Short Communication

Prevalence of type 2 diabetes among Yoga practitioners: A pilot cross-sectional study in two districts in India

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ABSTRACT

Introduction: Diabetes is one of the major health diseases in the world today. The efficacy of Yoga in the management of type 2 diabetes is well-established. The aim of this study was to assess the prevalence of type 2 diabetes among Yoga practitioners in two districts of India (one each in West and South of India).

Methodology: In this cross-sectional field study, 155 Yoga practitioners from Pune and 192 from Ernakulam districts were assessed using the diabetes risk test and fasting blood sugar. The data collected were entered in a statistics software package and analyzed using the Pearson's correlation analysis, *t*-test, univariate ANOVA, and linear regression to understand the predictors of risk for diabetes.

Results: The overall prevalence of diabetes among Yoga practitioners in Central Pune was 3.6% (95% confidence interval [CI]: [0.01–0.04]). 18.9% of participants (95% CI: [0.16–0.19]) were diagnosed to be "at risk" for diabetes. In Ernakulam, the overall prevalence of diabetes among practitioners was 26% (95% CI: [0.05-0.06]) with 12% of practitioners (95% CI: [0.05-0.06]) diagnosed to be "at risk" for diabetes (prediabetic). Higher age and lesser duration of Yoga practice were significant predictors of diabetes.

Conclusion: It is essential for every person above the age of 40 to undergo regular health check-ups and screening for diabetes and involve oneself in lifestyle modification programs such as Yoga for significantly long duration of time on a daily basis, to better manage diabetes.

Key words: Prevalence; type 2 diabetes; Yoga practitioners.

INTRODUCTION

Yoga aims to incorporate the body, mind, and spirit to bring about physical, mental, and spiritual health. Yoga practitioners are observed to gain physical strength and flexibility as well as calmness of the mind with Yoga postures, breathing and meditation. Though a number of healthy individuals take to Yoga to maintain their health, Yoga is also often observed to be practiced as a therapy postdiagnosis of a chronic condition such as diabetes, hypertension, obesity, and anxiety-related conditions.[1] Especially in management of type 2 diabetes, Yoga is considered as a safe and cost-effective intervention.[2-4]

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The latest statistics presented by International Federation of Diabetes (IDF) depict the prevalence of diabetes in India as 9%.[5] Published studies on selected populations in India have suggested that the prevalence of known diabetes in urban areas is around 5.0%.[6-9] As Yoga asanas and Pranayama are observed to better glycemic control and stable autonomic functions in type 2 diabetes,[10] it would be interesting to study the prevalence of type 2 diabetes among Yoga practitioners in India. In this context, the current pilot project was undertaken to study the cross-sectional prevalence of self-reported type 2 diabetes in Yoga practitioners in two districts of India (one each in West and South of India).

METHODOLOGY

The study was approved by the Institute Ethics Committee (IEC) of Swami Vivekananda Yoga Anusandhana

Samasthana. To study the prevalence of type 2 diabetes among Yoga practitioners, a pilot cross-sectional sample from one zone each in two districts of India-Pune (West of India) and Ernakulam (South of India) was selected. The selection of these districts was completely random: Initially, one state each was randomly selected from the West of India (Maharashtra) and South of India (Kerala); next, the districts in each of the states were listed (with urban/semi-urban areas) and one district was randomly selected for each state (Pune in Maharashtra and Ernakulam in Kerala). The purpose of choosing districts with urban/semi-urban locations in each state was the growth of Yoga centers/classes and institutions in the last few years. It was observed that the growth of these Yoga centers was more prominent in the urban and semi-urban areas than the rural. As this was a pilot project, only one zone in each district was randomly selected for this survey (Central Pune [mainly Pune, Pimpri, Kharakwasala] and South Ernakulam [mainly Paravur, Kunnathunad and Kochi]).

For selecting the sample for the survey, the total number of Yoga practitioners in the selected zones was initially enumerated. For this, the research team personally called each Yoga institution in the zone and elicited the number of Yoga practitioners enrolled with them. A Yoga practitioner was operationally defined as someone who has been practicing Yoga regularly for a minimum of 1-year. Those practitioners above the age of 40 years, with minimum 1-year of regular Yoga practice were included in the study. The researcher also contacted individual Yoga practitioners and Yoga teachers through the method of snow ball sampling. Once the number of Yoga practitioners in the zone was elicited, consent was taken from the Yoga centers and individual Yoga teachers to collect data. Those who were not willing to participate in the study and who had multiple co-morbid disorders were excluded from the study sample. As published studies on selected population in India suggested that the prevalence of known diabetes in urban/semi-urban areas is around 5%,[6-9] the researchers randomly selected 5% of the practitioners who fulfilled the inclusion and exclusion criteria, from the available sample for the study. In this method, the final sample surveyed in Pune was 155 and Ernakulam was 192. The study profile and recruitment process have been depicted in Figure 1.

A cross-sectional field survey was conducted in Yoga institutions, individual Yoga classes and the different Yoga schools operating in the two zones for the data collection. Participants who consented to participate and fitted the inclusion criteria of the study were asked to sign the written informed consent and fill in their sociodemographic data. The American Diabetes Association's diabetes risk test (DRT)[11] was then administered and if their score was found to be >5, the participant was advised to take a blood sugar test and report the results to the researcher.

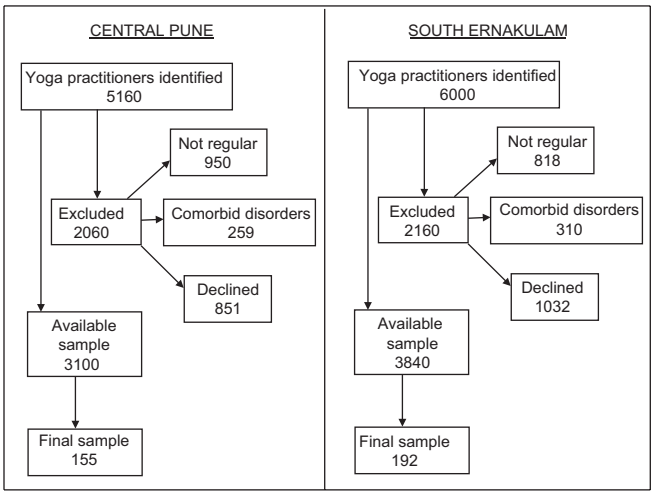

Figure 1: Study profile and recruitment process

The participants who were already diabetic were asked to submit their latest doctor's prescription and blood test reports to note the fasting blood sugar (FBS) levels. In the Central Pune sample, additional information about the quality-of-life of Yoga practitioners diagnosed with diabetes was collected using the quality-of-life Instrument for Indian Diabetes Patients, which is a 33 item reliable, valid, and sensitive tool in English language for the assessment of diabetes specific quality-of-life in India.[12]

Almost all the participants underwent a blood test (on the advice of the researcher) or submitted their blood test reports. Based on the FBS values mentioned in their reports, the decision on whether they were diabetic or "at risk for diabetes" was taken and the percentage of people with diabetes in the selected sample was calculated. Those who did not submit their reports even after repeated reminders were excluded from the analysis of the study.

The data were entered in a statistics software package and analyzed. The prevalence of diabetics was calculated along with confidence intervals (CIs). The sociodemographic details were analyzed and correlated with mean DRT score using the Pearson's correlation analysis, *t*-test and univariate ANOVA to understand the predictors of risk for diabetes. Further linear regression was used to assess the relative contribution of different variables toward diabetes risk.

RESULTS

A look at the profile of the two zones from where the sample was collected will give us a better context to understand the results. Pune district is located in Maharashtra state. As per the 2011 Census of India, the population of Pune district is 9,429,408. 52.3% of Pune's population is in the 15-59 years age category. The average literacy rate of Pune was 87.19% in 2011 and sex ratio was 915 females

per 1000 males.[13] There are approximately 5200 Yoga practitioners in the district who practice out of group Yoga classes and personal Yoga therapists. Ernakulam district is located in Kerala state, India, and in 2011, it had population of 3,282,388 of which male and female were 1,619,557 and 1,662,831, respectively, and the literacy rates were 95.89%.[13] There are mainly five different Yoga institutions, which have branches in most of the towns of the district– overall there are 30-50 Yoga centers working for a period of more than 10 years with approximately 6000 Yoga practitioners in the district. There is however no count on the individual classes that are held in the district. Both the districts differ with respect to their population and sex ratio but are similar in their literacy rates. The number of Yoga practitioners in this study from Ernakulam was mainly from Yoga institutions, but the number of Yoga practitioners sampled from Pune was from Yoga institutions and individual therapists.

Participants from both areas who scored 5 and above on the DRT,[11] but did not have abnormal FBS were considered as "risk for diabetes." Participants who scored above 110 levels on FBS and/or were on medication for diabetes were considered as having "diabetes." The remaining participants who did not fit into any of the above two criteria were considered as "nondiabetic."

Table 1 depicts the overall prevalence of diabetes in Yoga practitioners in Central Pune and South Ernakulam districts. In Central Pune, the overall prevalence of diabetes was 3.6% (95% CI: [0.01–0.04]). 18.9% of participants (95% CI: [0.16-0.19]) were diagnosed to be "at risk" for diabetes and the remaining 77.5% (95% CI: [0.75–0.78]) of participants were not found at risk for diabetes. In South Ernakulam, the overall prevalence of diabetes was 26.0% (95% CI: [0.05–0.06]). 12.0% of practitioners (95% CI: [0.05-0.06]) were diagnosed to be "at risk" for diabetes and the remaining 62.0% (95% CI: [0.04–0.07]) of practitioners were found to be nondiabetic (not diabetic/not at risk for diabetes).

Table 2 depicts the sociodemographic profile of the Yoga practitioners in the two districts. In Pune and in Ernakulam, practitioners in the "diabetic" group and "risk for diabetes" groups were significantly older than the practitioners in the "nondiabetic" group. In Pune, "diabetic" group (mean [standard deviation (SD)]: 1.2719 [0.47]) practiced significantly more frequently in a day as compared to the nondiabetic group (mean [SD]: 0.800 [0.31]) and to the "risk for diabetes" group (mean [SD]: 1.016 [0.36]; f = 7.36, $P = 0.01$) and the duration of practice varied from 55–70 min daily in all three groups (f = 2.60, $P = 0.08$). Majority of the practitioners in "nondiabetic" group were married (Chi-square: 16.62, $P < 0.01$) and did not indulge in any addictive substances such as nicotine and alcohol (Chi-square: 12.37, $P = 0.02$), as compared to the other two groups.

Table 1: Prevalence of diabetes in Yoga practitioners in Central Pune and South Ernakulam

Diagnosis	Central Pune		South Ernakulam	
	n (%)	CI	*n* (%)	CI
Diabetic	6 (3.6)	0.01-0.04	50 (26.0)	0.05-0.06
Risk for diabetes	32 (18.9)	0.16-0.19	23 (12.0)	0.05-0.06
Nondiabetic	131 (77.5)	0.75-0.78	119 (62.0)	0.04-0.07
Total	155 (100)	-	192 (100)	-

CI = Confidence interval

In Ernakulam, the "nondiabetic" group (mean [SD]: 71.16 [29.98] min) significantly practiced for longer duration of time in minutes per day as compared to practitioners in the "risk for diabetes" group (mean [SD]: 57.62 [21.25] min) and to the "diabetic" group (mean [SD]: 50.52 [20.03] min; f = 10.40, $P < 0.01$), with all the three groups practicing some physical activity once a day (f = 2.47, $P = 0.08$). There was a trend toward the "risk for diabetes" practitioners being more educated than the "nondiabetic group" and "diabetic" group (f = 2.90, $P = 0.05$). Significantly more number of males as compared to females were in the "risk for diabetes" group (chi sq: 6.47, $P = 0.04$). There were significantly (Chi-square = 17.65 $P = 0.01$) more practitioners in the nondiabetic group (n[%]: 92 [77.3]) who were employed as compared to the diabetic (n[%]: 24 [48.0]) and the "risk for diabetes" group (n[%]: 14 [60.9]). Majority of the practitioners in the diabetic group (n [%]: 9 [18.0]) were either retired or housewives (n [%]: 16 [32.0]). Further, majority of the practitioners in the diabetic group had a family history of diabetes (n [%]: 31 [62.0]) as compared to practitioners in the other two groups (n [%]: Risk for diabetes' group-13 [56.5]; nondiabetic group- 41 [34.5]; Chi-square = 17.40, $P = 0.03$).

Table 3 depicts the determinants of diabetes risk. In Pune, the mean (SD) total DRT score for the entire sample was 6.02 (1.54). The age of the Yoga practitioners had a significant positive correlation with diabetes risk ($r = 0.62$, $P < 0.01$). Further, physical activity frequency ($r = 0.40$; $P < 0.00$) and duration ($r = 0.26$, $P < 0.00$) were significantly positively correlated with diabetes risk (DRT). On Independent sample *t*-test, it was observed that male subjects had higher DRT score (mean [SD]: 6.41 [1.54]) than female subjects (mean [SD]: 5.64 [1.45]; $t = 3.33$ $P < 0.01$). Further, unmarried practitioners (mean [SD]: 6.57 [1.46]) had higher diabetes risk (on DRT) than married practitioners (mean [SD]: 4.91 [1.03]). On Univariate ANOVA, the mean DRT score was observed to be significantly higher for retired practitioners (mean [SD]: 7.55 [1.37]) as compared to employed (mean [SD]: 5.73 [1.30]), unemployed (mean [SD]: 6.60 [2.07]) or housewives (mean [SD]: 5.82 [1.64]; f = 10.19 $P < 0.01$). On analysis of the quality-of-life of Yoga practitioners (in Pune) with "diabetes" and "risk for diabetes," it was observed

Table 2: Sociodemographic profile of Yoga practitioners

Variable	Central Pune (*n*=155)					South Ernakulam (*n*=192)				
	Mean (SD)			*F*	*P*	Mean (SD)			*F*	*P*
	Diabetic	Risk for diabetes	Nondiabetic			Diabetic	Risk for diabetes	Nondiabetic		
Age (years)	56.91 (8.86)	55.17 (5.97)	52.50 (9.08)	3.22	0.04#	57.88 (8.87)	56.70 (8.78)	49.55 (8.06)	20.67	<0.01*
Education (years)	14.34 (2.47)	12.50 (6.18)	14.47 (2.69)	1.40	0.24	12.98 (3.16)	14.52 (3.55)	13.97 (2.64)	2.90	0.05
Physical activity frequency/day	1.2719 (0.47)	0.800 (0.31)	1.016 (0.36)	7.36	0.01#	1.04 (0.29)	1.00 (0.00)	1.14 (0.35)	2.47	0.08
Physical activity duration (min)	73.59 (27.83)	55.00 (12.25)	66.34 (19.31)	2.60	0.08	50.52 (20.03)	57.62 (21.25)	71.16 (29.98)	10.40	<0.01*
Years of Yoga practice	1.22 (0.42)	1.17 (0.41)	1.11 (0.32)	1.20	0.30	11.40 (11.76)	12.85 (11.79)	10.85 (9.24)	0.36	0.69
Gender										
Male	3 (50.0)	18 (56.2)	61 (46.6)	0.99	0.62	26 (52.0)	19 (82.6)	68 (57.1)	6.47	0.04#
Female	3 (50.0)	14 (43.8)	70 (53.4)			24 (48.0)	4 (17.4)	51 (42.9)		
Occupation				10.26	0.12				17.65	0.01#
Unemployed	1 (3.1)	0 (0.0)	4 (3.1)			1 (2.0)	-	-		
Employed	13 (40.6)	5 (83.3)	79 (60.3)			24 (48.0)	14 (60.9)	92 (77.3)		
Retired	9 (28.1)	0 (0.0)	13 (9.9)			9 (18.0)	5 (21.7)	10 (8.4)		
Housewife	9 (28.1)	1 (16.7)	35 (26.5)			16 (32.0)	4 (17.4)	17 (14.3)		
Marital status										
Single	5 (15.6)	6 (100.0)	45 (34.4)	16.62	<0.01*	-	1 (4.3)	4 (3.4)	1.88	0.39
Married	27 (84.4)	0 (0.0)	86 (65.6)			50 (100)	22 (95.7)	115 (96.6)		
Family history										
Nil	28 (87.5)	5 (83.5)	105 (80.2)	12.36	0.14	14 (28.0)	10 (43.5)	64 (53.8)	17.40	0.03#
Diabetes	4 (12.5)	1 (16.7)	4 (3.1)			31 (62.0)	13 (56.5)	41 (34.5)		
Hypertension	0 (0.0)	0 (0.0)	18 (13.7)			3 (6.0)	-	6 (5.0)		
Obesity/others	0 (0)	0 (0.0)	1 (0.8)			2 (4.0)	-	8 (6.7)		
Diet										
Vegetarian	23 (71.9)	4 (66.7)	100 (76.3)	0.514	0.77	21 (42.0)	12 (52.2)	55 (46.2)	0.68	0.71
Nonvegetarian	9 (28.1)	2 (33.3)	31 (23.7)			29 (58.0)	11 (47.8)	64 (53.8)		
Addiction										
Nil	31 (96.9)	3 (50.0)	117 (89.0)	12.37	0.02#	44 (88.0)	20 (87.0)	103 (86.6)	5.49	0.71
Smoking	0 (0.0)	2 (33.3)	9 (6.9)			1 (2.0)	-	4 (3.4)		
Alcohol	1 (3.1)	1 (16.7)	5 (3.8)			3 (6.0)	2 (8.7)	8 (6.7)		
Others	-	-	-			2 (4.0)	1 (4.3)	4 (3.3)		

#*P*<0.05; **P*<0.01. SD = Standard deviation

Table 3: Predictors of diabetes risk (Pearson's correlation coefficient test)

Variable	Central Pune		South Ernakulam	
	Pearson's *R*	*P*	Pearson's R	*P*
Age	0.62	<0.01*	0.53	<0.01*
Education	0.02	0.85	−0.04	0.60
Physical activity frequency per day	0.40	<0.01*	−0.07	0.42
Physical activity duration (in min)	0.26	<0.01*	−0.20	0.01*
Years of experience in Yoga	−0.04	0.58	0.18	0.01*
FBS	−0.06	0.71	−0.14	0.27

**P*<0.01. FBS = Fasting blood sugar

that there was a trend toward the quality-of-life being better among diabetic group (mean [SD]: 133.2 [21.8]) as compared to the risk for diabetes group (mean [SD]: 122.4 [12.1]; $t = 1.24$, $P = 0.09$). The regression model was significant at $P < 0.001$ and explained 43% of variance (Adjusted R Square = 0.439). Age of the Yoga practitioners (Beta = 0.095; $P < 0.001$) emerged as a significant predictor of risk for diabetes.

In Ernakulam, the mean (SD) total DRT score for the entire sample was 3.74 (1.23). The age of the Yoga practitioners had a significant negative correlation with diabetes risk (r = 0.53, $P < 0.01$). The longer the duration (in minutes) of physical activity indulged in a day, the lesser was the risk for diabetes (r = −0.20, $P = 0.01$). Further, practitioners who had higher number of years of experience in practice of Yoga, had greater risk for diabetes (r = 0.18, $P < 0.01$). The risk for diabetes was observed to be significantly higher for males (mean [SD]: 3.96 [1.17]) as compared to females (mean [SD]: 3.42 [1.26]; $t = 3.01$, $P < 0.01$). Practitioners who were unemployed had a significantly higher risk for diabetes (mean [SD]: 4.48 [1.16]) than who were house wives (mean [SD]: 3.81 [1.31]) and employed (mean [SD]: 3.59 [1.18]; f = 5.37, $P < 0.01$). Further practitioners who had a family history of diabetes, had a significantly higher risk for diabetes (mean [SD]: 4.15 [1.23]) than practitioners who had family history of other disorders (f = 5.07, $P < 0.01$). Practitioners who indulged in addictive substances such as drugs, betel leaf, tobacco (others), (mean [SD]: 5.67 [1.53]), and alcohol (mean [SD]: 4.15 [1.07]) had significantly higher risk for diabetes than those practitioners who indulged only in smoking (mean [SD]): 3.80 [0.84]) or who did not have any addictive habits (mean [SD]: 3.67 [1.23]; f = 2.40, $P = 0.05$). The regression model was significant at $P < 0.001$ and explained 33% of variance (Adjusted R

Square = 0.337). Age of the Yoga practitioners (Beta = 0.546; $P = 0.000$) and duration of physical activity (in minutes) indulged in by the practitioners (Beta =-0.183; $P = 0.005$) emerged as significant predictors of risk for diabetes.

DISCUSSION

Statistics show that 347 million people worldwide have diabetes.[14] Data on diabetes prevalence by age and sex from a limited number of countries were extrapolated to all 191 World Health Organization member states and applied to United Nations' population estimates for 2000 and 2030. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000-366 million in 2030.[15] According to the Diabetes Atlas (2006), the number of people with diabetes in India is currently around 40.9 million and is expected to rise to 70 million by 2025.[16] Published studies on selected population in India have suggested that the prevalence of known diabetes in urban areas is around 5.0%.[6-9] This was the available statistics when started the study; however, when we completed the study a year later, the prevalence of diabetes in India according to the latest statistics presented by IDF was 9%.[5] As these data were available only after we completed the study, we have compared all our results to the earlier prevalence rates of 5%.

The current study result shows the overall prevalence of self-reported diabetes among the Yoga practitioners in Central Pune, Maharashtra state was 3.6% (95% CI: [0.01-0.04]). 18.9% of participants (95% CI: [0.16-0.19]) were diagnosed to be "at risk" for diabetes and the remaining 77.5% (95% CI: [0.75-0.78]) of participants were not found at risk for diabetes. A comparison with the already existing statistics shows that the prevalence of type 2 diabetes in an urban slum of Pune city is 4.6%.[17] We can observe that the overall prevalence of diabetes in Yoga practitioners in central Pune is lower than the above-mentioned Pune statistics, indicating that possibly Yoga could be acting as a protective or effective management intervention for type 2 diabetes.

Among the Yoga practitioners in Ernakulam district, the overall prevalence of diabetes was 26% (95% CI: [0.05–0.06]). 12% of practitioners (95% CI: [0.05-0.06]) were diagnosed to be "at risk" for diabetes and the remaining 62% (95% CI: [0.04–0.07]) of practitioners were found to be nondiabetic (not diabetic/not at risk for diabetes). A study in Kerala shows the prevalence of undetected diabetes between ages 18 and 80 years (Reported prevalence of known diabetes mellitus in the survey was 9.0%; (M-8.7% and F-9.2%) The prevalence of newly diagnosed diabetes was 10.5%. Increasing age, obesity, positive family history of diabetes, abnormal sub scapular triceps skin fold ratio, and presence of acanthosis nigricans were all found to be associated with increased risk of DM.[17] We can observe that the overall prevalence of diabetes in Yoga practitioners in Ernakulam district is higher than the above mentioned Kerala study.[18] This finding that Yoga practitioners have a higher prevalence rate than the general population in Kerala is surprising, as they are supposed to have the beneficial effects of Yoga in management of diabetes. Or possibly in Ernakulam, these practitioners had been diagnosed with diabetes and hence joined Yoga to help manage their diabetes. The other reasons possibly could be that Ernakulam district statistics may be unique (based on its diet, urbane locale, culture, and work patterns) and cannot be generalized to the state of Kerala. Additional data if collected on whether these Yoga practitioners in both the districts started practicing Yoga before their diagnosis of diabetes or after could have shed light on the interpretation of these results. As a word of caution though, routine screening of high-risk groups for early detection of the disease, and advocating for lifestyle modification such as regular practice of Yoga for diabetes as a preventive method needs be practiced.

Age of the Yoga practitioners (in Pune and Ernakulam) and duration of physical activity (in minutes, in Ernakulam) indulged in by the practitioners emerged as significant predictors of risk for diabetes. Hence, it is important to note from the results of this study that older people who are prone to diabetes could opt to practice Yoga for longer duration per day to manage their health and prevent diabetes.

The results depict that there is a huge difference in the diabetes prevalence rate among Yoga practitioners in Pune and Ernakulam. Research has indicated earlier that incidence of diabetes is very high among urban South Indians.[6] Further, the unique diet, locale, culture, and work patterns of each of the districts possibly added to the rates. This prevalence complexity could have been understood if additional parameters of work pattern, diet details, and stress were assessed and correlated with the prevalence of diabetes. In Ernakulam especially, the survey was conducted with the help of Yoga school heads across the district, due to the large magnitude of the sample. Many Yoga schools falsely assuming this being a "diabetes study" might have brought in known diabetics from Yoga practitioners, instead of involving every student, to participate in the study. Personalized data collection by multiple researchers (instead of just one), as attempted in Pune could have helped reduce this possible bias.

The current study results, only tells us the prevalence of diabetes among Yoga practitioner in Pune and Ernakulam. It did not elicit data on the number of years the practitioners were suffering from type 2 diabetes. It could be possible that these practitioners had been diagnosed with diabetes

and hence joined Yoga to help manage their diabetes. A comparison of prevalence among nonpractitioners, and information on when they were diagnosed with diabetes (before or after Yoga therapy) would give us an idea whether Yoga has any effect on the prevalence rate of diabetes among Yoga practitioners. This could form the basis of future studies. However, as no studies have been conducted to assess the prevalence of type 2 diabetes among Yoga practitioners, the results of this study could be considered as a significant pilot for future studies in this area.

CONCLUSION

The overall prevalence of diabetes among Yoga practitioners is 3.6% and 26% in Pune and Ernakulam districts, respectively, and 18.9% (Pune) and 12% (Ernakulam) of practitioners were "at risk" for diabetes. Higher age and longer duration of Yoga practice are significant predictors of diabetes. There is thus a need for every person above the age of 40 to undergo regular health check-ups and screening for diabetes and involve himself in lifestyle modification programs such as Yoga for significantly long duration of time, on a daily basis.

REFERENCES

1. Monk-Turner E, Turner C. Does yoga shape body, mind and spiritual health and happiness: Differences between yoga practitioners and college students. Int J Yoga 2010;3:48-54.
2. Kim SM, Lee JS, Lee J, Na JK, Han JH, Yoon DK, *et al.* Prevalence of diabetes and impaired fasting glucose in Korea: Korean National Health and Nutrition Survey 2001. Diabetes Care 2006;29:226-31.
3. Raub JA. Psychophysiologic effects of Hatha Yoga on musculoskeletal and cardiopulmonary function: A literature review. J Altern Complement Med 2002;8:797-812.
4. Innes KE, Vincent HK. The influence of yoga-based programs on risk profiles in adults with type 2 diabetes mellitus: A systematic review. Evid Based Complement Alternat Med 2007;4:469-86.
5. International Diabetes Federation. Summery table - IDF Diabetes Atlas. 6th ed. Brussels, Belgium: International Diabetes Federation; 2013.
6. Mohan V, Deepa M, Anjana RM, Lanthorn H, Deepa R. Incidence of diabetes and pre-diabetes in a selected urban south Indian population (CUPS-19). J Assoc Physicians India 2008;56:152-7.
7. Sadikot SM, Nigam A, Das S, Bajaj S, Zargar AH, Prasannakumar KM, *et al.* The burden of diabetes and impaired glucose tolerance in India using the WHO 1999 criteria: Prevalence of diabetes in India study (PODIS). Diabetes Res Clin Pract 2004;66:301-7.
8. Mohan V. Age-and sex-specific prevalence of diabetes and impaired glucose regulation in 11 Asian cohorts. Diabetes Care 2003;26:1770-80.
9. Ramachandran A, Snehalatha C, Vijay V, King H. Impact of poverty on the prevalence of diabetes and its complications in urban southern India. Diabet Med 2002;19:130-5.
10. Nayak NN, Shankar K. Yoga: A therapeutic approach. Phys Med Rehabil Clin N Am 2004;15:783-98, vi.
11. Bang H, Edwards AM, Bomback AS, Ballantyne CM, Brillon D, Callahan MA, *et al.* Development and validation of a patient self-assessment score for diabetes risk. Ann Intern Med 2009;151:775-83.
12. Nagpal J, Kumar A, Kakar S, Bhartia A. The development of 'Quality of Life Instrument for Indian Diabetes patients (QOLID): A validation and reliability study in middle and higher income groups. J Assoc Physicians India 2010;58:295-304.
13. Indian States Census 2011. Census Organization of India. Government of India; 2011. Availible from: http://www.censusindia.gov.in/2011census/population_enumeration.html. [Last retrieved on 2014 Jan 01].
14. Danaei G, Finucane MM, Lu Y, Singh GM, Cowan MJ, Paciorek CJ, *et al.* National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: Systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 27 million participants. Lancet 2011;378:31-40.
15. King H, Rewers M. Global estimates for prevalence of diabetes mellitus and impaired glucose tolerance in adults. WHO Ad Hoc Diabetes Reporting Group. Diabetes Care 1993;16:157-77.
16. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C. Epidemiology of type 2 diabetes: Indian scenario. Epidemiology of type 2 diabetes: Indian scenario. Indian J Med Res 2007;125:217-30.
17. Patil RS, Gothankar JS. Prevalence of type-2 diabetes mellitus and associated risk factors in an urban slum of Pune City, India. Natl J Med Res 2013;3:346-9.
18. Usha Menon V, Vinod Kumar K, Gilchrist A, Sugathan TN, Sundaram KR, Nair V, *et al*. Prevalence of known and undetected diabetes and associated risk factors in central Kerala – ADEPS. Diabetes Res Clin Pract 2006;74:289-94.

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