Original Article

Assessment of Blood Glucose and Calcium Concentrations Among healthy female volunteers

Kiran Ashraf[1], Iraj Jamsheed[1], Farheen Zaidi[1], Morad Yaser Al Mostafa[2*]

[1]University Institute of Diet and Nutritional Sciences, Faculty of Allied Health Sciences, The University of Lahore, Lahore, Pakistan
[2]Ministry of Health, Princess Basma Hospital, Jordan
*morad_95@icloud.com

Abstract:

Hypoglycemia and Hyperglycemia are associated with a number of complications including kidney damage, neurological damage, cardiovascular damage, damage to the retina or damage to feet and legs, lethargy, impaired mental functioning and irritability. The most abundant mineral in the body is calcium. Its abnormal levels also associated with multiple disorders. **Objectives:** The aim of this study was to assess the blood glucose and calcium levels in healthy female volunteers **Methods:** A cross sectional study was conducted at the Sir Ganga Ram Hospital, Lahore, over a period of 6 months, after obtaining the ethical approval from the The University of Lahore. A total number of 60 females were enrolled through consecutive sampling technique. Females of all age groups were included. All of the females had gone through routine history taking and lab investigations for the assessment of blood glucose an calcium concentrations. **Results:** In this study out 60 female participants, 33.3% were between ages of 15-30 years, 33.3% were between age of 31-50 years and remaining 33.3% were above 50 years old. All females of age group 15-30 years had normal glucose levels while single case of age group 15-30 years had abnormal calcium level. The results indicated that females of above age 50 years had low calcium and high glucose levels due to poor nutrition and less physical activity. **Conclusions:** The results of the current study showed that females with increasing age should intake food enriched in calcium and low glucose and adopt a physically active life style to manage normal blood glucose levels.

Key words: Blood Glucose, Hyperglycemia, Hypoglycemia, Hypercalcaemia, Hypocalcaemia

Introduction:

Approximately in all types of biosynthetic reactions glucose is used as well as glucose is also used as a base of energy. For normal biological functions metabolism of glucose is important [1]. The total sum of glucose in the blood is called as concentration of blood glucose. The blood glucose level endured by the human body is 64.8 and 104.4 mg/D, or 3.6 and 5.8 mM (mmol/L, i.e., millimoles/liter) [2]. As a part of metabolic balance system, blood glucose level is regulated naturally. For cells of the body, the chief source of energy is glucose. In humans, the mean normal value of blood glucose level is around 4 mmol/L (72 mg/dL or 4 mM) [3]. At several times of day and before and after meals, level of glucose differs; Generally, the normal range for fasting people (adults) is around 4 to 6 mmol/l or 80 to 110 mg/dl. An individual having a rang above 7 mmol/l or 126 mg/dl is usually apprehended to have high blood glucose level or hyperglycemia, while an unswerving range less than 4 mmol/l or 70 mg/dl is characterized as low blood sugar level or hypoglycemic. The blood plasma glucose shouldn't surpass 126mg/dL in fasting individuals (adults) [4]. Recurring high level of blood glucose harms the blood vessels and the organs they supply blood to, leading towards the complications of diabetes [5].

Without making any lasting effect/ symptom, blood glucose level can elevate above the normal value for substantial time periods [6]. But, over a period of years long term hyperglycemia slightly above normal value can cause many complex complications which include nerve damage, kidney damage, damage to retina of eyes or damage to feet and legs and damage to the cardio-vascular system. Chronic high blood sugar level can cause diabetic neuropathy [7]. An early rise in blood sugar level is caused by consumption of alcohol and then afterwards inclines to decrease the sugar levels. Similarly, some drugs can upsurge or decline the glucose levels [8]. The treatment of Diabetes mellitus intends at maintaining blood glucose at a level as close to normal as possible, so that the serious long-term complications can be avoided. In Acute hyperglycemia that involves dreadfully elevated blood glucose levels leads to medical emergency that can quickly yield grave complications [9].

Individuals having uninhibited insulin-dependent diabetes exhibit this more often. Hypoglycemia occurs when blood sugar levels drop drastically. Twitching, weakness in arm and leg muscles, impaired mental functioning, lethargy, shaking, irritability, sweating, paranoid or aggressive mentality, loss of consciousness and pale complexion are the symptoms of hypoglycemia [10]. Cerebral damage is also possible. Numerous kinds of blood glucose tests are used. For diagnosing prediabetes and diabetes, RBS (Random blood sugar). FBS (Fasting blood sugar), Oral glucose tolerance test are used. In oral glucose tolerance test, a number of blood glucose measurements are taken after a person consume a sugary drink/liquid that has glucose. For diagnosing gestational diabetes (diabetes that occurs during pregnancy), commonly oral glucose tolerance test is used [11]. Management of diabetes is a lifetime obligation of, healthy eating, blood sugar monitoring, sometimes, diabetes medications or insulin therapy and regular exercise [12].

Calcium is the amplest mineral in the body. Calcium is available as dietary supplement and also found in the food. Some antacids also contain Calcium [13]. Many body functions need calcium such as muscle function, vascular contraction and vasodilation, nerve transmission and intracellular signaling and hormonal secretion. Although to support these critical metabolic functions, less than 1% of total body calcium is required [14]. Bones and teeth stores the remaining 99% Calcium of the body and it supports their function and structure. Depending upon the life age group, intake of Calcium range for women was 748 to 968 mg/day and for males' range was from 871 to 1,266 mg/day. Girls aged 9–13 years and 14–18 years, women aged 51–70 years, and both men and women older than 70 years are the groups which fall in the Group of below desirable intakes [15]. In Pakistan, the frequency of osteoporosis is high, with 55% of women aged 45-54 years and 97% of women aged 75-84 years inclined to osteoporosis [16].

Generally, women are less expected than men to get suggested amount of calcium from food [17]. According to National institute of health, absorption of Calcium is as high as 60% in babies and young children because they need large quantity of Calcium in order to build bones. In adulthood, absorption declines to 15%–20% and as people age it continues to decline. Women older than 50 years and for both men and women older than 70 years: as compared to younger adults [18]. Low blood calcium level is known as Hypocalcaemia, it occurs when in the blood concentration of free calcium ions falls below 4.0 mg/dL. 4.0-6.0 mg/dL is the mean concentration of free calcium ions in the blood serum.

Hypoglycemia can become a reason to develop different diseases like osteopenia, renall failure, muscle cramps, tingling in fingers, osteoporosis numbness, convulsions and abnormal heart rhythms[19]. Vitamin D deficiency can also cause hypoglycemia. Vitamin D is necessary for calcium absorption, deficiency of calcium can also leads to mortality [20]. Inadequate calcium intake for a

long time can lead to osteopenia which can also leads to osteoporosis if remain untreated.Older individuals are at high risk of bone fracture. Calcium deficiency can also cause rickets [21].Hypocalcaemia causes pancreatitis, renal failure or hyperparathyroidism [22].

Neonatal hypocalcaemia includes early and late hypocalcaemia. Early hypocalcaemia begins in the first few days of life. Late hypocalcaemia can be resulted due to feeding with formulas that have amount of phosphate and can deplete levels of calcium. This type of hypocalcaemia is thought to be occurred by high intake of phosphate or problems with an under active parathyroid gland. Any newborn who are showing the signs of hypocalcaemia should be assessed immediately so that treatment can begin. A healthy dietary intake and being physically active can prevent from adult osteoporosis to develop during childhood [23].

Hypercalcemia is an abnormally high level of calcium in the blood, usually more than 10.5 milligrams per deciliter of blood. Hypocalcaemia is an elevated calcium level in the blood (Normal range: 9–10.5 mg/dL or 2.2–2.6 mmol/L). It can cause vascular and soft tissue calcification, renal insufficiency, hypercalciuria (high levels of calcium in the urine) and kidney stones. Consumption of high amount of calcium from supplements instead of food has resulted in development of kidney stones [24]. Increased calcium intake may increase the advantageous effects of energy restriction on blood pressure and abdominal obesity [25].Vitamin D and calcium have a chemo preventive effect against breast cancer [26]. Consumption of calcium rich foods like fruits, vegetables, dry fruits and intake of calcium supplements can help to treat the disease related to calcium [27].

Methods:

A cross sectional study was conducted at Sir Ganga Ram Hospital, Lahore, over a period of 6 months from June 2018 to December 2018 after obtaining the ethical approval from the The University of Lahore, Lahore, Pakistan. A total number of 60 females were selected through consecutive sampling technique. Females of all ages, who were healthy and visited hospital for routine checkup or to attend a patient were included while Infants, children and men were excluded. Study particiants were divided into three different age groups as follows: Group 1: 15-30 years, Group 2: 31-50 years and Group 3: Above 50 years. Blood testing for alleged results of glucose and calcium for data collection as well as routine history was taken from all of the females. By using SPSS 16.0 statistical analysis was done.

Results:

In this study, 20 females (33.3%) were between age of 15-30 years, 33.3% were between age of 31-50 years and remaining 33.3% were above 50 years old. The results indicated that most of the females (45) had blood glucose levels within normal ranges (Table 1). Out of 20 females of age group above 50 years, 8 females had more glucose value than normal value as with the increased age females weight and glucose level got raised too due to poor nutrition and less physical activity Table 2. From the results, it was observed that 51 females among all had normal calcium values and 9 had below than 8.5mg/dl value as shown in Table 3. Most of them belonged to the age group 15-30 years while single case of age group 15-30 years had abnormal calcium level (Table 4). There were 2 abnormal cases of calcium in the age group of 31-50 years (Table 5). More deranged cases were found among females of above 50 years group because calcium decreases with age as shown in Table 5. Among the total cases, 52 had normal ranges of glucose concentration in blood while 51 had normal calcium ranges (Table 5).

Blood Glucose Range	Total
Below 60mg/dl	0
60 to120mg/dl	45
Above 120mg/dl	15
Total females	60

Table 1: Frequency distribution of glucose Levels

Age groups (years)	Below 60 mg/dl	60-120mg /dl	Above 120mg /dl	Total
15-30	0	20	0	20
31-50	0	13	7	20
50 above	0	12	8	20
Total female	0	45	15	60

Table 2: Blood Glucose Levels with Different Age Groups

Calcium	Total patients
Below 8.5 mg/dl	9
8.5 to10.5 mg/dl	51
Above 5110.5 mg/dl	0
Total females	60

Table 3: Frequency distribution of Blood calcium Levels

Age groups (Years)	Below 8.5mg/ dl	8.5-10.5mg /dl	Above 10.5mg /dl	Total
15-30	1	19	0	20
31-50	2	18	0	20
Above 50	6	14	0	20
Total females	9	51	0	60

Table 4: Calcium Levels with Different Age Groups

Age (Years)	Glucose Levels		Cacium Levels	
	Normal	Abnormal	Normal	Abnormal
15-30	20	0	19	1
31-50	15	5	18	2
<50	17	3	14	6
Total	52	8	51	9

Table 5: Frequency distribution of Normal and deranged
Glucose & Calcium concentrations in blood

Discussion:

There were 6 derranged cases in females those above 50 because calcium always decreases with age. This decline could be due to a reduction in either diffusion component of the calcium absorption system or the active calcium transport [28]. Similarly, as we considered the glucose level in females with different age groups it was observed that glucose level was normal in age of 15 to 30 yrs. Because diet is usually proper in this while the few cases in which there were deranged values, it may be due to imbalance of diet and there may be some other causes due to which glucose level decreases such as hypertension and pregnancy. When we had taken the history of females, we came to know that those females which were hyper or hypocalcaemia were unaware of this. But the females which were hyperglycemic present the complain of diabetes and some of them had family history. Similarly, it was observed that people were unaware from calcium and glucose: some research was done in Russia. The study showed that the awareness of diabetes and calcium was three times more frequent in women (6%) than men (2%). Less educated defendants and people of rural areas were less aware and socioeconomic differences widened during the study [29]. Blood glucose level is directly related to diet. The level of blood glucose falls when a person has not consumed food for several hours and rises after food is consumed. Dietary choices of food determines how instant and high the

blood glucose level rises. Food choices have a major impact as to how quickly and how high the blood glucose levels rise. Carbohydrates have a major role in determining the blood glucose level [30]. So it is noticed that we should include such types of food in our diet which maintain the level of glucose and calcium in our bodies.

Conclusions:

All the nutrients should be managed through proper diet. Foods that are intact and dense in nutrients mostly contain all the minerals and vitamins that are present in supplements and also are a good source of dietary fiber and other naturally occurring substances that may have positive health effects. Dietary supplements may be advantageous in specific situations to increase intake of a specific vitamin or mineral.so we should include these nutrients such as calcium and glucose in our daily diet so that we can avoid the diseases which may lead to death or otherwise a low quality of life.

References:

1. Stryer, (1995). "Chapter 30: Integration of Metabolism." Biochemistry, 4th ed. W.H. Freeman & Company, New York.
2. Daly, M. E., Vale, C., Walker, M., Littlefield, A., Alberti, K. G., & Mathers, J. C. (1998). Acute effects on insulin sensitivity and diurnal metabolic profiles of a high-sucrose compared with a high-starch diet. *The American Journal of Clinical Nutrition*, **67**(6): 1186-1196.
3. Giovannucci, E. (2003). Nutrition, insulin, insulin-like growth factors and cancer. *Hormone and Metabolic Research*, **35**(11/12): 694-704.
4. Seshadri, R. (2002). American diabetes association gestational diabetes mellitus. *Diabetes Care*, **25**, S94-S96.
5. Lee, J. Y., & Pearce, E. N. (2002). Reproductive endocrinology. Seoul: Seoul National University Publisher, 322.
6. Horwich, T. B., & Fonarow, G. C. (2010). Glucose, obesity, metabolic syndrome, and diabetes: relevance to incidence of heart failure. *Journal of the American College of Cardiology*, **55**(4): 283-293.
7. Jenssen, T. G., Tonstad, S., Claudi, T., Midthjell, K., & Cooper, J. (2008). The gap between guidelines and practice in the treatment of type 2 diabetes: a nationwide survey in Norway. *Diabetes Research and Clinical Practice*, **80**(2): 314-320.
8. Rosenn, B. M., Miodovnik, M., Holcberg, G., Khoury, J. C., & Siddiqi, T. A. (1995). Hypoglycemia: the price of intensive insulin therapy for pregnant women with insulin-dependent diabetes mellitus. *Obstetrics & Gynecology*, **85**(3): 417-422.
9. Metzger, B. E. (1998). Proceedings of the fourth international workshop conference on gestational diabetes mellitus. *Diabetes Care*, **21**(2): B1-B167.
10. Cudworth, A. G., & Veevers, A. (1975). Carbohydrate metabolism in the menstrual cycle. BJOG: *An International Journal of Obstetrics & Gynaecology*, **82**(2): 162-169.
11. Bartoli, E., Fra, G. P., & Schianca, G. C. (2011). The oral glucose tolerance test (OGTT) revisited. *European Journal of Internal Medicine*, **22**(1): 8-12.
12. Culver, A. L., Ockene, I. S., Balasubramanian, R., Olendzki, B. C., Sepavich, D. M., Wactawski-Wende, J., Manson, J.E., Qiao, Y., Liu, S., Merriam, P.A.& Ma, Y. (2012). Statin use and risk of diabetes mellitus in postmenopausal women in the Women's Health Initiative. *Archives of Internal Medicine*, **172**(2): 144-152.
13. Nordin, B. C., Need, A. G., Morris, H. A., O'Loughlin, P. D., & Horowitz, M. (2004). Effect of age on calcium absorption in postmenopausal women. *The American Journal of Clinical Nutrition*, **80**(4): 998-1002.
14. Han, W., & Li, C. (2010). Linking type 2 diabetes and Alzheimer's disease. *Proceedings of the National Academy of Sciences*, **107**(15): 6557-6558.

15. Menon, B., Harinarayan, C. V., Raj, M. N., Vemuri, S., Himabindu, G., & Afsana, T. K. (2010). Prevalence of low dietary calcium intake in patients with epilepsy: a study from South India. *Neurology India*, **58**(2): 209.
16. Habiba, U., Ahmad, S., & Hassan, L. (2002). Predisposition to osteoporosis in postmenopausal women. *Journal-College of Physicians and Surgeons of Pakistan*, **12:** 297-301.
17. Mawer, E. B., & Davies, M. (2001). Vitamin D nutrition and bone disease in adults. *Reviews in Endocrine and Metabolic Disorders*, **2**(2): 153-164.
18. Heaney, R. P., Recker, R. R., Stegman, M. R., & Moy, A. J. (1990). Calcium absorption in women: Relationships to calcium intake, estrogen status, and age. *Maturitas*, **12**(2): 146.
19. Dawson-Hughes, B., Harris, S. S., Krall, E. A., & Dallal, G. E. (1997). Effect of calcium and vitamin D supplementation on bone density in men and women 65 years of age or older. *New England Journal of Medicine*, **337**(10): 670-676.
20. Mawer, E. B., & Davies, M. (2001). Vitamin D nutrition and bone disease in adults. *Reviews in Endocrine and Metabolic Disorders*, **2**(2): 153-164.
21. Hawkesworth, S., Walker, C. G., Sawo, Y., Fulford, A. J., Jarjou, L. M., Goldberg, G. R., ... & Moore, S. E. (2011). Nutritional supplementation during pregnancy and offspring cardiovascular disease risk in The Gambia. *The American Journal of Clinical Nutrition*, **94**(suppl_6), 1853S-1860S.
22. Sumaili, E. K., Krzesinski, J. M., Cohen, E. P., & Nseka, N. M. (2010). Epidemiology of chronic kidney disease in the Democratic Republic of Congo: review of cross-sectional studies from Kinshasa, the capital.
23. Jain, A., Agarwal, R., Sankar, M. J., Deorari, A., & Paul, V. K. (2010). Hypocalcemia in the newborn. *The Indian Journal of Pediatrics*, **77(**10): 1123-1128.
24. Jackson, R. D., LaCroix, A. Z., Gass, M., Wallace, R. B., Robbins, J., Lewis, C. E., Bassford, T., Beresford, S.A., Black, H.R., Blanchette, P. & Barad, D. (2006). Calcium plus vitamin D supplementation and the risk of fractures. *New England Journal of Medicine*, **354**(7): 669-683.
25. Li, P., Fan, C., Lu, Y., & Qi, K. (2016). Effects of calcium supplementation on body weight: a meta-analysis. The American journal of clinical nutrition, 104(5), 1263-1273.
26. Chen, P., Hu, P., Xie, D., Qin, Y., Wang, F., & Wang, H. (2010). Meta-analysis of vitamin D, calcium and the prevention of breast cancer. *Breast Cancer Research and Treatment*, **121**(2): 469-477.
27. Farag, Y. M., & Gaballa, M. R. (2011). Diabesity: an overview of a rising epidemic. *Nephrology Dialysis Transplantation*, **26**(1): 28-35.
28. Nordin, B. C., Need, A. G., Morris, H. A., O'Loughlin, P. D., & Horowitz, M. (2004). Effect of age on calcium absorption in postmenopausal women. *The American Journal of Clinical Nutrition*, **80**(4): 998-1002.
29. Perlman, F., & McKee, M. (2008). Diabetes during the Russian transition. *Diabetes Research and Clinical Practice*, **80**(2): 305-313.
30. Hu, F. B., & Malik, V. S. (2010). Sugar-sweetened beverages and risk of obesity and type 2 diabetes: epidemiologic evidence. *Physiology & Behavior*, **100**(1): 47-54.