International Journal of Clinical Biochemistry and Research 2021;8(2):130–134

Content available at: https://www.ipinnovative.com/open-access-journals

International Journal of Clinical Biochemistry and Research

Journal homepage: https://www.ijcbr.in/

Original Research Article

TyG index as a cardiovascular risk factor, with reference to anthropometry in first year medical students - A cross sectional study

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ARTICLE INFO

Article history:
Received 18-06-2021
Accepted 23-06-2021
Available online 23-07-2021

Keywords:
TyG index
Anthropometric measures
Atherosclerotic indices
Cardio-metabolic risk

ABSTRACT

Background: Triglyceride-Glucose (TyG) index is an independent predictor of cardiovascular risk in several pathological conditions such as T2DM, Metabolic syndrome (MetS), CVD, and CAD. Early studies which were done on TyG index focus on insulin resistance. High TGL level induces production of small density LDL particle. All these proposed theories, explains why TyG index used as an independent factor of cardiovascular risk.

Materials and Methods: 150 First year medical students were included and their anthropometric measures done using standard scale. Fasting blood glucose estimated by GOD POD method. Total cholesterol, triglyceride, High density lipoprotein and direct low density lipoprotein were estimated by IFCC approved methods. Statistical analysis was performed using IBM SPSS version 20.

Results: Results 26% were obese and 5.33% were overweight. Lipid profile found to be significant different among the group. Atherosclerotic indices were found to have mild to moderate correlation with anthropometric measures ($p < 0.05$).

Conclusion: Present study showed a high prevalence of overweight to obesity ratio in first year medical students. With TyG index we observed an independent association of cardio-metabolic risk with BMI in young adult.

1. Introduction

Studies have shown that Triglyceride-Glucose (TyG) index is an independent predictor of cardiovascular risk in several pathological conditions such as T2DM, Metabolic syndrome (MetS), CVD, CAD, etc.[1,2] Sanchez et al. documented the association of TyG index with hypertension in health individuals.[3] Early studies which were done on TyG index focus on insulin resistance.[4] Triglyceride-glucose (TyG) index, product of triglyceride and fasting plasma glucose (FPG) is a novel tool that has been found to correlate with surrogate and direct measures of IR.[5]

Later research found that TyG index was an independent predictor of cardiovascular risk in MetS. Since TyG index was calculated based on TGL and glucose, both compounds are responsible for adverse cardiovascular events.[6,7] It has been evident that high TGL levels elevate the lipoprotein and cause CVD. High TGL level induces production of small density LDL particle. All these proposed theory, explains why TyG index used as an independent predicate of cardiovascular risk.[3]

Currently about 10% of first year medical students affected by MetS.[8] Major factor for increase in MetS was overweight and obesity. In 2015, ICMR documented in one of its study that 11.8% to 31.5% and 16.9 to 36.3% of young adults have obesity and central obesity.[9] Numerous

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https://doi.org/10.18231/j.ijcbr.2021.028

studies have discussed the predictive ability of obesity and lipid-related indices in identifying metabolic abnormalities. Body mass index (BMI) is a simple measurement of obesity status, while waist circumference (WC) reflects abdominal adiposity and may represent visceral adiposity better than BMI.[10]

Increase in overweight and obesity was due to life style modification. Stress found to be important factor for obesity, along with improper diet and reduced physical activity. Many studies have documented increased stress level in First year medical students.[11–13]

In this study we have tried to evaluate the role of TyG index as a risk factor for cardiovascular disease, with reference to BMI, in first year medical students.

2. Materials and Methods

A cross sectional study was done on medical students at Trichy SRM Medical College hospital and research centre. They were included in the study after obtaining informed consent. The study was approved by the institutional research and human ethics committee. Total number of students participating in the study was 150 based on the following inclusion and exclusion criteria. The duration of the study was about three months from November 2018 to January 2019. Students were sub-grouped into Underweight, Normal, Overweight and Obesity based on their BMI respectively.

2.1. Inclusion criteria

Healthy volunteers between the age group 18 – 25 were included.

2.2. Exclusion criteria

Students who were not willing, had severe illness and those who are regular medication were excluded.

2.3. Anthropometric measures

For all the students, height and weight were measured using a standard scale respectively. Body mass index was calculated by formula using, weight in Kg divided by height in meter square [kg/m^2].[14] Waist circumference, measured to the nearest 0.1 cm at the midpoint between tip of iliac crest and last costal margin in the back and at umbilicus in the front using a non-stretchable tape at the end of normal expiration with subject standing erect in a relaxed position.[15] Waist-hip ratio and waist-height ratio were calculated.

2.4. Sample collection

5ml of fasting venous blood sample was collected under aseptic precautions. 3ml was added in red tube for analyzing lipid profile and 2ml was added in fluoride tube for glucose estimation. Both parameters were analyzed on the same day.

2.5. Biochemical investigation

Fasting blood glucose was estimated by GOD POD method. In lipid profile that includes total cholesterol, triglyceride, high density lipoprotein and direct low density lipoprotein were estimated by IFCC approved methods. Above mentioned biochemical parameters were analyzed in Roche C311 autoanalyzer using kits from Roche diagnostics, Germany. Other atherosclerotic index such as non-LDL-c, TC/ HDL-c ratio, LDL-c/ HDL-c ratio, TGL/ HDL-c ratio, non-HDL-c/ HDL-c ratio and TyG index were calculated.

2.6. Statistical analysis

Anthropometric measurements and lipid profile were the primary variable. Atherosclerotic index variables along with WHR and hip height ratio were secondary variable. Descriptive analysis was carried out and values were expressed as mean ± SD, median with inter-quartile range for quantitative variables, frequency and proportion for categorical variables. Independent t test was performed to assess statistically significant for quantitative variable. Pearson's correlation was used to assess the association between two variables. Chi-square test was used to assess the statistical significant for categorical variable. Data was entered in Microsoft office excel and statistical analysis was performed using IBM SPSS version 20. For all the statistical analysis $p < 0.05$ considered as significant.

3. Result

Totally 150 students were included in the study based on inclusion and exclusion criteria, out of which 55 [36%] were male and 95 [64%] were female. We measured the anthropometric index of cardiovascular risk factor BMI and waist hip ratio. Results showed 60% of students were in normal BMI, 8.67% were underweight, 26% were obese and remaining 5.33% were only overweight.

In waist hip ratio 64% were found to be low, 35% were normal and 19% were high. Both measurements are depicted in Table 1. Present study estimated a mean weight to height ratio of 0.43 with SD 0.15, which is an emerging anthropometric measure in assessing the cardiometabolic risk factor in obesity.

The results of lipid profile and fasting blood sugar are shown in Table 2. Using lipid value, atherosclerotic indexes such as non-HDL-c, TC/ HDL, LDL/ HDL ratio, TGL/ HDL ratio and Non-HDL/ HDL were calculated using standard formulae. TyG index was calculated with above values, since it's an emerging cardiovascular risk factor assessment tool, using the formula [(TGL x Fasting Glucose)/2].[16] To find significance of biochemical parameters in the study population, subjects were sub-grouped based on the BMI

Table 1: Gender and anthropometrics measurement of first year MBBS students

Parameters	**N (%)**
Gender	
Male	55 (36.67)
Female	95 (63.33)
BMI	
Underweight	13 (8.67)
Normal	90 (60)
Overweight	39 (26)
Obesity	8 (5.33)
Waist Hip Ratio	
Low	96 (64)
Moderate	35 (23.33)
High	19 (12.67)

Table 2: Association of biochemical parameter with body mass index (n=150)

Parameter	**Overall**	**Underweight (n = 13)**	**Normal (n = 90)**	**Overweight (n = 39)**	**Obesity (n = 8)**	**p Value**
FBS	85.07 ± 9.81	81.92 ± 5.8	84.07 ± 9.82	87.79 ± 10.27	88.25 ± 10.44	0.104
Cholesterolc	146.85 ± 25.8	146 ± 20.75	142.34 ± 25.63	157.38 ± 26.46	147.63 ± 19.96	0.024
TGL[a,c]	83.03 ± 35.89	64.38 ± 25.41	76.17 ± 24.99	105.23 ± 50.12	82.38 ± 27.07	0.000
HDL[a,b,c]	47.43 ± 9.91	55.85 ± 11.84	48.46 ± 8.99	43.18 ± 9.5	43 ± 8	0.000
LDL[c]	96.11 ± 23.91	91.31 ± 15.85	92.12 ± 23.79	106.41 ± 24.18	98.63 ± 22.68	0.014
Non-HDL	99.42 ± 25.54	90.15 ± 17.19	93.89 ± 23.08	114.21 ± 28.15	104.63 ± 22.42	0.000
TC/HDL ratio	3.21 ± 0.84	2.68 ± 0.49	3 ± 0.62	3.8 ± 1.03	3.55 ± 0.9	0.000
LDL/HDL ratio	2.12 ± 0.75	1.71 ± 0.51	1.95 ± 0.57	2.6 ± 0.9	2.41 ± 0.88	0.000
TGL/HDL ratio	1.9 ± 1.19	1.19 ± 0.52	1.65 ± 0.8	2.68 ± 1.69	2.05 ± 1.03	0.000
Non-HDL/HDL ratio	2.21 ± 0.84	1.68 ± 0.49	2 ± 0.62	2.8 ± 1.03	2.55 ± 0.9	0.000
TyG index[b,c]	4.39 ± 0.19	4.26 ± 0.18	4.36 ± 0.17	4.51± 0.22	4.42 ± 0.18	0.000

a - The mean difference is significant at the 0.05 level between underweight and overweight
b- The mean difference is significant at the 0.05 level between underweight and Obesity
c - The mean difference is significant at the 0.05 level between Normal and overweight

Table 3: Correlation between anthropometric measurements and lipid profile (n =150)

Parameters	**Body Mass Index r**	**Waist Hip Ratio R**	**Weight Height Ratio r**
FBS	0.177*	0.112	0.015
Cholesterol	0.213**	0.074	0.088
TGL	0.317**	0.239**	0.214**
HDL	-0.348**	-0.209*	-0.154
LDL	0.275**	0.158	0.127
Non-HDL	0.351**	0.156	0.149
TC/HDL ratio	0.447**	0.244**	0.208*
LDL/HDL ratio	0.420**	0.263**	0.210**
TGL/HDL ratio	0.363**	0.274**	0.226**
Non-HDL/HDL ratio	0.447**	0.244**	0.208*
TGL glucose index	0.374**	0.216**	0.257**

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level(2-tailed).

following which one way ANOVA was performed. Glucose didn't show any statistical significance among the group. In lipid profile, there was a statistical significance between the estimated and calculated values among the groups, which has been depicted in Table 2.

In Table 3 lipid profile, atherosclerotic and TGL glucose index was correlated with anthropometric measurement which included weight to height ratio. All atherosclerotic indexes were found to have mild to moderate correlation with anthropometric measures ($p < 0.05$). BMI had the highest 'r' value of 0.447 with TC/HDL ratio and Non-HDL/HDL ratio. But HDL showed negative correlation.

4. Discussion

In the present study, primary date showed that 26% was overweight and 5.33% was obesity, based on WHO guidelines for BMI.[14] Nearly 9% of student found to be underweight and 60% were observed to be normal. Similar result was found in Boo NY et al[17] with overall 30% found to be both overweight and obese, where 15% of students were in underweight group. The overweight/obesity ratio was 4.61% in first year medical students. In a study by Gupta et al.[16] it's recorded 17.5% and 3.4% of prevalence of overweight and obesity in Midnapore medical college, India. Another study done by Chhabra et al.[18] it was documented that there was an overall prevalence of 11.7% and 2% of overweight and obesity in medical students at Delhi. Studies conducted by Fernandez et al.[19] and Gopalakrishnan et al.[20]in Pune and Malaysia respectively, obtained a high prevalence of overweight/obesity ratio in medical students.

Secondarily, We have investigated dyslipidaemia and patho-glycemia along with atherosclerotic index and TyG index which has been emerging as an independent factor causing cardiovascular disease in many pathological conditions.[21]

Our results have shown very high significance with TyG index as a risk factor in obese and overweight individuals which correlates well with the studies reported by Locateli et al.[22] and Gurrola et al.[23]

We have noticed TyG index and other atherosclerotic indices showing significant correlation with anthropometric measurements in this study which goes well with the study reported by Kim et al.[24]

In this study, we also found significant correlation between TyG and other anthropometric measures, which also aligned with the study by Manjareeka et al.[25]

5. Conclusion

Present study showed a high prevalence of overweight to obesity ratio in first year medical students. With TyG index we observed an independent association of cardio-metabolic risk with reference to BMI in young adults. Thereby focussing on individuals' risk of getting any cardiovascular disease seems to be higher in association to TyG index and BMI.

6. Source of Funding

None.

7. Conflict of Interest

None.

8. Acknowledgement

We acknowledge the sincere support of Ms.Shruthi V and Ms. Aravinth Bharathy of 2^{nd} yr. MBBS, Trtichy SRM Medical College, Hospital & Research Centre, in this project.

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Cite this article: Khan MR, Sivakumar K, Babu S V, Velu V K, Sowmithri K D. TyG index as a cardiovascular risk factor, with reference to anthropometry in first year medical students - A cross sectional study. *Int J Clin Biochem Res* 2021;8(2):130-134.