Original Article

Association of Parathyroid Hormone with Obesity among Women of Reproductive Age in an Urban Locality of Dhaka, Bangladesh

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Abstract

Background: Obesity is a major health concern worldwide. Obesity affects both metabolic and endocrine functions. Recent research suggests that there is a link between obesity and elevated levels of parathyroid hormones (PTH), a hormone that help to regulate calcium levels in the body. Higher PTH levels may contribute to various metabolic disorders, including osteoporosis. However, data on this association among Bangladeshi women are scarce.

Objective: To explore the association of serum parathyroid hormone (PTH) in obese women of reproductive age in a selective urban locality of Dhaka, Bangladesh.

Methods: An analytical cross-sectional study was conducted with 30 obese women (BMI>30 kg/m^2) and 30 non-obese women (BMI 18.5-24.9 kg/m^2). Participants were selected using a convenience sampling method and aged 25 to 50 years; post-menopausal women were excluded. All study subjects were recruited from the Urban Primary Health Care Project (UPHCP) in old Dhaka city, and study was conducted at Dhaka Medical College. Serum iPTH levels, total calcium and BMI, were measured. Statistical analysis was performed by using statistical package for social sciences (SPSS) v10.0. Data were expressed as Mean±SD, comparison between two groups were done by using Student's unpaired 't' test, Ethical clearance was taken from ethical review committee of Dhaka Medical College, data was collected in a prescribed data collection sheet.

Results: Obese women had significantly higher serum iPTH levels (38±16 pg/ml) compared to non-obese women (25±3 pg/ml; p<0.001). Serum calcium levels were found slightly lower in obese women (8.2±0.6 mg/dl) than in non-obese women (8.4±0.4 mg/dl), but this difference was not statistically significant.

Conclusion: This study found that obesity in women of reproductive age is linked to significantly higher PTH secretion, which may contribute to metabolic disturbances like osteoporosis. While the relationship between obesity and calcium levels was not significant, further research is needed with more study population to explore whether elevated PTH levels are a cause or result of obesity.

Keywords: Parathyroid hormone, Obesity, Calcium, Osteoporosis, Metabolic dysfunction.

Introduction

Obesity has emerged as one of the most pressing public health challenges recently.[1] It affects both endocrine and metabolic functions.[2] In the year 2022, obesity affected 890 million (about 16%) of the adult population of the world.[3] This figure is expected to continue rising in both developed and developing countries, including Bangladesh. Obesity is not merely a cosmetic concern; it is a complex medical condition that is closely associated with a wide range of endocrine, metabolic, and cardiovascular disorders.[4] These include diabetes, hypertension, dyslipidemia, metabolic syndrome and certain cancers. Increasing evidence also suggests a significant impact of obesity on bone metabolism and mineral homeostasis, highlighting its potential role in the pathogenesis of osteoporosis.

Bone health is intricately regulated by several hormones, among which parathyroid hormones (PTH) play a central role. PTH is secreted by parathyroid glands in response to changes in serum calcium levels.[5] Its primary function is to maintain calcium homeostasis by increasing renal calcium reabsorption, stimulating osteoclastic bone resorption and promoting the activation of vitamin D in the kidneys, thereby enhancing intestinal calcium absorption.[6] When PTH levels are persistently elevated, it can cause bone demineralization and may increase the risk of osteoporosis- a condition characterized by decreased bone mass and increased fracture risk.[7]

Recent studies suggest that obesity may be associated with altered parathyroid gland function and elevated circulating levels of serum parathyroid hormone (PTH). The exact mechanism of this association is not fully understood, but several hypotheses has been worked on. One theory posits that increased adiposity leads to sequestration of vitamin D in fat tissues, resulting in reduced bioavailability of vitamin D and a compensatory rise in PTH levels.[8] Another hypothesis suggests that altered renal handling of calcium in obesity could contribute to secondary hyperparathyroidism.[9] Furthermore, excess PTH itself may promote lipid accumulation in adipocytes, potentially creating a vicious cycle that reinforces both obesity and elevated PTH levels.[10] This could lead to a higher risk of bone demineralization and osteoporosis.[11] However, limited research has been done on this issue in Bangladeshi women of reproductive age. This study aims to examine whether obesity is associated with higher PTH levels in Bangladeshi women and how these levels relate to calcium levels.

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Materials and Methods

This cross-sectional study was conducted in Dhaka, Bangladesh, with participants recruited from the Urban Primary Health Care Project (UPHCP) Dhaka and study conducted at Dhaka Medical College, Dhaka. A total of 30 obese females (BMI > 30 kg/m^2) and 30 non-obese females (BMI 18.5-24.9 kg/m^2) were enrolled. All participants were in reproductive age, between 25 to 50 years. Both case and controls were selected from middle class socioeconomic status. Post-menopausal women were excluded. None had any history of metabolic disorders such as diabetes, thyroid dysfunction, or osteoporosis. Individual with renal or parathyroid diseases and persons on medications which may affect calcium metabolism were excluded from the study. Statistical analysis was done by using statistical package for social sciences (SPSS) for windows v10. Data were expressed as Mean±SD and comparison between two groups were done by using Student's unpaired 't' test, Ethical clearance was taken from ethical review committee of Dhaka Medical College, data was collected in a prescribed data collection sheet.

BMI which is the measurement of weight related to height was measured. The Hight and weight were measured by height weight machine to calculate BMI. The formula used here is, BMI=weight (in kg)/height (in meter^2).[12] BMI>30 kg/m^2 was considered as obese.[13]

Blood samples were drawn after an overnight fast to measure serum intact parathyroid hormone (iPTH) and total calcium levels. Serum iPTH levels were measured using chemi- luminescent immunoassay method. Serum calcium was measured by biometric endpoint technique in Dimension® clinical chemistry system. The data were analyzed using unpaired Student's t-test to compare PTH and calcium levels between obese and non-obese females. A p-value of <0.05 was considered statistically significant.

Results

A total of 60 women were enrolled in the study, with 30 classifieds as obese (BMI > 30 kg/m^2) and 30 as non-obese ((BMI 18.5-24.9 kg/m^2). The mean age of participants was 33.23±7.47 years, ranging from 25 to 50 years. There was no statistically significant difference in age between the obese (32.83±7.35 years) and non-obese groups (33.63±7.69 years; p = 0.682).

Table-I: Summarizes the baseline characteristics of the study population.

Characteristics		Obese (n=30)	Non-obese (n=30)	p-value
Age (years), mean ± SD		32.83±7.35	33.63±7.69	0.682
BMI (kg/m^2), mean ± SD		35.14±4.19	23.25±1.42	0.0001
Education	Primary	10 (33%)	8 (27%)	0.57
	Secondary	15(50%)	16 (53%)	
	Higher	5(17%)	6 (20%)	

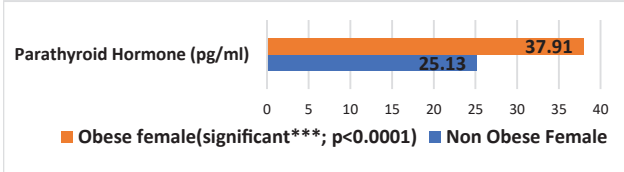

Figure-1: Parathyroid Hormone level in obese and non-obese female.

Serum calcium concentrations were lower in obese females (8.2+0.6 mg/dl) compared to non-obese females (8.4+0.4 mg/dl), but the difference was not statistically significant (p>0.05). Further investigations are required to confirm any significant changes in calcium homeostasis.

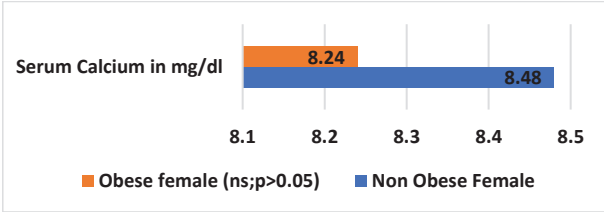

Figure-2: Serum Calcium level in obese and non-obese female.

Discussion

This study demonstrated significantly higher serum intact parathyroid hormone levels in obese women of reproductive age in Dhaka, consistant with previous research linking obesity to elevated PTH across diverse populations. Pitroda et al found increased PTH with higher body fat in older adults independent of vitamin D status[14], while Jumaahm et al reported a similar association with vitamin D deficiency in obese patients.[15] Saab et al confirmed that obesity predicts higher PTH even in chronic kidney disease[16] and Shapses et al showed altered vitamin D-PTH dynamics in obese women.[17] Although vitamin D was not measured here, these studies collectively support the notion that obesity disrupts calcium and vitamin D metabolism, leading to elevated PTH. This study findings extend this knowledge to Bangladeshi women of selected locality of Dhaka city, highlighting the need for further research including vitamin D assessment to clarify underlying mechanism.

However, in this study, obese females of study population have significant higher serum iPTH levels compared to their non-obese counterparts. This aligns with some studies indicated that obesity is associated with altered parathyroid function. The observed elevation in PTH level may contribute to disturbances in calcium homeostasis and could potentially increase the risk of conditions such as osteoporosis.[18]

Overweight resulting from elevated serum PTH can be attributed to several underlying mechanisms. One key process may be PTH promoting renal hydroxylation of 25-hydroxyvitamin D (25(OH) Vit-D) to its active form, 1,25-dihydroxyvitamin D (1,25(OH) Vit-D). this conversion increases calcium influx into adiposities, enhancing intracellular calcium levels, which in turn facilitates lipid storage in adipose tissue.[19]

On the other hand, elevated serum PTH levels in obesity might be a consequence of the condition itself, rather than a causative factor. In individuals with obesity, altered renal calcium handling can lead to a negative calcium balance, resulting in elevated serum PTH levels. This mechanism has been well documented in different studies.[20,21]

Furthermore, parathyroid hormone dysregulation has been linked to metabolic syndrome, suggesting that the changes in PTH could be a part of a broader metabolic disturbance in obese individuals.[22]

Additionally, higher serum intact PTH (iPTH) levels observed in females may have an influence of the hormone estrogen. Research indicates that parathyroid gland depends on adequate estrogen levels to properly respond to fluctuations in serum calcium levels. In females of reproductive age, the presence of estrogen may contribute to the observed increase in PTH levels, as estrogen appears to modulate the sensitivity of the parathyroid glands to calcium changes.[23]

The lack of statistically significant difference in serum calcium levels between obese and non-obese females suggests that other factors, such as dietary calcium intake, calcium absorption, or renal calcium handling, might be influencing calcium metabolism in this population. Further studies, including measurement of calcium intake and bone mineral density, are necessary to fully understand the effects of obesity on calcium balance in females.

The study addressed a clear research question with defined criteria and objective biochemical measurements, and included a comparison group for direct evaluation. However, its small sample size, convenience sampling, and cross-sectional design limit generalizability and causal inference. Unmeasured confounders such as dietary calcium, vitamin D status, and physical activity, along with reliance on BMI alone, may have influenced the findings.

Conclusion

The study concludes that obesity in females is associated with increased secretion of parathyroid hormone. Elevated PTH levels may play a role in metabolic disturbances observed in obesity, including an increased risk of osteoporosis. However, further research is required to determine whether elevated PTH levels are a cause or consequence of obesity and its associated complications. Future longitudinal studies should focus on exploring the long-term impact of high level of PTH in obese females and its relationship to bone health and other metabolic disorders.

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