PROGRESSIVE RESISTANCE EXERCISES ALONG WITH DIETARY MODIFICATION ON THE LEVEL OF TSH IN SUBCLINICAL HYPOTHYROIDISM AMONG FEMALES WITH MENSTRUAL DISORDERS

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ABSTRACT

OBJECTIVE: Subclinical hypothyroidism and menstrual disorders are common clinical manifestations affecting women. The management of subclinical hypothyroidism remains sparse, considering it a mild disorder. The literature is ambiguous regarding the effect of exercises on TSH levels; thus, the present study was designed to identify the effect of progressive resistance exercises along with dietary modification on TSH levels among females with subclinical hypothyroidism.

METHODS: A total of 74 females aged 18–35 years suffering from menstrual disorders were recruited. All participants underwent thyroid profile testing (T3, T4, and TSH). Participants with normal T3, T4, and raised TSH (4.6–10 μIU/mL) were included and divided into two groups. Participants in Group A received dietary modification, and Group B received progressive resistance exercises (PRE) along with dietary modification. A protocol of six weeks was administered to both groups, and TSH levels were compared with baseline readings after the completion of the protocol.

RESULTS: A paired t-test showed a significant improvement in TSH levels in both groups. Additionally, an unpaired t-test revealed that Group B was more effective than Group A.
Conclusion: Progressive resistance exercises along with dietary modification is an effective protocol for improving TSH levels in subclinical hypothyroidism among females with menstrual disorders.

KEYWORDS: Subclinical Hypothyroidism; Hypothyroidism; Progressive resistance exercises; Menstrual disorders.

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INTRODUCTION

Thyroid dysfunctions often start during the reproductive period and can lead to various menstrual problems and infertility among women.[1,2] Past studies showed an association between thyroid dysfunctions and menstrual health in women.[3-5] Subclinical hypothyroidism (SCH) is a mild disorder (4–10 mIU/mL) associated with few or no symptoms/signs of hypothyroidism,[6] and it is often overlooked or underdiagnosed. However, if left untreated for a long time, it can lead to severe consequences, such as menstrual irregularities, fewer pregnancies, abortions, and even infertility, [3, 7] and it can progress to overt hypothyroidism. Common clinical manifestations of subclinical hypothyroidism include dry skin, poor memory, headache, slow thinking, muscle cramps, muscle weakness, fatigue, cold intolerance, puffy eyes, constipation, hoarseness, anxiety, and depression.[8-11] It may also be associated with hyperlipidemia, neuromuscular, and neuropsychiatric symptoms and an increased risk of cardiovascular disease.[12]

In order to prevent the consequences and progression of subclinical hypothyroidism, timely management is highly important. However, the treatment of subclinical hypothyroidism remains controversial. In addition to pharmacological agents, exercise and dietary modifications in the management of subclinical hypothyroidism have been proposed, though the outcomes remain controversial. TSH levels after exercise have shown varied results, with some studies reporting either an increase or decrease in TSH levels.[13-18]

On the other hand, some studies reported a reduction in TSH levels after exercise.[17 19-21] As literature shows substantial gaps and diversity regarding the effect of various exercises on thyroid hormone levels, we aimed to examine the effect of progressive resistance exercises along with dietary modifications on TSH levels.

This study is intended to be novel research in establishing non-pharmacological treatment for subclinical hypothyroidism among females with menstrual disorders.

Methods

After obtaining ethical clearance from the institutional committee of Punjabi University, Patiala, the study protocol adhered strictly to the Declaration of Helsinki (2013). In this experimental study, we recruited 74 females (aged 18–35 years) residing in Amritsar City, India. Females with normal T3 and T4 levels and raised TSH levels ≥ 4.6 µIU/mL were included. The participants were then randomly divided into two groups (Group A and Group B). Each participant provided written consent and was briefed on the study protocol before confirming participation. Following this, anthropometric and demographic data were recorded. Participants were randomly assigned to one of two groups for six-week interventions using block randomization with sequentially numbered opaque sealed envelopes (SNOSE). There were four blocks in each row with 19 rows, creating a matrix design of 4 × 19. Each row had two blocks for Group A and two for Group B. Once one row was completed, the next block in the subsequent row was opened, and so on. This method ensured an approximately equal number of patients in both groups at any time and minimized allocation bias.

Participants in Group A underwent dietary modification, while those in Group B received progressive resistance exercises along with dietary modification. All interventions were set for a duration of six weeks. The CONSORT flowchart of the study is displayed in Figure 1.

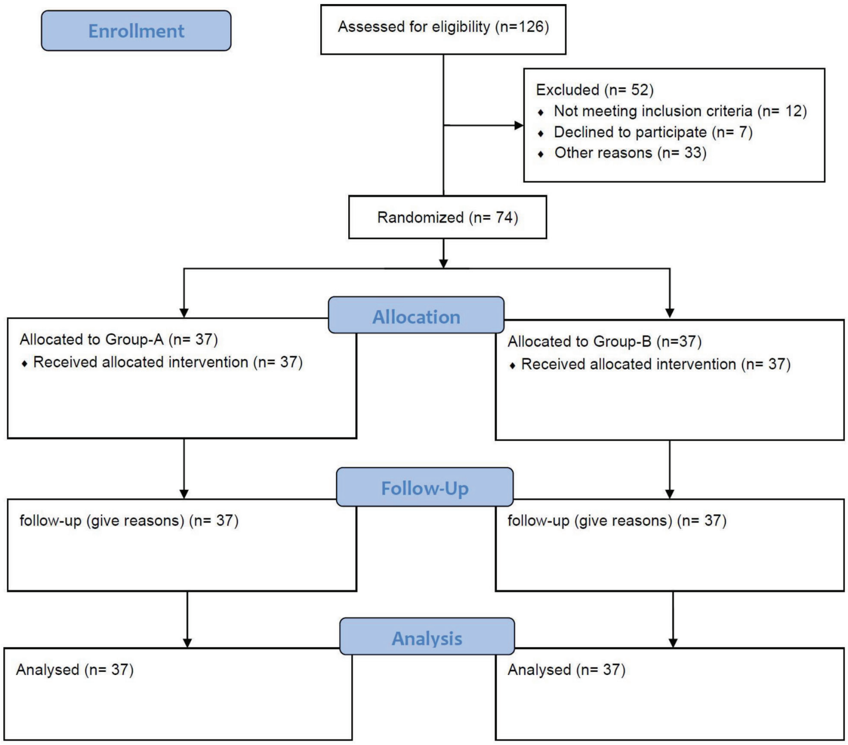

Figure 1: CONSORT flowchart of the study

The diet plan was kept constant for both groups. It was prepared by an expert dietician to provide 1800–2400 kcal per day, including 55g/d of protein, 25g/d of fat, 600mg/d of calcium, and 21mg/d of iron. The subjects were encouraged to follow the diet chart, and a record of compliance was maintained and signed by the researcher on a weekly basis. There was no restriction on the intake of water and roughage.

The resistance exercise protocol (Table 1) for Group B was partially adopted from Tracy et al. (1999)[22]. One repetition maximum (1 RM) is the maximum amount of weight that can be lifted once through a prescribed range of motion, and it was measured for all subjects. Thereafter, a total of five sets were performed by the subjects for the biceps, triceps, quadriceps, and hamstring muscles. The first set consisted of five repetitions at 50% of the 1 RM. The second set consisted of five repetitions at the current RM value. The third set consisted of ten repetitions, with the first five repetitions at the current RM value and the other five repetitions at 50% of the current RM. The fourth set consisted of 15 repetitions, with the first ten repetitions at the current RM value and the other five repetitions at 50% of the current RM. The fifth set consisted of 20 repetitions, with the first 15 repetitions at the current RM value and the other five repetitions at 50% of the current RM. The second, third, fourth, and fifth sets were preceded by rest periods lasting 30, 90, 150, and 180 seconds, respectively. Each session was followed by a cool-down period, including stretching of the biceps, triceps, quadriceps, and hamstrings. Every participant was instructed and supervised throughout the program by the investigator.

Any questions regarding the diet chart were addressed and managed personally by the investigator after discussion with the dietician. Before the actual start of the exercise program, three low-resistance training sessions with little or no resistance were conducted to familiarize the participants with the exercise program. The total duration of the protocol was 6 weeks, with sessions held 3 days per week. Each session took approximately 45 minutes for a subject to complete.

Table 1: The resistance exercise protocol

Warm up	Ten minutes warm up on bicycle ergometer and stretching of muscles (biceps, triceps, quadriceps, hamstrings)
Training	Resistance exercises: Three low resistance training session to make the subjects familiar with the exercises(biceps, triceps, quadriceps, hamstrings)
1st set	5 rep at 10 % of 1 RM
Rest period	30 sec
2nd set	5 rep of current RM
Rest period	90 sec
3rd set	10 rep (First 5 rep at current RM + 5 rep with 50% of 1 RM)
Rest period	150 sec
4th set	15 rep (10 rep with 1 RM + 5 with 50% of 1 RM)
Rest period	180 sec
5th set	20 rep(15 rep with 1 RM + 5 with 50% of 1 RM)
Cool Down	Stretching of muscles (biceps, triceps, quadriceps, hamstrings)
Total Duration	6 weeks (3 days per week)

Data Analysis

The normality of the collected data was assessed using the Kolmogorov-Smirnov test. As the data followed a normal distribution, the descriptive statistics of the collected data were expressed as mean ± standard deviation. If not, it would be reported as the geometric mean with a 95% confidence interval.

Table 2: Distribution of participants according to the categories of menstrual disorder

Type of Menstrual Disorders	Total (N= 74) N	%
Dysmenorrhea	36	48.6
Premenstrual Syndrome (PMS)	25	33.8
Menorrhagia	06	8.1
Oligomenorrhea	04	5.4
Amenorrhea	03	4.1

The distribution of participants according to the categories of menstrual disorder was reported as a percentage (%) with numbers (frequency). Pre- and post-intervention changes in T3, T4, and TSH in Group A and Group B were expressed as mean ± standard deviation. Their statistical significance was reported using paired t-tests and independent t-tests. For all statistical analyses, SPSS (Statistical Package for the Social Sciences) software, IBM SPSS 27 (27th version), was used, and the level of statistical significance was set at $p < 0.05$.

Table 3: Distribution of participants according to menstrual disorder in Group A and Group B

Type of menstrual Disorder	Group A(N=37)		Group B(N=37)	
	n	%	n	%
Dysmenorrhea	18	48.6	18	48.6
Pre-Menstrual Syndrome	13	35.1	12	32.4
Menorrhagia	02	5.4	04	10.8
Oligmenorrhea	03	8.1	01	2.7
Amenorrhea	01	2.7	02	5.4

Table 4: Distribution of participants according to age in Group A and B

Age group	Group A (N=37)		Group B (N=37)	
(in years)	Number (n)	Percentage (%)	Number (n)	Percentage (%)
18-23	8	21.62	10	27.02
24-29	14	37.83	11	29.72
30-35	15	40.54	16	43.24

Table 5: Distribution of the participants according to BMI in Group A and B

BMI (kg/m2)	Group A (N=37)		Group B (N=37)	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)
Normal (18.5- 24.9)	11	29.72	13	35.13
Pre-obese (25-29.9)	18	48.64	17	45.94
Obese (30.0-34.9)	8	21.62	7	18.91

Table 6: Comparison of pre and post values of BMI in both the Groups

BMI (kg/m2)	Mean ± SD		df	t
	Pre	Post		
Group A	27.28±3.27	26.09±2.54	36	4.201
Group B	26.80±3.16	26.30±2.60	36	3.090

*p≤0.05

Table 7: Comparison of pre and post values of BMI in both the Groups

Sr. No.	Thyroid Hormone	Group - A						Group - B					
		Mean± SD		SEM	95% confidence interval of the difference		t	Mean± SD		SEM	95% confidence interval of the differenc		t
		Pre	Post		Lower	Upper		Pre	Post		Lower	Upper	
1.	T3 (ng/mL)	1.44±.035	1.47±0.34	0.006	0.043	0.017	4.78*	1.20±0.32	1.42±0.32	0. 43	0.308	0.133	5.10*
2.	T4 (ug/dL)	9.69±2.66	9.76±2.69	0.029	0.133	0.015	2.54	8.83±2.44	9.49±2.58	0.17	1.006	0.314	3.87*
3.	TSH (mIU/mL)	7.74±0.98	6.74±1.01	0.072	0.855	1.150	13.8*	7.51±1.41	5.45±0.76	0.19	1.672	2.444	10.82*

Table 8: Comparison of improvement score of T3, T4 and TSH between both the groups

Variable	Group	Mean Difference	SD	SEM	T
T3 (ng/mL)	Group A	0.22	0.26	0.043	4.34*
	Group B	0.03	0.03	0.006	
T4 (ug/dL)	Group A	0.66	1.03	0.17	3.38*
	Group B	0.07	0.17	0.02	
TSH (mIU/mL)	Group A	2.05	1.15	0.19	5.18*
	Group B	1.00	0.44	0.076	

DISCUSSION

As subclinical hypothyroidism (SCH) is a modifiable risk factor for menstrual dysfunction, it should be included in the investigative process for females suffering from menstrual disorders to ensure early diagnosis and treatment. Timely treatment, if initiated, can prevent progression to overt hypothyroidism and may alleviate symptoms related to menstrual disorders. This study tested two non-pharmacological methods—progressive resistance exercises along with dietary modifications and dietary modifications alone—for their efficacy in managing SCH in females with menstrual disorders. Participants in Group A underwent a balanced dietary program focusing on content, quantity, and timing of diet intake over a six-week duration. Paired t-test results revealed a statistically significant decrease in TSH level (t=13.8), a significant increase in T3 (t=4.78), and a non-significant change in T4 level (t=2.54) after the intervention, along with a significant decrease in BMI among participants in the dietary program. These findings align with the study by Soad and Lalia (2009), which suggested that thyroid hormones, especially T3, could stimulate metabolism and enhance tissue lipolysis, mobilizing triglycerides and promoting fatty acid lipogenesis.

It is well known that a balanced diet plays a vital role in health and well-being. Moreover, dietary habits can significantly impact thyroid function, leading to fluctuations in thyroid levels.[23] Deficiencies in micronutrients such as iron, iodine, vitamin A, calcium, magnesium, sodium, chromium, cobalt, selenium, manganese, and zinc have been identified as causative factors for alterations in thyroid hormone production.[24-31] The current study recommended a nutritious diet containing adequate protein, calcium, iron, fat, and other micronutrients, which is accessible to all social classes. This balanced diet helped improve thyroid function. Subclinical hypothyroidism is a common issue in obese individuals.[32] The reduction in BMI (t=3.090) in this study may have contributed to lower TSH levels, in line with findings by Bansal et al.[24,33] Thus, dietary modifications can be a cost-effective treatment approach for subclinical hypothyroidism.

In Group B, results showed a significant decrease in TSH levels (t=10.82) and a significant increase in T3 (t=5.10) and T4 (t=3.87) levels after six weeks of intervention. Additionally, a statistically significant difference between the groups suggested that progressive resistance exercises combined with dietary modification were more effective in managing subclinical hypothyroidism than diet alone.

Resistance exercises, or increased mechanical load on exercising muscles, can stimulate thyroid function, leading to a notable increase in T3 and T4 levels.[34,35] Moreover, during recovery from resistance exercises, metabolism increases to support tissue repair, which may contribute to increased T3 levels.[18] Similar results were observed in male rowers after three weeks of high-intensity resistance training[17] and in weight lifters after one week of intense strength training.[22] Based on these studies and the current study, strength training or progressive resistance exercises is an effective protocol for reducing TSH levels. Only one cited study reported no changes in TSH levels following a resistance training program.[19]

The present study also revealed a significant reduction in BMI (t=3.09) following progressive resistance exercises and dietary intervention. The reduction in body weight or BMI observed here may also have contributed to the reduction in TSH levels. Furthermore, progressive resistance exercises increased the metabolic rate,[14 15] which likely influenced TSH levels. This indicates that progressive resistance exercises combined with dietary modifications is an effective protocol for reducing TSH levels. These findings imply that females with subclinical hypothyroidism should be educated about the role and importance of progressive resistance exercises combined with diet to manage their condition. Thus, the current study recommends diet and exercise as an effective strategy for managing subclinical hypothyroidism. Our recommendation—that resistance exercises combined with dietary modifications is an effective approach for managing subclinical hypothyroidism—is further supported by a study suggesting that diet and exercise should be initiated when TSH levels are mildly elevated to prevent progression.[36] Therefore, progressive resistance exercises combined with dietary modification were found to be more effective in decreasing TSH levels than dietary modification alone.

CONCLUSION

The two interventions—progressive resistance exercises combined with dietary modification and dietary modification alone—tested in this study proved to be effective approaches for managing subclinical hypothyroidism. However, comparisons showed that resistance training, when added to dietary modifications, amplifies the effects in terms of TSH reduction, resulting in greater improvement in subclinical hypothyroidism. Therefore, this study recommends that progressive resistance exercise combined with dietary modification is an effective method for alleviating the burden of subclinical hypothyroidism in females with menstrual disorders.

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