Original Article

Prevalence of Modifiable Risk Factors Associated with Diabetes in Indian Adolescents and Young Adults: A Pilot Study

V. Venugopal, Judu V. Ilavarasu[1], A. Mooventhan[2]

Departments of Yoga and [2]Research and Development, Government Yoga and Naturopathy Medical College, Chennai, Tamil Nadu, [1]Division of Yoga and Physical Sciences, SVYASA (Deemed to be University), Bengaluru, Karnataka, India

Abstract

Introduction: This was a cross sectional study to understand the prevalence of modifiable risk factors of diabetes among adolescents and young adults in India. **Materials and Methods:** The pilot study was carried out using a questionnaire based survey. A literature review was performed to explore the common risk factors associated with type 2 diabetes mellitus and a self administered questionnaire was developed and validated. The snowball sampling method was applied and the questionnaire was sent through E mails, social networking sites, and applications. **Results:** A total of 317 young adults and adolescents, aged between 16 and 25 years, across eight different states of India completed the survey. Among the various risk factors, 64.04% had normal healthy sleeping hours of 6–8 h, and 71.61% happy with the sleep quality. Only 23.08% skipped breakfast more than three times a week and 40.69% reported to consume whole grains every day. About 68.46% had little or no stress. The major concern was the low of physical activity (>150 min/week) and inadequate fruit intake (>1 serving a day) among 75.1% and 81.07% of respondents, respectively. **Conclusion:** Low physical activity and inadequate fruit intake are the important risk factors prevalent in the given age group.

Keywords: Lifestyle, physical activity, risk factors, type 2 diabetes mellitus, young adults

Introduction

The increase in the incidence of type 2 diabetes mellitus (T2DM) is attributable to various factors such as genetic predisposition, rapid urbanization, smoking, and intake of diet rich in refined carbohydrates, sugar-sweetened beverages (SSBs), sedentary lifestyle, and obesity.[1] The World Health Organization (WHO) urges the health decision makers to develop effective strategies to pause the steady rise in noncommunicable diseases (NCDs) through proper control of risk factors.[2] There are several lifestyle interventions that are being interrogated for their efficacy to prevent the incidence and effective management of complications of T2DM. Studies in the past have suggested that simple lifestyle modifications delay the onset of diabetes mellitus by 11 years when compared to metformin, which was able to delay it only by a span of 3 years.[3] However, risk factors for any given condition might vary in different ethnic populations.[4,5] Indians especially have multiple risk factors making them more prone to T2DM when compared to Caucasian counterparts.[6] Rapid physical and psychological changes are quite common in adolescents and young adults due to increasing demand from peers, family, and society, and it is well documented that the behaviors developed during this period have a bigger impact on health in adulthood.[7] The lifestyle of adolescents and young adults is complex, which increases the significance of the current study conducted on the Indian population aged between 16 and 25 years.

Materials and Methods

The study design

A cross-sectional study design was adopted for this study. All the participants were asked to provide their response to

Submitted: 27-Jul-2020 **Accepted:** 16-Oct-2020. **Published:** 22-Dec-2020

Access this article online

Quick Response Code:

Website: www.actamedicainternational.com

DOI: 10.4103/ami.ami_124_20

Address for correspondence: Dr. A. Mooventhan, Department of Research and Development, Government Yoga and Naturopathy Medical College, Chennai, Tamil Nadu, India. E-mail: dr.mooventhan@gmail.com

How to cite this article: Venugopal V, Ilavarasu JV, Mooventhan A. Prevalence of modifiable risk factors associated with diabetes in indian adolescents and young adults: A pilot study. Acta Med Int 2020;7:108-12.

a questionnaire-based survey at only one point in time. The analysis was performed after completion of the study.

Study settings

The study was carried out at Anvesana laboratories, SVYASA (Deemed to be University), Bengaluru, India.

Participants

A total of 317 participants aged between 16 and 25 years from eight different states of India were recruited through the snowball sampling method based on the following inclusion and exclusion criteria. Male and female adolescents and young adults of Indian citizen who are willing to provide their response to the specified questionnaire through social media and willing to participate in the study were included. Nonresident Indians, participants with a history of diabetes and other systemic illness, and mental illness were excluded from the study. The study protocol was approved by the Institutional Ethics Committee (IEC) of SVYASA (Deemed to be University) (IEC approval Number: RES/IEC-SVYASA/74/2015) and informed consent was obtained from the participants.

Assessments

The assessment was taken using a questionnaire related to various modifiable risk factors associated with T2DM. An initial literature search was performed to identify the various risk factors associated with T2DM, in PubMed, Medline, and Google Scholar. Questions were framed under four major domains, namely diet, physical activity, sleep, and stress. After framing the questions, it was sent to 25 subject matter experts (SMEs) for construct validity. SMEs were selected based on the criteria of being endocrinologists, with a minimum of five research publications in peer-reviewed journals. The response was obtained from 16, out of the 25 SMEs to whom the questions were sent (64%). After framing the final set of questionnaires, it was digitalized and sent to respondents across the country, through the snowball sampling method.

A total of 12 close-ended questions were asked along with demography details. Social networking sites and mobile applications were used for the same. Every question was carrying a brief description of one or two lines explaining the question further. For example, an explanation of what "one serving size of fruit" means, what are "whole and refined grains," etc.

Data analysis

Responses received from the assessment were pooled together in Microsoft Excel. Descriptive statistics were performed and the sample data (demographic details and the response to the questionnaire) were presented in frequency and percentage using Statistical Package for the Social Sciences (SPSS) for Windows, Version 16.0. Chicago, SPSS Inc.

Results

A total of 317 participants from eight different states of India responded to the questions. The demographic details of the respondents are provided in Table 1. On skipping breakfast, 38.43% of respondents said that they never skip breakfast and another 38.49% skip only once or twice per week. About 81.07% take <1 serving, whereas 16.72% take 2–3 servings, and only 2.21% take >5 servings of fruit in a day. Consumption of carbonated drinks was less, as 34.7% said that they hardly consume carbonated drinks and 41.32% said that they drink only once or twice per week. Whole-grain consumption was a part of everyday diet in 40.69% and 17.67% mentioned that whole grains are rarely part of their diet. On taking refined flour products, 61.20% responded that they take 1–3 days/week, whereas 26.50% take rarely, 6.31% take 4–6 days/week, and 5.99% take almost every day. No structured physical activity or outdoor sports activity was reported in 33.4% of respondents. Another 41.64% did 30–90 min of physical activity in a week, whereas only 9.78% and 15.14% did 90–150 min and >150 min of physical activity in a week. Around 63.1% of respondents mentioned that their usual mode of transport was either two-wheeler or a four-wheeler and only 36.9% of individuals in this particular age group preferred using public transport or commuting by walk. Six to 8 h of sleep was reported by 64.04% of respondents. About 71.61% are happy with their

Table 1: Demographic details of the study participants

Parameters	*n* (%)
Age group	
Adolescence (16-18)	89 (28.10)
Early adulthood (19-25)	228 (71.90)
Education	
School going	65 (20.50)
College going	222 (70.03)
Postgraduate	26 (8.20)
Working	4 (1.26)
City/town	
Rural	141 (44.48)
Urban	176 (55.52)
Gender	
Male	136 (42.90)
Female	181 (57.10)
State	
Andhra Pradesh	36 (11.36)
Bihar	21 (6.62)
Gujarat	28 (8.83)
Karnataka	68 (21.45)
Kerala	37 (11.67)
Maharashtra	22 (6.94)
Tamil Nadu	68 (21.45)
Uttar Pradesh	37 (11.67)
Family history	
None	116 (36.59)
Either or	126 (39.75)
Both	75 (23.66)
Socioeconomic status - Total family income	
Low (<Rs. 2 lakhs/annum)	185 (58.36)
Medium (Rs. 2-5 lakhs/annum)	87 (27.44)
High income (>Rs. 5 lakhs/annum)	45 (14.20)

Table 2: Participants' responses to the questionnaire assessed in the study

Parameters	Participant responded, *n* (%)
Skipping breakfast/week	
Never	125 (39.43)
1-2 days	122 (38.49)
3-5 days	35 (11.04)
Almost everyday	35 (11.04)
Fruit intake/day	
0-1 serving	257 (81.07)
2-3 servings	53 (16.72)
5 or more servings	7 (2.21)
Carbonated drinks/week	
Never	110 (34.70)
Up to 400 mL	131 (41.32)
Up to 1000 mL	68 (21.45)
>1000 ml	8 (2.52)
Whole grains intake/week	
Rarely	56 (17.67)
1-3 days	106 (33.44)
4-6 days	26 (8.20)
Almost everyday	129 (40.69)
Refined flour products intake/week	
Rarely	84 (26.50)
1-3 days	194 (61.20)
4-6 days	20 (6.31)
Almost everyday	19 (5.99)
Exercise/outdoor sports activity/week	
<30 min	106 (33.44)
30-90 min	132 (41.64)
90-150 min	31 (9.78)
>150 min	48 (15.14)
Mode of transport	
By walk	60 (18.93)
Public transport	57 (17.98)
Two-wheeler	162 (51.10)
Four-wheeler	38 (11.99)
Stress	
No stress	58 (18.30)
Mild stress	159 (50.16)
Moderate stress	92 (29.02)
Severe stress	8 (2.52)
Sleeping h/day (h)	
>6	82 (25.87)
6-8	203 (64.04)
8-9	30 (9.46)
>9	1 (0.32)
Overall sleep quality (subjective)	
Happy	227 (71.61)
Unhappy	90 (28.39)

quality of sleep. Mild or no stress was perceived by 68.46% of respondents [Table 2].

Discussion

Lifestyle plays a significant role in the development of Type 2 diabetes. There are numerous modifiable risk factors that are attributed to the increased prevalence of T2DM. It is well documented that Indians are more prone to T2DM than Caucasians, and the increased risk is not merely due to the nonmodifiable genetic risk factors.[6] Modifiable risk factors such as diet and physical activity also play an important role in the increased prevalence of T2DM.[8] Early intervention might probably help prevent T2DM and metabolic syndrome better. The current study was conducted on Indian adolescents and young adults to understand the degree of exposure to various risk factors of T2DM. Skipping breakfast more than three times a week increases the risk of obesity and T2DM.[9] About 38.43% of respondents in our study mentioned that they never skip breakfast and another 38.49% reported that they skip once or twice a week. Whole-grain consumption reduces the risk of diabetes.[10,11] Around 40.69% mentioned that whole grains are a part of their everyday meal. Carbonated and SSBs are the other dietary risk factors that increase the risk of T2DM.[12,13] Consumption of one serving of carbonated drink per day increases the risk of T2DM by 26%,[14] but 34.7% of the respondents had reported that they hardly consume carbonated drinks and another 41.32% said that they drink only once or twice per week.

Sleep duration and quality of sleep are gaining increasing significance as an important risk factor in the pathogenesis of T2DM.[15] Sleep duration has a "U-shaped" relation with the risk of diabetes. Sleeping <6 h or >8 h increases the risk of diabetes.[16] In our study, 64.04% of respondents reported to have the optimum sleep of 6–8 h every day and 71.61% were happy with the quality of sleep.

The major concern in the given sample which constituted mostly young adults (71.9%) and school-going adolescents (28.1%) is the lack of physical activity. No structured physical activity or outdoor sports activity was observed in 33.4% of respondents. Another 41.64% did 30–90 min of physical activity in a week which is below the American Diabetes Association recommendation of 150 min physical exercise per week.[17] The findings are in line with the findings of a previous large-scale study in India, in which 54.4% were found to be not physically active.[8] Reduced physical activity had been reported in adolescents of other ethnic groups as well.[18,19] Another interesting observation in the study was the preferred mode of transport in particular adolescence and young adults' age group. Around 63.1% of respondents mentioned that they use either a two-wheeler or a four-wheeler for commuting and only 36.9% preferred using public transport or commuting by walk. Thus, reduced physical activity seems to be the strongest risk factor observed in the given adolescent and young adult population.

An increase in fruit consumption is associated with the reduction in body weight, waist circumference,[20] and T2DM risk.[21,22] Higher fruit intake was associated with significantly lower fasting blood insulin, homeostatic model assessment of insulin resistance, and risk of developing diabetes by 12%

compared to nonconsumers. Likewise, consuming fresh fruit more than 3 days/week was associated with a 13%–28% lower risk of developing diabetes-related complications affecting large blood vessels (e.g., ischemic heart disease and stroke) and small blood vessels (i.e., kidney diseases, eye diseases, and neuropathy) compared to consuming fresh fruit <1 day/week.[20] In addition, the dose-response relations also indicate that relatively high fruit may still decrease the risk of T2DM. To minimize the risk of dietary factors and reduce the incidence of T2DM; The WHO has recommended the public for consuming more than 400 g or five servings of fruit and vegetable per day.[22] In the present study, 81.07% of respondents reported that they take <1 serving, whereas 16.72% take 2–3 servings, and only 2.21% take >5 servings of fruit in a day. This suggests that inadequate fruit intake is also an important risk factor contributing to the increased incidence of T2DM in India. In summary, the current study was conducted on respondents from eight different states across India. Reduced physical activity and inadequate fruit intake seem to be the most common risk factors observed in the given adolescent and young adult population.

With the increasing prevalence of diabetes in India, there is a growing need for a public health strategy to address the problem of physical inactivity in this age group and prevent T2DM. The promotion of physical activity is an essential public health and health promotion strategy to improve the health of individuals.[2] Likewise, school-based programs on healthy lifestyle and improved physical activity would be beneficial. A large systematic review conducted on 36,593 children and adolescents suggested that school-based physical activity promotion programs are effective in increasing the duration of physical activity and reduce time spent watching television.[23] A combination of school-based and community-based health promotion programs might have a synergistic effect in improving the health status and would prevent childhood obesity and T2DM.

Strengths and limitations

The main strength of the study is focusing exclusively on the adolescent and young adult population. Several health-compromising behaviors and health-enhancing behaviors adopted in adolescence often persist into adulthood.[7] Early dietary modifications and improved physical activity would be beneficial not only in overcoming childhood obesity but also help in preventing metabolic syndrome and T2DM.[24-26] Targeting this particular age group and improving their lifestyle would be of greater significance, especially while designing and implementing lifestyle modification strategies in nationwide diabetes prevention programs. In this study, we had also piloted on the usage of social media as an effective health tool to recruit using the snowball sampling method. Our initial concern was whether the questionnaires would reach low-socioeconomic and rural parts of the country. To our surprise, 44.5% of the respondents were from rural parts of the country and 58.4% of the respondents were from low socioeconomic status. One of the limitations of the study is responses given by the respondents were "subjective" and thus might be less reliable than objective ways of measuring. Second is the unavailability of data from the remaining states of the country. The data used in the current pilot study are only from eight of the 29 states in India. Representative samples from all the states of the country would possibly be obtained in our main study.

Conclusion

Among the various risk factors of diabetes, lack of physical activity and inadequate fruit intake seem to be the major risk factors of this particular adolescent and young adult group. Promoting physical activity in the form of sports or other community activity and adequate fruit intake is essential to prevent the increase in the prevalence of NCDs in developing countries like India. Large-scale studies across the country are required to consolidate our findings.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Hu FB. Globalization of diabetes: The role of diet, lifestyle, and genes. Diabetes Care 2011;34:1249-57.
2. Global Strategy on Diet, Physical Activity and Health. World Health Organization; 2014. Available from: https://apps.who.int/gb/archive/pdf_files/WHA59/A59_23-en.pdf?ua=1." [Accessed on 25 October 2020].
3. Herman WH, Hoerger TJ, Brandle M, Hicks K, Sorensen S, Zhang P, *et al*. The cost-effectiveness of lifestyle modification or metformin in preventing type 2 diabetes in adults with impaired glucose tolerance. Ann Intern Med 2005;142:323-32.
4. Tillin T, Hughes AD, Wang Q, Würtz P, Ala-Korpela M, Sattar N, *et al*. Diabetes risk and amino acid profiles: Cross-sectional and prospective analyses of ethnicity, amino acids and diabetes in a South Asian and European cohort from the SABRE (Southall and Brent REvisited) Study. Diabetologia 2015;58:968-79.
5. Kanaya AM, Herrington D, Vittinghoff E, Ewing SK, Liu K, Blaha MJ, *et al*. Understanding the high prevalence of diabetes in U.S. South Asians compared with four racial/ethnic groups: The MASALA and MESA studies. Diabetes Care 2014;37:1621-8.
6. Vijayakumar V, Mavathur R, Sharma MNK. Ethnic disparity and increased prevalence of type 2 diabetes among South Asians: Aetiology and future implications for diabetes prevention and management. Curr Diabetes Rev 2018;14:518-22.
7. Qidwai W, Ishaque S, Shah S, Rahim M. Adolescent lifestyle and behaviour: A survey from a developing country. PLoS One 2010;5:e12914.
8. Anjana RM, Deepa M, Pradeepa R, Mahanta J, Narain K, Das HK, *et al*. Prevalence of diabetes and prediabetes in 15 states of India: Results from the ICMR–INDIAB population-based cross-sectional study. Lancet Diabetes Endocrinol 2017;5:585-96.
9. Sjöberg A, Hallberg L, Höglund D, Hulthén L. Meal pattern, food choice, nutrient intake and lifestyle factors in The Göteborg Adolescence Study. Eur J Clin Nutr 2003;57:1569-78.
10. Jannasch F, Kröger J, Schulze MB. Dietary patterns and type 2 diabetes: A systematic literature review and meta-analysis of prospective studies. J Nutr 2017;147:1174-82.
11. Aune D, Norat T, Romundstad P, Vatten LJ. Whole grain and refined grain consumption and the risk of type 2 diabetes: A systematic review

and dose Response meta-analysis of cohort studies. Eur J Epidemiol 2013;28:845-58.
12. Wang M, Yu M, Fang L, Hu RY. Association between sugar-sweetened beverages and type 2 diabetes: A meta-analysis. J Diabetes Investig 2015;6:360-6.
13. Greenwood DC, Threapleton DE, Evans CE, Cleghorn CL, Nykjaer C, Woodhead C, *et al*. Association between sugar-sweetened and artificially sweetened soft drinks and type 2 diabetes: Systematic review and dose-response meta-analysis of prospective studies. Br J Nutr 2014;112:725-34.
14. Malik VS, Popkin BM, Bray GA, Després JP, Willett WC, Hu FB. Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes. Diabetes Care 2010;33:2477-83.
15. Shan Z, Ma H, Xie M, Yan P, Guo Y, Bao W, *et al*. Sleep duration and risk of type 2 diabetes: A meta-analysis of prospective studies. Diabetes Care 2015;38:529-37.
16. Kowall B, Lehnich AT, Strucksberg KH, Führer D, Erbel R, Jankovic N, *et al*. Associations among sleep disturbances, nocturnal sleep duration, daytime napping, and incident prediabetes and type 2 diabetes: The Heinz Nixdorf Recall Study. Sleep Med 2016;21:35-41.
17. American Diabetes Association. Lifestyle Management. Sec. 4. In Standards of Medical Care in Diabetes-2017. Diabetes Care 2017;40:S33-43.
18. Savage MP, Scott LB. Physical activity and rural middle school adolescents. J Youth Adolesc 1998;27:245-53.
19. Gordon-Larsen P, Nelson MC, Popkin BM. Longitudinal physical activity and sedentary behavior trends: Adolescence to adulthood. Am J Prev Med 2004;27:277-83.
20. Dreher ML. Whole Fruits and Fruit Fiber Emerging Health Effects. Nutrients 2018;10:pii: E1833.
21. Schwingshackl L, Hoffmann G, Lampousi AM, Knüppel S, Iqbal K, Schwedhelm C, *et al*. Food groups and risk of type 2 diabetes mellitus: A systematic review and meta-analysis of prospective studies. Eur J Epidemiol 2017;32:363-75.
22. Li M, Fan Y, Zhang X, Hou W, Tang Z. Fruit and vegetable intake and risk of type 2 diabetes mellitus: Meta-analysis of prospective cohort studies. BMJ Open 2014;4:e005497.
23. Dobbins M, Husson H, DeCorby K, LaRocca RL. School□based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18. Cochrane Database Syst Rev 2013;2:CD007651.
24. Telama R, Yang X, Leskinen E, Kankaanpää A, Hirvensalo M, Tammelin T, *et al*. Tracking of physical activity from early childhood through youth into adulthood. Med Sci Sports Exerc 2014;46:955-62.
25. Kemper HC, Post GB, Twisk JW, van Mechelen W. Lifestyle and obesity in adolescence and young adulthood: Results from the Amsterdam Growth and Health Longitudinal Study (AGAHLS). Int J Obes Relat Metab Disord 1999;23 Suppl 3:S34-40.
26. Nupponen M, Pahkala K, Juonala M, Magnussen CG, Niinikoski H, Rönnemaa T, *et al*. Metabolic syndrome from adolescence to early adulthood: Effect of infancy-onset dietary counseling of low-saturated-fat: The Special Turku Coronary Risk Factor Intervention Project (STRIP). Circulation 2015;131:605-13.