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Comparative Studies on Deficiency of Calcium in Blood Group "AB" of Female Hostelized Students with Other Blood Group Types

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Research Article

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ABSTRACT

Research studies on micronutrient supplementation based on blood group types is gaining popularity with accurate results. Pakistan Government is also spending millions of rupees with the help of world health donors on combating deficiency of calcium through supplementation of calcium in milk. Research studies should be focused on particular deficiencies specific to blood groups as they vary in different regions of the world. The objective of this study was to test the hypothesis that blood group "AB" individuals are most vulnerable to calcium deficiency. Pakistan has blood groups population as "B" 36%, "O" 33%, "A" 21%, and "AB" 9%. Calcium level was determined by using ultra sound bone densitometer (Sonometer®) in female hostelized students having different blood groups in university of Sargodha, Pakistan. The nutritional status of blood group "AB" was compared with other blood group individuals. Data was subjected to statistical analyses. Results confirmed the hypothesis that blood group "AB" subjects were having lesser calcium levels i.e. t-statistic of (A-AB) was -6.80 highly significant, (O-AB) and (B-AB) were -6.72 and -5.61 respectively, also highly significant. Subjects having blood group "AB" were found to be calcium deficient as compared to other blood groups. It was concluded that major deficiency of calcium is prevailing in population having blood group "AB" and should be taken care for calcium intake. In other blood groups individuals a problem of over load may have deleterious effects on health. Studies also emphasized that diet relevant to blood groups should be promoted.

INTRODUCTION

University of Sargodha has newly been established and for the maintenance of health and to achieve good nutrition, one must ingest the required amount of essential nutrients in the form of daily diet. There are over 40 essential nutrients supplied by food, which are used to produce literally thousands of substances necessary for life to maintain physical fitness [1]. These are more than 0.005% of body weight and almost 100 mg are required per day. Calcium is the most abundantly found mineral in human body and essential macro mineral required for good nutrition and bone health of young women [2].

Sir Humphry Davy isolated the calcium for the first time [3]. It has numerous vital functions in human body [4]. It plays a central role in blood clotting, wound healing, maintaining blood pressure, transmission of nerve, and discharge of neurotransmitters. It also plays a vital role in the synthesis of enzymes and hormones that control fat metabolism, digestion, and regulates energy. It helps in the maintenance of connective tissues and all cells of the body [5,6].

It is necessary for our body that even supply of calcium must be maintain throughout in the life of every individual, but it is particularly essential for the periods of growth, for normal health of women during pregnancy, and lactation [4,7]. This mineral is stored more than 99% in the bones and teeth and 1% in the blood, nerves, and muscles [5]. Approximately 27.5 g of calcium is present in infant body whereas, 1000 to 1200 g is present in the adult human body [4].

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Calcium absorption depends on amount of calcium in the body, status of vitamin D, age and pregnancy. Its absorption and utilization also depend on some other factors such as phosphorus, parathyroid, estrogen and calcitonin hormones [8]. Almost 15-20% of calcium absorption gradually reduces in maturity and even more reduction takes place in old age.

Recommendations for intake of calcium are higher for grown persons, but it reduces markedly in ages from year 51 and over [9]. Malnutrition is the state that consequences from taking an unbalanced diet in which certain nutrients are missing, surplus or in the incorrect magnitude [10]. Malnutrition is usually taken as under nutrition [2].

High intake of sodium, potassium, caffeine, protein and also high consumption of phosphate included in diet (carbonated soft beverages) and alcohol influence excretion of calcium from the body [11].

If intake of calcium is inadequate, less calcium absorption occur then high calcium losses occur and net calcium level reduces in the body that results the occurrence of the calcium deficiency in the individual. If an individual have the problem of calcium deficiency due to above mentioning factors, then calcium is withdrawn from their bones in order to maintain calcium levels in the blood [4].

Generally in developing countries, over one billion humans have inadequate levels of vitamin D and dietetic scarcity of calcium [12]. It is found that calcium is deficient in Pakistani diet [13].

Calcium deficiency is basically due to under nutrition or any other issue is involved. It can be determined by its various symptoms. These include too much tightening of muscles, causing tetany, hyperparathyroidism, hypomagnesaemia, malabsorption, deficiency of vitamin D, cardiac arrhythmias [2].There are also some diseases that relate to calcium deficiency, also known as major symptoms of calcium deficiency. These include abnormalities of body skeleton i.e. bones like osteomalacia [14], Osteopenia, rickets [15] and osteoporosis [16].

Different diseases are observed in different people in different nations worldwide. These diseases are even related to under nutrition and obesity. The incidences of certain diseases are related to blood groups [17,18].

The distribution of ABO blood systems vary in different populations of the world. Among Western Europeans the blood type "O" has largest part of the population that is 46% and group AB is the rarest group that is 3% [19]. In Asians, group "O" is most common blood type and exists in 43% and the rarest blood type is AB blood group that is 5%. Correspondingly, the most common blood group "O" is 35% and again the rarest blood group AB is 8% in Pakistan [19].

The nutrition of young women residing in university hostels depends largely on the availability, amount and quality of food that is provided in hostels. Surveys related to nutrition exposed that the major part of young women diets consists of cereals and also insufficient consumption of protective foods. The results due to little intake of protective foods are nutritional problems such as vitamin A, B-complex, ascorbic acid deficiency as well as anaemia disease [20]. The dietary inadequacy of energy has been reported in this section of population [21]. Food frequency questionnaire are used to estimate the calcium in young women. Food frequency questionnaire method has been broadly used for measuring intake of nutrients in the old aged people [22].

Bone marrow density (BMD) test determines the calcium level in body of individuals from calcareous bones of the foot and show calcium deficiency as osteopenia or osteoporosis [23]. A comprehensive study is conducted on co-relation between diet survey especially intake of calcium rich foods, blood groups, deficient minerals and clinical symptoms of deficient mineral (Calcium) for blood group AB. The current study provided a mean to evaluate calcium deficiency of young women having ABO blood groups residing in University hostels.

MATERIALS AND METHODS

The research work was carried out at the Institute of Food Science and Nutrition, University of Sargodha, Pakistan on 179 young women student subjects living at University hostels to study prevalence of deficiency of calcium in young women having different blood group types. Blood grouping was carried out at University medical diagnostic centre.

COLLECTION OF PERSONAL INFORMATION

All subjects were provided with a questionnaire to collect general information about subjects including; names, age, height, weight, any disease suffering, contact numbers, E-mail address, postal address, and marital status [24].

CLINICAL TEST

For the estimation of calcium in the bones, an Ultrasound bone densitometer (Sonometer®) was obtained from a pharmaceutical company in Lahore city. Before the analysis of calcareous bone of the foot, the place from where subjects had to insert her foot were cleaned by coupling gel and plenty of coupling gel was also applied to both sides of patient's heel as shown in **Figure 1**. All subjects were asked to keep their foot on Sonometer®, which analysed the calcareous bone of feet and provided direct results regarding calcium deficiency within few minutes. Right foot of all subjects was used for the analysis. Foot of subject was inserted on measuring device, and then the subject moved her foot to a set position with the help of medical

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instrument operator as shown in **Figure 2**. The position of body and sonometer® were kept in one line as shown in **Figure 3**. Then measurement started after insertion. Monitor of Sonometer® displayed the results in graphs in the form of T and Z scores. Whereas, T is the indication of low bone mass at increased risk for fracture and it is used to predict the risk of future fracture qualitatively and Z is used to predict the risk of future fracture quantitatively [25]. The results obtained were analysed according to the standard method of [26] which is given below:

- Less than minus 1— normal calcium level.
- Minus 1.1 to less than minus 2.5— indication of osteopenia, whereas, osteopenia is the initiation of calcium deficiency.
- Above minus2.5— confirmation of osteoporosis.
- Greater than 2.5— severe form of osteoporosis.

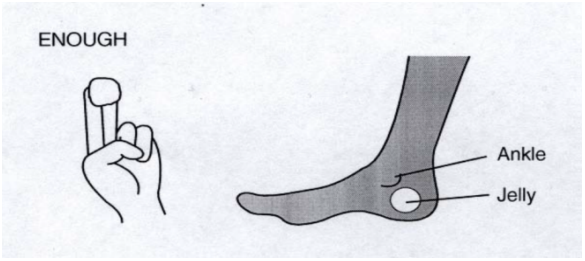

Figure 1. Accurate quantity of gel that should be applied.

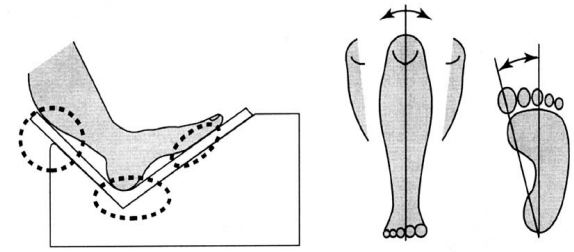

Figure 2. Standard position of heel adhering to measuring device.

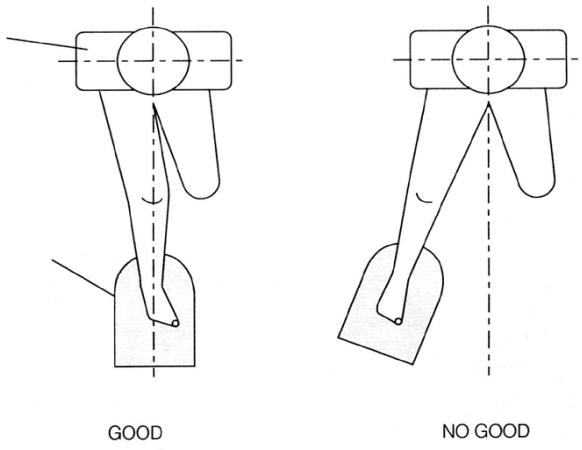

Figure 3. Position of measuring device and body should be in one line.

PRECAUTIONARY MEASURES TAKEN FOR ACCURATE READINGS ON DENSITOMETER

STATISTICAL ANALYSES

The data was collected and analysed according to the methods as described by Steel [27].

RESULTS AND DISCUSSIONS

Deficiency of calcium is one of the major deficiencies that are related to malnutrition [27] and is major cause of osteoporosis [28]. There are various symptoms of calcium deficiency and certain diseases related to it, such as rickets [29] osteopenia [26], and osteoporosis. Due to low intake of dietary calcium, there are high chances of osteoporosis, especially in postmenopausal women of Asia and America [30]. Ultrasound bone densitometer expressed calcium deficiency in two stages in young women living in hostels of university of Sargodha, Pakistan in relation to “AB” blood type in comparison with other blood group types. The data was

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expressed as t-statistic significant at (P<0.05-P<0.001), where *=0.05, **=0.01, and ***=0.001. The results are presented in **Table 1**, showing t-statistic of (A-AB) was -6.80 which is highly significant. Highly significant values clearly indicated that there was difference in the prevalence of calcium deficiency in both blood types A and AB.

Table 1. Comparison between calcium deficiencies in female students living in University hostels based on Blood groups.

Blood groups	A-AB	B-AB	O-AB
t-statistic	-6.80	-5.61	-6.72
Df	67	82	72
p-value	0.0000000***	0.0000003***	.000000004***

While the t-statistic for (B-AB) was -5.6,this was also highly significant. This value also indicated that there was difference in the prevalence of calcium deficiency in both blood types B and AB.

Similarly t-statistic of (O-AB) was -6.72, again which was also highly significant. Highly significant values clearly indicated that there was difference in the prevalence of calcium deficiency in both blood types "O" and AB. Calcium deficiencies in hostelized female students are graphically represented in **Figure 4**. This graph basically showed the normal level of calcium deficiency or bone mineral density in subjects that was 1 and the value of osteopenia from -1.1 to -2.5 and below -2.5 values showed the occurrence of osteoporosis.

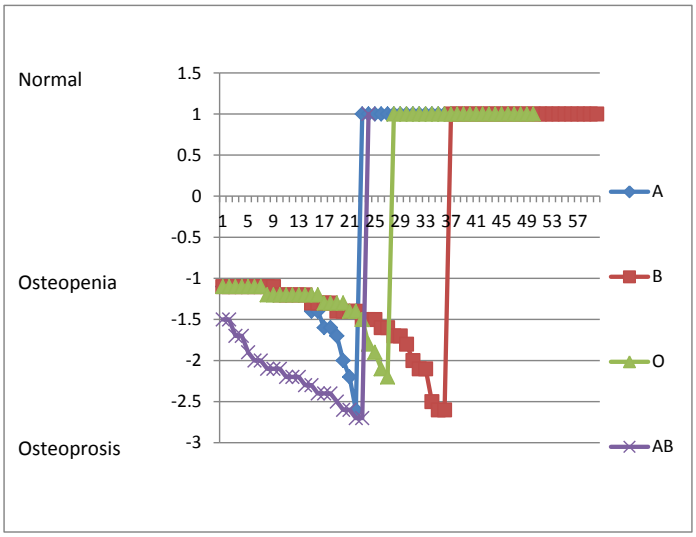

Figure 4. Graphical representation of deficiencies of calcium in female students living in University hostels based on Blood groups.

The subjects having blood group "AB" exhibited more deficiency as compared to other blood types such as occurrence of osteopenia started with the value of -1.5 and ended with the value of -2.5 but this behaviour was not found in "A", "B" and "O" blood types. The value of osteopenia above -1.5 expressed negligible level of calcium deficiency. This graph also showed the prevalence of osteoporosis in "AB" blood type. High deficiency of calcium was observed in females having blood type "AB" as compared to "A", "B" and "O" blood groups. Females having "B" blood type were less calcium deficient as compared to other blood types ("A" and "O").

Four types of tissues have been reported by many scientists and health workers which need to be specifically cared for as "A" Nervous tissues, "B" Epithelial tissues, "AB" Connective tissues and "O" Muscular tissues [31]. These tissues also need some specific nutrient requirements including some minerals to carry out functions of body smoothly. People with blood group "A" are deficient in Zinc and Magnesium, "B" in Iron, "AB" in calcium and blood group "O" individuals are deficient in Iodine. Some similar work has recently been published about Iodine for blood group "O", which confirmed one of the hypotheses about specific requirement of minerals [32]. The present research also confirms about specific requirement of Calcium by blood group "AB". Another hypothesis was also confirmed through MS level thesis research at Institute of Food Science and Nutrition, University of Sargodha about specific requirement of Zinc and Magnesium by blood group "A" [18]. Dr Bernard [33] has recommended health cocktails for common disorders, and special foods, drinks and herbs for twelve body systems to function properly including skeletal ("AB"), muscular ("O"), respiratory, endocrine, digestive, reproductive, integumentary, lymphatic, excretory, nervous (A) and urinary systems. He used to prescribe foods instead of medicines to cure his patients.

Research work carried out at Harvard School of Public Health shows that there is a strong correlation between blood group and heart diseases. Findings were based on two large US analytical studies in which 62,073 women from nurses and 27,428 subjects from health profession were studied between the age of 30 and 75 years and followed for 20 years. The work was published in an American Heart Association Journal. It was claimed that blood group "AB" individuals were more vulnerable to heat attack and people having blood group "O" were 20% more resistant to heart disease based on lifestyle, and diet [34].

Blood group "B" is dominant in the Himalayas, in the region of today's India and Pakistan. According to one of our nutrition

survey on preferences of diet indicated that blood group "B" individuals like buffalo milk and milk products as yoghurt, lassi (yoghurt water shake), buffalo cheese, whey products, milk shake with relevant fruits (Strawberry, apple, banana). It is further noted that "Lactic acid" present in milk products is also beneficial for blood group "B" to keep these individuals healthy and provide energy. Similarly, milk sugar "Lactose" is also good sugar for this particular blood group. According to some recent work, "An Ultimate Diet Pyramid Based on Blood Groups" has been introduced which reflects complete diet patterns of all four blood groups [35]. Target organ for Blood group "AB" is spleen, who can also use milk and milk products to absorb calcium from such rich sources. The diet charts formulated by [35] (Appendix-1) not only described various suitable diet for blood group "AB" but also has reviewed specific diseases of blood groups "AB" (Appendix-ii). It is obvious that these diseases have specific correlation with climatic conditions of various regions in which these blood groups are present in various proportions. These studies are not beyond the objectives of scientific research being carried out at various levels in the world but studies on blood group diet will result in better understanding to use foods for specific blood groups as suitable diet to remain healthy and prevent any disease including cancer, diabetes, obesity, osteoporosis, and cardiovascular diseases.

CONCLUSION

It is concluded from this comparative study that the prevalence of calcium deficiency is high in young women living in University hostels having blood group type "AB" in comparison to other blood group types as diet of female students living in hostels do not contain appropriate supply of foods rich in calcium especially it lacks consumption of fresh fruits, milk and dairy products.

SUGGESTIONS

It is recommended that further attempts should be made to find the cause that why calcium deficiency is higher in "AB" blood group type as compared to other blood groups.

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