

## Frequency distribution of hypocalcaemia (calcium deficiency) in male and female population of district Gilgit and adjacent areas

Sharista<sup>1</sup>, Imtiaz Ahmed Khan<sup>1</sup>, Abdul Latif<sup>2</sup>, Tika Khan<sup>1</sup>

<sup>1</sup>Department of Biological Sciences, Karakoram International University, Gilgit, Pakistan

<sup>2</sup>Government City Hospital Kashrote, Gilgit, Pakistan

**Abstract:** Calcium is a very important mineral in human body and plays important role in the optimum functioning of the heart, hormone release, relaxation of muscles and regulation of blood pressure. Globally 13% to 18% of women between the ages of 14 to 34 years suffer from calcium deficiency. This study is unique and conducted for the first time in the history of Gilgit Baltistan. Calcium level in 100 (69 females (54 married and 15 unmarried) and 31 male) individuals was assessed using micro lab machine ML 300. Results revealed significant level difference across gender with 4.9 mg/dL to 10.0 mg/dL (average 7.87 mg/dL) in female and 5.6 mg/dL-10.2 mg/dL (average 8.7 mg/dL) in male. Average calcium level in single female was 8.2 mg/dL while average calcium level in married female was 7.8mg/dL. Female (71 %) had calcium level below normal while 1.4 % female had calcium level above normal. 38.7 % male had calcium level below normal while 19.3 % male had calcium level above normal. Average calcium level of women having less than 3 children was 7.8 mg/dL while for the women having 3 or more than 3 children average calcium level was 7.3 mg/dL. Correlation coefficient between calcium level and age of the individual was -0.11876 indicating that with increase in age, calcium level decreases. Average calcium level of individuals (including both males and females) who have exposure to sun and those who do not have exposure to sun were 8.8 mg/dL and 7.6mg/dL respectively.

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**Key words:** Calcium deficiency, Hypocalcaemia, Gilgit, Vitamin D deficiency, Prevalence.

### 1. Introduction

Calcium is an essential mineral that human body requires to construct and sustain strong bones and teeth. It also plays an important role in the appropriate functioning of the heart nerves and hormone, contraction and relaxation of muscles and regulation of blood pressure. Human body needs active form of vitamin D to absorb calcium from gastrointestinal tract. Vitamin D can be obtained by exposure to sun and also from some food sources like fortified milk, fish, eggs and cod liver oil (Higdon, 2011). The recommended nutritional intake of calcium is 1,300 milligrams per day for individuals 0 to 18 years of age. While for individuals of ages 19-30, the reference range is lower at 1,000 mg/day (IOM, 2011).

The term calcium deficiency is used when the body has an insufficient amount of calcium. Calcium must be consumed daily in recommended range and absorbed efficiently in order to maintain optimal health. Calcium is present in variety of foods such as green vegetables, sea foods, nuts, dried beans, milk and other dairy products etc. Calcium is also added to orange juice, breakfast cereals, breads and other fortified food products. People can fulfill their dietary needs of calcium by taking such foods. Calcium is the most plentiful stockpiled nutrient in the human body.

More than 99% of calcium is stored in the bones and teeth and less than 1% is found in extracellular serum. The rate of absorption of calcium is different in different individuals depending upon variety of factors for example, during pregnancy when more calcium is required for the growing fetus the calcium absorption rate increases. The average absorption rate of calcium is approximately 30% in adults. (Goodman and Quarles, 2008).

Calcium is disseminated among various tissue partitions in the human body. Consuming enough calcium (between 1,000 and 1,200 milligrams per day) for healthy men and women is a must for ideal nutrition and health. Calcium is used throughout the body to perform various processes i.e. vascular contraction, vasodilation, muscle contraction, nerve impulse transmission, intracellular signaling, and secretion of various hormones. Any change in serum calcium can disturbs one or more of these functions. For example, hypocalcaemia has been associated to higher risk of seizures due to its relationship with nerve transmission and intracellular signaling. Calcium absorption occurs through all gastrointestinal tract but amount of absorption differs by region depending upon various factors especially pH. Approximately 65% calcium is absorbed where the pH

is between 6.5 - 7.5. Calcium absorption does not occur in stomach. The total amount of calcium that is absorbed depends on the amount of calcium existing, the total and segmental transport time and the amount of calcium that is present in each unique pH environment. The solubility of calcium increments are directly affected by the pH level (Van der velde et al., 2014).

Calcium deficiency is usually due to an insufficient intake of calcium when blood calcium levels drop too low. In order to maintain it in normal range calcium is borrowed from the bones. It is repaid to the bones from calcium supplied through the diet. If an individual's diet is not sufficient in calcium, there may not be adequate amount of calcium available in the blood to be returned to the bones to maintain strong bones. This condition can lead to osteoporosis. Taking recommended amount of calcium regularly is fundamental to prevention and treatment of calcium deficiency (Pravina et al., 2013).

Due to importance of calcium deficiency in human health, number of studies have been conducted worldwide on prevalence of hypocalcaemia. Flynn (2003) and Pettifor (2008) reported that 13-33% females all over the world have calcium deficiency. In Pakistan also some studies have been conducted on prevalence of hypocalcaemia. These studies include Danish et al., (2014), Mehmood et al., (2009), Zuberi et al., (2008). They reported 15.3 to 83% population in Pakistan has calcium deficiency. But no such studies have been reported from Gilgit Baltistan. Therefore present research was designed for the first time to estimate prevalence of hypocalcaemia in Gilgit and adjacent areas.

## 2. Materials and Methods

Gilgit Baltistan (GB) previously called Northern areas of Pakistan is a newly established province. It is the most magnificent mountainous area of the world surrounded by mighty mountain systems of Himalaya, Karakoram, Hindukush and Pamir (fig 1). Area of GB is 72,496 km<sup>2</sup> (27,991 sq mi). Population of GB is 1,800,000. Population density of the province is 25/km<sup>2</sup> (64/sq mi). The study was undertaken at Department of Pathology, District Headquarter Hospital Gilgit. A sample of 100 individuals (including both females and males) visiting DHQ hospital were studied. The individuals included in present study belonged to all major areas of Gilgit Baltistan including Gilgit, Ghizer, Hunza-Nagar, Chilas, Astore, Skardu etc (Fig. 1) ranging in altitude from 1300 meter – more than 3000 meter above sea level. Complete history (age, marital status, dietary habits, demography, sun exposure, education, income) were recorded. Calcium serum test was performed to

estimate the calcium level in blood. Serum calcium was tested by C-P-C method using o-Cresolphthalein Complexone kit. For this purpose 10 ml of blood was taken from each individual using sterilized syringe by vein puncture with minimal sepsis. Blood was immediately transferred to the glass tubes and centrifuged at 1500 rpm for 5 minutes. After centrifugation the separated blood serum was transferred to fresh tubes and followed by serum calcium test.



Figure 1. Map of study area

Proper procedure was followed for conducting this study, necessary approval was taken from the concerned authorities during the course of study. The authorities of DHQ hospital Gilgit and Department of Biological Science KIU, were taken on board prior to any practical step. Patient names were not described in this thesis. Whereas patient's consent was obtained for test. Most of the individuals included in this study visited DHQ because of complaints like body aches, bones pain, joints pain, back pain, hypertension, skin mlasma, legs pain, seizures, pain in arms, weakness, ankle pain, polyarthritis, pain in bones of hands, pain in bones of arms and legs, dried skin, obesity, Pain in right arm, swelling around joints of fingers, swelling of left leg, brittle and whitish nails, rashes on skin, dryness of skin.

Out of 100 individuals studied, 69 were female and 31 were male. Fifty four out of 69 females were married while fifteen were unmarried. Individuals included in present research ranged in age from 12-65 years in case of male while female individuals included in present research ranged in age from 12-70 years. Average number of children in case of married women included in present research was 5. Average Calcium level of women having less than 3 children was 7.8 mg/dL while for the women having 3 or more than 3 children average calcium level was 7.3 mg/dL. These 2 averages were significantly different from each other (t value= 30.2, p value =0.02). Most of the male individuals included in present research (18

males) ranging in age from 23-55 years had calcium level ranging from 8.2 – 9.2 mg/dL. Fig. 2 represent scatter diagram representing relationship between age of individual and calcium level. Correlation coefficient between calcium level and age of the individual (calculated using Past computer program was negative) ( $r=-0.11876$ ) indicating that with increase in age, calcium level decreases. Average calcium level of individuals (including both males and females) who have exposure to sun and those who do not have exposure to sun were 8.8 and 7.6mg/dL respectively. These averages were significantly different at  $p \leq 0.05$  ( $t$ - value = 12.54,  $p$ - value=0.05).

Monthly Income of individuals ranged from Rs. 8000 to Rs. 80000. Basic statistical analyses was carried out using computer program PAST (PAleontological Statistics, Hammer, 2016) version 3.11. Graphical representations were made using computer program “Create a graph”.

### 3. Results and Discussion

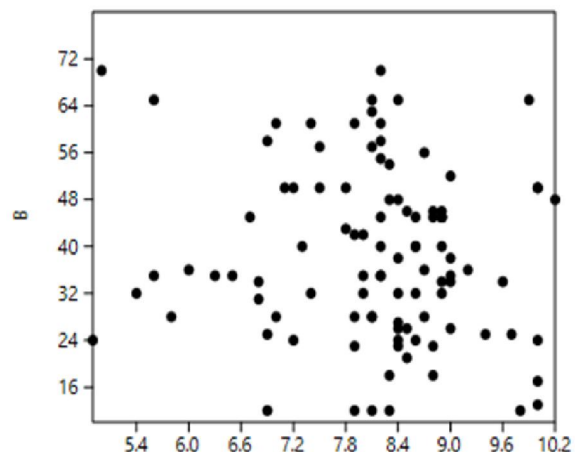
Basic statistics including minimum, maximum, mean, median, standard error, standard deviation and coefficient of variation were calculated using PAST. In general calcium level among 100 individuals (including both male and female) ranged from 4.9 mg/dL to 10.2 mg/dL with an average of 8.1 mg/dL (Table 1). Gender wise, in 69 female individuals, calcium level ranged from 4.9 mg/dL to 10.0 mg/dL with an average of 7.87 mg/dL. In male population studied during present research, calcium level ranged from 5.6-10.2 mg/dL. Average calcium level in male individuals was 8.7 mg/dL (Table 1).

Statistical significance-test was performed for male calcium level vs female calcium level using t test calculated t- value (19.9) was significant ( $p= 0.03$ ). Average calcium level in single female was 8.2 mg/dL while average calcium level in married female was 7.8mg/dL. This difference was highly significant ( $t =34.06$ ,  $p= 0.01$ ). Calcium level ranging from 8.5 - 9.8 mg/dL was considered as normal (Eperla and Pathak, 2015; personal communication, Dr. Latif, Chief Pathologist, DHQ, Gilgit). Out of 100 individuals tested, 61 individuals had below normal calcium level (less than 8.5 mg/dL) and 7 had above normal (more than 9.8 mg/dL). Thirty two percent total population under study showed calcium level within normal limits (8.5 – 9.8 mg/dL). Gender wise, forty nine (out of 69 females studied (71% female) had calcium level below normal (less than 8.5 mg/dL) while only 1 females out of 69 females studied (1.4 % female) had calcium level above normal (more than 8.5 mg/dL) (Fig.2). Nineten females (27.5 % of female population) had calcium level within normal limits. Twelve (out of total 31 males studied (38.7 % male) had calcium level

below normal (less than 8.5 mg/dL) while 6 males out of 31 males studied (19.3.0% male) had calcium level above normal (more than 8.5 mg/dL). Thirteen male individuals (41.9 % male population of Gilgit and adjacent areas) had calcium level within normal range (8.5-9.8mg/dL).

**Table 1.** Basic statistics for calcium level in 100 individuals

Parameter	Over all Ca level	Ca level in female	Ca level in male
Min	4.9	4.9	5.6
Max	10.2	10.0	10.2
Mean	8.1	7.87	8.7
Median	8.3	8.2	8.7
St. error	0.11	0.13	0.17
St deviation	1.11	1.09	0.95
Coefficient of variation	13.7	13.85	10.99



**Figure 2.** Scatter diagram showing relationship between age and calcium level in 100 individuals tested. X-Axis=Calcium level, Y-Axis=Age of individual

Various studies have been done on causes of calcium deficiency for example Fong and Khan (2016) described that Vitamin D deficiency plays major role in hypocalcemia. Genetic causes and Renal and end-stage liver disease also play important role in development of hypocalcemia. (Nawaz et al., 2014). Women especially those in developing countries and during pregnancy have serious risk of hypocalcemia as they consume too little calcium through their diet (Zeni et al., 2003; Garcia and Martini, 2010).

Hypocalcemia may occur due to low socio-economic status, multiple pregnancies, nutritional insufficiency and vitamin D deficiency (Holick, 2007). Symptoms of hypocalcaemia include tiredness, muscle cramps, deadness and prickling in the fingers, and problems with heart rhythm (Avinash., 2013; Saha and Goswami 2014).

In women change in menstrual cycle can create problems with calcium deficiency. Most severe symptoms of calcium deficiency are bone fractures or breakage. The ultimate result of weakened bones is osteoporosis, in which the bones become porous and fragile because calcium is introverted from the bones and other areas faster than it is deposited in them. Some time Obesity is also considered as symptom of calcium and vitamin D deficiency because various studies have revealed that there is high prevalence of vitamin D deficiency in obese women (Arunabh et al., 2003; Hypponen and Power, 2006).

Vitamin D helps in calcium absorption and prevent hypocalcaemia. Easiest way to obtain vitamin D is by exposure to sunlight every day for 15 to 30 minutes. Hypocalcaemia women are often treated with estrogen therapy which restores bone remodeling levels back to those of pre-menopause, leading to a lowering rate of bone loss. According to investigation in Pakistan 72% women have vitamin D deficiency (Mahmood et al., 2009). Zuberi et al., (2008) reported that 92% population in Karachi is suffering from vitamin D deficiency while in Islamabad it is approximately 56% (khan et al.,2013). Atiq et al., (1998) reported the prevalence of hypovitaminosis D in Pakistan, is 66.7% in infants and 81.1% of breastfeeding mothers. But unfortunately no such study had been conducted in Gilgit Baltistan.

Present research concludes that in general, women population of Gilgit and adjacent areas has lower calcium level than males. Also it was observed that pregnant women have relatively higher prevalence of hypocalcaemia. It is therefore recommended that women especially those who are pregnant should use calcium rich food especially fortified milk, orange juice, cheese butter, cereals, green vegetables, nuts, sea food and dried beans. In severe cases it is also recommended to take 1,000 mg of elemental calcium daily for six months It is also evident from present research that exposure to sun is important for maintaining calcium level in human body, hence it is recommended that approximately 15-20 minutes of exposure to sun (especially at the time of dawn) is important for maintaining healthy calcium level.

## References

1. Arunabh, S., Pollack, S. Yeh, J. and Aloia, J.F. 2003. Body fat content and 25-hydroxyvitamin D levels in healthy women. *J. Clin. Endocrinol. Metab.* 88: 157-161.
2. Atiq, M., Suria, A., Nizami, S.Q., Ahmed, I. 1998. Maternal vitamin-D deficiency in Pakistan. *Acta Obstet Gynecol Scand.* 77: 970-973.
3. Avinash, M., Pravina, P. and Sayaji, D. 2013. Calcium and its Role in Human Body. *International Journal of Research in Pharmaceutical and Biomedical Sciences.* 4(2):659-668.
4. Danish, S.H., Ahmad, F., Hassan, F., Khan, S.A. and Hashmi, A.A. 2014. Osteoporosis and its associated factors revisited: Case control study. *Pak. J. Med. Dent.* 3(3):13-20.
5. Eperla, N. and Pathak, R. 2015. Hypocalcaemia Secondary to Zoldronate Therapy in patients with low Vitamin D level. *Case Report (WMJ).* 114,163-166.
6. Flynn, A. 2003. The role of dietary calcium in bone health. *Proc. Nutr. Soc.* 62: 851-858.
7. Fong, J. and Khan, A. 2016. Hypocalcemia updates in diagnosis and management for primary. *Canadian family physician.* 62(4): 158-162.
8. Garcia, V.C. and Martini, L.A. 2010. Vitamin D and cardiovascular disease. *Nutrients.* 2:426-437.
9. Goodman W.G. and Quarles, L., D. 2008. Development and progress of secondary hyperparathyroidism in chronic kidney disease lessons from molecular genetics kidney. 74: 276-288.
10. Hammer, Q. 2016. Natural History Museum. University of Oslo. <http://folk.uio.no/ohammer/past/>. Retrieved on March, 17, 2016.
11. Higdon, J.2011. Vitamin D. Micronutrient Information Center <http://lpi.oregonstate.edu/infocenter/vitamins/vitaminD/2011>.
12. Holick, M.F. 2007. Vitamin D deficiency. *N. Engl. J. Med.* 357: 266-281.
13. Hypponen, E. and Power, C. 2006. Vitamin D status and glucose homeostasis in the 1958 British birth cohort: the role of obesity. *Diabetes Care.* 29: 2244-22.
14. IOM.2011. Institute of Medicine, Committee to Review Dietary Reference Intakes for Vitamin D and Calcium. *Dietary Reference Intakes for Calcium and Vitamin D: The National Academies Press.*
15. Khan, H., Ansari, M.A., Waheed, U. and Farooq, N. 2013. Prevalence of vitamin D deficiency in

- general population of Islamabad, Pakistan. *Ann. Pak. Inst. Med. Sci.* 9:45-7.
16. Mahmood, K., Akhtar, S.T., Talib, A. and Haider, I. 2009. Vitamin-D status in a Population of Healthy Adults in Pakistan. *Pak. J. Med. Sci.* 25(4):545-550.
  17. Nawaz, R., Amin, R., Gul, S. and Khanani, R. 2014. Association of hypovitaminosis D and hypocalcemia with neuropsychiatric disorders. *J Dow Uni Health Sci* 8(3): 126-133.
  18. Pettifor, J.M. 2008. Vitamin D and calcium deficiency rickets in infants & children: a global perspective. *Indian. J. Med. Res.* 127: 245–249.
  19. Pravina, P., Sayaji, D. and Avinas, M. 2013. Calcium and its Role in Human Body. *International Journal of Research in Pharmaceutical and Biomedical Sciences.* 4(2):659-668.
  20. Saha, S. and Goswami, R., 2014. Menstruation associated hypocalcemic symptoms and serum calcium in patients with idiopathic hypoparathyroidism. *BMC Endocrine Disorders.* 14: 28-35.
  21. Van der Velde, R.Y., Brouwers J.R., Geusens, P.P., Lems, W.F. and Van, Den, Bergh, J.P. 2014. Calcium and vitamin D supplementation: state of the art for daily practice. *Food. Nutr. Res.* 58.
  22. Zeni, S.N., Ortela, C.R. and Lazzari, A. 2003. Interrelationship between bone turn- over markers and dietary calcium intake in pregnant women. A longitudinal study. *Bone.* 33:606–613.
  23. Zuberi, L.M., Habib, A., Haque, N. and Jabbar, A. 2008. Vitamin D deficiency in ambulatory patients. *J. Pak. Med. Assoc.* 58:482-4.

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