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A Case Control Study to Evaluate the Correlation of Body Mass Index and Waist Hip Ratio With High Sensitivity C Reactive Protein in Obese Females

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ABSTRACT:
INTRODUCTION *:Obesity is defined as a Body Mass Index(BMI) greater than 30. The WHO states that abdominal obesity is defined as a waist-hip ratio above 0.90 for males and above 0.85 for females.It is one of the leading chronic,multifactorial and complex diseases which poses a major public health issue increasing the risk of non - communicable diseases like Type 2 Diabetes Mellitus, Cardiovascular diseases and Hypertension. It is considered to be a disorder of energy balance and it has recently been suggested that some form of obesity is associated with chronic low-grade inflammation. The present study aimed toemphasize the burden of obesity in inflammation by associating with elevated levels of high sensitivity CReactive Protein (CRP) in obese females.CRP is an independent risk factor for cardiovascular disease and is positively associated with body weight in obese individuals.*
AIM & OBJECTIVE*:The aim of the present study was to assess the morbidity risk in Overweight by analyzing the levels of the inflammatory marker Hs CRP in comparison with normal controls and also to correlate the Hs CRP with the body composition parameters such as Body Mass Index and Waist Hip Ratio.*
MATERIALS AND METHODS: *The study was a case control study including30−60 years old 40 obese females with BMI (≥30 kg/m^2), WHR (≥ 0.85) and 40 normal weight females with BMI (≥18 and ≤25 kg/m^2), WHR (≤ 0.85) of similar age group. Other systemic diseases were excluded. Assessment was done by measuring the weight and height for all the participants.BMI was calculated by Quetelet Body Mass Index and the Waist-hip ratio or Waist-to-Hip ratio. WHRis the dimensionless ratio of the circumference of the Waist to that of the Hips. This is calculated as waist measurement divided by hip measurement (*W ÷ H*).The measurement ofHs CRP was done by Immunoturbidometer. The results obtained were tabulated and analyzed.*
RESULTS: *The statistical analysis was done by Paired t test and Pearson correlation using SPSS.In obese participantsHsCRP was significantly elevated. The level of HsCRP was proportionally elevated in relation to Body Mass Indexand Waist-Hip Ratioin obese subjects.*
CONCLUSION: *Elevated HsCRP levels in obese individuals indicate a proinflammatory state.The relation between the parameters was found to be correlated and also significant in all obese participants with p value of 0.000.This result suggested that Hs CRP had been correlated with BMI& WHR and thence it can be used effectively for evaluation of Obesity in assessing the Cardiovascular risks for morbidity and mortality as early as possible.*
Key Words: *BMI, WHR, OBESITY, HS CRP.*

ABBREVIATIONS: BMI,Body Mass Index;WHR , Waist Hip Ratio; Hs CRP, High sensitivity C – Reactive Protein;Ht, Height;Wt, Weight ; DM ,Diabetes Mellitus.

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I. Introduction

Obesity has been associated with numerous chronic non communicable diseases like type 2 Diabetes Mellitus, Hypertension and Cardiovascular diseases. [(1)]Adipose tissue in the body is not just an energy store but also serve as an endocrine organ with release of various hormones and cytokines.

Some of these cytokines have been implicated in the initiation and propagation of inflammation and hence atherosclerosis. [(2)]The prevalence of overweight and obesity has increased 27.5% for adults and 47.1% for children from 1980 to 2013 worldwide and the number of overweight and obese individuals rises from 857 million in1980 to 2.1 billion in 2013. [(3)]

Although this epidemic is most severe in developed countries, it is also causing a big public health challenge in developing countries like India and China. Due to the rapid economic boom in the past decades, the accompanying changes in dietary habits and lifestyle lead to a significant increase of overweight and obese population in India.

The association between BMI and mortality has been widely debated, especially for people with chronic diseases such as Diabetes, Heart failure and Chronic kidney disease. BMI and WHR are shown to have a positive association with all cause of mortality in some epidemiological studies.

Others find that obesity does not increase or even decrease mortality in some clinical conditions, thus the concept of **"Obesity Paradox"** was introduced.[4]

C-reactive protein (CRP) is one of the common test parameters used in clinical practice to assess, diagnose and also to prognoses the inflammatory conditions. However, the role played by CRP in physiological processes is not clearly elucidated. CRP, belonging to pentraxin family of protein shows a 1000-fold or more increase in concentration during the occurrence of an injury, inflammation or tissue death. [5]The halflifeof plasma CRP is about 19 hours and is constant under all conditions of health and disease. [6, 7]

In addition to CRP, the levels of few other proteins which are termed as acute phase proteins are also increased during inflammation. CRP, the first acute phase protein to be described, is a sensitive systemic marker of inflammation and tissue damage and a predictor of Cardiovascular diseases. [6,8,9]

II. Aim & Objective

The aim of the present study was to assess the morbidity risk in Obesity by analyzing the levels of the inflammatory marker Hs CRP in comparison with normal control and also to correlate the Hs CRP with the body composition parameters such as Body Mass Index and Waist-Hip Ratio.

III. Materials And Methods

The study was done with proper approval from the institutional ethical committee. A case control study was conducted in the Department of Physiology, Thanjavur Medical College by recruiting 80 participants comprising of 40 obese females and 40 normal weight females in the age group of 30-60 years. Informed consent was obtained from the subjects prior to the commencement of study.

We divided the participants based on BMIand WHR as follows:

1) The normal group with normal range of BMI($\geq$18 and $\leq$25 kg/m^2) and WHR $\leq$ 0.85
2) The obesity group with high BMI ($\geq$30 kg/m^2) and WHR $\geq$ 0.85

Anthropometric measures like height and weight were taken for all the participants in this study group. Height was taken and measured without foot wears. Weight was measured with light clothing and without foot wears.

BMI was calculated by dividing weight (Kg) with the square of height (m). WHR was calculated as waist measurement divided by hip measurement ($W \div H$). Blood samples were collected from all the participants for measuring the inflammatory parameter Hs CRP. The samples were immediately centrifuged at 3000 rpm for 5 minutes and serum was separated. The Sera was stored at 20 degree Celsius until assayed by Immunoturbidometer.

Subjects with known Thyroid disorders, Cushing's disease, Pregnant & Lactating women were excluded from the study.

IV. Result Analysis

Statistical analysis was carried out using SPSS software. The mean values were compared by a Paired t test. Bi-variate linear correlation was estimated using Pearson's correlation coefficient.All the statistical tests done were two sided and differences with probability values <0.05 were considered statistically significant.

Paired Samples Test
TABLE 1

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Normal									
Pair 1	bmi - hscrp	21.47175	1.89810	0.30012	20.86471	22.07879	71.545	39	0.000
Pair 2	whr - hscrp	-.73050	0.68990	0.10908	-0.95114	-.50986	-6.697	39	0.000
OBESE									
Pair 3	bmi - hscrp	31.86	0.77394	0.10900	30.10	33.33	261.203	39	0.000
Pair 4	whr - hscrp	-2.50075	0.74066	0.11711	-2.73762	-2.26388	-21.354	39	0.000

TABLE 1 : Pair 1 and 2 are the Paired sample test values of the normal weight individuals and Pair 3 and 4 are the values of Obese Subjects. All the statistical tests done were two sided and differences with probability values < 0.05 were considered statistically significant.

TABLE 2

Paired Samples Correlations Among Normal weight and Obese participants				
		N	Correlation	Sig.
Normal				
Pair 1	bmi&hscrp	40	0.707	0.000
Pair 2	whr&hscrp	40	0.196	0.225
OBESE				
Pair 3	bmi&hscrp	40	0.592	0.000
Pair 4	whr&hscrp	40	0.368	0.019

TABLE 2 : Pair 1 and 2 are the Paired samples of correlation values of the normal weight individuals and Pair 3 and 4 are the values of Obese Subjects. All the statistical tests done were considered statistically significant.

	N	**Mean**	**S.D**	**Correlation**	**Sig.**	**T**	**df**	**Statistical inference**
BMI	40	22.86	2.32488	0.707	0.000	71.545	39	0.000
WHR	40	0.779	0.036088	0.196	0.225	-6.697	39	0.000

The above table show the mean and standard deviation of the normal weight participants. The results were statistically significant with p value of 0.000 <0.05 and also showed a positive correlation.

Table 3: CASE

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
crp	40	2.00	6.00	3.3925	0.75256
whr	40	0.85	0.99	0.8918	0.03419
bmi	40	30.10	33.33	31.86	0.77394

Paired Sample - t Test

	N	**Mean**	**S.D**	**Correlation**	**df**	**Statistical inference**
BMI	40	31.86	0.77394	0.390807	39	0.000
WHR	40	0.8918	0.03419	0.368292	39	0.000

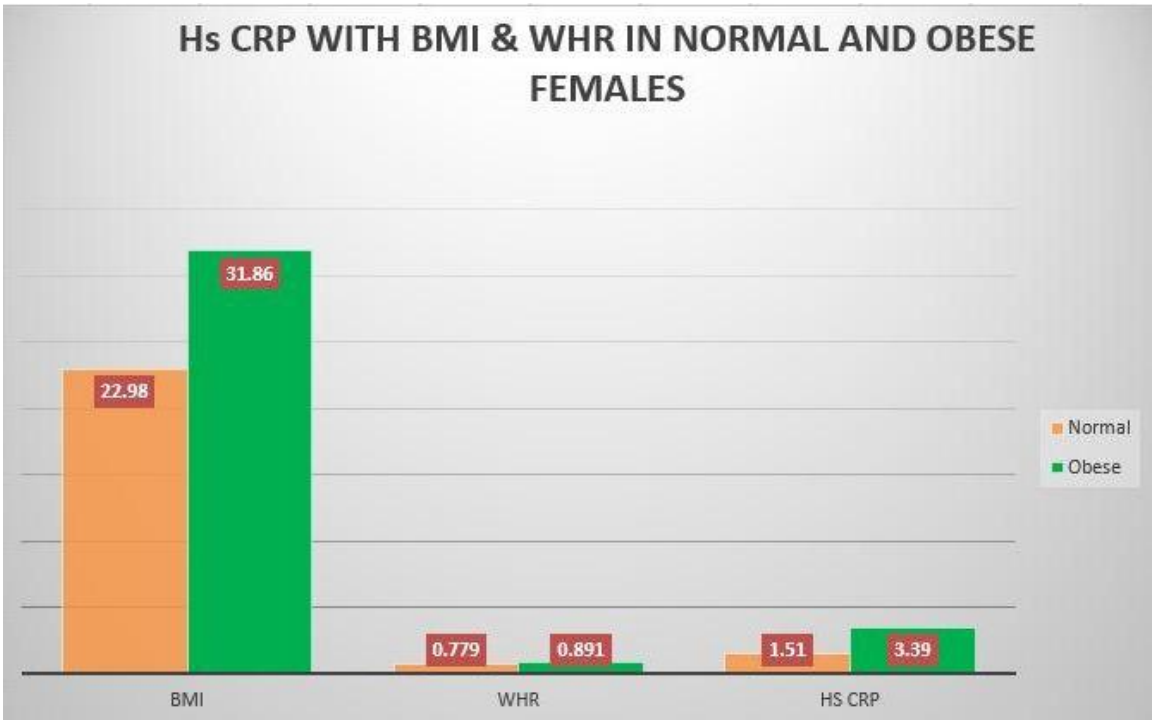
The table 3 showed the mean and standard deviation of the obese participants.The results were statistically significant with p value of 0.000 <0.05 and also showed a positive correlation.

Table 4: Comparison of biochemical parameters among two groups

Parameter	**Case group (Mean±SD)**	**Control group (Mean±SD)**	**p-value**
BMI (kg/m^2)	31.86±0.77	22.86±2.32	0.000
WHR	0.891±0.0344	0.779±0.036088	0.000
Hs CRP	3.39±.75	1.51±.70	0.000

The table 4 showed the mean and standard deviation of the obese and normal participants. The results were statistically significant with p value of 0.000 <0.05.

FIGURE 1:HIGH SENSITIVITY CRP, BMI & WHR IN NORMAL AND IN OBESE FEMALES



The figure1 showed the correlation of Hs CRP with BMI and WHR in normal and Obese Participants. High sensitivity C Reactive protein elevated in Obese females with a mean value of 3.39.

Table 4: Pearson's correlation in obese participants and normal weight participants

Parameters	r Value	correlation
BMI	-0.18946	Negative
WHR	0.098414	Positive
Hs CRP	-0.08698	Negative

The table 4 showed a correlation between BMI,WHR & Hs CRP among Obese participants and normal weight participants with r value < 1.

SUMMARY OF THE ASSOCIATION BETWEEN VARIATION IN INFLAMMATORY PARAMETER WITHIN THE STUDY GROUP REFERENCE RANGE AND POSSIBLE OUTCOMES

OUTCOME	ASSOCIATION	PARAMETER	EVIDENCE QUALITY
BMI	YES	Hs CRP	GOOD
WHR	YES	Hs CRP	GOOD
HEART FAILURE	POSSIBLE	Hs CRP	Not assessed in this study
CARDIOVASCULAR MORTALITY	POSSIBLE	Hs CRP	Not assessed in this study

V. Discussion

Obesity is a condition described as an excess body weight in the form of fat. When this fat accumulates, it leads to several health problems. It has become highly prevalent among the Indians.The most widely used index of excess body fatness is Body Mass Index. However, recent studies have shown that central adiposity rather than total body fatness is a more serious clinical entity.[10]

In the present study, an attempt was made to assess the possible association between the inflammatory marker high sensitivity CRP and generalized obesity. Participants with obesity had higher levels of Hs-CRP and this finding was consistent with previous reports of **BelfkiH et al**, which showed that elevated levels of this marker was associated with obesity.[11]

Recently there were several studies to confirm the positive association between obesity indices and inflammatory markers, mainly C – Reactive Protein in women by **Bochud M et al**, [12, 13] but also other inflammatory markers, both in women and men by **Nijhuis J et al**. [14]

Similarly the results arein consistent with the studies of **Mortensen OHet al**[15] which reported that CRP was positively associated with the degree of overweight and obesity.

Many research studies has tested the utility of CRP level as a marker for the initiation and monitoring of treatment with statin for obese individuals.[16] Obesity activates the pathways for the production of abnormal adipokines and cytokines which can be considered as biological markers of inflammation. [17]

WHR was significantly correlated with CRP in both men and women[18]

The link between obesity and inflammation is based on two basic theories. According to the first theory, obesity induced inflammation has been considered to be a protective mechanism, which stops the body from losing activity or fitness by storing the fat in tissues and organs by anabolic process. Second theory suggests that inflammation as a catabolic process which breaks down the tissue to control the body weight within the normal limits. [19]

Limitations of this study:

1. Absence of longitudinal follow-up toward clinical endpoints such as myocardial infarction and stroke.
2. Small sample size prohibits us from generalization and studies with larger sample size are recommended.
3. No detailed inquiries were made regarding dietary habits that might potentially alter the Hs-CRP and association between them and obesityrelated factors.

VI. Conclusion

The positive association of obesity with elevated Hs-CRP level suggests the importance of reducing obesity and its related morbidity and mortality.Hs-CRP is an easily measured inflammatory biomarker and is released by the liver under the stimulation of cytokines, including interleukin-6, interleukin-1, and tumor necrosis factor-alpha.

Elevated Hs-CRP levels in young obese individuals heighten the inflammatory link, which might leadto drastic complication in the future inducing theprogression of noncommunicable diseases. In obese individual the non pharmacological methods such as weight loss, healthy food habits and regular exercise may help in controlling the high sensitivity CRP to attain a normal level, which may eventually help to reducethe risk of development of various diseases.

Thus the present study insists and motivates the people for healthy dietary habits, periodical assessment of BMI,WHR and high sensitivity CRP along with other biochemical parameters.

References

[1]. Klein J, Perwitz N, Kraus D, Fasshauer M. Adipose tissue as source and target for novel therapies.TrendsEndocrinolMetab. 2006; 17:26–32.

[2]. David Soyoye1, BabatopeKolawole, Rosemary Ikem&AdenikeEnikuomehinRelationship between high-sensitivity C-reactive protein and anthropometric indices of obesity Endocrine Abstracts (2015) 38 P235 | DOI:10.1530/endoabs.38.P235

[3]. Organization WH. Obesity: Preventing and managing the global epidemic. WHO Consultation.2004. ISBN: 9241208945. 1. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2014. Epub 2014/06/02. DOI:10.1016/S0140-6736(14)60460-8.

[4]. Ding Ding, Min Wang, Dongfang Su, Changjiang Hong, Xinrui Li, Yunou Yang, Yuan Zhang, Gang Hu,andWenhua Ling Body Mass Index, High-Sensitivity C-Reactive Protein and Mortality in Chinese with Coronary Artery Disease PLoSOne. 2015; 10(8):e0135713.Published online 2015 Aug 17. doi: 10.1371/journal.pone.0135713 PMCID: PMC4539189

[5]. Pepys MG and Hirschfield GM. C-reactive protein: a critical update. J ClinInvest 2003;111(12).

[6]. Black S, Kushner I, Samols D. C-reactive protein. J BiolChem2004;279:48487-48490.

[7]. Ying SC, Marchalonis JJ, Gewurz AT, Siegel JN, Jiang H, Gewurz BE, etal.Reactivity of anti human C-reactive protein (CRP)and serum amyloid Pcomponent (SAP) monoclonal antibodies with limulin and pentraxins of otherspecies. Immunology 1992;76(2):324-330.

[8]. Pepys MB andBaltz ML. Acute phase proteins with special reference to C-reactive protein and related proteins(pentaxins) and serum amyloid A protein. AdvImmunol1983;34:141-212.

[9]. Ridker PM. C-reactive protein and the prediction of cardiovascular events among those at intermediate risk: moving an inflammatory hypothesis toward consensus. J Am CollCardiol. 2007;49:2129–2138.

[10]. PreisSR,MassaroJM,HoffmannU,D'Agostino RB Sr,LevyD,Robins SJ et al.Neck circumference as a novel measure of cardio metabolic risk: The vFramingham Heart study. J ClinEndocrinolMetab 2010;95:3701-10.

[11]. Belfki H, Ben Ali S, Bougatef S, Ben Ahmed D, Haddad N, Jmal A, et al. Relationship of Creactiveprotein with components of the metabolic syndrome in a Tunisian population. Eur J InternMed. 2012;23:e5–9.

[12]. Bochud M, Marquant F, Marques-Vidal P-M, et al. Association between C-reactive protein and adiposity in women. Journal of Clinical Endocrinology and metabolism. 2009;94(10):3969–3977.

[13]. Shemesh T, Rowley KG, Jenkins A, Brimblecombe J, Best JD, O'Dea K. Differential association of C-reactive protein with adiposity in men and women in an Aboriginal community in northeast Arnhem Land of Australia. International Journal of Obesity. 2007;31(1):103–108.

[14]. Nijhuis J, Rensen SS, Slaats Y, van Dielen FMH, Buurman WA, Greve JWM. Neutrophil activation in morbid obesity, chronic activation of acute inflammationand obesity. 2009;17(11):2014–2018.

[15]. Mortensen OH, Nielsen AR, Erikstrup C, et al. Calprotectin and CRP —a novel marker of obesity. PLoS ONE. 2009;4(10, article e7419)

[16]. Ridker PM, Danielsol E, Fonseca FAH et al. Rosuvastatin to prevent vascular events in man and women with elevated C-reactive protein. New England Journal of Medicine 2008; 359(21):2195-2207.
[17]. Hotamisligil GS, Shargil NS, Spiegelman BM. Adipose expression of tumor necrosis factor α: direct role in obesity-linked insulin resistance. Science 1993; 259(5091):87-91.
[18]. Festa A, D'Agostino R, Williams K, Karter AJ, Mayer-Davis EJ, Tracy RP, Haffner SM. The relation of body fat mass and distribution to markers of chronic inflammation. International Journal of Obesity. 2001;25:1407–1415. doi: 10.1038/sj.ijo.0801792.
[19]. Greenberg AS, Obin MS. Obesity and the role of adipose tissue in inflammation and metabolism. TheAmerican Journal of Clinical Nutrition 2006; 83(2):461S-465S.

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