Anthropometric and Bone Health Status of Rural Adult Females at Border Belt of Indian Punjab

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Abstract

A cross-sectional study was conducted (2018–2019) on randomly selected 70 rural adult females, visiting Community Health Centre, Harike Pattan, district Tarn Taran, Punjab, India. The respondents were interviewed for their sociodemographic profile such as age, education level, and socioeconomic status. Simultaneously, anthropometric parameters, namely, height and weight were recorded; body mass index (BMI) was calculated and obtained data were subjected to t-test and figures were expressed in terms of Mean ± SD. The respondents were categorized according to their BMI categories. Subsequently, blood samples of all the respondents were taken for biochemical parameters such as serum calcium, serum phosphorus, and serum uric acid by cresolphthalein complexone, ammonium molybdate, and enzymatic methods, respectively, to determine their bone health status. The prevalence of obesity, hypocalcemia, and hyperuricemia was presented in terms of percentage. On the basis of findings obtained on anthropometric parameters, obesity was prevalent among 10% of the respondents. For biochemical parameters, it was observed that hypocalcemia was prevalent among 70% of respondents. Further, serum uric acid of respondents ranged from 3.9 to 8.2 mg/dl and 58.6% of the total respondents had hyperuricemia. On the whole, above findings revealed poor anthropometric and bone health status of rural adult females at border belt of Indian Punjab.

Keywords: Hyperuricemia, Hypocalcemia, Obesity, Rural adult females, Sociodemographic profile

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Introduction

The prevalence of obesity among Indians has been increased at quite fast-paced trend and it was also noted as more than the global average.[1] Further, it is projected that by the year 2040, the prevalence of overweight and obesity will be reached to 27.4 and 13.9%, respectively, among Indian women aged between 20 and 69 years.[2] Specifically in rural India, this prevalence is estimated to be >20% by the year 2030 among adult women.[3] Poor socioeconomic status is considered as one of the contributory factors in developing obesity among rural adult women with state-level variations.[4,5]

Calcium, an important cation involved in various biological processes including blood clotting, cardiac rhythm, muscle contraction, and neurotransmission in human body, is also an evitable mineral for bone development and maintenance through aiding bone mineral density.[6,7] This nutrient is a key component in bone health as approximately 30–35% of bone mass is consisted of calcium. Deficiency of calcium in the form of hypocalcemia has been affecting adult population worldwide, especially women aged above 30 years. Reference range for serum calcium is 8.5–10.5 mg/dl and serum calcium level below 8.5 mg/dl is known as hypocalcemia.[8] Etiology of hypocalcemia is attributed to deficit supply and lower absorption of dietary calcium in adult women as requirements for the mineral increase after the age of 18 years due to reduction in the micronutrient used to cope up the physiological changes take place during pregnancy, lactation, and till the age of menopause in women.[9]

The prevalence of hyperuricemia has been increasing in developing countries over the past two decades. Hyperuricemia is a condition characterized by elevated serum uric acid level above the normal range of 2–6 mg/dl which leads to serious complications such as gout if subsequent deposition of uric acid is there in joints. Uric acid is the resultant product from endogenous, that is, daily synthesis of 300–400 mg in human body and exogenous sources in the form of diet rich in purines as well.[10] Thus, imbalanced diet

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can be a contributory factor for elevated serum uric acid level among individuals.

Studies on the prevalence of hypocalcemia among adult Indian females with other diseases such as diabetes and cardiovascular diseases are abundant but literature related to the prevalence of hypocalcemia and hyperuricemia among normal adult women in India still remains scarce. Therefore, the present cross-sectional study was planned to find out the prevalence of obesity, hypocalcemia, and hyperuricemia among rural adult females in border belt of Indian Punjab. Thus, required strategic interventions to improve bioaccessibility of iron in adolescent girls can be planned to strengthen health and nutritional status of prospective mothers.

Objectives

The objectives of the study were as follows:
1. To record sociodemographic profile of rural adult females
2. To assess anthropometric and bone health status of rural adult females
3. To find out the prevalence of obesity, hypocalcemia, and hyperuricemia among rural adult females.

Materials and Methods

Study Design

A total number of 70 rural adult females visiting community health center, Harike Pattan, a village in Tarn Taran district (a North Western district in Majha Region of Indian Punjab, known as border belt attached to Pakistan) were selected by employing simple random sampling design.

Sociodemographic Profile

Sociodemographic factors of rural adult females were recorded as age, education, and per capita income by interview method through recording the responses on predesigned interview schedule.

Anthropometric Measurements

Height (cm.) and weight (kg.) of rural adult females were recorded through following standard methods by stadiometer (24 SM) and digital weighing balance, correspondingly. Obtained data on above parameters were compared with the reference values[11] and also used to calculate body mass index (BMI) of the respondents. Besides, the prevalence of obesity was determined by categorizing them [Table 1] according to the classification of BMI.[12] The following formulae were used to calculate BMI to assess the proportionality of physique of the respondents.

Bone Health Status

Blood samples of the respondents were taken for biochemical parameter. Drawn blood samples were subjected to biochemical analysis by applying standard procedures. Elaborately, serum calcium, serum phosphorus, and serum uric acid were analyzed by cresolphthalein complexone, ammonium molybdate, and enzymatic methods, respectively, to determine bone health status of the respondents.

Statistical Analysis

Sociodemographic profile and prevalence of obesity, hypocalcemia, hypophosphoremia, and hyperuricemia-related data have been expressed in percentages. Data on anthropometric and bone health status of rural adult females were subjected to *t*-test and were expressed in terms of Mean ± SD using the software GraphPad Prism, version 5.01.[13]

Ethical Considerations

The study was ethically approved by Scientific Advisory Committee (December, 2017) of Krishi Vigyan Kendra (Agriculture Science Centre), Tarn Taran, working under the aegis of Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India, and Indian Council of Agricultural Research, New Delhi, India. Further, approval from Community Health Centre, Harike Pattan was obtained. Moreover, written consent of the study participants was also taken after explaining the significance and entire procedure of the study.

Results

Sociodemographic Profile of Rural Adult Females

Sociodemographic profile of the respondents is presented in Table 2. These rural adult females aged between 21 and 66 years. Majority (31.5 and 25.7%) of the respondents were in the age groups of 31–40 and 41–50 years, respectively. Data on education level depict that 27.1% of total respondents were illiterate, whereas 32.9 and 28.6% were educated below matriculation and completed matriculation, respectively. Only few (11.4%) received education after matriculation. With regard to per capita income, 68.6% of respondents belonged to low-income strata with per capita income up to INR 5000/- (US $ 78), while 17.1 and 14.3% had INR 5000–10,000/- (US $ 78–156.0) and INR >10,000/- (>US $ 156.0) of per capita income, respectively.

Anthropometric Measurements of Rural Adult Females

The mean height of rural adult females was recorded as 154.3 ± 6.2 cm with reported range of 142–169 cm. Further, weight of respondents ranged from 33 to 90 kg with mean weight of 58.7 ± 11.2 kg [Table 3].

Besides, mean BMI of the respondents was 24.7 ± 4.6 kg/m² and the lowest and the highest figures were reported as 12.5 and

Table 1: Classification of body mass index (WHO, 2004)

Classification	BMI (Kg/m²) principal cutoff points
Underweight	<18.50
Normal	18.50–24.99
Overweight	≥25.00
Pre-obese	25.00–29.99
Obese	≥30.00

BMI (kg/ m²) = Weight (kg)/Height (m)². BMI: Body mass index

Table 2: Sociodemographic profile of rural adult females

Variable	Frequency (n=70)	Percentage
Age (years)		
21–30	15	21.4
31–40	22	31.5
41–50	18	25.7
51–60	11	15.7
>60	4	5.7
Education level		
Illiterate	19	27.1
Up to matriculation	23	32.9
Secondary school	20	28.6
Post-secondary degree/diploma	8	11.4
Per capita income (INR)		
INR <5000/-	48	68.6
INR 5000–10,000/-	12	17.1
INR >10,000/-	10	14.3

Table 3: Anthropometric measurements of rural adult females

Parameters	Range	Mean±SD	Reference range
Height (cm)	142–169	154.3±6.2	161*
Weight (kg)	33–90	58.7±11.2	55*
BMI (kg/m²)	12.5–36.6	24.7±4.6	18.50–24.99**

*ICMR 2010; **WHO 2004. BMI: Body mass index

36.6 kg/m², respectively. The findings showed that 5.7, 48.6, 2.9, 32.9, and 10% of total rural adult females were categorized as underweight, normal, overweight, pre-obese, and obese, respectively [Figure 1].

Bone Health of Rural Adult Females

Figure 2 represents the findings related to biochemical parameters of the respondents. Broadly, mean figures for serum calcium, phosphorus, and uric acid level were reported as 8.25 ± 0.62, 2.95 ± 0.42, and 6.11 ± 1.19, with maximum and minimum values of biochemical parameters as 9.7 and 6.3; 4.6 and 2.05; and 8.2 and 3.9 mg/dl, in above order.

Prevalence of Hypocalcemia, Hypophosphoremia, and Hyperuricemia among Rural Adult Females

Although quite less variations in bone health parameters were identified among the respondents at individual level, 70 and 11.4% of rural adult females had serum calcium and phosphorus levels below the minimum reference value, depicts pervasiveness of hypocalcemia and hypophosphoremia [Figure 3]. Hyperuricemia was prevalent among 58.6% of the total respondents. The present study portrays an awful picture of overall bone health status for rural adult female at border belt villages of Punjab.

Discussion

The current study attests a high enormity of hypocalcemia along with hyperuricemia among rural adult females belonged to poor sociodemographic profile, along with poor anthropometric status. With regard to sociodemographic characteristics, a study conducted on 224 females aged between 20 and 49 years in New Delhi aimed at assessing their serum calcium level reported that the mean age of the respondents was 37 years and 33% of them belonged to upper socioeconomic status.[14] Age-related findings during the present study were in accordance with the above-mentioned investigation and an another study which reported majority of the adult females between the age of 40 and 55 years in Jharkhand, India,[15] while, during the present study, majority (68.6%) of the adult females were from poor socioeconomic status. A high prevalence of low bone mineral density among adult women aged between 18 and 36 years, from low socioeconomic status in Bangladesh,[16] these results were in accordance with the findings of the present investigation. Further, it was concluded that socioeconomic status has no significant (P > 0.01) on serum calcium level of adult females in Tamil Nadu, India.[17] It is also noteworthy that subjects in the present study represent the rural masses, whereas most (86%) of the subjects in the previous study were residing in urban settings. The prevalence of hypocalcemia is affected by educational level among masses as knowledge regarding dietary sources and enhancing absorption of calcium, is directly associated with increased educational level,[17] while results of the current study do not advocate the above statement as there is no significant (P > 0.05) difference which was observed in the serum calcium level of adult rural females with regard to their education level.

With regard to the prevalence of obesity among rural adult females, 32.9 and 10% of the total subjects were found pre-obese and obese, respectively, in the present investigation. These findings were close to the prevalence figures (47.8%) of obesity among adult Pakistani women.[18] During a study, the reported BMI
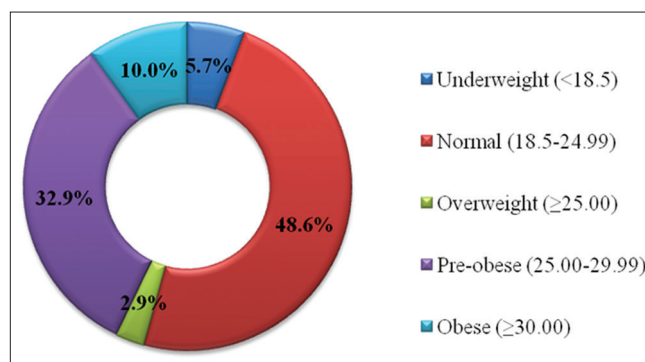

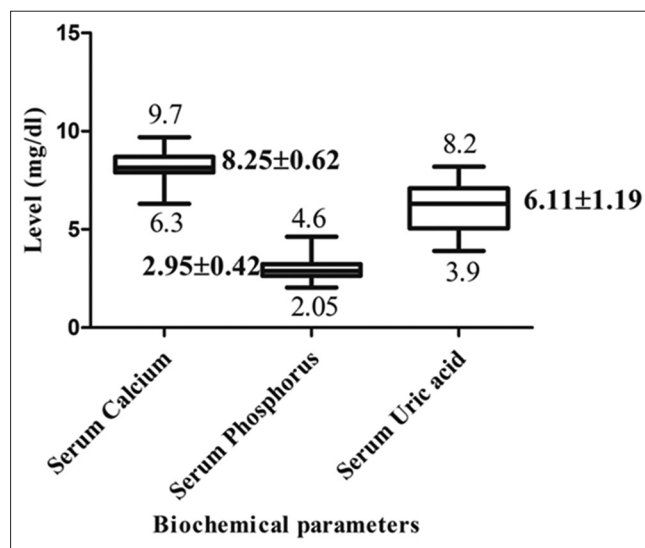**Figure 1:** Distribution of rural adult females according to body mass index

Figure 2: Serum calcium, phosphorus, and uric acid levels of rural adult females
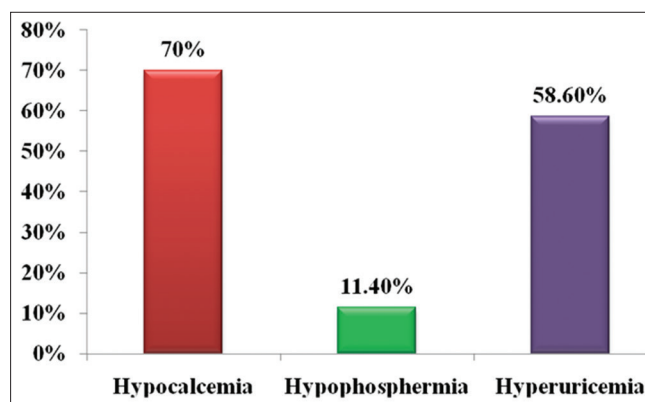

Figure 3: Prevalence of hypocalcemia, hypophosphoremia, and hyperuricemia among rural adult females

among non-obese and obese females was 23.45 and 35.81 kg/m², respectively, for Indian population.[19] While reporting an inverse relationship between serum calcium level and BMI of the women, the authors stated that serum calcium level was decreased with increased BMI and the correlation was significant at 1 and 5% level

among same study group, respectively.[20] In contrast to this, the findings of the previous study[19] reflected significantly (*P* < 0.01) increased serum calcium level among obese female participants aged 25–50 years in Maharashtra, India.

Although studies on Vitamin D deficiency are there for Punjabi adult females, no investigation on calcium deficiency among Punjabi women in North-West Punjab of India has been conducted so far.[21] Results of the present study (i.e., mean calcium level 8.25 mg/dl) are in agreement with the findings in which the investigators stated that 65% of adult females (aged from 21 to 50 years) with mean serum calcium level of 7.25 mg/dl in Meerut, Uttar Pradesh, India, were suffering from hypocalcemia.[22] Mean serum calcium and phosphorus level were 9.18 and 4.93 mg/dl among adult females in Tamil Nadu, India.[17]

Furthermore, serum calcium level was observed in the range of 7.1–8.3 mg/dl in the women aged between 40 and 75 years at Jharkhand State, India.[15] On the contrary, mean figures for above-mentioned parameters were observed as 7.25 and 3.99 mg/dl, respectively.[22] Further, the mean serum calcium level as 8.47 mg/dl in postmenopausal women at and 21.6 and 76.66% of total subjects was in the stage of osteopenia and osteoporosis, correspondingly.[23]

In the current study, extent of the prevalence of hyperuricemia was quite high, that is, 37.5% among rural adult females. A cross-sectional study on 167 women in Karachi, Pakistan, was conducted[18] and the findings revealed that the prevalence of hyperuricemia was 17.9% with mean uric acid level of 5.57 mg/dl among adult Pakistani women. Thus, after scrutinizing the results of the present and preceding studies, it is quite distressing to know about the scary picture for bone health status of women in rural areas of developing nations.

Conclusions

Convincingly, findings of the present study reflected a high prevalence of hypocalcemia and hyperuricemia among rural adult females in border belt villages of Indian Punjab. These types of bone health conditions further lead to awful health conditions such as osteoporosis and gout. The present study indicates the need to conduct studies focused on bone health status through assessment of hypercalcemia and hyperuricemia and their associated factors among rural adult females to check this menace in developing countries.

Acknowledgments

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