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# A Comparative study on the effect of hypothyroidism on menstrual cycles and BMI and assessing the dietary habits of students residing in government residential schools of Telangana

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**Abstract:**

Based on the prevalence and availability of hypothyroid cases, 12 schools from The Telangana Social Welfare Residential Educational Institutions Society (TSWREIS) were chosen. Adolescent girls aged 14 to 19 were chosen using cluster sampling. A total of 150 responses were gathered 75 responses taken from the hypothyroid subject's (case group). The control group consisted of the 75 non-hypothyroid subjects. The questionnaire used to gather data was divided into five sections: the first section included questions about the respondent's consent, demographic profile, and health parameters; the second section included questions about the family history and understanding of the subject; the third section included the thyroid assessment; the fourth section included the menstrual cycle assessment; and the final section was the food frequency questionnaire to assess dietary habits. The majority of the subjects were interviewed in person, with only a few responses obtained through online Google meetings. Using MS Excel, SPSS software and the Chi Square test the collected data was compiled, organized, tabulated, and statistically analyzed.When hypothyroid subjects were compared to controls, they had significantly more abnormal menstrual cycles. The menstrual cycle assessment revealed a significant association between hypothyroidism and the menstrual cycle, with a p-value of 0.001. The Chi Square test revealed a significant association between hypothyroidism and BMI of about 0.001.According to a standardised questionnaire, hypothyroidism has negative consequences on a person's physical systems, including the menstrual cycle and altered BMI.

**KEY WORDS:** Hypothyroidism, Menstrual cycles, BMI, TSH levels,Thyroid, Assessment

## Introduction:

The main aim of the study is to compare the menstrual cycles and BMIs of hypothyroid and non-hypothyroid subjects. The objectives of the study is to evaluate the association between hypothyroidism and menstrual cycles, to evaluate the association between hypothyroidism and BMI and to assess the dietary habits of students

Hypothyroidism: Hypothyroidism is a clinical condition that most primary care physicians see. Hypothyroidism, if left untreated, can lead to hypertension, dyslipidaemia, infertility, cognitive impairment, and neuromuscular dysfunction. According to data from the National Health and Nutrition Examination Survey, approximately one in every 300 people in the United States has hypothyroidism. The prevalence rises with age and is greater in women than in men. Hypothyroidism can be caused by primary gland failure or a lack of thyroid gland. The most common cause of hypothyroidism in the United States is autoimmune thyroid disease. Clinical symptoms of hypothyroidism are nonspecific and can be subtle, particularly in the elderly. A serum thyroid-stimulating hormone test is the most accurate laboratory test for thyroid function. Screening asymptomatic adults does not appear to improve outcomes. The majority of patients can be relieved of their symptoms by taking synthetic levothyroxine orally, and the majority will require lifelong therapy. Triiodothyronine/thyroxine combination therapy has no advantages over thyroxine monotherapy and is not recommended. (Gaitonde et al; 2012)

**Diagnosis of Hypothyroidism**

TSH, T3, and T4 levels were considered normal if they were within the normal range (TSH level = 0.39-6.16 IU/ml, free T3 level = 1.4-4.2 ng/ml, and free T4 level = 0.8-2.0 ng/ml); subclinical hyperthyroidism is diagnosed when TSH is low and T3 and T4 levels are high, and overt hyperthyroidism is diagnosed when TSH is low and T3 and T4 are high (Ajmani et al; 2016). An elevated serum TSH level and a low serum free T4 level indicate overt primary hypothyroidism. A high serum TSH level combined with a normal serum free T4 level indicates subclinical hypothyroidism. (Gaitonde et al; 2012)

**Symptoms of Hypothyroidism**

Primary hypothyroidism is characterised by elevated serum TSH and low serum FT4. When TSH is elevated but FT4 is within the normal reference range, SCH is present. Secondary (pituitary) or tertiary (hypothalamic) hypothyroidism is characterised by low FT4 and an inappropriately elevated TSH. Imaging of the hypothalamus and pituitary gland should be performed on patients suspected of having central hypothyroidism. A third-generation chemiluminometric assay is commonly used to measure (Almandoz et al; 2012)

Many patients with subclinical hypothyroidism are asymptomatic, such patients tend to report symptoms of overt hypothyroidism. These symptoms are usually milder than those in patients with overt hypothyroidism and tend to increase in both number and severity with higher thyrotropin levels. Some studies have shown higher rates of depressive symptoms and reduced quality of life, cognitive function, and memory among persons with subclinical hypothyroidism than among persons with normal thyroid function. Increased rates of fatigue, muscle weakness, weight gain, cold intolerance, and constipation have also been reported variably in association with subclinical hypothyroidism. Elderly persons seem to have fewer symptoms than younger persons. In similar meta-analyses based on individual participant data. Subclinical hypothyroidism is associated with increased total cholesterol levels and low-density lipoprotein cholesterol levels and with subclinical measures of cardiovascular disease. Higher serum thyrotropin levels are associated with increased body-mass index and increased waist circumference. However, substantial weight loss typically results in a decrease in the thyrotropin level, which suggests that subclinical hypothyroidism is an unlikely cause of obesity. The risks of female infertility, spontaneous abortion,

and other complications associated with pregnancy, such as gestational hypertension and preeclampsia, are increased in women with subclinical hypothyroidism and thyroid autoimmunity (Peeters, R. P 2017)

## Prevalence of Hypothyroidism

A cross-sectional, multi-center epidemiological study was carried out in eight major cities in India (Bangalore, Chennai, Delhi, Goa, Mumbai, Hyderabad, Ahmedabad, and Kolkata) to investigate the prevalence of hypothyroidism among adults. Laboratory results were used to diagnose thyroid abnormalities (serum FT3, FT4 and Thyroid Stimulating Hormone [TSH]). Patients with a history of hypothyroidism and on levothyroxine therapy, as well as those with serum free T4 of 0.89 ng/dl and TSH of 5.50 U/ml, were classified as hypothyroid. The prevalence of self-reported and undiagnosed hypothyroidism, as well as anti-thyroid peroxidase (anti-TPO) antibody positivity, was investigated. A total of 5376 adult male or non-pregnant female participants aged 18 were enrolled, with 5360 (mean age: 4614.68 years; 53.70% females) evaluated. The overall prevalence of hypothyroidism was 10.95% .When compared to coastal cities, inland cities had a higher prevalence of hypothyroidism. Adults with hypothyroidism were diagnosed in a significantly higher (P0.05) proportion of females than males (15.86% vs 5.02%) and older than younger (13.11% vs 7.53%). Hypothyroidism was common, affecting approximately one in every ten adults in the study population. Female gender and older age were discovered to have a significant relationship with hypothyroidism. Other common findings included subclinical hypothyroidism and anti-TPO. (Unnikrishnan et al; 2013)

In India, the prevalence of hypothyroidism is 11%, compared to 2% in the UK and 46% in the US. In comparison to coastal cities (such as Mumbai, Goa, and Chennai), inland cities (such as Kolkata, Delhi, Ahmedabad, Bangalore, and Hyderabad) have a higher prevalence (117% vs 95%). According to Ambrish Mithal, chairman of the Medanta Division of Endocrinology and Diabetes (Gurgaon, India), the higher mean thyroid-stimulating hormone concentration and range in India compared to western countries is possibly due to the country's long-standing iodine deficiency, which has only been partially corrected over the past 20 years. People aged 46-54 years have the highest prevalence of hypothyroidism (131%), while those aged 18-35 years have the lowest (75%). (Bagcchi S 2014 )

## Hypothyroidism and Menstruation

Secondary amenorrhea, hypomenorrhea, oligomenorrhea, hypermenorrhea, polymenorrhea, and irregular menstrual cycle were studied in 586 patients with Graves' disease hyperthyroidism, 111 with hypothyroidism, 558 with euthyroid chronic thyroiditis, 202 with painless thyroiditis, and 595 with thyroid tumour. The overall patient group had the same prevalence as the 105 healthy controls. Patients with severe hyperthyroidism, on the other hand, had a higher prevalence of secondary amenorrhea (2.5%) and hypomenorrhea (3.7%) than those with mild or moderate hyperthyroidism (0.2% and 0.9%, respectively). Furthermore, menstrual disturbances were more common in patients with severe hypothyroidism (34.8%) than in mild to moderate cases (10.2%). Menstrual irregularities in thyroid dysfunction were less common than previously thought. (Kakuno et al; 2010)

## Treatment of Hypothyroidism

When hypothyroidism is diagnosed, the majority of patients can begin LT4 replacement therapy right away. This dose

is approximately 1.6 g/kg/day for a person with no residual thyroid function. Patients who have had thyroid surgery may require 1.8 g/kg/day. A lower dose may restore a normal serum TSH value in patients who retain some endogenous function. (Jonklass J 2019)

Different thyroid hormone formulations are available for treatment of hypothyroidism. They are either synthetic or natural desiccated preparations from the thyroid glands of animals (usually porcine or bovine origin). However, only synthetic L-T4 is strongly recommended by international guidelines as the treatment of choice to replace hypothyroid patients for its proven efficacy in normalizing thyroid function and resolving hypothyroid symptoms. Thyroid extracts were frequently used in the past, before the availability of synthetic L-T4 preparations. Nevertheless, they are still used in some countries because they can facilitate weight loss in hypothyroid patients as stated by (Biondi, B etal.,2019)

**Hypothyroidism and BMI:**

Hypothyroidism is associated with decreased thermogenesis, decreased metabolic rate, and has also been shown to correlate with a higher body mass index (BMI) and a higher prevalence of obesity. There is clinical evidence suggesting that even mild thyroid dysfunction in the form of subclinical hypothyroidism is linked to significant changes in body weight and represents a risk factor for overweight and obesity (Sanyal, Detal.,2016)
Diet and Hypothyroidism:

Cruciferous (brassica) vegetables are very common foods, especially in plant-based diets. They contain many healthy nutrients, including phytochemicals with anticarcinogenic, antioxidative and anti-inflammatory activity. However, they also contain goitrogens such as progoitrin and thiocyanate-producing indole glucosinolates, which may interfere with thyroid hormone production or utilization (Kob, M 2018)

**Introduction to TSWREIS:**

The Telangana welfare Residential academic establishments Society (TSWREIS), beneath the patronage of the Ministry of Welfare, has been turbulently and impeccably rendering its services for the past thirty five years to enhance the living standards of the regular Caste students by providing them quality and property education in English medium up to graduation.

The Society with 268 establishments and around one,50,000 students believes in seamless experimentation, syncing itself with the rising trends within the education house. The Society conjointly started venturing into specialised faculties, reflective upon the aims and aspirations of its business. The diligent, diligent and meticulously planned functioning of the Society has allowed it to grow by leaps and bounds, sculpting thousands of normal boys and women into outstanding personalities over the last 3 decades.

Given its unconquerable standing within the worldwide public residential education domain, TSWREIS continues to draw in educationalists from totally different elements of Bharat and therefore the world each year. With 1,45,485 students, TSWREIS covers roughly 100% of cohorts among all Schedule Casts in Telangana. It runs high faculties, junior schools, and degree schools covering each arts and sciences. These establishments area unit a lot of girl-centric, with a hundred seventy five of them impartation education to one,04,360 girls. This includes seventeen,185 young girls, United Nations agency loose the clutches of early wedding to pursue teaching.

Besides giving a lot of required foundational education, TSWREIS additionally started venturing into specialised faculties to organize students to

figure in associate array of settings within the twenty first century. The TSWREIS team comes with a plus of over three decades of expertise in residential education system and has well-trained and practiced lecturers United Nations agency play a important role in moulding students into socially accountable voters. TSWREIS additionally introduced several programs within the annals of the govt. education sector in Bharat to liberate marginalized kids from all kinds of economic condition, despondence, and complex, and eventually putting them within the orbit of upper education and dignity.

**Materials and Methods:**

Study Design: It is a qualitative and quantitative study

Study Area: The study was conducted in 12 Government Residential schools across various districts of Telangana covering the following areas: Karimanagar, Khammam, Narayanpet, Veldanda, Telkapalli, Luxettipet, Jagital, Bhupalapalli, Sircilla, Kataram, Kamareddy, Thungaturthy.

Age Group: 14- 19 years old

Sample Size: 75 Hypothyroid and 75 Non hypothyroid subjects

Study Population: Students residing in hostels under Telangana Social Welfare residential Educational Institutions Society suffering from hypothyroidism as well as normal students.

Sampling Technique: All the subjects who satisfied the inclusion criteria (TSH Level > 5.5 mIU / L) were a part of the study

Inclusion Criteria: Subjects residing in Government Residential Schools of Telangana suffering with hypothyroidism and have had TSH levels above 5.5 mIU/ L. and those under treatment for hypothyroidism

Exclusion Criteria: Below 14 years of age , above 19 years of age

A consent form from the health supervisors of the students was obtained as the subjects were minor. This study was undertaken with the permission and under the supervision of authorities of Synergy India Foundation, who are involved in assessing the health status of children residing in the Government Residential Schools of Telangana. This was possible due to the collaboration of Department of Nutrition at St Ann's with Synergy India Foundation.

Data regarding hypothyroid subjects was sourced from the Dashboard of the Panacea Command Centre of the Synergy India Foundation and the NGO which works with Telangana Government in monitoring the health status of the students and also maintains the health records.

Materials:

A questionnaire including components like Food Frequency Questionnaire, Anthropometric Assessment, Thyroid Assessment, Menstrual Cycle Assessment were a part of it

A standardized questionnaire was designed and a generalized food frequency questionnaire was used.

Methodology:

The questionnaire had an attached form for consent of the subject. Since most of the subjects are below 18 years of age, a consent was also taken from their guardians which included the health supervisors and Principals of the schools they reside in.

The surveys were collected via Google meet, which involved screen sharing for the necessary sections. The audio and video quality were constantly checked before administering needed questions.

The first section of the questionnaire was on the demographic profile. This section covered the school name, student unique ID and name of the student, class, age

which were divided into 2 sub groups and religion. Both age and class were taken as parameters considering the fact that not every child belongs to the class/standard in which children of that age group usually are. The subjects did not know their BMI hence BMI was calculated using the IAP growth chart

The second section of the questionnaire included the family history and the medical profile about their knowledge on hypothyroidism.

The third section included the thyroid assessment that would assess the thyroid status it included TSH levels which were backed by the test reports from the database at Synergy India foundation. Other were direct questions which included, consumption of iodized salt, iodine supplements and the medications taken. The dosage of medications taken backed up by the data with the health supervisors.

The fourth section covered the menstrual cycle assessment included about the menstrual cycle abnormalities, gap between menstrual cycles, frequency of changing the sanitary pads, length of a menstrual cycle and whether the subject is experiencing only spotting. It also included the psychological and physical symptoms experienced prior periods.

It also covered physical activity, sleep cycle duration, severity of acne and hair fall

The last part was the food frequency questionnaire which was used to assess the general dietary habits of the subjects.

Statistical Methods Used: The collected data was compiled, organized, tabulated and statistically analyzed using MS Excel and SPSS software (statistical package for the social sciences). For quantitative data like age, gender, height, weight, BMI and thyroid level, the range, mean and standard deviation were calculated. Chi-square test (Annexure 2) was performed to test whether the stated hypothesis was true or false and the statistical significance was found to be 0.001.

## Results

Menstrual Cycles:

Table:1 Period abnormalities

| Parameter | Case N (%) | Control N (%) | Overall N (%) |
|---|---|---|---|
| Period Abnormalities | | | |
| Yes (1) | 25 (33.3%) | 0 (0%) | 25 (16.7%) |
| No (2) | 50 (66.7%) | 75 (100%) | 125 (83.3%) |

The results of the period abnormailites shows that in the cases, out of the 75 people suffering from hypothyroidism, 25 (33.3%) suffer from abnormailites in the menstrual cycles and 50 (66.7%) do not face any kind of abnormalities.

BMI Category

Table: 2 BMI Category

| Parameters | Case N (%) | Controls N (%) | Overall N (%) |
|---|---|---|---|
| BMI Category | | | |
| Underweight | 14 (18.7) | 36 (48.0) | 50 (33.3) |
| Healthy Weight | 52 (69.3) | 34 (45.3) | 86 (57.3) |
| Overweight | 7 (9.3) | 5 (6.7) | 12 (8.0) |
| Obesity | 2 (2.7) | 0 (0) | 2 (1.3) |

From the above table and the graph out of the 150 respondents, 75 participants in the case group 14 (18.7%) belonged to the underweight category where their percentiles according to the IAP growth chart were less than 5$^{th}$ percentile. 52 (69.3%) belonged to the healthy weight category where their percentiles according to the IAP growth chart were 5$^{th}$ percentile to less than the 85$^{th}$ percentile. 7 (9.3%) belonged to the overweight category where their percentiles according to the IAP growth chart were 85$^{th}$ to less than 95$^{th}$ percentile and lastly, 2 (2.7%) belonged to the obese category where their percentiles were equal to or greater than 95$^{th}$ percentile.

In the controls, 36 (48%) belonged to the underweight category where their percentiles according to the IAP growth chart were less than 5$^{th}$ percentile. 34 (45.3%) belonged to the healthy weight category where their percentiles according to the IAP growth chart were 5$^{th}$ percentile to less than the 85$^{th}$ percentile. 5 (6.7%) belonged to the overweight category where their percentiles according to the IAP growth chart were 85$^{th}$ to less than 95$^{th}$ percentile and lastly, 0 (0%) belonged to the obese category where their percentiles were equal to or greater than 95$^{th}$ percentile.

Overall, 50 (33.3%) belonged to the underweight category, 86 (57.3) belonged to the healthy weight category, 12 (8%) in the overweight category, and 2 (1.3%) in the obese category.

Statistical Analysis

Objective 1: To evaluate the association between hypothyroidism and menstrual cycles

If P-value is less than los, reject the hypothesis that there is no significant association between the factors/characteristics considered. We infer that there is a significant association between the factors/characteristics considered.

Table:3 Chi Square Association Table

| Menstrual cycle and related features Vs Hypothyroidism | Chi-square test P-value |
|---|---|
| Period (Menstrual Cycle) Abnormalities | 0.000* |
| Usual gap between periods | 0.001* |
| Frequency of changing the pads during periods | 0.000* |
| Length of a menstrual cycle | 0.000* |
| Only spotting without any actual bleeding | 0.000* |
| *Significant at 1% los and all levels of significance i.e., all P-values are less than 0.01 (1%) | |

Chi-square test has been used to find the association between the state of hypothyroidism and menstrual cycle and related features. The P-values of the Chi-square test is given in the Table 3

Interpretation:

It was found that there is a significant association at 1% level of significance (los) between the state of the subject being hypothyroid or not and menstrual cycle abnormalities, gap between menstrual cycles, frequency of changing the sanitary pads, length of a menstrual cycle and whether the subject is experiencing only spotting, as P-Values for all the parameters related to menstrual cycles are less than 0.001.

Result:

Therefore, this study indicates and supports the positive correlation between hypothyroidism and increased magnitude of period abnormalities among students of Government Residential Schools.

Objective – 2 To evaluate the association between hypothyroidism and BMI

Table 4 Chi Square Association Table

| Hypothyroidism Vs BMI | Chi-square test P-value |
|---|---|
| BMI Category | 0.001* |
| *Significant at 1% los and all levels of significance i.e., all P-values are less than 0.01 (1%) | |

Chi-square test has been used to find the association between the state of hypothyroidism and BMI. The P-values of the Chi-square test is given in the Table 4

Interpretation:

It was found that there is a significant association at 1% level of significance (los) between the state of the subject being hypothyroid or not and BMI. It can also be inferred that there is significant association between hypothyroidism and BMI levels as P-Value is less than 0.001.

Result:

Therefore, this study indicates and supports the positive correlation between hypothyroidism and BMI among students of Government Residential Schools.

Objective 3: Assessing the Dietary Habits of the Subjects

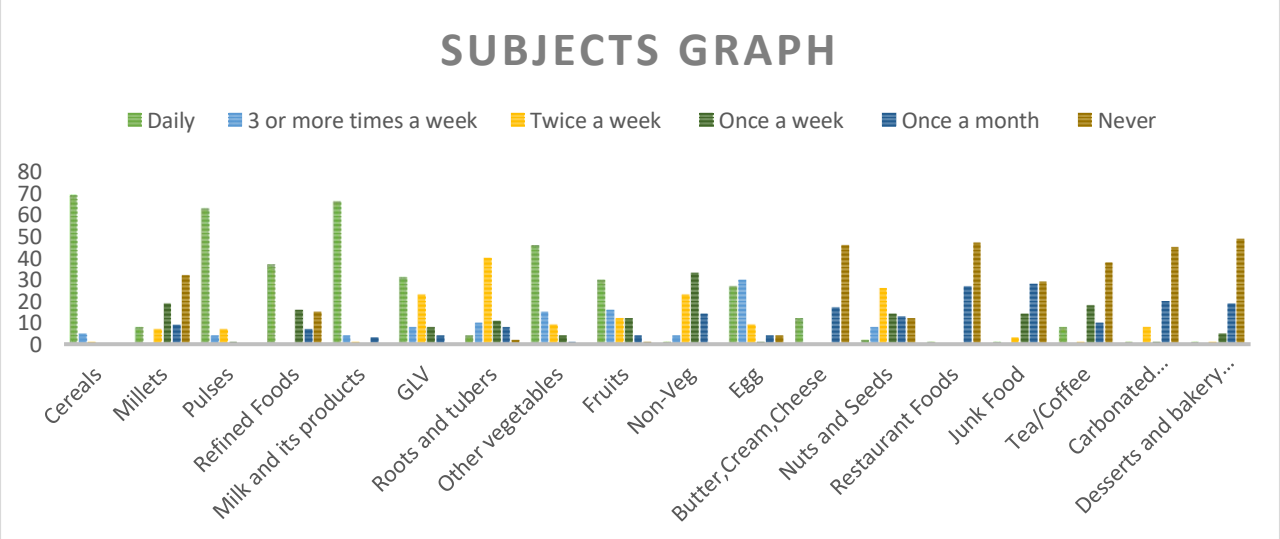


Figure 1

Cereals Consumption:

69 (92%) consume daily, 5 (6.7%) consume it 3 or more times a week, 1 (1.3%) consume it 2 times a week. In the controls, 25 (33.3%) consume it daily, 50 (66.7%) cosume it 3 or more times a week.

Millets Consumption:

In the cases, 8 (10%) cosume it daily, 7 (9.3%) consume it 2 times a week, 19 (25%) consume it once a week, 9 (12%) consume once a month, 32 (42.7%) have marked that they never consumed millets. In the controls, 25 (33.3%) consume it daily, 1 (1.3%) consume it once a month, 65 (60.5%) consume has marked that they have never consumed it.

Pulses Consumption:

63 (84%) consume it daily, 4 (5.3%) consume it 3 times or more times a week, 7 (9.3%) consume 2 times a week, 1 (1.3%) consume it once a week. In the controls, 74 (98.7%) consume it daily and 1 (1.3%) consume it three times or more times a week.

Refined Foods – Ready to eat foods:

37 (49.3%) consume it daily, 7 (9.3%) consume it once a month, 15 (20%) have marked that they have never consumed. In the controls, 23 (30.7%) consume it daily, 1 (1.3%) consume it 3 or more times a week, 2 (2.7%) consume it once a week, 13 (17.3%) consume it once a month, 36 (48%) have marked that they have not consumed yet.

Milk and Milk products:

66 (88%) consume it daily, 4 (5.3%) consume it 3 or more times a day, 1 (1.3%) consume it twice a week, 3 (4%) consume it once a month. In the controls, 72 (97.3%) consume it daily, 1 (1.3%) consume it 3 or more times a week, 1 (1.3%) consume it once a week.

Green leafy vegetables:

31 (41.3%) consume it daily, 8 (10.7%) consume it 3 or more times a day, 23 (30.7%) consume it twice a week, 8 (10.7%) consume it once a week, 4 (5.3%) consume it once a month. In the controls, 1 (1.3%) consume it daily, 54 (72%) consume it twice a week, 20 (26.7%) consume it once a week.

Roots and tubers:

4 (5.3%) consume it daily, 10 (13.3%) consume it 3 or more times a week, 40 (53.3%) consume it twice a week, 11 (14.7%) consume it once a week, 8 (10.7%) consume it once a month, 2 (2.7%) have marked that they have not consumed yet. In the controls, 75 (100%) consume it twice a week

Other vegetables:

46 (61.3%) consume it daily, 15 (20%) consume it 3 or more times a day, 9 (12%) consume it twice a week, 4 (5.3%) consume it once a week, 1 (1.3%) consume it once a month. In the controls, 24 (32%) consume it daily, 1 (1.3%) consume it 3 or more times a week, 49 (65.3%) consume it twice a week, 1 (1.3%) consume it once a week.

Fruits:

30 (40%) consume it daily, 16 (21.3%) consume it three or more times a day, 12 (16%) consume it twice a week, 12 (16%) consume it once a week, 4 (5.3%) consume it once a month, 1(1.3%) have marked that they have not consumed yet. In the controls, 74 (98.7%) consume it daily, 1 (1.3%) consume it three or more times a week,

Non-Veg:

1 (1.3%) consume it daily, 4 (5.3%) consume it three or more times a day, 23 (30.7%) consume it twice a week, 33 (44%) consume it once a week, 14 (18.7%) consume it once a month. In the controls, 47 (62.7%) consume it once a week, 24 (32%) consume it once a month, 4 (5.3%) have marked that they have not consumed yet

Egg:

27 (36%) consume it daily, 30 (40%) consume it three or more times a week, 9 (12%) consume it twice a week, 1 (1.3%) consume it once a week, 4 (5.3%) consume it once a month. In the controls, 69 (92%) consume it daily, 1 (1.3%) consume it three or more times a week, 2 (2.7%) consume it twice a week, 3 (4%) have marked that they have not consumed yet.

Butter, Cream, Cheese:

12 (6%) consume it daily, 17 (22.7%) consume it once a month, 46 (61.3) have marked that they have not consumed it yet. In the controls, 30 (40%) consume it once a month, 45 (60%) have marked that they have not consumed yet.

Nuts and seeds:

2 (2.7%) consume it daily, 8 (10.7%) consume it three or more times a week, 26 (34.7%) consume it twice a week, 14 (18.7) consume it once a week, 13 (17.3%) consume it once a month, 12 (16%) have marked that they have not consumed yet. In the controls, 23 (30.7%) consume it twice a week, 52 (69.3%) consume it once a month.

Restaurant Food/ Street food:

1(1.3%) consume it daily, 27 (36%) consume it once a month, 47 (62.7%) have marked that they have not consumed yet. In the controls, 21 (28%) consume it once a month and 54 (72%) have marked that they have not consumed yet.

Junk Food:

1 (1.3%) consume it daily, 3 (4%) consume it twice a week, 14 (18.7%) consume it once a month, 28 (37.3%) consume it once a month, 29 (38.7%) have marked that they have not consumed it yet. In the controls, 1 (1.3%) consume it once a week, 65 (86.7%) consume it once a month, 9 (12%) have marked that they have not consumed yet

Tea/Coffee:

8 (10.7%) consume it daily, 1(1.3%) consume it tiwce a week, 18 (24%) consume it twice a week, 10 (13.3%) consume it once a month, 38 (50.7%) have marked that they have not consumed yet. In the controls, 75 (100%) have marked that they have not consumed yet.

Carbonated beverages:

1 (1.3%) consume it daily, 8 (10.7%) consume it twice a week, 1(1.3%) consume it once a week, 20 (26.7%) consume it once a month, 45(60%) have marked that they have not consumed yet . In the controls, 75 (100%) have marked that they have not consumed yet.

Desserts and Bakery Items:

1 (1.3%) consume it daily, 1 (1.3%) consume it twice a week, 5 (6.7%) consume it once a week, 19 (25.3%) consume it once a month, 49 (65.3%) have marked that they have not consumed yet. In the controls, 75 (100%) have marked that they have not consumed yet.

Hypothesis

Null Hypothesis (Hө): The menstrual cycles and BMI of hypothyroid subjects differs from non-hypothyroid subjects

Alternate Hypothesis (Hα): The menstrual cycles and BMI of hypothyroid subjects does not differ significantly from that of the non-hypothyroid subjects.

Chi square test was conducted to see if there was any association between hypothyroidism and menstrual cycles and BMI. The following table gives the Chi square test statistic value and the corresponding P-value. 1% or 0.001 level of significance is considered to draw inference. If P-Value is < 0.05, it can be inferred that there is a significant association between the considered attributes, otherwise the attributes are independent.

Hypothesis Result

From the above table it can be concluded that the data of the study group revealed that there is significant association between hypothyroidism and menstrual cycles and BMI.

Table 5 Hypothesis Result

| Menstrual cycle and related features & BMI Vs Hypothyroidism | Chi-square test P-value |
|---|---|
| Period (Menstrual Cycle) Abnormalities | 0.000* |
| Usual gap between periods | 0.001* |
| Frequency of changing the pads during periods | 0.000* |
| Length of a menstrual cycle | 0.000* |
| Only spotting without any actual bleeding | 0.000* |
| BMI Category | 0.001* |
| *Significant at 1% los and all levels of significance i.e., all P-values are less than 0.01 (1%) | |

Level of Significance: 1% or 0.01
P Value: 0.001

Inference: Since P value is less than the level of significance, we accept null hypothesis and reject alternate hypothesis.
Result: The P-value was found to be 0.001 which is < 0.05%, indicating that there is a significant association between menstrual cycle and hypothyroidism magnitude.

Conclusion: Therefore, this study indicates and supports the positive correlation between irregular gaps between the menstrual cycles and hypothyroidism among students of Government Residential Schools. Very obvious results obtained from the menstrual cycle assessment test also indicate the negative impact. Hence, the stated hypothesis is proven to be true

Discussion:

We made the hypothesis that the menstrual cycles of hypothyroid subjects differ from that of non-hypothyroid subjects. There was a significant association between the two variables, p value of the analysis was 0.001 and the level of significance is 1%. The results of the period abnormailites shows that in the cases, out of the 75 people suffering from hypothyroidism, 25 (33.3%) suffer from abnormailites in the menstrual cycles and 50 (66.7%) do not face any kind of abnormalities. out of the 75 cases, 4 (5.3%) have lesser gaps between their periods i.e; they have polymenorrhagia, 46 (61.3%) have a normal gap between their periods suggesting that they have normal menstrual cycle, 16 (21.3%) have at least a gap of 1.5 to 2 months which states that might have oligomenorrhea and lastly, 9 (12%) state that they have a gap 3 or more than that suggesting that they have amenorrhea.

In the controls, 3 (4%) have lesser gaps between their periods i.e; they have polymenorrhagia, 66 (88%) have a normal gap between their periods suggesting that they have normal menstrual cycle, 6 (8%) have at least a gap of 1.5 to 2 months which states that might have oligomenorrhea and lastly, no subjects have a gap 3 or more than that suggesting that they have amenorrhea

Overall, we can conclude that, 7 (4.7%) have polymenorrhagia, 112 (74.7%) have a normal cycle, 22 (14.7%) have oligomenorrhea and 9 (6%) have amenorrhea.

We used the IAP growth chart to calculate the BMI of the subjects as the age group taken into consideration is from 13-19 years.

Out of the 150 respondents, 75 participants in the case group 14 (18.7%) belonged to the underweight category where their percentiles according to the IAP growth chart were less than $5^{th}$ percentile. 52 (69.3%) belonged to the healthy weight category where their percentiles according to the IAP growth chart were $5^{th}$ percentile to less than the $85^{th}$ percentile. 7 (9.3%) belonged to the overweight category where their percentiles according to the IAP growth chart were $85^{th}$ to less than $95^{th}$ percentile and lastly, 2 (2.7%) belonged to the obese category where their percentiles were equal to or greater than $95^{th}$ percentile.

In the controls, 36 (48%) belonged to the underweight category where their percentiles according to the IAP growth chart were less than $5^{th}$ percentile. 34 (45.3%) belonged to the healthy weight category where their percentiles according to the IAP growth chart were $5^{th}$ percentile to less than the $85^{th}$ percentile. 5 (6.7%) belonged to the overweight category where their percentiles according to the IAP growth chart were $85^{th}$ to less than $95^{th}$ percentile and lastly, 0 (0%) belonged to the obese category where their percentiles were equal to or greater than $95^{th}$ percentile.

Overall, 50 (33.3%) belonged to the underweight category, 86 (57.3) belonged to the healthy weight category, 12 (8%) in the overweight category, and 2 (1.3%) in the obese category

For assessing the dietary habits of the subjects food frequency questionnaire was used, the prefernces were asked according to the food groups, 17 different food groups were included but due to lesser differences between food habits of cases and controls, there was lesser association and served as a limitation to the study.

Since the sample size was less, limited statisitical tests were applied which prevented from detailed analysis.

Conclusion:

- From this study it can be concluded that there is significant association in menstrual cycle irregularities and hypothyroidism
- The hypothyroid subjects were found to have more altered BMI has compared to the non-hypothyroid subjects.
- The hypothyroid subjects have more menstrual cycle abnormalities when compared to the non-hypothyroid subjects within the age group of 13-19 years residing in Government Residential Schools of Telangana

The higher the TSH levels, higher were the abnormalities.

The lower the TSH levels, the better was the cycle

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