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Thyroid profile and C-reactive protein in metabolic syndrome

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Abstract

Metabolic syndrome is a predictor of future cardiovascular diseases and type 2 diabetes mellitus. Over hypothyroidism and sub-clinical hypothyroidism (SCH) are risk factors for atherosclerotic cardiovascular disease, hyperlipidemia, low grade inflammation and hypercoagulability. The systemic inflammation is measured by measuring the sensitivity of C reactive protein which is a known risk factor for cardiovascular disease. The association between metabolic syndrome and high sensitivity CRP is explained in a Japanese study which redefined the link between metabolic syndrome with high sensitivity CRP as a component in this definition. This prospective observational study was conducted in the Post Graduate Department of Physiology, Government Medical College, Jammu, in 2019 with the aim to determine the correlation between thyroid profile and C-reactive protein in patients with metabolic syndrome. In the present study majority of the participants were females and maximum number of male patients were in age group of 41 – 50 years and female were in the age group of 31 – 40 years. All the patients had waist circumference more than the cut off criteria i.e >102 CMS in case of males and > 88 CMS in females, hip circumference was higher in males than females. Male patients had a higher mean blood sugar fasting i.e, 123.2 mg/dl than female subjects i.e, 112.01 mg/dl. The study concluded that the subclinical hypothyroidism is associated with increased co-morbidities as there was a statistically significant correlation was observed between thyroid dysfunction (SCH) and raised CRP levels in both male and female patients with metabolic syndrome.

Keywords: Metabolic syndrome, Thyroid function, C-reactive protein, and Prognostic marker.

Introduction

Metabolic syndrome is a predictor of future cardiovascular diseases and type 2 diabetes mellitus.[1]

In India the prevalence of metabolic syndrome is increasing rapidly similar to another Asian countries, which leads to mortality and morbidity due to cardiovascular disease and type 2 diabetes mellitus.[2]

The literature said that Indians are at risk of developing obesity related co-morbidities.[3] Thyroid hormones play

an important role in regulating the metabolic pathway which influences the resting energy expenditure. The physical inactivity leads to obesity which can alter the thyroid hormones.[4]

Overt hypothyroidism and sub-clinical hypothyroidism (SCH) are risk factors for atherosclerotic cardiovascular disease, hyperlipidemia, low grade inflammation and hypercoagulability. The systemic inflammation is measured by measuring the sensitivity of C reactive protein which is a known risk factor for cardiovascular disease. The association between metabolic syndrome and high sensitivity CRP is explained in a Japanese study which redefined the link between metabolic syndrome with high sensitivity CRP as a component in this definition.[5,6,7,8]

The hyper cholesterolemia produces accumulation of cholesterol in macrophages and thus induces inflammation. The role of inflammatory markers like high sensitivity -CRP may be important in subclinical hypothyroidism patients because without inflammation cholesterol cannot be trapped.[9]

Thus this prospective observational study was done to determine the correlation between thyroid profile and C-reactive protein in patients with metabolic syndrome.

Methodology

This prospective observational study was conducted in the Post Graduate Department of Physiology, Government Medical College, Jammu, in 2019 after obtaining approval from the institutional ethical committee.

After obtaining the informed consent a total of 60 patients attending the Medicine Outpatient department were included in the study.

Inclusion Criteria

1. Patients who are willing to participate.
2. Patients who fulfilled the NCEP-ATP III criteria.

Exclusion criteria

1. Patients under 18 years of age.
2. Patients who had co-morbidities.

Procedure of data collection

Whole procedure was explained to the patients. A detailed history and physical examination was done. All the patients were on nothing per oral since last 12 hours. After 12 hours of fasting venous blood sample was withdrawn and sent to the biochemistry laboratory for further analysis of T3, T4, TSH and C- reactive protein.

The statistical analysis was performed by using Student's unpaired t- test with the help of Windows-based Excel and SPSS version 22 applications tofind the difference between the various parameters and the results were expressed as mean ± standard deviation. A p-value of < 0.05 was taken as statistically significant in all analyses.

Observations and result

Total of 60 patients were involved in this observational study among them majority of the participants were female and maximum number of male patients were in age group of 41 – 50 years. And female were in the age group of 31 – 40 years. All the patients had waist circumference more than the cut off criteria i.e >102 CMS in case of males and > 88 CMS in females, hip circumference was higher in males than females. Male patients had a higher mean blood sugar fasting i.e, 123.2 mg/dl vthan female subjects i.e, 112.01 mg/dl.

Table 1: Serum Triglycerides (mg/dl)

Blood sugar (mg/dl)	**Male n (%)**	**Female n (%)**
<150	3(13.04)	7(18.9)
≥150	20(86.9)	30(81.08)

Table 1 depicts more than 4/5th subjects studied from both the genders had S. Triglycerides > 150 mg/dl, with a mean S. Triglycerides level slightly higher in female subjects (213.05 mg/dl) than the male subjects (201.1 mg/dl) and the mean serum triglyceride was 208.4±61.3.

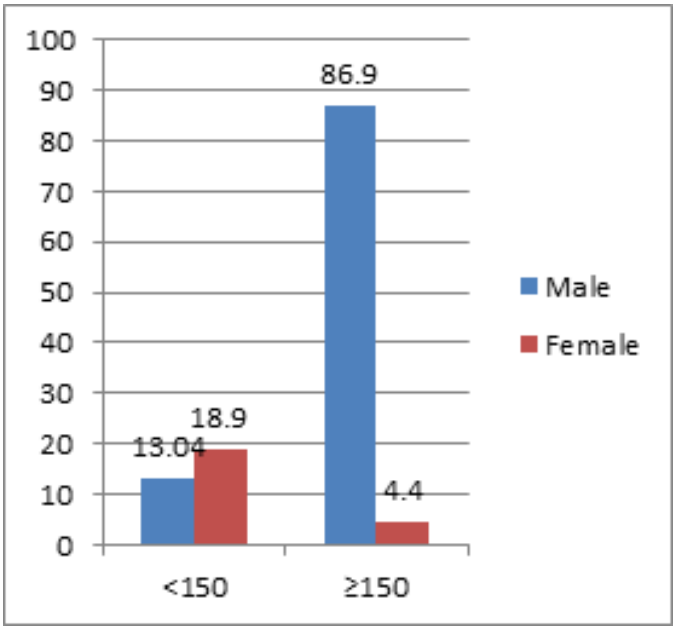

Figure 1: Serum Triglycerides (mg/dl)

Table 2: HDL Cholesterol (mg/dl)

HDL Cholesterol	Male n (%)	HDL Cholesterol	Female n (%)
<40	17(73.9)	<50	28(75.6)
≥40	6 (26.08)	≥50	9 (24.3)

Table 2 depicted that majority of the male patients had HDL Cholesterol <40 mg/dl with the mean 44.05±9.31 and similarly majority of the female patients had <50mg/dl HDL Cholesterol with mean 41.4±10.2.

Table 3: LDL Cholesterol (mg/dl)

LDL Cholesterol	Male n (%)	Female n (%)
<100	9(39.1)	15(40.5)
>100	14(60.8)	22(59.4)

Table 3 presents that nearly 60% subjects had S. LDL cholesterol ≥ 100 mg/dl and 40% had S. LDL cholesterol ≤ 100 mg/dl incase of both male and female subjects with mean LDL Cholesterol 105.6±19.9.

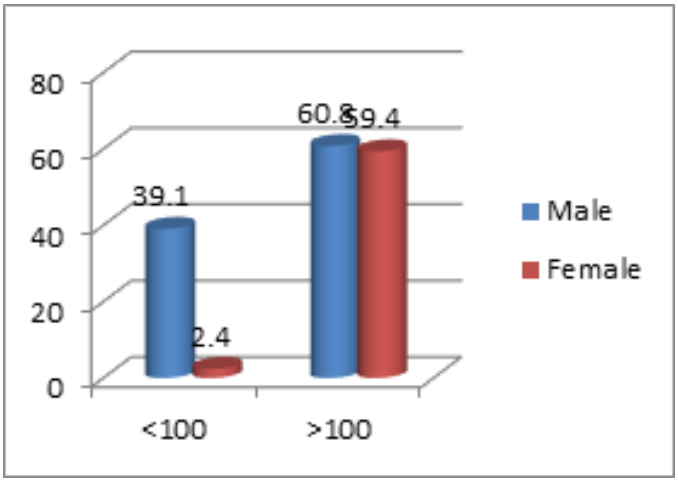

Figure 2: LDL Cholesterol (mg/dl)

Table 4: TSH (µIU/ml)

TSH (µIU/ml)	Male n (%)	Female n (%)
<0.35	0(0)	0(0)
0.35-5.5	18(78.2)	21(56.7)
>5.5	5(21.7)	16(43.2)

Table 4 showed that the nearly 80% male subjects were having TSH level in normal range (0.35 – 5.5 µIU/ml) and 20 % had TSH level > 5.5 µIU / ml, Whereas 57% females had TSH in normal range 0. .35 – 5.5 µIU/ml) and 43% were having TSH level > 5.5 µIU/ml. The mean TSH was 6.3±5.2.

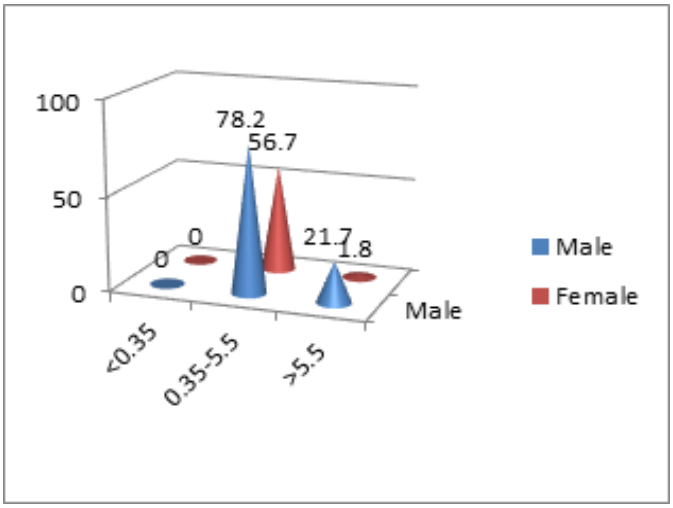

Figure 3: TSH (µIU/ml)

Table 5: T3 (ng/ml)

T3 (ng/ml)	Male n (%)	Female n (%)
<0.6	2(8.6)	9(24.3)
0.6-1.81	21(91.3)	27(72.9)
>1.81	0(0)	1(2.7)

Table 5 depicted that 91.3% males had T_3 level in the range of 0.6 – 1.81 ng/ml & 8.6% having < 0.6 ng/ml and 73% females had T_3 level in the rangeof 0.6 – 1.81 ng/ml & 24 % having < 0.6 ng/ml. The mean T3 was 1.15±0.56.

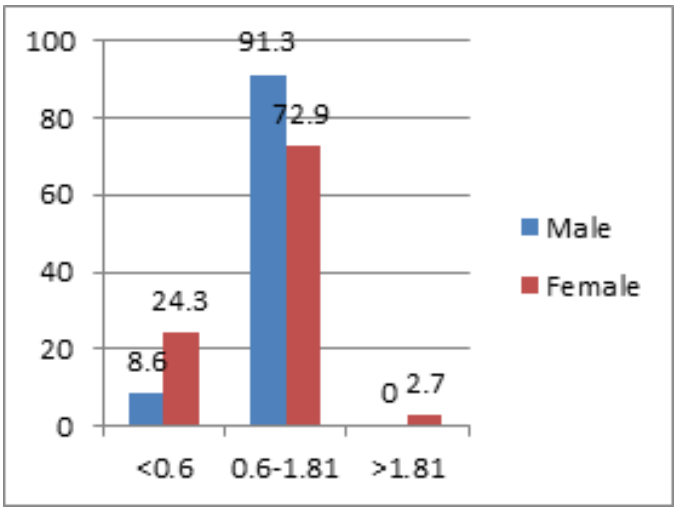

Figure 4: T3 (ng/ml)

Table 6: T4 (µg/ml)

T4 (µg/ml)	**Male n (%)**	**Female n (%)**
<5.01	2(8.6)	11(29.7)
5.01-12.45	21(91.3)	24(64.8)
>12.45	0(0)	2(5.4)

Table 6 stated that 91.3% males had T4 level in the range of 5.01 – 12.45µg/dl and 64.8% females had T4 level in the rangeof 5.01 – 12.45µg/dl. The mean T4 was 7.9±2.9.

Table 7: C-reactive protein (mg/l)

C-reactive protein (mg/l)	**Male n (%)**	**Female n (%)**
<2.0	2(8.6)	4(10.8)
2.0-6.0	15(65.2)	23(62.1)
>6.0	6(26.0)	10(27.0)

Table 7 represents that 65.2% were having C – Reactive protein level in the range of 2.0 – 6.0 mg/L and 26% having > 6 mg/L. In case of female's subjects 62.1% were having C - reactive protein level in the range of 2.0 – 6.0 mg/L and 27% having >6 mg/L. The mean C-reactive protein in male was 5.2±4.1 and in females 5.7±5.4.

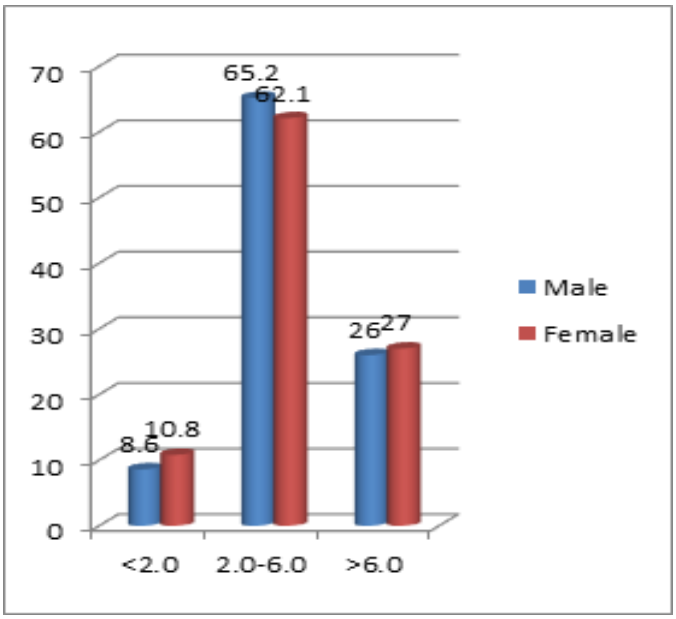

Figure 5: C-reactive protein (mg/l)

Table 8: TSH (µIU/ml) Levels and CRP (mg/L) Levels in Male

TSH (µIU/ml)	**CRP (2.0-6.0mg/l)**	**CRP (<2.0mg/l)**	**C-RP (>6.0mg/l)**
<0.35	0	0	0
0.35-5.5	13	2	3
>5.5	2	0	3

Table 8 showed the significant correlation (r) between TSH and CRP Levels in Male patients =0.639 (p value = 0.001).

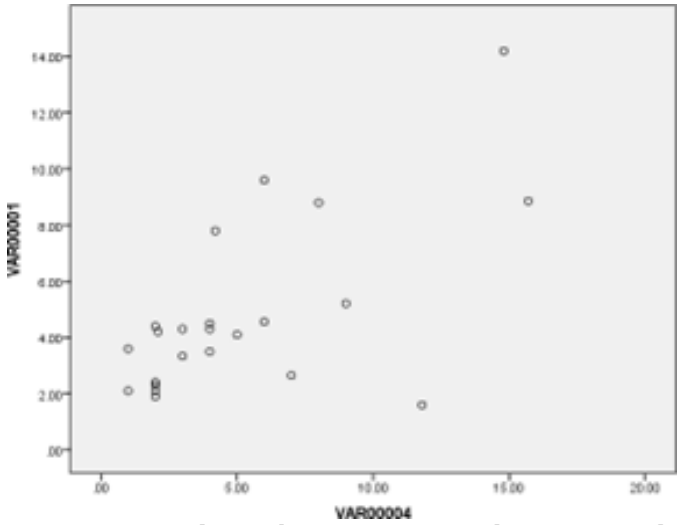

Figure 6: Correlation between TSH and CRP in Male patients

Table 9: T3 (***n***g/ml) Levels and CRP (mg/L) Levels in Male

T3 (*n*g/ml)	**CRP (2.0-6.0mg/l)**	**CRP (<2.0mg/l)**	**C-RP (>6.0mg/l)**
<0.6	0	0	2
0.6-1.81	15	2	4
>1.81	0	0	0

Table 9 showed the significant correlation (r) between T3 and CRP Levels in Male patients =0.403 (p value = 0.001).

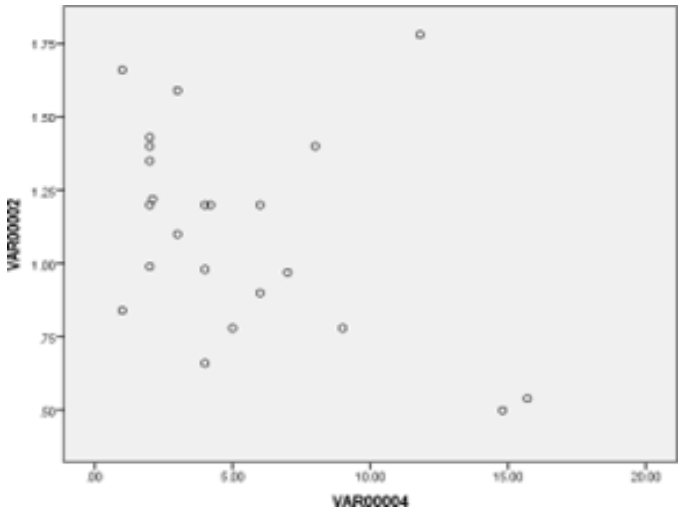

Figure 7: Correlation between T3 (***n***g/ml) Levels and CRP (mg/L) Levels in Male

Table 10: T4 (µg/dl) Levels and CRP (mg/L) Levels in Male

T4 (µg/dl)	**CRP (2.0-6.0mg/l)**	**CRP (<2.0mg/l)**	**C-RP (>6.0mg/l)**
<5.01	2	0	0
5.01-12.45	14	02	5
>12.45	0	0	0

Table 10 depicted the negative correlation (r) between T4 and CRP Levels in Male patients -0.338 (p value = 0.114).

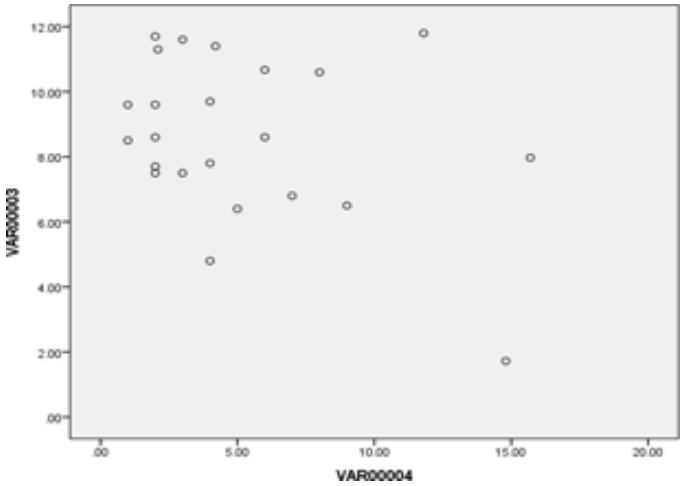

Figure 8: Correlation between T4 (µg/dl) Levels and CRP (mg/L) Levels in Male

Table 11: TSH (µIU/ml) Levels and CRP (mg/L) Levels in Females

TSH (µIU/ml)	**CRP (2.0-6.0mg/l)**	**CRP (<2.0mg/l)**	**C-RP (>6.0mg/l)**
<0.35	0	0	0
0.35-5.5	17	2	2
>5.5	6	2	8

Table 11 showed the highly significant correlation (r) between TSH and CRP Levels in female patients = 0.509 (p value = 0.001).

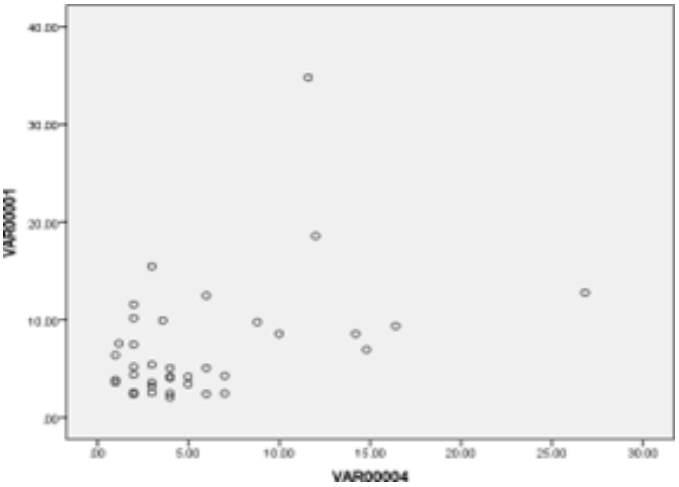

Figure 9: Correlation between TSH and CRP in female patients

Table 12: T3 (***n***g/ml) Levels and CRP (mg/L) Levels in females

T3 (*n*g/ml)	**CRP (2.0-6.0mg/l)**	**CRP (<2.0mg/l)**	**C-RP (>6.0mg/l)**
<0.6	5	0	4
0.6-1.81	18	4	5
>1.81	0	0	1

Table 12 showed the negative correlation (r) between T4 and CRP Levels in female patients -0.020 (p value = 0.9)

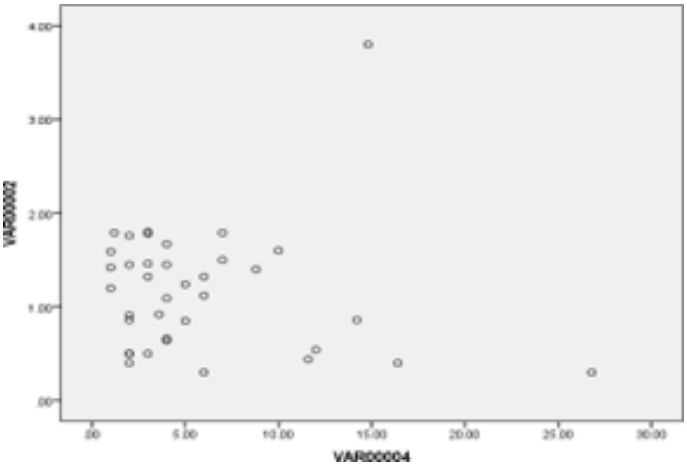

Figure 10: Correlation between T3 & CRP in females

Table 13: T4 (µg/dl) Levels and CRP (mg/L) Levels in females

T4 (µg/dl)	**CRP (2.0-6.0mg/l)**	**CRP (<2.0mg/l)**	**C-RP (>6.0mg/l)**
<5.01	6	0	5
5.01-12.45	16	4	4
>12.45	1	0	1

Table 13 depicted the negative correlation (r) between T4 and CRP Levels in female patients -0.245 (p value = 0.144).

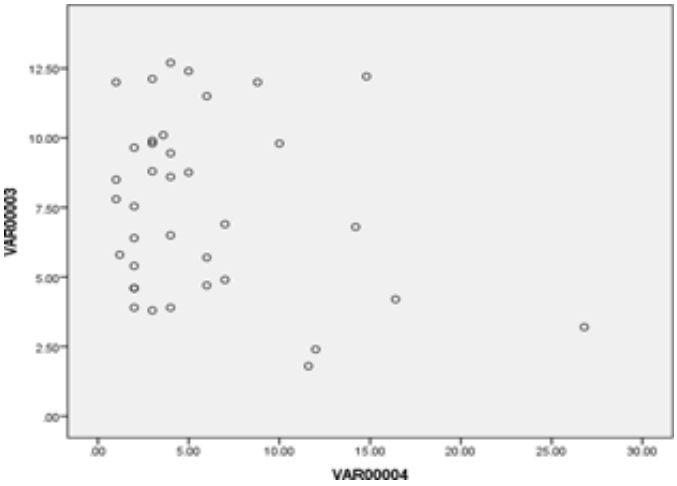

Figure 11: Correlation between T4 & CRP in females.

Discussion

This study involved a total of 60 patients having metabolic syndrome. Among them majority of the participants were female and maximum number of male patients were in age group of 41 – 50 years. and female were in the age group of 31 – 40 years. All the patients had waist circumference more than the cut off criteria i.e >102 CMS in case of males and > 88 CMS in females, hip circumference was higher in males than females. Male patients had a higher mean blood sugar fasting i.e, 123.2 mg/dl than female patients i.e, 112.01 mg/dl.

The mean serum triglycerides were 208.4 ± 61.3 mg/dl and they were 201.1 ± 52.07 mg/dl and 213.05 ± 66.7 mg/dl in male and female subjects respectively, whereas, the combined mean serum LDL cholesterol was 105.6 ± 19.9 mg/dl and it was 103.1 ± 18.1 mg/dl in male subjects and 107.1 ± 21.02 mg/dl in female subjects. In similar study conducted by Roos A et al., 2007 observed that, S. triglycerides and LDL cholesterol levels were higher in male than female patients.[10]

The principal role of HDL Cholesterol in lipid metabolism is the uptake and transport of cholesterol from peripheral tissues to the liver through a process known as reverse cholesterol transport (a proposed cardio protective mechanism) (Badimon JJ et al., 1990). Mean serum HDL cholesterol in male subjects was 44.05 ± 9.31 mg/dl and in female subjects was 41.4 ± difference between them (p=0.32). statistically non-significant. 75% subjects (combined) in our study had decreased levels of S. HDLcholesterol. A similar finding was observed in a study done in North India (Gutch M et al., 2017).[11,12]

The mean serum TSH was 6.3 ± 5.2 µIU/ml with mean TSH of 4.7 ± 3.08 µIU/ml and 7.2 ± 5.9 µIU/ml in male and female subjects respectively with statistically non-significant difference between them (p = 4.56), mean serum T3 was 1.15 ± 0.56 ng/ml with mean T3 in male subjects was 1.12 ± 0.35 ng/ml and in female subjects was 1.17 ± 0.60 ng/ml with statistically non-significant mean difference between them (p = 0.18) and mean serum T4 was 7.9 ± 2.9 µg/dl and mean T4 in male subjects was 8.6 ± 2.4 µg/dl, whereas it was 7.5 ± 3.1 µg/dl in female subjects with statistically non-significant difference between them (p = 0.169). Similarly Shah P, et al. (2017) observed the prevalence of thyroid dysfunction was more in female patients.[13]

The present study revealed that 16.7% patients had subclinical hypothyroidism, 18.3% had overt hypothyroid and 65% patients had euthyroid. In accordance with the study Shantha GPS et al., (2009) have observed findings similar to our study. 57.1% female subjects and 42.9% male subjects were included in their study and found 21.9% to have SCH while 7.4% were overtly hypothyroid and 77.7% were euthyroid. However our observations differed from that of a Turkish study (Usually M et al., 2007) which had prevalence of Mets with SCH of 53.6%. The difference between the two studies may be because of large sample size (n=410) in that study.[14,15]

The Pearson-correlation was applied to determine the association between subclinical hypothyroidism and CRP and it was found that there was a significant correlation between theses parameters (p value=0.001). In another study conducted by Kumar P, et al. (2018), shown that there is a significant positive association between TSH and CRP in subclinical Hypothyroid patients (P<0.01). [16]

Conclusion

The present observational study concluded that the subclinical hypothyroidism is associated with increased co-morbidities as there was a statistically significant correlation was observed between thyroid dysfunction (SCH) and raised CRP levels in both male and female patients with metabolic syndrome.

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