)**

Management of Prediabetes

The Programme to Prevent Diabetes was conducted in the United States for individuals with prediabetes revealed that embracing a wholesome lifestyle published a 58% lowering of the type 2 diabetes risk development, however using metformin only caused a 31% reduction in risk **(Knowler et al., 2002)** During a six-year observation period, the research revealed that among Chinese adults with impaired glucose tolerance (IGT), dietary modifications resulted in a 31% decrease in the progression to diabetes. Furthermore, engaging in regular exercise led to a 46% reduction, while a combination of both diet and exercise resulted in a 42% decrease in the development of diabetes **(Pan. et al., 1997)** .It is crucial to have pediatric statistics as T2DM in young individuals exhibits unique features. The study enrolled 111 were 10 to 17 year-olds people are fat or overweight and demonstrate prediabetes and symptoms of insulin resistance. Metformin was administered to the participants were subsequently randomized to receive either a moderate carb/higher-protein diet or a high-carb diet. The duration of this dietary intervention was six months. Additionally, an exercise intervention was implemented from month's four to six. An increase in the insulin sensitivity index was noted at the conclusion of the three-month period. Conversely, after 6 months, there was a reduction observed in both the insulin to glucose ratio and BMI. Nevertheless, it is crucial to highlight that there were no notable differences were found noticed amidst the different

nutritional groups **(Garnett et al., 2013)** This review seeks to establish the global prevalence of prediabetes by synthesizing the findings from relevant studies conducted on various continents.The significance of these discoveries is considerable as they can provide direction for the creation of interventions and policies to efficiently tackle the worldwide occurrence of prediabetes.

Methods

Search techniques

The guidelines were adhered to by the systematic review set by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses standards. To gather relevant articles, search of online databases like PubMed and Google Scholar to find pertinent literature. The search focused on articles published between 2019 and 2024. Keyword combinations such as "Prediabetes", ;"Adults"; "overweight", "prevalence", and "Diabetes" were utilized during the investigation.

Criteria for inclusion and exclusion

In order to be included in the meta-analysis, articles must meet certain criteria are as follows: (1) the studies included in the analysis were cross-sectional population-based studies conducted between 2013 and 2024, which stated that prediabetes was prevalent. (2) The studies considered eligible for inclusion involved adults aged 15 and above as participants. Studies that were not published in English were excluded from the meta-analysis. Furthermore, studies that only reported the frequency of prediabetes without providing data to calculate the 95% confidence interval, as well as studies with mixed reporting of prediabetes, were also excluded.

Data extraction

The articles found in databases underwent screening using keyword, title, and abstract. To methodically collect relevant data from every trial, a predefined and standardised data extraction form was used. This provided information on the study design, sample characteristics, study setting, year of publication, prediabetes prevalence and associated factors, and the identity of the first author.A random-effects meta-analysis framework was utilized to consolidate prevalence estimates from multiple studies, while accounting for the variability among these studies.The relevant articles were evaluated, and data extraction was performed from the eligible articles. The collected information was then stored in Microsoft Excel.

Results

As part of the literature review conducted between 2013 and 2024, a total of 41 articles were screened. In general, global prediabetes prevalence was 22.8%. The prediabetes prevalence was analyzed in 30 different countries, including Nepal, India, Central India- Gwalior Chambal region, Cameroon, Saudi Arabia-Jeddah, Malaysia, India-15 states ICMR INDIAB, India–adolescents, India-Bangalore, Iran, Vietnam, Pakistan, Faroe Islands (Denmark), Ethiopia, India-Mangalore, Turkey, UAE, India-East Delhi, Saudi Arabia-Al Kharj, Nigeria, Saudi Arabia, Cech republic, France, India-Chennai, Japan, England, India-Kerala, Ecuador, Mexico, and Indonesia. This review included a sum of 13,11,085 peoples aged between 18 and 89 years. The meta-analysis report revealed that Iran had the greater prevalence of prediabetes among countries with a sample size of less than 10,000 individuals (Figure 1), while India had the highest prevalence with a sample size greater than 10,000 individuals (Figure 2).

Prevalence of Prediabetes

In Iran, 25.4% prevalence of prediabetes was found with young people aged 35-70 years associated with specific ethnic background, obesity, old age people, and high waist to hip ratio (WHR) **(Hamoudi et al., 2019)** The 2020 report indicated that a significant number of individuals above the age of 40 had prediabetes, accounting for 76.4% with the overweight and obese condition **(Budiastutik et al., 2022).** In East China, the prevalence of prediabetes was 40.9%, and it was found that higher systolic blood pressure was the sole factornotably associated with anhigher risk of prediabetes **(Yu et al., 2020)** . In Nepal, among individuals aged 45-64 with HbA1c-based prediabetes, 5% followed an imbalanced diet, were non-smokers, did not consume alcohol, had hypertension, and had no diabetes in the family history **(Shakya et al., 2022)** . In France, the prediabetes weighted prevalence was 9.9% and 28.6% according to the standards established by the American Diabetes Association (ADA) and the World Health Organization (WHO) **(Lailler et al., 2022)** . In the Czech population, prediabetes prevalence in adults were 27.8%, and it was significantly associated with higher risks of overweight, hypertension, obesity, and low values of HDL and prevalence was significantly increased in lifestyle changes of marijuana, physical activity and alcohol drinking frequency **(Brož et al., 2020)** . In India, the prediabetes prevalence was 10.3% with age group of above 20 years and found higher prevalence of impaired fasting glucose compared to impaired glucose tolerance and independent risk factors for prevalence was based on the obesity, hypertension, and family history of diabetes (Kumar et al., 2020).36.9% of prediabetes prevalence among older adults with obese subjects, hypertension or hypertriglyceridemia **(Orces et al., 2018).** An urban slum of Bangalore was recorded with 11.57% of prediabetes prevalence increases which associated with diet habits, obesity, tobacco consumption and sedentary lifestyle **(Mainous et al., 2014).**
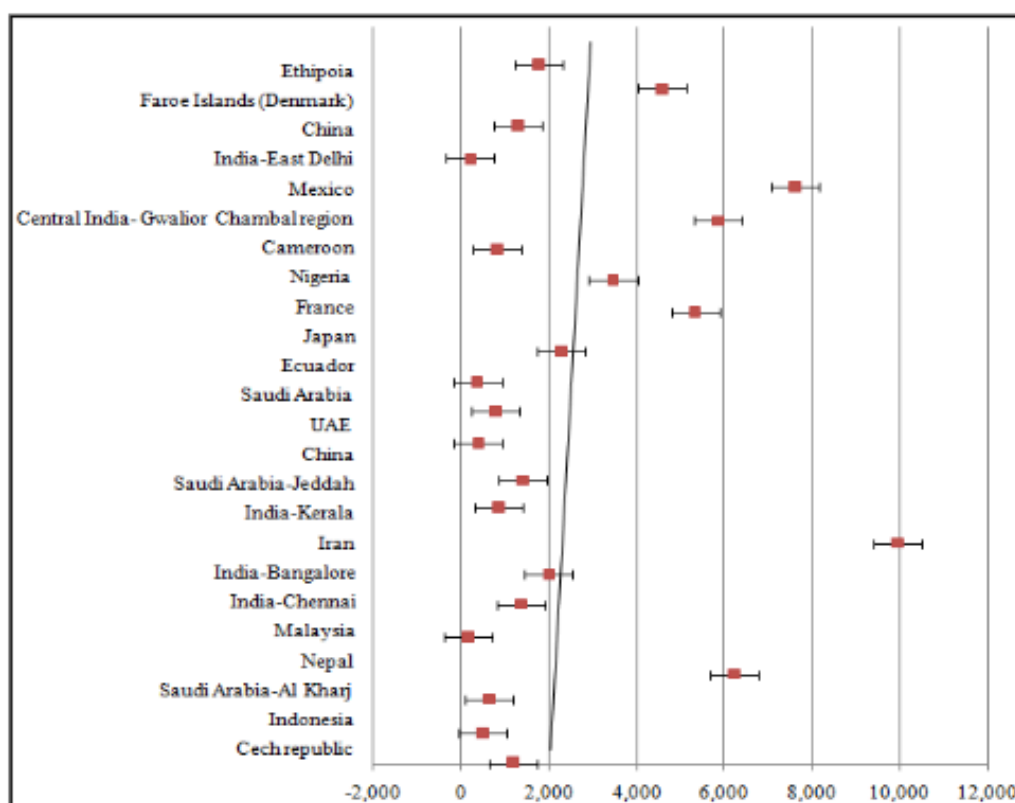
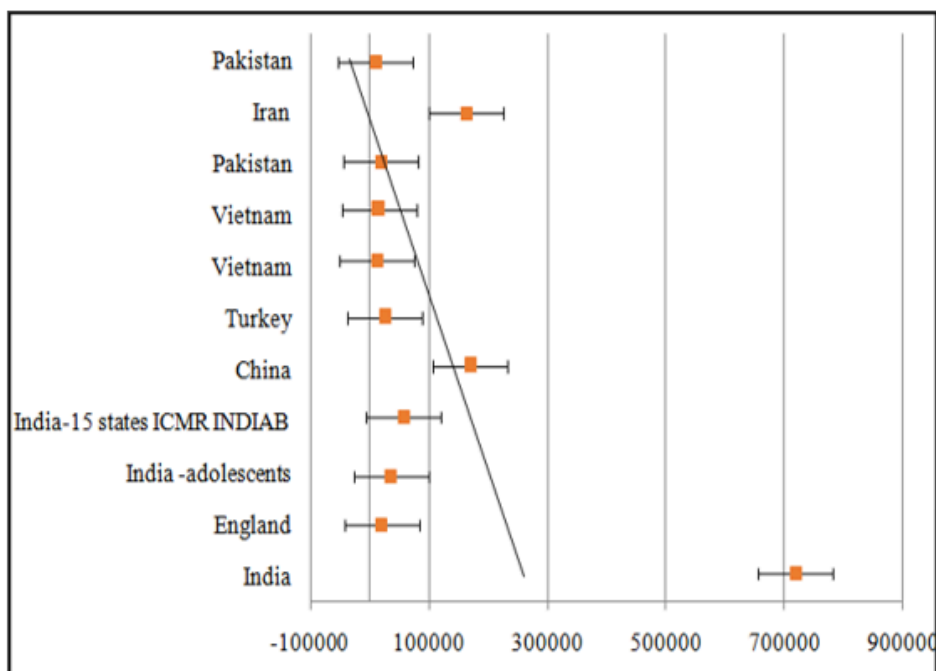Figure 1: Prevalence of Prediabetes among sample size less than 10,000

Figure 2: Prevalence of Prediabetes among sample size greater than 10,000

Conclusion:

The meta-analysis reveals that the prediabetes prevalence of worldwide is growing at a notable rate, resulting in an elevated risk of cardiovascular disease and diabetes development. Our research emphasizes the potential for enhanced monitoring of prediabetes epidemiologically and underscores the necessity for intensified initiatives to alleviate its worldwide impact.The primary approach to managing or preventing prediabetes is to consistently maintain a nutritious diet and adopt a healthy lifestyle.

Review Article

References:

Selvin, E., Rawlings, A. M., Bergenstal, R. M., Coresh, J., & Brancati, F. L. (2013). No racial differences in the association of glycated hemoglobin with kidney disease and cardiovascular outcomes. Diabetes care, 36(10), 2995–3001. https://doi.org/10.2337/dc12-2715

ADA (Am. Diabetes Assoc.).Classification and diagnosis of diabetes: Standards of Medical Care in Diabetes. Diabetes Care 2020;43(Suppl. 1):S14–31.

. Magge, S. N., Silverstein, J., Elder, D., Nadeau, K., & Hannon, T. S. (2020). Evaluation and Treatment of Prediabetes in Youth. The Journal of pediatrics, 219, 11–22. https://doi.org/10.1016/j.jpeds.2019.12.061

Liu, C., Wu, S., & Pan, X. (2021). Clustering of cardio-metabolic risk factors and pre-diabetes among U.S. adolescents. Scientific reports, 11(1), 5015. https://doi.org/10.1038/s41598-021-84128-6

. Mai, L., Wen, W., Qiu, M., Liu, X., Sun, L., Zheng, H., Cai, X., & Huang, Y. (2021). Association between prediabetes and adverse outcomes in heart failure. Diabetes, obesity & metabolism, 23(11), 2476–2483. https://doi.org/10.1111/dom.14490

Knowler, W. C., Barrett-Connor, E., Fowler, S. E., Hamman, R. F., Lachin, J. M., Walker, E. A., Nathan, D. M., & Diabetes Prevention Program Research Group (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. The New England journal of medicine, 346(6), 393–403. https://doi.org/10.1056/NEJMoa012512

Pan, X. R., Li, G. W., Hu, Y. H., Wang, J. X., Yang, W. Y., An, Z. X., Hu, Z. X., Lin, J., Xiao, J. Z., Cao, H. B., Liu, P. A., Jiang, X. G., Jiang, Y. Y., Wang, J. P., Zheng, H., Zhang, H., Bennett, P. H., &Howard, B. V. (1997). Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance. The Da Qing IGT and Diabetes Study. Diabetes care, 20(4), 537–544. https://doi.org/10.2337/diacare.20.4.537

Garnett, S. P., Gow, M., Ho, M., Baur, L. A., Noakes, M., Woodhead, H. J., Broderick, C. R., Burrell, S., Chisholm, K., Halim, J., De, S., Steinbeck, K., Srinivasan, S., Ambler, G. R., Kohn, M. R., & Cowell, C. T. (2013). Optimal macronutrient content of the diet for adolescents with prediabetes; RESIST a randomised control trial. The Journal of clinical endocrinology and metabolism, 98(5), 2116–2125. https://doi.org/10.1210/jc.2012-4251.

Orces, C. H., & Lorenzo, C. (2018). Prevalence of prediabetes and diabetes among older adults in Ecuador: Analysis of the SABE survey. Diabetes & metabolic syndrome, 12(2), 147–153. https://doi.org/10.1016/j.dsx.2017.12.002.

. Lailler, G., Piffaretti, C., Fuentes, S., Nabe, H. D., Oleko, A., Cosson, E., & Fosse-Edorh, S. (2020). Prevalence of prediabetes and undiagnosed type 2 diabetes in France: Results from the national survey ESTEBAN, 2014-2016. Diabetes research and clinical practice, 165, 108252. https://doi.org/10.1016/j.diabres.2020.108252.

Brož, J., Malinovská, J., Nunes, M. A., Kučera, K., Rožeková, K., Žejglicová, K., Urbanová, J., Jenšovský, M., Brabec, M., &Lustigová, M. (2020). Prevalence of diabetes and prediabetes and its risk factors in adults aged 25-64 in the Czech Republic: A cross-sectional study. Diabetes research and clinical practice, 170, 108470. https://doi.org/10.1016/j.diabres.2020.108470.

Chowdhury, A. & S, . D. K. (2019) Prevalence and risk factor of prediabetes: A cross-sectional study among young medical students in Mangalore. National Journal of Physiology, Pharmacy and Pharmacology, 9 (5), 405-410. doi:10.5455/njppp.2019.9.0206110032019

Review Article

Mukai, N., Hata, J., Hirakawa, Y., Ohara, T., Yoshida, D., Nakamura, U., Kitazono, T., & Ninomiya, T. (2018). Trends in the prevalence of type 2 diabetes and prediabetes in a Japanese community, 1988-2012: the Hisayama Study. Diabetology international, 10(3), 198–205. https://doi.org/10.1007/s13340-018-0380-0.

Aldossari, K. K., Aldiab, A., Al-Zahrani, J. M., Al-Ghamdi, S. H., Abdelrazik, M., Batais, M. A., Javad, S., Nooruddin, S., Razzak, H. A., & El-Metwally, A. (2018). Prevalence of Prediabetes, Diabetes, and Its Associated Risk Factors among Males in Saudi Arabia: A Population-Based Survey. Journal of diabetes research, 2018, 2194604. https://doi.org/10.1155/2018/2194604.

Budiastutik, I., Kartasurya, M. I., Subagio, H. W., &Widjanarko, B. (2022). High Prevalence of Prediabetes and Associated Risk Factors in Urban Areas of Pontianak, Indonesia: A Cross-Sectional Study. Journal of obesity, 2022, 4851044. https://doi.org/10.1155/2022/4851044.

Yu, X., Duan, F., Lin, D., Li, H., Zhang, J., Wang, Q., Wang, X., Zhao, Q., Deng, J., Song, G., Ji, Q., Zheng, H., Chen, X., & Zhou, G. (2020). Prevalence of Diabetes, Prediabetes, and Associated Factors in an Adult Chinese Population: Baseline of a Prediabetes Cohort Study. International journal of endocrinology, 2020, 8892176. https://doi.org/10.1155/2020/8892176.

Das, A. S. (2021). A study to assess the prevalence of pre-diabetic among adults residing in selected village at Unnamalaikadai, Kanyakumari District, Tamilnadu. International Journal of Midwifery Nursing, 4(2), 1–6.

Al-Zahrani, J. M., Aldiab, A., Aldossari, K. K., Al-Ghamdi, S., Batais, M. A., Javad, S., Nooruddin, S., Zahid, N., Razzak, H. A., & El-Metwally, A. (2019). Prevalence of Prediabetes, Diabetes and Its Predictors among Females in Alkharj, Saudi Arabia: A Cross-Sectional Study. Annals of global health, 85(1), 109. https://doi.org/10.5334/aogh.2467.

Mangurian, C. V., Schillinger, D., Newcomer, J. W., Vittinghoff, E., Essock, S. M., Zhu, Z., Dyer, W. T., &Schmittdiel, J. A. (2018). Diabetes and Prediabetes Prevalence by Race and Ethnicity Among People With Severe Mental Illness. Diabetes care, 41(7), e119–e120. https://doi.org/10.2337/dc18-0425.

Basit, A., Fawwad, A., Qureshi, H., Shera, A. S., & NDSP Members (2018). Prevalence of diabetes, pre-diabetes and associated risk factors: second National Diabetes Survey of Pakistan (NDSP), 2016-2017. BMJ open, 8(8), e020961. https://doi.org/10.1136/bmjopen-2017-020961.

Aamir, A. H., Ul-Haq, Z., Mahar, S. A., Qureshi, F. M., Ahmad, I., Jawa, A., Sheikh, A., Raza, A., Fazid, S., Jadoon, Z., Ishtiaq, O., Safdar, N., Afridi, H., & Heald, A. H. (2019). Diabetes Prevalence Survey of Pakistan (DPS-PAK): prevalence of type 2 diabetes mellitus and prediabetes using HbA1c: a population-based survey from Pakistan. BMJ open, 9(2), e025300. https://doi.org/10.1136/bmjopen-2018-025300.

Shakya, P., Shrestha, A., Karmacharya, B. M., Shrestha, A., Kulseng, B. E., Skovlund, E., & Sen, A. (2022). Prevalence of prediabetes and associated factors of prediabetic stages: a cross-sectional study among adults in Nepal. BMJ open, 12(12), e064516. https://doi.org/10.1136/bmjopen-2022-064516.

Ton, T. T., Tran, A. T. N., Do, I. T., Nguyen, H., Nguyen, T. T. B., Nguyen, M. T., Ha, V. A. B., Tran, A. Q., Hoang, H. K., & Tran, B. T. (2020). Trends in prediabetes and diabetes prevalence and associated risk factors in Vietnamese adults. Epidemiology and health, 42, e2020029. https://doi.org/10.4178/epih.e2020029.

Chandrupatla, S. G., Khalid, I., Muthuluri, T., Dantala, S., & Tavares, M. (2020). Diabetes and prediabetes prevalence among young and middle-aged adults in India, with an analysis of geographic differences: findings from the National Family Health Survey. Epidemiology and health, 42, e2020065. https://doi.org/10.4178/epih.e2020065.

Review Article

Rahim, F. F., Abdulrahman, S. A., Kader Maideen, S. F., & Rashid, A. (2020). Prevalence and factors associated with prediabetes and diabetes in fishing communities in penang, Malaysia: A cross-sectional study. PloS one, 15(2), e0228570. https://doi.org/10.1371/journal.pone.0228570.

Zhao, M., Lin, H., Yuan, Y., Wang, F., Xi, Y., Wen, L. M., Shen, P., & Bu, S. (2016). Prevalence of Pre-Diabetes and Its Associated Risk Factors in Rural Areas of Ningbo, China. International journal of environmental research and public health, 13(8), 808. https://doi.org/10.3390/ijerph13080808.

Subramani, S. K., Yadav, D., Mishra, M., Pakkirisamy, U., Mathiyalagen, P., & Prasad, G. (2019). Prevalence of Type 2 Diabetes and Prediabetes in the Gwalior-Chambal Region of Central India. International journal of environmental research and public health, 16(23), 4708. https://doi.org/10.3390/ijerph16234708.

Kodali, V. R. R., & Ali, I. (2016). Prediabetes: The cat is out! International Journal of Diabetes in Developing Countries, 36(2), 143–145. https://doi.org/10.1007/s13410-016-0513-6

Bigna, J. J., Nansseu, J. R., Katte, J. C., &Noubiap, J. J. (2018). Prevalence of prediabetes and diabetes mellitus among adults residing in Cameroon: A systematic review and meta-analysis. Diabetes research and clinical practice, 137, 109–118. https://doi.org/10.1016/j.diabres.2017.12.005.

Akhtar, S., Nasir, J. A., Ali, A., Asghar, M., Majeed, R., & Sarwar, A. (2022). Prevalence of type-2 diabetes and prediabetes in Malaysia: A systematic review and meta-analysis. PloS one, 17(1), e0263139. https://doi.org/10.1371/journal.pone.0263139.

Madhu, S. V., Sandeep, G., Mishra, B. K., & Aslam, M. (2018). High prevalence of diabetes, prediabetes and obesity among residents of East Delhi - The Delhi urban diabetes survey (DUDS). Diabetes & metabolic syndrome, 12(6), 923–927. https://doi.org/10.1016/j.dsx.2018.05.016.

Pham, N. M., & Eggleston, K. (2016). Prevalence and determinants of diabetes and prediabetes among Vietnamese adults. Diabetes research and clinical practice, 113, 116–124. https://doi.org/10.1016/j.diabres.2015.12.009.

Mukai, N., Doi, Y., Ninomiya, T., Hirakawa, Y., Nagata, M., Yoshida, D., Hata, J., Fukuhara, M., Nakamura, U., Kitazono, T., & Kiyohara, Y. (2014). Trends in the prevalence of type 2 diabetes and prediabetes in community-dwelling Japanese subjects: The Hisayama Study. Journal of diabetes investigation, 5(2), 162–169. https://doi.org/10.1111/jdi.12136.

Anjana, R. M., Shanthi Rani, C. S., Deepa, M., Pradeepa, R., Sudha, V., Divya Nair, H., Lakshmipriya, N., Subhashini, S., Binu, V. S., Unnikrishnan, R., & Mohan, V. (2015). Incidence of Diabetes and Prediabetes and Predictors of Progression Among Asian Indians: 10-Year Follow-up of the Chennai Urban Rural Epidemiology Study (CURES). Diabetes care, 38(8), 1441–1448. https://doi.org/10.2337/dc14-2814.

Dasappa, H., Fathima, F. N., Prabhakar, R., & Sarin, S. (2015). Prevalence of diabetes and pre-diabetes and assessments of their risk factors in urban slums of Bangalore. Journal of family medicine and primary care, 4(3), 399–404. https://doi.org/10.4103/2249-4863.161336.

Mainous, A. G., 3rd, Tanner, R. J., Baker, R., Zayas, C. E., & Harle, C. A. (2014). Prevalence of prediabetes in England from 2003 to 2011: population-based, cross-sectional study. BMJ open, 4(6), e005002. https://doi.org/10.1136/bmjopen-2014-005002.

Rooney, M. R., Fang, M., Ogurtsova, K., Ozkan, B., Echouffo-Tcheugui, J. B., Boyko, E. J., Magliano, D. J., & Selvin, E. (2023). Global Prevalence of Prediabetes. Diabetes care, 46(7), 1388–1394. https://doi.org/10.2337/dc22-2376.

Anjana, R. M., Deepa, M., Pradeepa, R., Mahanta, J., Narain, K., Das, H. K., Adhikari, P., Rao, P. V., Saboo, B., Kumar, A., Bhansali, A., John, M., Luaia, R., Reang, T., Ningombam, S., Jampa, L., Budnah, R. O., Elangovan, N., Subashini, R., Venkatesan, U., ... ICMR–INDIAB Collaborative Study Group (2017). Prevalence of diabetes and prediabetes in 15 states of India: results from the ICMR-INDIAB

Collaborative Study Group (2017). Prevalence of diabetes and prediabetes in 15 states of India: results from the ICMR-INDIAB population-based cross-sectional study. The lancet. Diabetes & endocrinology, 5(8), 585–596. https://doi.org/10.1016/S2213-8587(17)30174-2.

Kumar, P., Srivastava, S., Mishra, P. S., &Mooss, E. T. K. (2021). Prevalence of pre-diabetes/type 2 diabetes among adolescents (10-19 years) and its association with different measures of overweight/obesity in India: a gendered perspective. BMC endocrine disorders, 21(1), 146. https://doi.org/10.1186/s12902-021-00802-w.

.   Najafipour, H., Farjami, M., Sanjari, M., Amirzadeh, R., Shadkam Farokhi, M., & Mirzazadeh, A. (2021). Prevalence and Incidence Rate of Diabetes, Pre-diabetes, Uncontrolled Diabetes, and Their Predictors in the Adult Population in Southeastern Iran: Findings From KERCADR Study. Frontiers in public health, 9, 611652. https://doi.org/10.3389/fpubh.2021.611652.

Vijayakumar, G., Manghat, S., Vijayakumar, R., Simon, L., Scaria, L. M., Vijayakumar, A., Sreehari, G. K., Kutty, V. R., Rachana, A., & Jaleel, A. (2019). Incidence of type 2 diabetes mellitus and prediabetes in Kerala, India: results from a 10-year prospective cohort. BMC public health, 19(1), 140. https://doi.org/10.1186/s12889-019-6445-6.

Bahijri, S. M., Jambi, H. A., Al Raddadi, R. M., Ferns, G., &Tuomilehto, J. (2016). The Prevalence of Diabetes and Prediabetes in the Adult Population of Jeddah, Saudi Arabia--A Community-Based Survey. PloS one, 11(4), e0152559. https://doi.org/10.1371/journal.pone.0152559.

Endris, T., Worede, A., & Asmelash, D. (2019). Prevalence of Diabetes Mellitus, Prediabetes and Its Associated Factors in Dessie Town, Northeast Ethiopia: A Community-Based Study. Diabetes, metabolic syndrome and obesity : targets and therapy, 12, 2799–2809. https://doi.org/10.2147/DMSO.S225854.

.   Satman, I., Omer, B., Tutuncu, Y., Kalaca, S., Gedik, S., Dinccag, N., Karsidag, K., Genc, S., Telci, A., Canbaz, B., Turker, F., Yilmaz, T., Cakir, B., Tuomilehto, J., & TURDEP-II Study Group (2013). Twelve-year trends in the prevalence and risk factors of diabetes and prediabetes in Turkish adults. European journal of epidemiology, 28(2), 169–180. https://doi.org/10.1007/s10654-013-9771-5

Khamseh, M. E., Sepanlou, S. G., Hashemi-Madani, N., Joukar, F., Mehrparvar, A. H., Faramarzi, E., Okati-Aliabad, H., Rahimi, Z., Rezaianzadeh, A., Homayounfar, R., Moradpour, F., Valizadeh, N., Kheirandish, M., Zaboli, E., Moslem, A., Ahmadi, A., Hamzeh, B., Harooni, J., Pourfarzi, F., Abolghasemi, M. R., ... Malekzadeh, R. (2021). Nationwide Prevalence of Diabetes and Prediabetes and Associated Risk Factors Among Iranian Adults: Analysis of Data from PERSIAN Cohort Study. Diabetes therapy : research, treatment and education of diabetes and related disorders, 12(11), 2921–2938. https://doi.org/10.1007/s13300-021-01152-5.

Hamoudi, R., Saheb Sharif-Askari, N., Saheb Sharif-Askari, F., Abusnana, S., Aljaibeji, H., Taneera, J., & Sulaiman, N. (2019). Prediabetes and diabetes prevalence and risk factors comparison between ethnic groups in the United Arab Emirates. Scientific reports, 9(1), 17437. https://doi.org/10.1038/s41598-019-53505-7.

Robles-Ordaz, M. D., Gallegos-Aguilar, A. C., Urquidez-Romero, R., Diaz-Zavala, R. G., Lavandera-Torres, M. G., & Esparza-Romero, J. (2018). Prevalence of prediabetes and modifiable factors in an ethnic group of Mexico: the Comcáac Project. Public health nutrition, 21(2), 333–338. https://doi.org/10.1017/S1368980017002658.

Mirahmadizadeh, A., Fathalipour, M., Mokhtari, A. M., Zeighami, S., Hassanipour, S., &Heiran, A. (2020). The prevalence of undiagnosed type 2 diabetes and prediabetes in Eastern Mediterranean region (EMRO): A systematic review and meta-analysis. Diabetes research and clinical practice, 160, 107931. https://doi.org/10.1016/j.diabres.2019.107931.

OPEN ACCESS

Review Article

Wang, L., Gao, P., Zhang, M., Huang, Z., Zhang, D., Deng, Q., Li, Y., Zhao, Z., Qin, X., Jin, D., Zhou, M., Tang, X., Hu, Y., & Wang, L. (2017). Prevalence and Ethnic Pattern of Diabetes and Prediabetes in China in 2013. JAMA, 317(24), 2515–2523. https://doi.org/10.1001/jama.2017.7596.

xxxxxxxxxxxxxx-----------------------xxxxxxxxxxxxxxxxx

CITE THIS ARTICLE (APA FORMAT):

Anusuya, M., Kumar, S., Krishnan, V., Thirumal & Jane, S. M. (2024). An Extensive Meta-analysis of Prediabetes Prevalence on a Global Scale. Asian Journal of Nutrition & Food Sciences, 1(5): pp: 26-35. DOI: https://doi.org/10.5281/zenodo.13709604