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Relationship between Hypothyroid and High LDL Cholesterol

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Abstract

This paper shows the study of 100 PCOS cases in Rewa district that underwent several investigations for their metabolic conditions. The study suggests that hypothyroid patients usually have an increase in low-density lipoprotein (LDL) -cholesterol which rises due to several mechanisms. The cases were subjected to measures based on factors like diet, lifestyle, and thyroid medicines recommended by the doctors, which shows a decrease in TSH levels resulting in manageable LDL- cholesterol levels.From the study, it was clear that the TSH level drop fast in the cases wheremedicines were used as compared to the only diet option but if the cases were prescribed both(medicine and diet) they showed a positive faster rate drop in TSH levels resulting drop the LDL level.

Introduction

Hypothyroidism in individuals leads to decrease in their metabolism and also decrease in the breakdown of cholesterol and triglycerides. Thus, elevating the level of these fatty substances in the blood stream, which puts them at an increased risk of cardiovascular disease.

If someone has thyroid disease, they are prone to have high levels of cholesterol. High cholesterol can also be caused by an unhealthy diet and some genetic factors. But some medical factors also play a role. 13% of people suffering from hypothyroidism will also have bad LDL cholesterol.

High levels of triglyceride that is blood fat that are associated with cholesterol, are linked to hypothyroidism. Thus, Hypothyroidism and high level of cholesterol will put a patient at an increased risk for both heart disease and stroke.

In regulating the body metabolism thyroid hormones play a very important role. Not only this, they are also involved in the use & storage of fats for energy.

If someone's metabolism is slow, which generally occurs in hypothyroidism, the breakdown and elimination of cholesterol, also goes down. Thus, leading to higher circulating levels of cholesterol in the bloodstream. Increase in these circulating levels of cholesterol will lead to more chances of cardiovascular disease and stroke.

Doctors were able to report for the very first time in 1930 the Association between hypothyroidism and abnormal cholesterol metabolism. From that time, there is a gradual increase in the recognition of the role of hypothyroidism and its negative effect on the metabolism of cholesterol, particularly its components, total cholesterol, LDL, which is also called as the bad cholesterol and triglycerides.

In Hyperlipidaemic patients, the prevalence of hypothyroidism (marked by elevated TSH and low FT4) and subclinical hypothyroidism is(marked by elevated TSH and a normal FT4). 4.3% and 11.1%

respectively. Thus, there is an association of both thyroid hormones in the development of abnormally elevated levels of lipids, fats, cholesterol and triglycerides.

1.1 Can Hypothyroidism Cause High Cholesterol Levels?

High cholesterol levels are secondary caused by hypothyroidism, the primary cause being bad dietary habits. Lipid metabolism is affected by hypothyroidism by different mechanisms. There are several of those, such as, due to low T4 and T3, and at the same time, by elevations of TSH, directly affecting it.

On the surface of the liver there are receptor protein for the LDL Their job being to take up lipoproteins, certain cholesterol particles, and remove them from the bloodstream. These receptors are increased by the thyroid hormone.

In hypothyroidism with the level of thyroid hormone is deranged. The receptors for LDL on the liver surface are decreased thus decreasing the ability to clear cholesterol and decreasing its level in the bloodstream. Leading to an increased level of cholesterol, thus increasing the risk.

The second mechanism for the increase of triglycerides is as there is reduction of thyroid hormones, this promotes the absorption of cholesterol in the intestines. And it also decreases the breakdown of free fatty acid. Thus, both of these factors combine together to increase the serum triglycerides.

How bile acids are used by liver is also affected by thyroid hormone, as indicated by recent researches. The synthesis of bile acids in liver will help the liver to deplete its cholesterol store. Thus, this will create a negative balance in the liver, so it will increase its uptake of cholesterol from the bloodstream. But when thyroid hormone is not available as in hypothyroidism, this will not occur. So, the level of cholesterol in blood will increase.

Levels of HDL that is the good cholesterol is decreased in patients with hypothyroidism. This is because the enzyme CETP(cholesteryl ester transfer protein), is decreased this enzyme plays an important role in suppressing HDL. So HDL levels are increased in patients with hypothyroidism.Elevation of TSH will lead to increase in the cholesterol production, lipolysis that is breakdown of triglycerides into fatty acids released from fat cells into the bloodstream. And at the same time, there will be a decrease in cholesterol clearance.

1.2 What's the Link?

In the blood the cholesterol is a waxy substance. A part of it in the body is because the body produces it, and the remaining comes from the animal foods. There are various types of cholesterol.

High-density-lipoprotein (HDL) cholesterol, or "good" cholesterol. When HDL cholesterol level goes down this can contribute to heart disease and other issues. This will become more important if it is combined with high levels of LDL cholesterol and triglycerides.

Low-density-lipoprotein (LDL) cholesterol, or "bad" cholesterol. High levels of LDL will lead to narrowing of the arteries because it gets deposited there, and thus leading to heart problems and stroke.

Triglycerides are fats from the food. This is the circulating fat, which can be stored in the fat cells. Actually, triglycerides are not a type of cholesterol, but their levels are to be measured along with HDL&LDL to determine the risk factor for developing heart conditions.

Thyroid Hormone Now a few words about the thyroid hormone. It is produced by the thyroid gland, which is situated in the neck .It regulates the body's metabolism When someone has hypothyroidism it means his

body is not making enough amount of thyroid hormones, leading to an increase the cholesterol level in the blood. Not only this, even if there is slightly low level of thyroid hormone, this can cause a spike in the cholesterol level. Thyroid hormone also acts on the liver for processing of the blood. When thyroid level is low, the liver will process the blood more slowly, thus leading to a higher level of cholesterol, leading to a built-up cholesterol in the arteries and leading to their narrowing.

1.3 The High Cholesterol–Hypothyroidism Connection.

"Elizabeth A. McAninch, MD, assistant professor in endocrinology, diabetes, and metabolism at Rush University in Chicago**".** States that LDL particles for their metabolism in liver require thyroid hormone. If the thyroid hormone is low, that is in hypothyroidism, this will lead to an elevated LDL cholesterol level.

Cholesterol level in blood is measured by simple tests. The normal level of LDL should be less than 100 milligrams per deciliter (mg/dL); 160 milligram per deciliter or more is considered as high. If this level is more, the person should be screened for others causes, which leads to their high levels. This will include hypothyroidism and as it can be treated the thus brining the levels down to the normal.

1.4 How to Reduce One's Cholesterol Levels.

If a person has both hypothyroidism and high cholesterol, certain steps are to be taken to reduce the risk factor for the heart disease, these are as follows

Weight. It has been shown that excess weight will contribute to inflammation and metabolic problems including high cholesterol this was published in the Journal of international molecular sciences in April 2014 in a study. It also states. Even if a modest amount of weight is reduced, this will be helpful. This is generally 10% of the present weight but BMI is a much important factor indicating how much weight is to be reduced.

Role of regular exercise. Exercise helps in clearing lipids from the blood, particularly LDL. This was published in the December 2016 study in the journal "Translational Journal of American College of Sports Medicine". Here it is to be noted that for cardiovascular health a tailored excise plan should be based for the fitness level. Some can start with slow walking and gradually increase their activity but others can directly embark on high intensity exercise. It is important to find an activity that will be helpful for that particular individual**.**

Improving one's diet. A heart healthy diet is the one which contains lots of fruits and vegetables, along with whole grains and lean protein sources such as poultry, fish, nuts, and is low in saturated and trans fats. This can have a beneficial effect on one's cholesterol level. A meta-analysis was published in the May- June 2018 issue of progress in cardiovascular disease should people eat diet, rich in plant based & nuts had a lower cholesterol levels 17% lower than those who did not follow that particular diet. Junk foods such as soda, cakes, candies will all contribute to high levels of cholesterol.

Thyroid medication to be taken as prescribed. It is important for the patient of hypothyroidism to take the thyroid hormone replacement therapy as prescribed, and to go for regular checkups. This is a chronic medical condition, and it will be there throughout the life so a healthcare support team should always be consulted.

Methodology

The present study is based on a random sampling method in analytical research carried in 2022 in the Rewa district. 100 women were enrolled in the study. The age range of the women was 20 – 30 years. For the collection of data schedule methods would be used in this study and a pre tested schedule would

be formulated in which various question would be framed to take maximum information from the subject regarding the present study.

The schedule may include following sections: -

1) General information about subjects.
2) Medical history (obesity, diabetes, irregular menstruation)
3) Biochemical examination

The data obtained would be subjected for analysis to find out various finding and their percentage value. The analyzed data would be subjected for statistical analysis to find our significance.

This study is highly inclined towards the fast result output as a decrease in LDL level over a transitory period. As the study duration was short, the case selection also needed to be small. The general criteria for the selection of case number were based on thorough research, suggesting that the study case taken under consideration should provide reasonable problem ranging between 13 and 20%. Thus, the small lump sum of 100 cases was decided to undergo study and was investigated over the duration of 6 months. The additional categorization of the subjects was based upon analytical method selection within the age margin of 20–35 years and thus they were selected. The participants were chosen using the random sample approach to ensure that the results obtained from the test cases were close to what would have been achieved if the complete population had been measured. Cases were chosen from various colleges and hospitals that displayed indications of PCOS, such as hirsutism, acne, irregular period cycles, and obesity.

First, from the pool of 100 cases, further segregation of favorable cases was done based on general information, medical history and the blood test results. Each case was screened for hormone tests (FSH, LH, and TSH) and lipid profilestests.

The favorable casesshow a high level of TSH in hormone testing. Cholesterol levels were diverse in trait, alongside a significantly high level of LDL (low-density lipoprotein) and a low level of HDL (high-density lipoprotein), opposite the normal level in the lipid profile. Anthropometry established the type of obesity by measuring waist and hip size. Total plasma cholesterol and TG (triglyceride) were tested using the Technicon Auto-Analyzer (Model 11, Technicon Instruments Corp.), and concentrations of cholesterol in very low-density lipoproteins (VLDL), low-density lipoproteins (LDL), and high-density lipoproteins (HDL) were estimated as described in the Lipid Research Clinics Manual of Laboratory Operations. A total of 15 cases turned up with the above-described symptoms, which was the final case batch that will undergo medical procedures to bring the cholesterol and LDL levels back to normal.

The cases were instructed to eat DASH (Dietary Approach to Stop Hypertension), an American-based diet rich in fruits, vegetables, whole grains, and fibers. The subjects have to eat a total of five meals, two major and three minors, in a whole day. The diet strictly needs to be 1200 kcal per day to bring down the obesity level. Some home remedies were also suggested, such as two garlic cloves with lukewarm water on an empty stomach to lower cholesterol levels, cinnamon power water to reduce obesity, and turmeric water for healing breakdown due to diet.

In addition to this, major meals must be taken at 1 pm and 7:30 pm, while minor meals must be taken at 8 am, 11 am, and 4 pm respectively. The major meals must contain soluble fibers like oats, barley, and ragi with green vegetables, and the minor diet must include fruits and sprout salad. They were also advised to visit and take medications for hypothyroidism prescribed by the doctor.

This schedule has to be followed by each case for the whole trial period, after which they were again screened by the same test that they took at the start of the research trial.

Statistical Analysis

The data were expressed as Mean ± SD [Table/fig – 1] and as Mean ± SE [Table /fig – 2], [Table/fig – 3] and [Table/fig – 4]. Statical analysis was performed by employing t- test. The correlation of parametric values was performed by using Pearson's correlation analysis. p value which was £ 0.05 were considered to be statistically significant.

		BEFORE DIET				
		Average				
	Number of Cases	TSH Mean	Cholesterol mg/dl	Triglyceride mg/dl	HDL mg/dl	LDL mg/dl
Hypothyroidism	15	8.89	184.6	152.06	52.33	133.8
Normal	84	2.42	175.22	129.96	57.89	106.4
Hyperthyroidism	1	0.24	221	256	49	140

		AFTER DIET				
		Average				
	Number of Cases	TSH Mean	Cholesterol mg/dl	Triglyceride mg/dl	HDL mg/dl	LDL mg/dl
Hypothyroidism	5	5.104	179.2	108.4	53.00	130.4
Normal	95	2.47	169.2	129.24	59.52	101.24
Hyperthyroidism	0	0	0	0	0	0

[Table /Fig- 1]:

GROUP	**TSH**	**Cholesterol mg/dl**
Mean	8.8993	184.6000
SD	7.0797	32.9952
SEM	1.8280	8.5193
N	15	15

P value and statistical significance:
The two-tailed P value is less than 0.0001
By conventional criteria, this difference is considered to be extremely statistically significant.
Confidence interval:
The mean of TSH minus Cholesterol mg/dl equals -175.7007
95% confidence interval of this difference: From -193.5489 to -157.8524
Intermediate values used in calculations:
t = 20.1648
df = 28
standard error of difference = 8.713

[Table/ Fig 2]:

GROUP	TSH	Triglyceride mg/dl
Mean	8.8993	152.0667
SD	7.0797	53.2400
SEM	1.8280	13.7465
N	15	15

P value and statistical significance:
The two-tailed P value is less than 0.0001
By conventional criteria, this difference is considered to be extremely statistically significant.
Confidence interval:
The mean of TSH minus Triglyceride mg/dl equals -143.1673
95% confidence interval of this difference: From -171.5736 to -114.7610
Intermediate values used in calculations:
t = 10.3239
df = 28
standard error of difference = 13.868

[Table/ Fig – 3]

GROUP	TSH	HDL
Mean	8.8993	52.33
SD	7.0797	21.63
SEM	1.8280	5.58
N	15	15

P value and statistical significance:
The two-tailed P value is less than 0.0001
By conventional criteria, this difference is considered to be extremely statistically significant.
Confidence interval:
The mean of TSH minus HDL mg/dl equals -43.4340
95% confidence interval of this difference: From -55.4723 to -31.3957
Intermediate values used in calculations:
t = 7.3906
df = 28
standard error of difference = 5.877

[Table/ Fig – 4]

GROUP	TSH	LDL
Mean	8.8993	133.80
SD	7.0797	19.99
SEM	1.8280	5.16
N	15	15

P value and statistical significance:
The two-tailed P value is less than 0.0001
By conventional criteria, this difference is considered to be extremely statistically significant.
Confidence interval:
The mean of TSH minus LDL mg/dl equals -124.9007
95% confidence interval of this difference: From -136.1186 to -113.6828
Intermediate values used in calculations:
t = 22.8071
df = 28
standard error of difference = 5.476

Discussion

The following 15 cases were further divided into 3 groups based on TSH levels.

TSH mIU/ml		
Group 1	Group 2	Group 3
More than 8.00 mIU/ml	6.00 – 8.00 mIU/ml	5 – 6 mIU/ml
33.73	7.93	5.68
10.5	6.95	5.66
10.36	6.45	5.62
8.8	6.32	5.53
8.44	6.05	5.47
Mean= 77.83 %5 =15.56	Mean = 33.7% 5= 6.74	Mean = 27.96%5 = 5.59

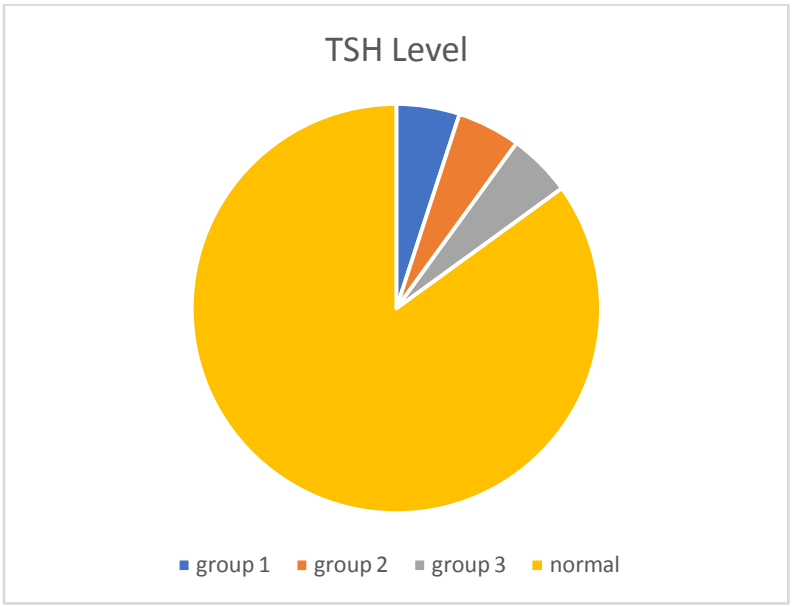
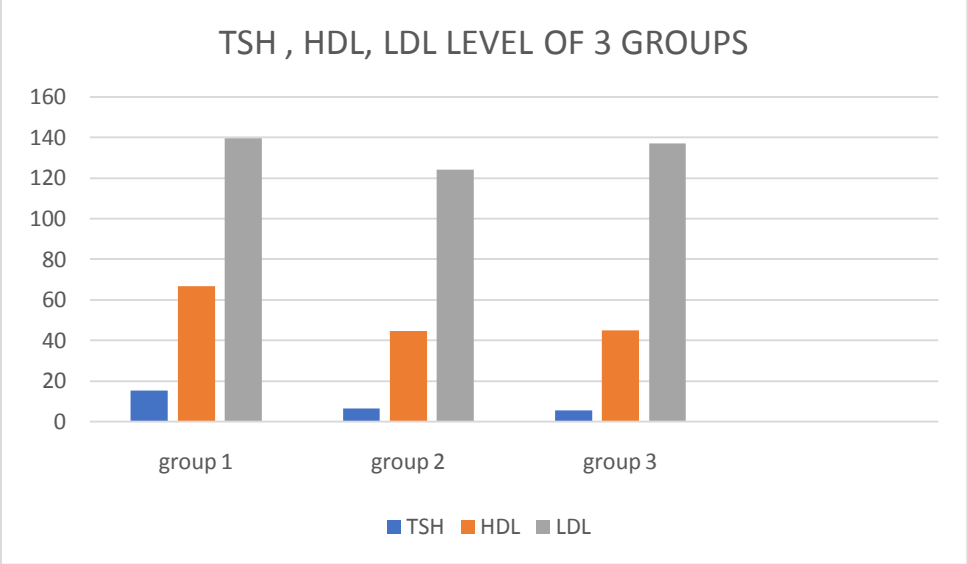


CHART SHOWING THE VALUE OF PARAMETERS IN THE STUDY GROUP

	Average		
	TSH	HDL	LDL
Group 1	14.36	67	139.8
Group 2	6.74	44.8	124.4
Group 3	5.59	45.2	137.2



Group 1 has TSH levelvery high generally above 8. The doctor prescribed thyroxin according to weight, and a personal recommendation for diet study was given to group 1 as mentioned below. Herbal remedies like 2 garlic cloves with lukewarm water, and 2 teaspoons roasted flaxseed in the morning empty stomach was started. Instruction given were that the breakfast must include soluble fiber-rich food like oats-poha, oats-cheela, upma, sprouts, etc. In the midmorning, the case was recommended to have 1 walnut, 4 -5 soaked almonds, and 1 seasonal fruit available in the local market at a low price. At the time of lunch oats bran roti in a ratio of 30% oats bran and 70% whole wheat flour with added ½ teaspoon of carom seeds with vegetables and 1 bowl of curd and salad. In the evening the recommended to have 1 cup green tea, brown bread veg sandwich/ Murmura chaat At night only green vegetables and salad must be consumed. The case had to totally avoid cruciferous vegetables. Also, physical activity like a 5 km brisk walk in the morning was encouraged. The thyroid medicine along with the prescribed diet and changes in lifestyle brought great improvement in group 1 test results. The TSH levels fell back within the commendable range. Also, the cases showed physical changes such as loss of weight, voice becoming normal, and a downgrade in tiredness. Thus, the change in lifestyle act as a catalyst in lowering thyroid levels along with prescribed medicine.

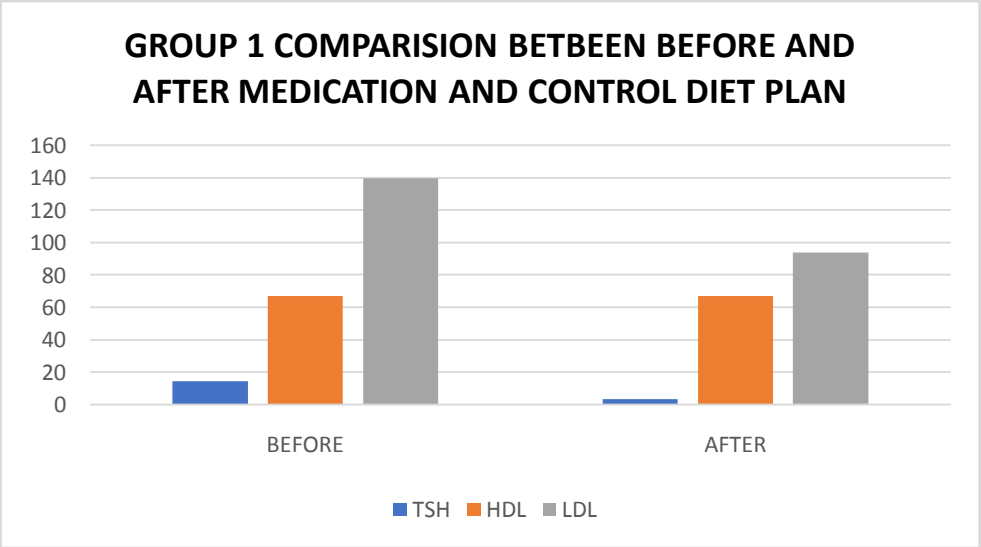
Diet Plan

Early morning (6:00 – 6:30 am)	2 Garlic clove & flaxseed with lukewarm water
Breakfast (8:00 – 9:00 am)	Oats – poha/ Oats – cheela/ upma/ Moth Sprouts
Mid-morning (11:00 – 11:30 am)	1 walnut + 4 -5 soaked almonds + 1 seasonal fruits

Lunch (1:00 – 1:30 pm)	Oats bran roti (30% oats bran + 70% whole wheat flour + 1tsp carom seed) + 1 bowl seasonal green veg + salad + 1 bowl curd
Evening tea (5:00 – 5:30 pm)	1 cup green tea + brown bread veg sandwich / murmura chaat
Night (7:30 – 8:00 pm)	1 bowl green vegetables + 1 bowl salad

Chart Showing the Value of Parameter of group 1 Before and After Medication and Control Diet

	Average		
Group 1	TSH	HDL	LDL
Before	14.36	67	139.8
After	3.09	67	93.8



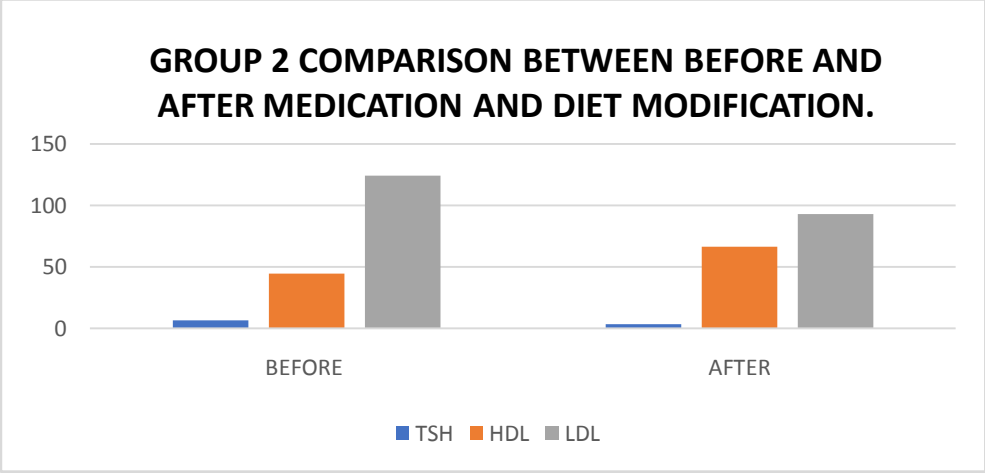
Group 2had case list with TSH levels being high in the range [6 - 8 mIU/ml]. For this group, the Doctors prescribed thyroxin according to weight, and personal recommendation is mentioned as follows. The case has to take early in the morning Herbal remedies like one glass of green juice with lemon water (Lauki, cucumber, pudina, ginger with half lemon), and 2 teaspoons of roasted flaxseed with lukewarm water in the morning empty stomach. Next breakfast must have protein-rich food like paneer sandwich, sprouts, lentil cheela, etc. In midmorning, cases were suggested to take 1 walnut, 4 -5 soaked almonds, and 1 seasonal fruit cheaply available in the market along with any one of the probiotic drinks like buttermilk or coconut water, or green tea. For lunch millets or jowar or wheat roti with green vegetables and 1 bowl of curd and salad. The final meal at night should have lentils or pulses cheela with lots of vegetables. Cruciferous vegetables to be avoided. These cases show fast loss of weight and TSH level showed promising levels due to medicine due to which LDL levels showed better improvement in lipid profile.

Diet Plan

Early morning (6:00 – 6:30 am)	1 glass of green juice with lemon water (Lauki, cucumber, pudina, ginger with half lemon), and 2 teaspoons of roasted flaxseed
Breakfast (8:00 – 9:00 am)	1 Paneer sandwich/ 1 bowl sprouts (add cinnamon powder and rock salt), 1 lentil cheela
Mid-morning (11:00 – 11:30 am)	1 walnut, 4 -5 soaked almonds, and 1 seasonal fruit/ 1 glass buttermilk / 1 glass coconut water
Lunch (1:00 – 1:30 pm)	1 – 2 bajara or jowar or wheat roti with green vegetables and 1 bowl of curd and salad
Evening tea (5:00 – 5:30 pm)	1 bowl veg soup/ 1 glass apple shake/ 2 oats biscuit + 1 cup green tea
Night (7:30 – 8:00 pm)	1 – 2 lentils or pulses cheela with lots of vegetables

Chart Showing the Value of Parameter of Group 2 Before and After Medication and Control Diet

	Average		
Group 2	TSH	HDL	LDL
Before	6.74	44.8	124.4
After	3.47	66.8	93.4



Group 3 consist of cases with TSH level below 6IU. This group was prescribed only a diet for improvement and doctor did not-prescribe any drugs for thyroid. This was done to understand the impact of diet on the thyroid. The cases have to follow the diet as mentioned. Early in the morning 1 glass of lemon water (1/2 lemon + 1 tsp cold pressed virgin coconut oil), 2 garlic cloves infused raw honey, or 1 glass beetroot juice (squeeze a few drops of lemon and add 1tsp virgin coconut oil), juice made out of 1 medium beetroot- add water if needed and consume the juice unstrained. After 20 -30 min post morning water 100 gm of fruit (any seasonal fruit, do not mix fruits) + 1 tbsp pumpkin seeds (soaked overnight).

Later for breakfast, a bowl of vegetable poha (add 2tbsp boiled chickpeas to this or moong sprouts) OR 2-3 medium-sized steamed rice-moong idlis with 1 cup sambhar+ 1tbsp coconut chutney OR 2 palm-sized Moong-oats chillas with fresh coriander/pudina chutney (use 1:1 ratio of yellow moong dal and oats) OR 2-3 eggs boiled, omelet or scrambled (1 whole the rest egg whites). After breakfast around mid-morning 20 mins walk was suggested followed by 1 glass of aam panna of thin consistency and sweetened with jaggery. 30 mins before lunch 1 glass warm water+ 1tbsp Apple cider vinegar or 1glass water+ 1tsp sabja seeds- soak for 20-30mins prior to consumption+ 1tbsp sugarless dried cranberries. For lunch, one bowl of vegetable salad along with (add radish to it), 1 jowar/ bajra/ ragi/ wheat roti+ 1 bowl daal+ 1bowl veggie of your choice (optional) OR 1-2 rajma wrap+ vegan garlic dip OR 1 bowl vegetable khichadi (add more of daal, less of rice and loads of veggies). Occasionally but not daily they can chew on 1/2tsp jaggery with 1/2tsp saunf after the meal to satisfy the sweet cravings. The following measurement was kept in mind while deciding the diet

1 cup = 100 gm;

1 bowl = 150- 200 gm

The following caution was taken while suggesting the diet. The cases needed to keep a diet rich in fiber by consuming cooked vegetables and salad. Rice must be taken thrice a week, mixed with veggies, so that the fiber could compensate sugar released due to rice. A bowl of raw salad is essential in this diet, one can add chopped cucumber, onions, lettuce, or any other vegetable of choice. 30 mins post-lunch one needs to walk for 10 mins at least followed by one glass of lemon water (1/2 lemon) or one glass of water+ 1tbsp fresh amla juice/1tsp dried amla powder. In Evening 1 glass almond milkshake- 1 glass almond milk, 1/2tsp coffee, 1/2tsp coco powder, 3-4 dates OR 1tbsp jaggery syrup along with a bowl of jowar puffs OR a bowl of baked raw baked banana chips OR 100gms of seasonal fruit+ 1tsp lightly roasted kalonji seeds+ 1tsp pumpkin seeds (soaked up to 6 hours). If the hunger is still not satisfied, after 30-60mins - a bowl of kurmura chaat OR A bowl of poha chaat. For dinner a bowl of sauté veggies along with 3-4 pieces of organic fish/hormone-free chicken breast (steamed, grilled, or boiled) OR 4-5 sprouts tikki+ mint-coriander chutney OR 1-2 moong dal cheela (add powdered oats to the batter) + mint-coriander chutney. Cruciferous vegetables to be avoided. After 6 months this group showed positive symptoms of weight loss and a decrease in TSH level but the rate of decrease of TSH level was slow.

Diet Plan

Early Morning 06:30AM	One glass lemon water (1/2lemon+1tsp cold pressed virgin coconut oil)
20-30mins post morning water 07:00AM	100gms of fruit (any seasonal fruit, do not mix fruits) + 1tbsp pumpkin seeds (soaked overnight)
Breakfast 09:00AM	A bowl of vegetable poha (add 2tbsp boiled chickpeas to this or moong sprouts) **OR** 2-3 medium sized steamed rice-moong idlis with 1 cup sambhar+ 1tbsp coconut chutney **OR** 2 palm sized Moong-oats chillas with fresh coriander/pudina chutney (use 1:1 ratio of yellow moong dal and oats) **OR** 2-3 eggs boiled, omelette or scrambled (1 whole the rest egg whites once a week) + a bowl of saute veggies
30 mins post breakfast	10 mins light walk

Mid Meal 11:30PM	20 mins walk followed by 1 glass aam panna- thin consistency and made out of jaggery
30 mins before lunch	1glass warm water+ 1tbsp Apple cider vinegar
Lunch 1:30PM	***One bowl vegetable salad along with (add radish to it),*** 1 jowar/bajra/ragi/khapli wheat roti+ 1 bowl daal+ 1bowl veggie of your choice (optional) **OR** 1-2 rajma wrap+ vegan garlic dip **OR** 1 bowl vegetable khichadi (add more of daal, less of rice and loads of veggies) **Can chew on 1/2tsp jaggery with 1/2tsp saunf after the meal to satisfy the sweet cravings**
30mins post lunch	10 mins walk followed by one glass lemon water (1/2 lemon)
Evening 5:30PM	1 glass almond milk shake- 1 glass almond milk, 1/2tsp coffee, 1/2tsp coco powder, 3-4 dates **OR** 1tbsp jaggery syrup along with A bowl of jowar puffs **OR** A bowl of baked raw banana chips
30 mins before dinner	1glass warm water+ 1tbsp Apple Cider Vinegar
Dinner 7:00PM- 7: 30PM	**A bowl of sauté veggies along with** **OR** 4-5 sprouts tikki+ mint-coriander chutney **OR** 1-2 moong daalcheela (add powdered oats to the batter)+ mint-coriander chutney **Can chew on 1/2tsp jaggery with 1/2tsp saunf after the meal to satisfy the sweet cravings**
30 mins post dinner	10 mins walk followed by one glass lemon water (1/2 lemon)

Chart Showing the Value of Parameter of Group 3 Before and After Diet Modification

	Average		
Group 3	TSH	HDL	LDL
Before	5.59	45.2	137.2
After	5.10	53	130.4

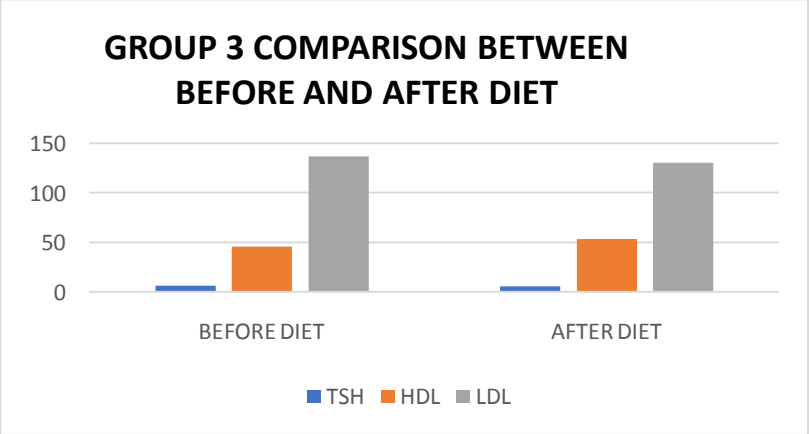
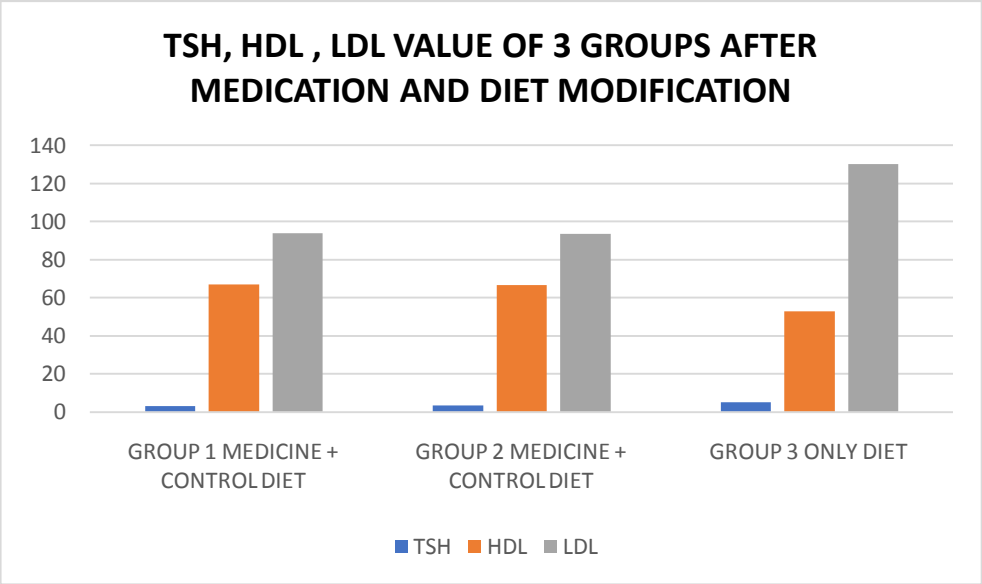


Chart Showing the Value of Parameter After Medication and Diet Modification in the Study Group			
	Average		
	TSH	HDL	LDL
Group 1	3.09	67	93.8
Group 2	3.47	66.8	93.4
Group 3	5.10	53	130.4



Role played by various ingredients of the diet in correcting the balance

Lemon – Lemon helps to cleanse the liver and this alkaline mixture washes off the acidity and Beetroot helps in improving iron levels with the help of vitamin C-from lemon. Coconut oil helps cleanse the liver.

Pumpkin seeds – Pumpkin seeds are rich in omega-3 and zinc. Seeds should be soaked overnight as it helps in getting rid of the enzyme inhibitors.

Apple cidar -Apple cidar is prebiotic and helps in keeping the body alkaline

Sabja – Sabja seeds help in keeping the body alkaline.

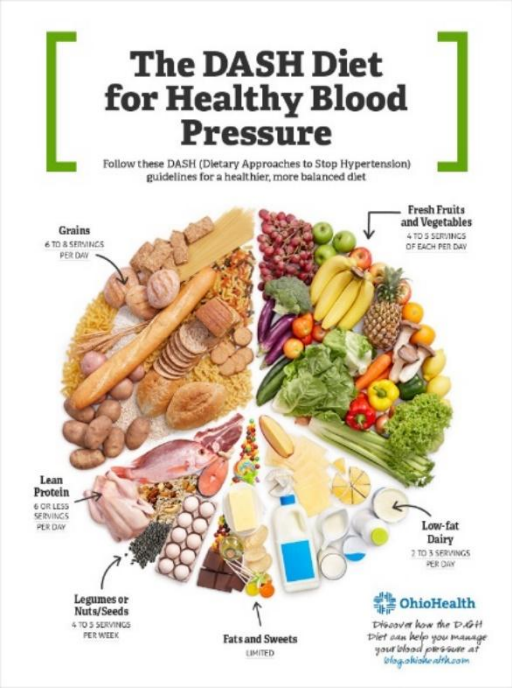
Amla – Amla is rich in Vitamin C which is essential for healthy skin. One of its most important roles in the body is in the production of collagen, a protein needed for wound healing.

Kalonji - Kalonji and its main active constituent, thymoquinone (TQ), to be medicinally very effective against various illnesses including different chronic illness such as inflammatory conditions as well as various infectious diseases due to bacterial, fungal, parasitic, and viral infections

Result

Though levels of LDL, Triglycerides found high in different group with a high statistical significance. LDL showed a positive correlation with TSH. These result thus provided valuable information that LDL had a strong relationship with thyroid hormones and alteration in thyroid hormone reflect the level of LDL.

Balanced diet plays a very important role for health. *DASH diet improves cholesterol level.
The three groups of cases which were studied thoroughly over the span of 6 months. From the study, it was clear that the TSH level drop fast in the case of medicine as compared to the only diet option but if the cases were prescribed both they showed a positive faster rate drop in TSH levels than in medicine-only cases. As per the study, group 3 that followed plan for diet without any intervention of medicine cases show promising result but as the span of the study was small the effectiveness was not of what if it was done over a longer period suggesting that diet adds to the cure of thyroid up to certain level if followed correctly under the supervision of dietician.



Keywords

1. CETP (cholesteryl ester transfer protein)
2. DASH (Dietary Approach to stop Hypertension)
3. HDL (High Density Lipoprotein)
4. LDL (Low density Lipoprotein)
5. PCOS (polycystic ovarian syndrome)

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