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Association between dietary intake with serum haemoglobin and calcium level among rural pre-Menopausal women

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Abstract
Among the various aspects of health promotion and lifestyle adaptation during the premenopausal period, nutritional habits are essential because they concern all women, can be modified, and impact both longevity and quality of life. Significant micronutrient deficiencies for menopausal women commonly are calcium and iron. Hence the present study was aimed to find the association between dietary intake with serum haemoglobin and calcium level among rural pre-menopausal women. Questionnaire was framed to collect the data regarding socioeconomic status, anthropometric, biochemical profile, 24-hour diet recall. Nearly 130 premenopausal women belongs to Vedapatti suburb area were the study subjects. Among them around 39% were mild anaemic and 14% were with low calcium levels. It was observed that 53% were overweight and 7% were obesity. It was analysed that the dietary calcium intake is weakly associated with serum calcium levels (.318), whereas dietary iron intake is strongly associated with serum haemoglobin levels (.718), p value significant at *<0.05*. It is evident that poor intake of iron rich sources leads to low haemoglobin levels. Regarding calcium aging has myriad effects on calcium homeostasis and metabolism. Hence, we conclude that awareness on micronutrient deficiencies should be a fundamental necessity to improve the nutritional status of rural women at premenopausal age. Prime importance must also be given to premenopausal age group women as given for pregnant and lactating women. Furthermore, it is requested that the guidelines for the premenopausal age group are essential to be provided from the higher authorities for the betterment of the premenopausal age group women.

Keywords: anthropometry, calcium, haemoglobin, micronutrients, pre-menopause

Introduction

Menopause is the permanent cessation of menses for 12 months resulting from oestrogen deficiency and is not associated with a pathology. The median age of menopause is 51 years. Most women experience vasomotor symptoms, but menopause affects many other areas of the body, such as urogenital, psychogenic, and cardiovascular. Perimenopause means "around menopause" and refers to the time during which your body makes the natural transition to menopause, marking the end of the reproductive years. Perimenopause is also called the menopausal transition. Women start perimenopause at different ages.

Though menopause is a natural biological process, the physical symptoms, such as hot flashes, and emotional symptoms of menopause may disrupt sleep, lower your energy or affect emotional health. There are many effective treatments available, from lifestyle adjustments to hormone therapy. Menopausal transition involves a myriad of physical, endocrine, and psychological changes which are influenced by ethnic, psychological, and socio-cultural factors. Every woman's experience of the menopausal transition is unique, and a one-size-fits-all approach to the management of symptoms does not work (Valdes and Bajaj *et al*., 2022) [10].

A study found that 43 women with anaemia were ascertained. Moderate microcytic anaemia due to an iron deficiency in a context of menorrhagia, was the most observed anaemia profile. Further research found that anaemia is considered as an independent risk factor of morbid mortality regardless of age or gender. Its consequences on health are extent and potentially serious: anemic syndrome, decrease of quality of life, decrease of physical, and mental capacities, psychiatric disorders, vulnerability to infections, and dander disorders (Bayen *et al*., 2020) [2].

Today, one of the most rapidly emerging global health problems in the postmenopausal women is osteoporosis. In postmenopausal women, two major causes of bone loss are oestrogen deficiency and age-related process Kumari *et al*., (2018) [1] aimed to evaluate calcium status in premenopausal and postmenopausal women. This cross-sectional study was carried out in 42 premenopausal and 58 postmenopausal women at the Department of Physiology, MGM Medical College, Jamshedpur to determine the Serum calcium level of subjects. The Mean serum calcium was significantly decreased in postmenopausal women compared to premenopausal women. They concluded that serum calcium level was significantly deficient in postmenopausal women than in premenopausal women.

Nutrients such as calcium, phosphorus, magnesium and vitamin D have been proven to be beneficial for bone health. Meanwhile, for the dietary patterns, foods such as dairy products especially milk, fibre and protein-rich foods, e.g., meat were directly linked to a positive association with bone mineral density (BMD). Likewise, fruits, vegetables and probiotic and prebiotic foods were reported for its positive relationship with BMD. Therefore, aside from physical activity, nutrition and diet in adequate proportions are suggested to be an important tool for ameliorating

osteoporosis and bone health issues in older age (Oyelere and Kruger, 2020) [3].

The quantity and quality of interpersonal relationships play an important role for women during menopausal changes and may affect both mental and physical health, quality of life, and mortality risk. Adults who are more socially connected are healthier, live longer, and have a better quality of life than their more isolated peers (Scocco and Nassuato, 2017) [8]. Women health education regarding iron and calcium rich diet must be given to middle aged women, especially those from low socioeconomic status to combat anaemia and hypocalcaemia. Hence the present study was conducted with the following objectives as to examine the association between dietary intake with serum haemoglobin and calcium level of the selected subject, to provide nutritional education to all the selected women at pre-menopausal stage.

Methodology

The study was conducted at Vedapatti suburb of Coimbatore, the selected subjects were premenopausal women age group 35-46 Years of age and the study period was from May 2022 to April 2023. The required data was collected using pretested, semi-structured questionnaire by house-to-house visits by the investigators after taking informed consent. If the succeeding woman also is not available, then preceding woman was selected. Help from field health workers of PHC was taken in contacting and tracing the sampled study subjects. The variables covered in study are (a) Socio-demographic variables: Age, educational status and marital status (b) Anthropometric status: height, weight, Body Mass Index (BMI), waist circumference, hip circumference and waist hip ratio (c) biochemical profile: serum haemoglobin and calcium, (d) dietary pattern: 24-hour diet recall. Ethical approval was received from PSG human ethics committee. The association between dietary intake with serum haemoglobin and calcium level of the selected subjects were analyzed using SPSS version 20.

Results and discussion

1. Socio demographic status of the selected menopausal rural women

Socio-demographic variables include, for example, age, sex, education, migration background and ethnicity, religious affiliation, marital status, household, employment, and income. Different index variables are formed on the basis of socio-demographic variables for research. The data regarding the socio demographic status of the selected menopausal rural women was displayed below.

Table 1: Socio demographic status of the selected menopausal rural women

Sr. no	Socio demographic status	Criteria	No of subjects	
			No	%
1.	Age criteria (years)	35-37	37	29
		38-40	31	24
		41-43	20	15
		44-46	42	32
		Total	130	100
2.	Marital status	Married	116	89
		Unmarried	02	2
		Widow	08	6
		Separated	04	3
		Total	130	100
3.	Educational qualification	Uneducated	34	27
		Primary	21	16
		Middle school	42	32
		Higher secondary	20	15
		Graduate	9	7
		Postgraduate	4	3
		Total	130	100

From the above table it was clear that majority (32%) of the subjects were between 44-46 years of age, 15% were between 41-43years. Most of the subjects (89%) were married, two percent were unmarried, three percent separated, and six percent were widow. Regarding their education status, 27% were uneducated, seven percent were graduates and only three percent were postgraduates. The menopause is emerged has an issue owing to rapid globalization, urbanization awareness of increased longevity in urban middle-aged Indian women are evolving as homogenous group. Improved economic condition and education may cause the attitude of women to be more positive towards the menopause (Kannur and Itagi, 2018) [5].

2. Anthropometry measurement of the selected menopausal women

At menopause, many women experience weight gain, particularly around the abdomen. Contributors to weight gain at menopause include declining oestrogen levels, age-related loss of muscle tissue and lifestyle factors such as diet and lack of exercise. The below table portrays the anthropometric measures of the study subjects.

Table 2: Anthropometry measurement of the selected menopausal women

S. No	Anthropometry	No of Subjects (n=130)	
		Mean	Standard Deviation
1.	Height	152.51	±6.52
2.	Weight	63.81	±12.52
3.	BMI	27.39	±4.87
4.	Waist circumference	107.55	±11.11
5.	Hip circumference	96.72	±11.18
6.	Waist to Hip ratio	1.12	±0.07

It was reported that the mean height of the selected subjects was 152.51±6.52cm, the mean weight 63.81±2.52 kg, and

the mean BMI was 27.39kg/m^2 ±4.87. The measured mean waist circumference was 107.55 ±11.11cm, the mean hip circumference was 96.72±11.18 cm, and the mean waist to hip ratio was 1.12±0.07.

2.1. Anthropometric status of the selected subjects

From the below figure, it was evident that only 48 subjects (37%) were with normal BMI, 69 subjects (53%) were overweight. Nearly 9% were obese and three percent were underweighted among the selected menopausal women. In a similar study by Roy *et al.*, (2020) [7] in their results indicates that, 43.0% of the post-menopausal women were found to be normal (BMI: 18.5-22.9 kg/m 2), 29.0% of the respondents were at the increased risk of adiposity (BMI: 23.0-27.5 kg/m 2) and 6.0% were belonged to category grade I obesity or higher high risk of adiposity (BMI: >27.5 kg/m 2), whereas 22% were underweight.

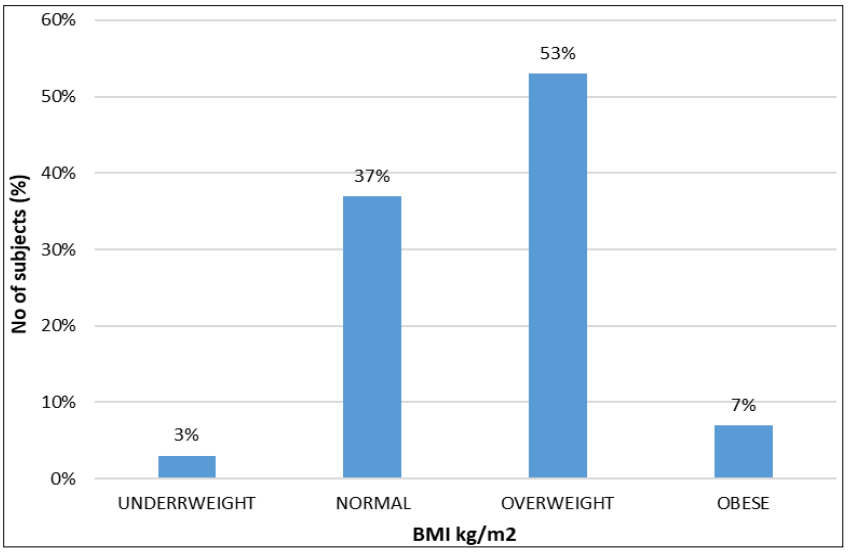

Fig 1: BMI status of the Subjects

3. Serum haemoglobin and calcium status of the selected subjects

Table 3: Serum haemoglobin and calcium status of the selected subjects

Serum Haemoglobin		
Haemoglobin (g/dl)	**Frequency**	**Percent**
7.1-9.9	22	17
10-11.9	51	39
>12	57	44
Total	130	100
Serum Calcium		
Calcium mg/dl	Frequency	Percent
<8	18	14
8-9	102	78
9.1-10	5	4
>10	5	4
Total	130	100

The above table reveals the serum haemoglobin and calcium among selected subjects. As per the above haemoglobin and calcium status, majority of subjects falls under mild anaemic and normal calcium levels. Farhud *et al.*, (2022) [4] in their study, the total study population, 74127 (81.23%) had normal serum calcium level (SCLs), 14110 (15.46%) had hypocalcaemia, and 3020 (3.31%) had hypercalcemia. SCLs were normal in 83.6% of men and 79.66% of women. Women had a significantly higher frequency of hypocalcaemia compared to men (17.2% vs. 12.83%, p<0.0001). Kaur (2018) reported that an age-associated decline in the mean values of haemoglobin concentration and the prevalence of anaemia was reported to be 85.2% among postmenopausal women. Anaemic women were lighter and had lesser circumferential measurements as well as lower BMD than their non-anaemic counterparts. The intake of nutrients such as protein, calcium, and iron and energy were lower among anaemic women than non-anaemic women. Binary logistic regression analysis identified age (odds ratio = 1.04, 95% confidence interval = 1.00–1.09) * as the possible predictor of anaemia.

4. Dietary behaviour of the selected subjects

Specific diets play a significant role in determining nutritional status and health outcomes, it is therefore imperative to study what patterns of diet affect or contribute to an individual's body composition and bone health status. The consumption of a nutrient dense dietary pattern has been recognized to reduce the effects of menopause in older women. Few studies have investigated the relationship between dietary patterns and body composition (Gunn *et al.*, 2015) [11].

Table 4: Dietary behaviour of the selected subjects

Nutrients	Mean intake	RDA* for moderate activity	Excess/Deficit
Energy (kcal)	2205.68±310.25	2130	Excess
Protein (g)	38.5±12.25	55	Deficit
Fat (g)	28.7±8.2	25	Excess
Fiber (g)	11.6±3.2	40	Deficit
Calcium (mg)	592.8±141.7	1000	Deficit
Iron (mg)	12.5±2.8	29	Deficit

*RDA 2020

The above table reveals that the mean daily intake of calories, protein, fat, fibre, calcium and iron of the participants which were assessed using 24 hour's recall method. Compared with Recommended Dietary Allowance, the average intake of protein (38.5±12.25 g), fibre (11.6±3.2

g), calcium (592.8±141.7 mg) and iron (12.5±2.8mg) were found to be deficit whereas intake of calories (2205.68±310.25 kcal and fat (28.7±8.2g) was found to be excess.

A study by Nnakwe and Yu (2014) [12] the consumption of fruits and vegetables, dairy products, and other food groups were below the recommended amounts. A majority of the participants received their information from books, magazines, and physicians. However, most of the participants received nutrition counseling from dietitians and physicians. The most common health conditions reported in this study were hypertension and osteoporosis in the population surveyed. The results from this study reinforced previous studies that abnormal eating behaviors exist in midlife women. The implication of this result is eating habits should be part of health assessment or a screening tool for women, especially during peri- and menopausal periods to identify the possibility of weight phobia. Women at midlife face increased risks for health problems, such as heart disease and hypertension. These health conditions are associated with weight problems, which, in turn, may be exacerbated by maladaptive eating behaviors.

5 Association between biochemical markers and dietary intake of calcium and iron

Table 5: Biochemical markers and dietary intake of calcium and iron

Total variables	N	X^2	Correlation	Sig.
Dietary calcium intake and Serum calcium	130	1.1	.22	.318
Dietary iron intake and Serum haemoglobin	130	0.0	.08	.718

p value significant at <0.05

From the above table it was clear that the dietary calcium intake is weakly associated with serum calcium levels, whereas dietary iron intake is strongly associated with serum haemoglobin levels. It is evident that poor intake of iron rich sources leads to low haemoglobin levels. Regarding calcium aging has myriad effects on calcium homeostasis and metabolism. Levels of parathyroid hormone rise, making the diagnosis of primary hyperparathyroidism more difficult. Vitamin D levels decline, affecting the rate of calcium absorption from the intestine. Wiafe *et al*., (2021) in their study they reported that after being adjusted for age and gender, partial correlation showed weak inverse and statistically significant relationship between dietary iron intake and iron DP 1 ($r = -0.234$), dietary iron intake and iron DP 2 ($r = -0.198$,), and iron DP 2 and vitamin C intake ($r = -0.201$,). Positive partial correlation and statistically significant relationship existed between dietary iron intake and dietary vitamin C intake ($r = 0.520$). There was weak negative partial correlation between dietary iron intake and ferritin ($r = -0.124$), and dietary iron intake and C-reactive protein ($r = -0.013$). Ko and Kim (2020) reported that furthermore, menopause is also associated with alterations in the levels of various lipids circulating in the blood, such as lipoproteins, apolipoproteins, low-density lipoproteins (LDLs), high-density lipoproteins (HDL) and triacylglycerol (TG). Alterations in lipid metabolism and excessive adipose tissue play a key role in the synthesis of excess fatty acids, adipocytokines, proinflammatory cytokines, and reactive oxygen species, which cause lipid peroxidation and result in the development of insulin resistance, abdominal adiposity, and dyslipidemia.

Conclusion

At present, premenopausal women in rural areas are not awareof the micronutrient deficiencies and their consequences and are suffering from various micronutrient deficiency diseases such as severe anaemia, osteoporosis etc. Hence it is recommended that awareness on micronutrient deficiencies should be a fundamental necessity to improve the nutritional status of rural women at premenopausal age. Prime importance must also be given to premenopausal age group women as given for pregnant and lactating women. Furthermore, it is requested that the guidelines for the premenopausal age group are essential to be provided from the higher authorities for the betterment of the premenopausal age group women.

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Conflict of interest

All authors has no conflict of interest or any affiliation or involvement in any organization academic, commercial, financial, personal and professionally relevant to the work.

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