Research article

A study of diagnostic parameters in assessment of metabolic syndrome (MetS) among medical students

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ABSTRACT

Introduction and Aim: Because lifestyle changes and treatments can reduce the incidence of type 2 diabetes and coronary vascular diseases (CVD), early detection of metabolic syndrome (MetS) is crucial. Using the new International Diabetes Federation (IDF) criteria, the study aimed to determine the prevalence of MetS and evaluate the known risk factors.

Methods and Materials: The current study was a cross-sectional quantitative study among students of 1st MBBS in Mahavir Medical College and Hospital, Vikarabad, Telangana, India. The study included 150 students of both genders. Anthropometric measurements, blood pressure, fasting blood sugar, lipid profile, demographic details, and risk factors were evaluated. Data was processed using SPSS version 20. P-value <0.05 was considered for statistical significance.

Results: In total, 148 students aged 19 years (mean age 18±4), were included in the study. Among them, 66 (44.59%) were males and 82 (55.4%) were females. The comprehensive prevalence of (MetS) was 28.35%. Females have a high risk at 37.8% when compared to males at 18.8%. Additionally, a high prevalence of overweight and obesity, high blood pressure, and low HDL were found to be the primary causes of MetS.

Conclusion: Due to the high prevalence of metabolic syndrome among medical students in their early years. Unhealthy habits and a lack of awareness could be to blame for this. Hence health education and early detection followed by lifestyle interventions are imperative in the early phase of their medical education to decrease the prevalence.

Keywords: Medical students; metabolic syndrome; IDF criteria; type-2 diabetes mellitus; cardiovascular disorders.

INTRODUCTION

There is a rapid increase in the prevalence of noncommunicable diseases worldwide. Approximately three-quarters of deaths in developing countries will be caused by these diseases by 2020, according to the World Health Organization (1). One of the emerging major public health issues all around the globe is metabolic syndrome (MetS). Within the younger population, it has won greater interest due to the unfavorable outcomes it has, and its early identification results in better health. The growing prevalence of obesity in children is an emerging public fitness trouble that results in the incidence of recent cases of metabolic syndrome in adolescence and young people (2).

India is a developing country going through swift urbanization with industrialization, up-gradation of income, improvement in education, and improved health care (3). In addition, the prevalence of non-communicable diseases is rising because of an increase in unhealthy lifestyles such as smoking, eating unhealthy foods, not getting enough exercise, and other unhealthy behaviors. The metabolic syndrome being a chronic disease has serious consequences in terms of mortality, morbidity, family difficulties, poverty, and economic impact on the country (4). The metabolic syndrome is characterized through the clustering of threat elements, which places humans at increased hazard of diabetes and cardiovascular diseases (CVD; 5). The metabolic syndrome attracted researchers since it's a modifiable risk factor to prevent cardiovascular disease and type 2 diabetes (6). The criteria used in this study are those given by means of the International Diabetes Federation (7). Adequate knowledge of metabolic syndrome and its risk factors is essential for taking precautions to prevent it in the process to have healthy generations. Health care professionals should conduct awareness and educational programs for healthy communities.

It is increasingly recognized worldwide and estimated that the 20-25%adult population in south Asia has

developed MetS (8). Excess weight and lack of physical activity are two important determinants of the Met (9). On the other hand, chronic stress has also been associated with the syndrome, especially in the work environment (13). Worksites represent one of the most promising settings for early detection and follow-up interventions for the MetS (10). The pathophysiology of the disorder is insulin resistance and central obesity is considered a significant factor (11).

Epigenetics, a sedentary way of life, proinflammatory nature, and organic changes may additionally have a causal effect, but the position of these may also range depending on the ethnic group (12). Since, medical students frequently use their time at the medical college, hospital attending lectures, practical and staying at the hostels during the study period. This kind of lifestyle is characterized by high levels of sedentary and stress which may represent a consequence of the syndrome. Another component is eating 'unhealthy food' (Junk food) with low nutritional value, with rich content of saturated fats and sugar, hyper calories, low in vitamins and minerals, or high-quality protein, whose consumption increases the risk of obesity. The study is aimed to assess the prevalence and evaluate the known risk factors of MetS. Improving the knowledge of participants on MetS may play a vital role in prevention and early diagnosis and thereby help in preventing long-term complications such as obesity, diabetes mellitus, and cardiovascular diseases.

MATERIALS AND METHODS

A cross-sectional interventional study was conducted over a period of 3 months on a sample of 150 conveniently selected medical students of first-year undergraduates at Mahavir Medical College and Hospital, Vikarabad, Telangana, India.

The study was approved by the ethics committee of Mahavir Institute of Medical Sciences (MIMS). Researchers obtained written informed consent from all study subjects before enrolling them in the study.

The new International Diabetes Federation (IDF) criteria for metabolic syndrome are abdominal obesity as a prerequisite (7, 13). In addition, triglyceride levels above 150 mg/dl (1.7m mol/L); HDL cholesterol less than 40 mg/dl (0.9 mmol/L) for males and less than 50 mg/dl (1.1 mmol/L) in females; Blood pressure, systolic greater than or equal to 130 mmHg or diastolic greater than or equal to 85 mmHg; Blood glucose level greater than or equal to 100 mg/dl (5.6 mmol per L) were found to be the criteria for MetS.

Inclusion criteria

Subjects who were willing to take part in this study and who could stand up for the measurement of waist circumference.

Exclusion criteria

Previously diagnosed with diabetes, hypertension, or dyslipidemia and were never treated with medications for the same.

Data collection procedure

The following parameters were measured for all the participants as summarized:

1. The prevalence of MetS was assessed using (IDF) criteria
2. Evaluation of the known risk factors for MetS was done using the:
   i. Pre-validated data collection questionnaire, which consisted of:
   ii. Demographic details: Age, gender
   iii. Family history: HTN, DM, CVD, smoking, and alcohol.
   iv. Risk factors: Smoking, (smokers were defined as those who reported smoking for at least 3 months in their life and who currently smoke at least on some days of a week). Alcohol consumption was considered for persons who reported alcohol consumption in the last 3 months. Exercise, fast food consumption, aerated drinks, no consumption of fruits and vegetables, psychological aspects: stress due to academics, stress at home, stressful life events in the past year, anxiety, or depression.
3. Intervention:
   i. Anthropometric measurements: BMI and WC (waist circumference)
   ii. Clinical examination: Blood pressure
   iii. Diagnostic profile: Fasting Blood Sugar, Total Cholesterol (TC), Triglycerides (TG), Very-low-density lipoprotein (VLDL), Low-density lipoprotein (LDL)

Anthropometric parameters

i. Waist circumference**:** An inelastic metric tape was used to measure the students' waist circumference while they were standing, with their arms running along their body and their feet together. Asian-Americans should have waist circumferences greater than or equal to 90 cm for men and 80 cm for women to be considered obese (13).
ii. Height**:** Using the height meter
iii. Weight: Standardized scale.
iv. Body mass index (BMI) was calculated as: Weight (kg)/Height2 (meters). BMI between 25 - 29.9 is overweight and 30.0 or higher is obese according to the Centre for Disease Control and Prevention and WHO.

v. Clinical examination

BP was measured after allowing the subject to rest for at least five minutes. He / she was asked

to be seated with the arm extended and resting on the table. BP was measured by the auscultation method, using calibrated sphygmomanometers. On three consecutive days, both systolic and diastolic blood pressure levels were taken. The final data was the average of 3 measurements.

Diagnostic parameters

Blood samples were collected from the antecubital vein, in the early morning, after a minimum of 12 hours of the fasting period, in a supine position. Biochemical analysis Serum triglycerides (TG), Fasting blood sugar (FBS) and Serum high-density lipoprotein (HDL) were measured by International Federation of clinical chemistry (IFCC) approved enzymatic methods processed Autoanalyzer Erba-200, reagents and calibrators were used for the analysis at Mahavir Medical College Hospital Laboratory, Vikarabad.

Data analysis

Data was processed using SPSS version 20. (SPSS Inc, Chicago, IL). P-value, confidence interval (CI), and odds ratio (OR) were used for statistical analysis. P-value <0.05 was considered for statistical significance.

RESULTS

Out of 150 students enrolled in our medical college during the study period, 148 students were included in this study. Of the total 148 study subjects, 66 (44.59%) were males and 82 (55.4%) were females. The mean age was 19 years (age range: 18-21 years). The comprehensive prevalence of MetS was 28.35%. Females have a high risk at 37.8% when compared to males at 18.8% (Table 1).

Prevalence of individual parameters for MetS are abdominal obesity (14.2% in men, and 37.8% in females), low HDL levels (in males 18.2%, in females 8.1%), hypertriglyceridemia (2%), hyperglycemia (10.8%), hypertension 41.9% (systolic BP 27.7% (28 male and 13 Female) diastolic BP 14.2% (12 male and 09 female; Table 1). In both genders, the most prevalent risk factors were abdominal obesity, and low HDL followed by hypertension (Table 2).

Table 1: Percentage of individual risk factors among participants with Metabolic Syndrome Features as per IDF- criteria

Variable	Frequency	Percentage
Blood sugar ≥100 mg/dl	16	10.8%
Systolic Blood pressure (≥130 mm Hg)	41	27.7%
Diastolic Blood pressure (≥85 mm Hg)	21	14.2%
Triglycerides (TG) (>150 mg/dl)	03	2%
HDL <40 mg/dl for male <50 mg/dl for female	 27 12	 18.2% 8.1%
Abdominal circumference ≥90 cm for men ≥ 80 cm for women	 21 56	 14.2% 37.8
Prevalence of MetS	Male: 18.9%	
	Female: 37.8%	
The overall prevalence	28.35%	

Table 2: Assessment of MetS parameters in terms of gender analysis

MetS parameter	Male (n=66)	Female (n=82)	P value	Odds Ratio (95% CI)
Blood sugar ≥100 mg/dl	08	08	0.4	1.2 (0.45-3.6)
Systolic Blood pressure (≥130 mm Hg)	28	13	0.0001*	3.91 (1.81-8.4)
Diastolic Blood pressure (≥85 mm Hg)	12	09	0.1	1.8 (0.7-4.5)
Triglycerides (TG) (>150 mg/dl)	02	01	0.2	2.5 (0.22-28.54)
HDL <40 mg/dl for male <50 mg/dl for female	27	12	0.0001*	3.90 (1.80-8.3)
Abdominal circumference ≥90 cm for men ≥ 80 cm for women	21	56	0.00005*	4.61 (2.3-9.2)

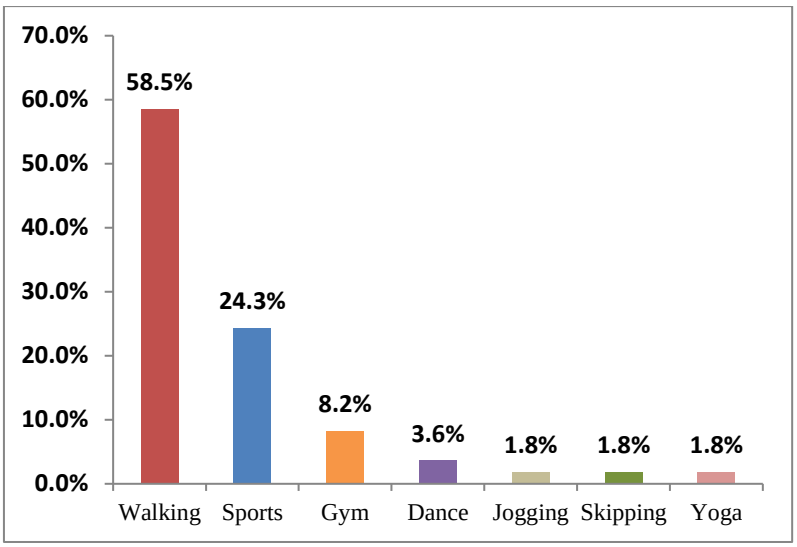

Fig. 1: Type of exercise

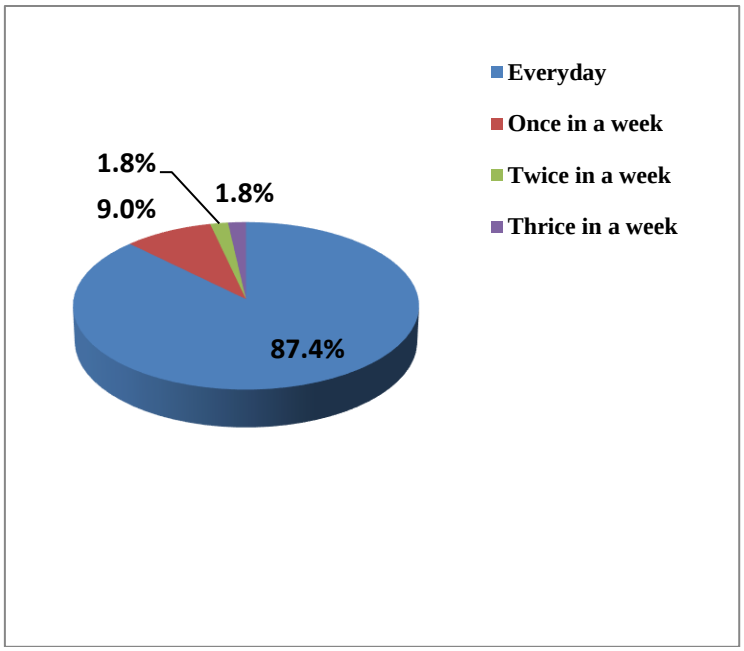

Fig. 2: Frequency of exercise

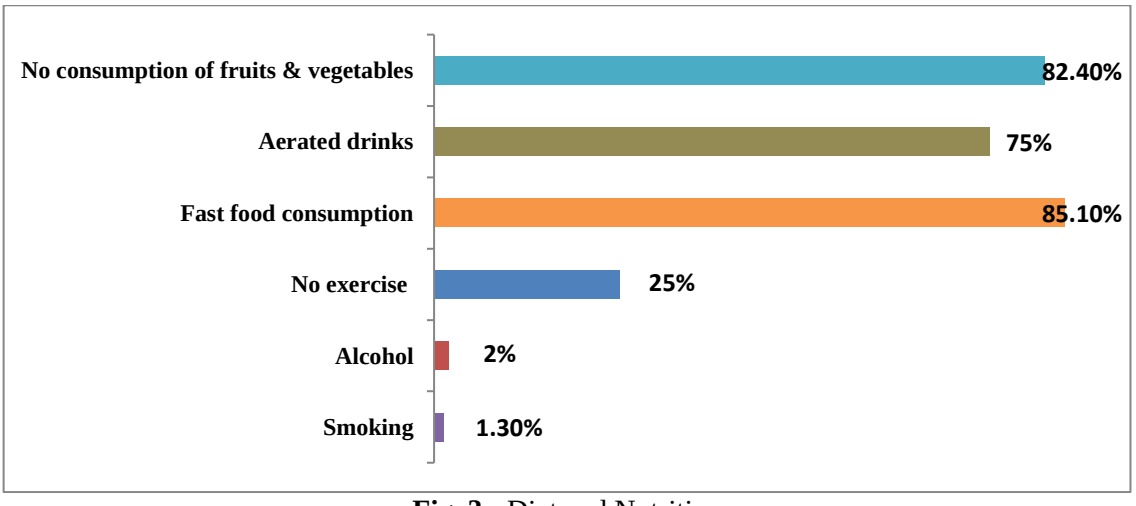

Fig. 3: Diet and Nutrition

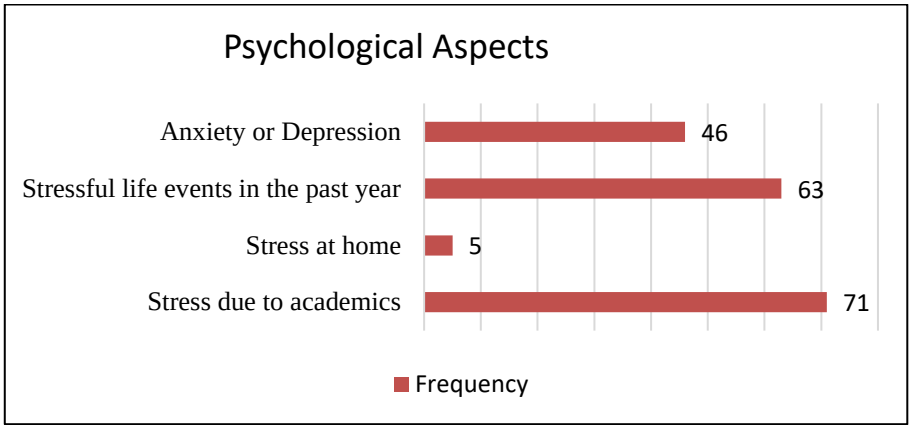

Fig. 4: Psychological aspects in subjects

Most of the subjects were exercising every day, walking was the main activity with the meantime duration of exercise was = 44.18±34.38 minutes as shown in Fig. 1. The number of smokers was 1.3% and alcohol consumers were 2% of the study subjects. Most of the study subjects had fast food (85.10%) followed by aerated drinks (75%) consumption. No consumption of fruits and vegetables (82.40%) followed by no exercise (25%) as shown in Fig. 3.

More important is stress due to academics followed by stressful life events in the past year and anxiety or depression as shown in the above Fig. 4.

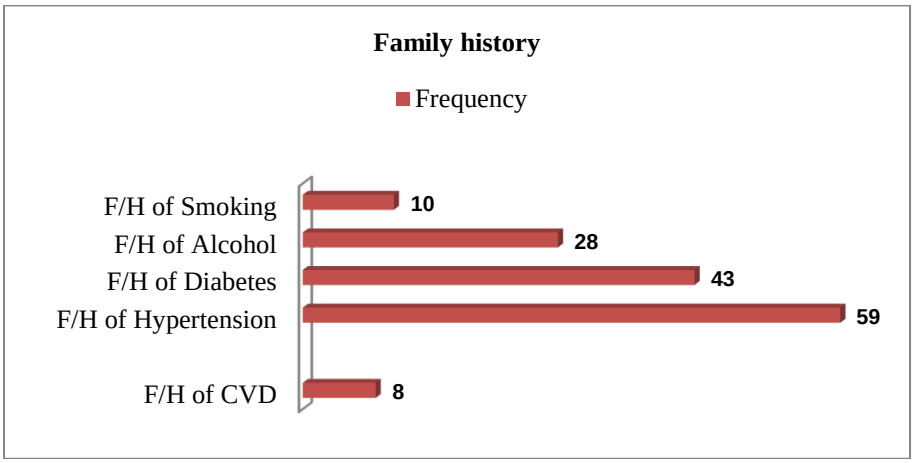

Fig. 5: Family history

Positive family history of hypertension was present in 39.8%, DM in 29.1%, CVD in 5.4%, alcohol in 18.9%, and smoking in 6.7% as depicted in above Fig. 5.

MetS components

Gender differences in the prevalence of MetS components were found when MetS patients were evaluated (Table 2). Systolic BP 27.7% of whom were 28 males and 13 females (Odds Ratio 95% CI: 3.91 (1.81-8.4) P-value 0.0001* with a significant distinction between men and women. The gender split in terms of prevalence was 2.15. Diastolic BP 14.2% of who were 12 males and 09 females. (Odds Ratio 95% CI: 1.8 (0.7-4.5) P-value 0.1 with no distinction between men and women. The gender split in terms of prevalence was 1.33. It was observed that 26.3% of whom were 27 males and 12 females had levels of lower HDL-c, (Odds Ratio 95% CI: 3.90 (1.80-8.3) P-value 0.0001* with a significant distinction between men and women. The gender split in terms of prevalence was 2.2. In these individuals, 52% had waist measurement above normal, of who were 21 Males and 56 females (Odds Ratio 95% CI: 4.61 (2.3-9.2)) P-value 0.00005* with a significant distinction between men and women. The prevalence ratio of women/men was 2.68. The prevalence of changes in TG levels was 2% of who were 02 males and 01 female (Odds Ratio 95% CI: 2.5 (0.22-28.54) P-value 0.2 with no significant difference between genders. The prevalence ratio of men/women was 2.01. Levels of fasting glucose ≥100 mg/dl occurred in 10.8% of who were 08 males and 08 females (Odds Ratio 95% CI:1.2 (0.45-3.6) P value 0.4 with no significant difference between genders. The prevalence ratio male/female was 1.0.

DISCUSSION

According to IDF criteria, the prevalence of MetS in our study was 28.35%, higher in females than males. It was in accordance with various studies that showed a prevalence of 35% by Deka *et al.*, (14), 40% in adults in a USA study (15), based on the IDF definition. In another study, the prevalence was very

high with 43.5% among Americans in the age group of 60-69 years (16). A study in Iran (17) also concluded the same findings. The explanation for this may be due to the less active life of women and their obesity, especially abdominal obesity, and hormonal issues. The prevalence of MetS in the current review is a lot lower than that detailed in a previous concentrate in metropolitan Indian matured grown-ups (20-50 years) in which the predominance was accounted for to be 41.1% (18).

In the present study, abdominal obesity was the most common risk factor in men (14.2%) and women (37.8%). It was in accordance with a study carried out in Hungary, showing abdominal obesity was the commonest risk factor for metabolic syndrome based on IDF (19). A study by Prasad *et al.*, showed that central obesity was present in 14.2% of males and 37.8% of females had a greater risk of developing MetS (20). Increased abdominal fat has low adiponectin, which is responsible for atherosclerotic and inflammatory properties. It also increases insulin secretion leading to hyperinsulinemia. It releases free fatty acids causing endothelial dysfunction resulting in hypertension and altered lipid levels in the blood. Hence central obesity is an important risk factor for coronary vascular diseases due to its relation to dyslipidemia, hyperinsulinemia, hypertension, and impaired fibrinolytic capacity (21). Men had higher incidence of increased systolic BP and diastolic BP as compared to women (P value- 0.0001 and 0.1 respectively), which is statistically significant. Central obesity, insulin resistance, sympathetic over activity, oxidative stress, endothelial dysfunction, stimulated renin-angiotensin framework, increased inflammatory markers, and obstructive rest apnea has been proposed to be potential variables to foster hypertension in the metabolic condition.

Numerous studies demonstrated that subjects' low HDL levels were a strong predictor of myocardial infarction (MI), stroke, severe coronary artery disease (CAD), atherogenic dyslipidemia almost always has low HDL-C levels, and it has been hypothesized that obesity lowers HDL-C levels. According to the findings of our study, approximately 35% of subjects with low HDL-C were either overweight or obese (22).

Risk Factors

Diet, nutrition, and physical activity

In the present study, most of the subjects were exercising every day, and walking was the main activity. MetS and urbanization have been linked, especially in South Asian countries that are in development. Globalization and changes in food habits have been noted across various age groups, especially in children and younger generations (22). The changes in food habits and increased tendency in consumption of junk foods along with physical inactivity, stress leads to increased occurrence of MetS among urban adults (23). Our study showed changes in food habits as the majority were consuming fast food (85.1%), and aerated drinks (75%) followed by others. Also, many conclude that 82.4% don't consume sufficient fruits and vegetables. Metabolic syndrome is influenced by the diet. The development of obesity, diabetes, and cardiovascular disease among South Asians is correlated with an array of dietary factors, such as an unbalanced fat intake, high sodium intake, and low dietary fibre intake (24).

Smoking and alcohol

There is evidence that smoking cigarettes independently contributes to metabolic syndrome (24). MetS is less clearly correlated with alcohol consumption. In our study the number of smokers was estimated as 1.3% and alcohol consumers were 2% of study subjects.

Psychological Aspects

More important is stress due to academics followed by stressful life events in the past year and anxiety or depression.

Family history

The risk factors in chronological order included F/H of hypertension, followed by diabetes and alcohol consumption. Positive family history of HTN was present in 39.8%, DM in 29.1%, CVD in 5.4%, alcohol in 18.9% and smoking in 6.7%.

CONCLUSION

MetS is more prevalent among female medical students than males indicating this group is at increased risk of developing CAD. Changes in lifestyle, food habits, physical inactivity, and academic stress may be contributing factors. It is therefore imperative that metabolic abnormalities are identified early and that appropriate intervention is implemented. To decrease the prevalence of MetS in adolescents with risk factors like obesity, hypertension, and diabetes we have made the following recommendations, First, identifying students who are overweight and obese is critical.

Educational interventions

The role of community outreach programs, such as media, power-point presentations on healthy diets and physical activity patterns will continue to be important in decreasing its prevalence.

College-based programs

There is a need for college food services to provide healthy meals, which directly affect health and

provide a unique opportunity to teach students by example. For transportation to colleges and leisure, walking or cycling is a practical and effective means of exercising. In addition, we urge governments to create environments that facilitate lifestyle changes.

Limitations: Due to the small sample size and single institution, the findings of this study cannot be generalized.

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CONFLICT OF INTEREST

Authors have declared that no competing interest exists.

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