**Material and Methods**

**Study Design –**

A cross sectional study.

**Study Population –**

Study group will consist of subjects both males & females, between 18 to 60 yrs of age. The study population will be divided in three groups. First group will consist of 151 hypothyroid Patients, second group will have 100 Euthyroid subjects and third group will include 210 Hyperthyroid patients. All the patients of thyroid disorder will be recruited from Rama medical college, Kanpur.

**Calculation of sample size –**

Sample size has been calculated to control type-1 and type-2 error.

**Sample size for hypothyroid patients –**

\[ P \text{ (prevalence) of hypothyroid} = 10.94\% \] \(^{(47)}\)

Assuming 95% confidence interval sample size has been calculated using formula.

\[ n = \frac{t^2 \times p \times (p-1)}{m^2} \]

**Description:**

\[ n = \text{required sample size} \]

\[ t = \text{confidence level at 95\% (standard value of 1.96)} \]

\[ p = \text{estimated prevalence of malnutrition in the project area} \]

\[ m = \text{margin of error at 5\% (standard value of 0.05)} \]
Sample size for hyperthyroid patients –

P (prevalence) of hyperthyroid = 1.3\% \textsuperscript{(48)}

Assuming 95\% confidence interval sample size has been calculated using formula.

\[ n = \frac{t^2 \times p(1-p)}{m^2} \]

\( m \) = margin of error at 7\% (standard value of 0.07)

Inclusion Criteria –

- BMI 20 - 40 kg/m\(^2\)
- Both male and female either euthyroid or suffering from hypothyroid, hyperthyroid.

Exclusion Criteria –

- Patients suffering from any type of chronic disease e.g. Diabetes Mellitus, tuberculosis, renal failure, hypertension.
- Patients with any physical disability.
- Female Subjects on hormone replacement therapy.
- Subjects on antihypertensive medicines or on any other medication.
- Alcoholics and smokers.
Methodology

Anthropometric Parameters –

Height

The subject will be asked to stand on a horizontal plane with heels together, starching upwards to the fullest and hand loosely hanging down. The marked Frankfurt plane is made horizontal. The reading is noted at the horizontal arm on the anthropometer from the level on which the subject will be standing. (49)

Weight

Standard portable weighing machine will be use to measure the weight. (49)

Body Mass Index

BMI will be calculated using following formula

$$BMI = \frac{\text{weight (Kg)}}{\text{Height (m}^2\text{)}}$$

Subject > 29 Kg / m\(^2\) will be considered as obese subject. (49)

Circumference measurement

Waist Circumference –

An elastic tape will be place around the subject, in a horizontal plane. The narrowest part of the torso will be measured at the level of natural waist. (49)

Hip Circumference –

An elastic tape will be place around the buttocks in a horizontal plane to measure hip circumference. (49)

Waist Hip Ratio (49)

<0.8 Normal
Biochemical Parameters -

Estimation of thyroid hormones

Thyroid function will be assessed by measuring serum total triiodothyronine (T3), free thyroxine (FT4), and TSH by Enzyme Linked Immunosorbent Assay (ELISA) method.\(^{(50)}\)

Estimation of Lipid Profile

Lipid profile in that serum sample will be measured by serum concentrations of following parameters.

a. Serum concentration of total cholesterol will be estimated by the enzymatic CHOD-POD method.\(^{(50)}\)

b. Serum concentration of triglycerides will be measured by the GPO-PAP method.\(^{(50)}\)

c. Serum concentration of high density lipoprotein will be measured by CHOD-POD/ Phosphotungstate method.\(^{(50)}\)

d. Serum concentration of low density lipoprotein will be measured by using Friedewald’s formula: LDL cholesterol = total cholesterol – HDL cholesterol – [triglycerides/5].\(^{(50)}\)

Estimation of blood glucose level

Blood glucose level will be measured by God - Pod method.\(^{(50)}\)

Estimation of serum calcium level

Serum calcium level will be measured by Arsenazo III Method.\(^{(50)}\)
**Estimation of Vitamin D level**

Vitamin D will be measured by Elisa method.\(^{(50)}\)

**Bone Mineral Density Test** – BMD will be measured dual electron x-ray absorptiometry (DXA) at lumbar spine and femoral neck.\(^{(51)}\)

\[
T\text{-score} = \frac{\text{subject}\_'s\ BMD\ value - \text{Mean young normal BMD value}}{\text{ISD young normal BMD}} \quad (17)
\]

‘X’ Ray Long bones and Vertebrae – ‘X’ Ray will be done on MDX – 100 (100 mA, 100 KVP Fixed X-Ray Machine) manufactured by Recorders & Medicare Systems Pvt Ltd, Panchkula (HR).
Statistical analysis

Baseline characteristics of the study participants will be expressed in Mean+-SEM (Standard Error of Mean). One way ANOVA will be used to analyze differences in baseline characteristics between three groups. Pearson correlation test on the entire data as well as within group will be used to test whether thyroid hormones are correlated with BMI, serum calcium, BMD, cholesterol, LDL-C, HDL-C, triglycerides, blood sugar. A p value < 0.05 will be considered statistically significant. IBM SPSS Statistics 21 manufactured by IBM USA will be used for entire calculations.