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Correlation of serum hsCRP with various defining parameters of metabolic syndrome in obese adolescents.

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Abstract:

Introduction: Elevated levels of hsCRP are associated with an increased WC, insulin resistance, BMI, and hyper glycemia and are increased with the number of the Mets components. hsCRP levels may be an important independent predictor of unfavourable outcomes in the Mets.

Methodology: 150 subjects were examined for anthropometric parameters and biochemical investigations as per the guidelines of IDF.

For BMI, of 19-year-old adolescents, WHO classification of obesity was used. Estimation of serum hsCRP was done by Latex turbidimetry method.

Results: Mean serum hsCRP was significantly higher in obese adolescents i.e., 5.15±1.89as compared to mean serum hsCRP in healthy adolescents' i.e., 1.08±0.30.

Conclusion: The results of present study indicate inflammatory state is present even during early stages of accumulation of weight and serum hsCRP level strongly associated with BMI, waist circumference, blood pressure and serum triglycerides which will lead into Mets and cardiovascular disease (CVD) in future.

Keywords: metabolic**,** Elevated, lipoprotein, adolescents, predictor

Introduction

The metabolic syndrome (syndrome X, insulin resistance syndrome) consists of a group of metabolic abnormalities that confer increased risk of cardio vascular disease (CVD) and type II diabetes mellitus.

The major features of the Mets include central obesity, hyper triglyceridemic, low levels of high-density lipoprotein (HDL) cholesterol, hyper glycemia, and hypertension.(1)

For children age 10 to 16 years, Mets can be diagnosed with abdominal obesity (using waist circumference percentiles) and the presence of two or more other features (elevated triglycerides,

low HDL-cholesterol, high blood pressure, increased fasting blood glucose)(2)(3).

Various studies have documented the prevalence of Pediatric Mets in different parts of India in the range of 3.3%–30%. (4)(5)

Childhood obesity is an important risk factor for the development of metabolic syndrome in children and adolescents. Obese children with Mets are at increasing risk of progressing to type 2 diabetes mellitus and cardiovascular disease in later life(6)

Therefore, early identification of children at risk and prompt preventive actions are very important.

There are several risk factors that constitute to cardiovascular complications. hsCRP is an acute-phase protein. It is present in normal serum and it increases significantly after most for Mets of tissue injuries, bacterial and virus infections, inflammation and malignant neoplasia.

hsCRP may be also useful in detecting atherosclerotic process and providing important prognostic information about patients with asymptomatic heart disease, unstable angina, and myocardial infarction.

Recent studies show that hsCRP concentration in serum rise long before traditional symptoms.(7)

Elevated levels of hsCRP are associated with an increased WC, insulin resistance, BMI, and hyper glycemia and are increased with the number of the Mets components. hsCRP levels may be an important independent predictor of unfavourable outcomes in the Mets.(8)

hsCRP is a major inflammatory cytokine that functions as a nonspecific defence mechanism in response to tissue injury or infection. Synthesized mainly in the liver, hsCRP activity is stimulated by other cytokines, especially interleukin (IL)-6, IL-1β, and tumour necrosis factor-α (TNF-α)(9)

Hence the present study was undertaken to assess the utility of hsCRP as a marker for cardiovascular disease and the metabolic abnormalities. Also, its association in obese children and adolescents was assessed in population of Jodhpur for better preventive measures.

Methodology

The present study was conducted in the Department of Biochemistry, Dr S. N. Medical College and its associated group of hospitals, Jodhpur (Rajasthan). The subjects selected for the study were grouped as follows:

- Group 1- Healthy adolescents (n=75)
- Group 2- Obese adolescents (n=75)

Healthy and obese adolescents aged between 10-19 years of either sex were included in the study.

Patients with history of infection and chronic disease, type II diabetes mellitus, familial hyper lipidemia, hypertension, genetic disorders, growth hormone deficiency, hypothyroidism were excluded from the study.

An informed consent was taken from all the subjects or their parents or their guardian who participated in the study for physical examination and biochemical procedures after apprising them the nature and objective of the study.

Physical examination and Anthropometry

Each subject was examined for anthropometric parameters and biochemical investigations as per the guidelines of IDF (2007).

In that report, the IDF recommended that Pediatric Mets be based on the adult IDF definition but that it should only apply to children 10 years and older and that, among those between10 and 16 years of age, the 90th percentile for waist circumference or adult cut point (which ever was lower) should define abdominal obesity. The IDF stated that for those 16 years and older, adult criteria should apply.

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Height was measured in meters (without footwear) by using a standard measuring tape.

Weight was measured on electronic weighing machine to the nearest 50 grams with children bare foot and wearing light clothing.

Waist circumference in centimetres, measured at a point midway between lower margin of the rib cage and the highest point of the iliac crest, in the standing position with the abdomen relaxed, arm hanging by the side and the feet together using a standard measuring tape.

Hip circumference in centimetres, at the level of greater trochentar in standing position with the arm hanging by the side using a standard measuring tape. Blood Pressure was recorded in the right arm of the relaxed, seated subject**.**

The body mass index was calculated from the height and weight.

$$\text{BMI}\left(\frac{\text{kg}}{\text{m}^2}\right) = \frac{\text{Weight(kg)}}{\text{Height(m2)}}$$

For the BMI, using IAP (Indian Pediatrics) growth charts for 5–18-year-old Indian children, approach 3rd, 5th, 10th, 25th ,50th ,23 adult equivalent (as overweight cut off), and 27 adults equivalent (as obesity cut off) percentiles. For BMI, of 19-year-old adolescents, WHO classification of obesity was used

Estimation of serum glucose was done by enzymatic glucose oxidase- peroxidase endpoint method. Estimation of serum cholesterol was made by enzymatic chod-pap endpoint method.

Estimation of serum triglyceride was done by enzymatic gpo/pap endpoint m method. Estimation of serum high density lipoprotein-c (HDL-c) and low-density lipoprotein-C (LDL-C) was done by direct homogenous method. Estimation of Serum VLDL was done by Fried Wald's formula

Estimation of serum hsCRP was done by Latex turbidimetry method (7)

Result

Table 1: Basic characteristics in group 1 and 2.

Parameters	**Group-1 (Healthy Adolescents) Mean±SD**	**Group-2 (Obese Adolescents) Mean±SD**	**Group-1 vs Group-2 p value**
Height	1.54±0.09	1.62±0.09	<0.0001(HS)
Weight	52.06±10.67	76.78±11.02	<0.0001(HS)
BMI	21.61±1.90	32.64±4.30	<0.0001(HS)
Waist circumference	67.32±4.52	101.81±11.80	<0.0001(HS)
Hip circumference	85.97±6.47	97.28±8.27	<0.0001(HS)
Waist to Hip Ratio	0.79±0.04	1.05±0.10	<0.0001(HS)
Systolic Blood Pressure	119.48±1.78	133.94±5.57	<0.0001(HS)
Diastolic Blood pressure	78.72±2.43	84.65±3.03	<0.0001(HS)

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Parameters	Group-1 (Healthy Adolescents) Mean±SD	Group-2 (Obese Adolescents) Mean±SD	Group-1 vs Group-2p value
Fasting Blood Glucose	81.81±8.17	107.08±13.21	<0.0001(HS)
Serum Total Cholesterol	116.57±13.17	189.18±32.12	<0.0001(HS)
Serum Triglycerides	80.12±13.09	134.06±25.38	<0.0001(HS)
Serum HDL	46.96±5.80	35.28±9.07	<0.0001(HS)
Serum LDL	90.66±9.16	109.77±18.38	<0.0001(HS)
Serum VLDL	16.05±2.60	26.77±5.11	<0.0001(HS)
Serum hs-CRP	1.08±0.30	5.15±1.89	<0.0001(HS)

Table 2: Biochemical parameters in group 1 and 2

Graph 1: Mean serum hsCRP(mg/L) of subjects studied

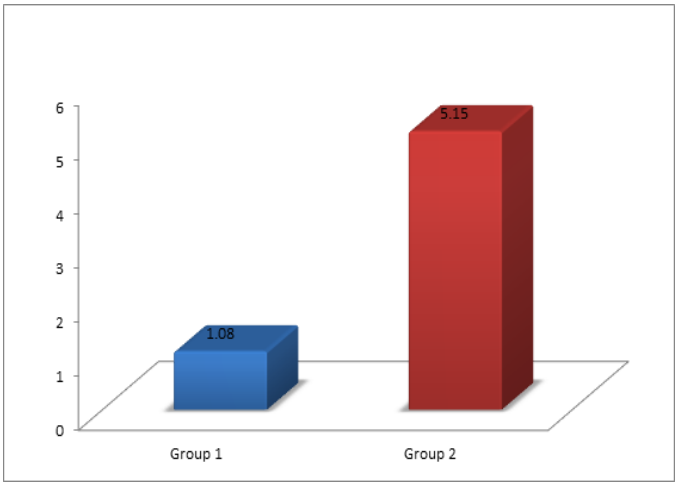

Table 3: Correlation of serum hsCRP with various defining parameters of Mets in group 1-healthy adolescents (10-19 years)

Defining criteria	Serum hs-CRP	
	r value	p value
BMI	0.171	0.142
Waist circumference	0.061	0.603
Waist-Hip Ratio	0.179	0.123
Systolic blood pressure	0.089	0.443
Diastolic blood pressure	0.038	0.741
Serum Triglyceride	0.072	0.538
Serum HDL	-0.042	0.717
Fasting Blood Glucose	0.163	0.161

Table 4: Correlation of serum hsCRP with various defining parameters of Mets in group 4-obese adolescents (10-19 years)

Defining criteria	Hs-CRP	
	r value	p value
BMI	0.239	0.038*
Waist circumference	0.231	0.045*
Waist-Hip Ratio	0.238	0.039*
Systolic blood pressure	0.232	0.044*
Diastolic blood pressure	0.283	0.013*
Serum Triglyceride	0.274	0.017*
Serum HDL	-0.094	0.421
Fasting Blood Glucose	0.077	0.510

Pearson's correlation test applied

* $p < .05$ (Significant)

Discussion

During the past decades, the world population has undergone significant changes in health and eating behaviour and lifestyle.

These changes are seen in the increasing consumption of high-calorie food and sugary beverages as well as more sedentary behaviour and severe lack of physical exercise.

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As a consequence, the global prevalence of overweight and obesity has continuously been growing and has now reached epidemic proportions.

In parallel with this development, the prevalence of obesity associated health consequences like cardiovascular diseases and type II diabetes mellitus has been increasing as well.

The Mets is frequently used to describe the pathophysiological connection between these trends.(10)

Low-grade inflammation is characteristic of the Mets. C-reactive protein (hsCRP), an acute phase protein, the best characterized biomarker of inflammation, is also an independent predictor of future cardiovascular events. hsCRP has been shown to impair insulin signalling and contributes to atherothrombosis. (11) .

In children and adolescents, even low-grade systemic inflammation has been shown to be associated with the metabolic syndrome(12)

In present study mean hsCRP level was significantly higher in obese children and adolescents in comparison to healthy children and adolescents in present study which indicate that the inflammatory state increase in hsCRP levels is present even during early stages of accumulation of weight.

The result was in agreement with Biswas D C et al (13), Mohamed et al (14), Chang C J et al(15), Dayal D et al (16), Namburi R P et al(17), Kitsios Konstantinos et al(18), Sarah M Warouw et al(2011), Hatem Hamed El-shorbagy et al(9), Leandro Soriano-Guillen et al(19).

Significant positive correlations were observed between hsCRP and BMI, waist circumference and waist to hip ratio in obese children and adolescents.

Earlier studies also have shown similar positive correlation between BMI and hsCRP in obese children and adolescents but the same degree of correlation was not seen with other anthropometric parameters.

The underlying cause of this association between BMI and hsCRP might be, adipose tissue is a source of cytokines like tissue necrosis factor, interleukin-6 and these cytokines increases the production of acute phase proteins like hsCRP.(14)(15)(16)(17)

The systolic blood pressure and diastolic blood pressure showed significant positive correlation with serum hsCRP which was in agreement with the study of Hatem Hamed El-shorbagy et al(9). Although Namburi R P et al (17) found that systolic blood pressure and diastolic blood pressure showed positive correlation with serum hsCRP with no significant difference.

Mohamed et al (14) and Dayal D et al(16)reported positive correlation between serum hsCRP and systolic blood pressure with no significant difference and negative correlation with diastolic blood pressure with no significant difference and concluded that elevated blood pressure has been associated with increased risk of cardiovascular disease and the underlying cause may be inflammation as shown by increase hsCRP levels.

The results of serum triglyceride and serum HDL in our study were in accordance with the study of Chang CJ et al(15), Hatem Hamed El-Shorbagy et al(9),Leandro Soriano-Guillen et al(19) which reported that serum hsCRP showed a significant positive relation with serum trigycerides and negative correlation with serum HDL in obese children and adolescents and suggesting its utility as a metabolic risk factor.

In our study the serum hsCRP showed a non-significant positive relation with fasting blood glucose which was in agreement with the study of Chang C J et al(15), Dayal D et al(16).

In contrast to our study Thakre R R et al(20) and Namburi R P et al(17)reported negative correlation between serum hsCRP and fasting blood glucose level in obese children and adolescents.

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Conclusion

The present study concludes that serum hsCRP level is significantly higher in obese adolescents which indicates inflammatory state is present even during early stages of accumulation of weight and serum hsCRP level strongly associated with BMI, waist circumference, blood pressure and serum triglycerides which will lead into Mets and cardiovascular disease in future.

References

1. Sangeetha G. A study on association between metabolic syndrome and acute coronary syndrome (Doctoral dissertation, Thanjavur Medical College, Thanjavur).

2. B. M, N. S. C. Early identification of risk factors and diagnosis of metabolic syndrome in overweight and obese children above 6 years of age. Int J Contemp Pediatr. 2017;4(4):1439.

3. Reisinger C, Nkeh-Chungag BN, Fredriksen PM, Goswami N. The prevalence of pediatric metabolic syndrome—a critical look on the discrepancies between definitions and its clinical importance. Int J Obes [Internet]. 2021;45(1):12–24. Available from: http://dx.doi.org/10.1038/s41366-020-00713-1

4. Gupta A, Sachdeva A, Mahajan N, Gupta A, Sareen N, Pandey RM, et al. Prevalence of pediatric metabolic syndrome and associated risk factors among school-age children of 10-16 Years living in District Shimla, Himachal Pradesh, India. Indian J Endocrinol Metab. 2018;22(3):373–8.

5. Singh N, Parihar R, Saini G, Mohan S, Sharma N, Razaq M. Prevalence of metabolic syndrome in adolescents aged 10-18 years in Jammu, J and K. Indian J Endocrinol Metab. 2013;17(1):133.

6. Bhat R, Paray I, Zargar S, Ganie A, Khan I. Prevalence of the metabolic syndrome among North Indian adolescents using Adult Treatment Panel III and pediatric International Diabetic Federation definitions. Arch Med Heal Sci. 2015;3(1):44.

7. Macy EM, Hayes TE, Tracy RP. Variability in the measurement of C-reactive protein in healthy subjects: implications for reference intervals and epidemiological applications. Clinical chemistry. 1997 Jan 1;43(1):52-8.

8. Retracted : A Comprehensive Review on Metabolic Syndrome. 2019;54(5):797–810.

9. El-shorbagy HH, Ghoname IA. High-sensitivity C-reactive protein as a marker of cardiovascular risk in obese children and adolescents. Health (Irvine Calif). 2010;02(09):1078–84.

10. Sashindran VK, Dudeja P. Obesity in school children in India. InPublic Health in Developing Countries-Challenges and Opportunities 2020 Jan 30. IntechOpen.

11. Devaraj S, Singh U, Jialal I. Human C-reactive protein and the metabolic syndrome. Curr Opin Lipidol. 2009;20(3):182–9.

12. Bennett NR, Ferguson TS, Bennett FI, Tulloch-Reid MK, Younger-Coleman NOM, Jackson MD, et al. High-Sensitivity C-Reactive Protein is Related to Central Obesity and the Number of Metabolic Syndrome Components in Jamaican Young Adults. Front Cardiovasc Med. 2014;1(December):1–9.

13. Biswas, D.C., Rahman, M.M., Sharmin, F., Jahan, I., Roy, A. and Begum, S., 2021. Association of High-sensitivity C-Reactive Protein Level with Central Obesity of the Children: A Case Study in a Tertiary Care Hospital of Bangladesh. Issues and Development .

14. Mohamed NS, Maher SE, Abozaid SMM, Moenes HM. Anthropometric and metabolic pattern in obese Egyptian children: its association with C-reactive protein. Egypt Pediatr Assoc Gaz. 2020;68(1).

15. Chang CJ, Jian DY, Lin MW, Zhao JZ, Ho LT, Juan CC. Evidence in obese children: contribution of

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hyperlipidemia, obesity-inflammation, and insulin sensitivity. PLoS One. 2015 May 26;10(5):e0125935.

16. Dayal D, Jain H, Attri SV, Bharti B, Bhalla AK. Relationship of high sensitivity C-reactive protein levels to anthropometric and other metabolic parameters in Indian children with simple overweight and obesity. J Clin Diagnostic Res. 2014;8(8):5–8.

17. Namburi R, Ponnala A, Karthik T, Rani Pr, Maheshwari R. A study on metabolic variables and its association with high sensitive C-reactive protein in obese children and adolescents. Indian J Endocrinol Metab. 2013;17(7):360.

18. Kitsios K, Papadopoulou M, Kosta K, Kadoglou N, Papagianni M, Tsiroukidou K. High-sensitivity C-reactive protein levels and metabolic disorders in obese and overweight children and adolescents. JCRPE J Clin Res Pediatr Endocrinol. 2013;5(1):44–9.

19. Soriano-Guillén L, Hernández-García B, Pita J, Domínguez-Garrido N, Del Río-Camacho G, Rovira A. High-sensitivity C-reactive protein is a good marker of cardiovascular risk in obese children and adolescents. Eur J Endocrinol. 2008;159(1):10–3.

20. RR T, Abhang SA, Naik SS. Study of vitamin b12, folate and adipokines with respect to insulin resistance (IR) and anthropometry (birth weight and BMI) in children (age 10–20 years).

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