



A PROJECT REPORT

on

Evaluation of mineral (Calcium, phosphorus, zinc and Magnesium) intake and its association with lipid profile among adults in Dhaka city by dietary approach.

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LETTER OF ACCEPTANCE

Date:

To

Professor Dr.Md. Bellal Hossain

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Daffodil International University

Subject: Submission of Thesis Report.

Dear Sir, I would like to take this opportunity to thank you for the guidance and support you have provided me during the course of this report. Without your help, this report would have been impossible to complete.

To prepare the report I collected what I believe to be most related information to make this report as analytical and reliable as possible. I have concentrated my best effort to achieve the objective of the report and hope that my effort will serve the purpose. The practical knowledge and experience I have gathered during preparation report will immeasurably help in my future professional life. I request you to excuse me for any mistake that may occur in the report despite of my best effort.

I would really appreciate it you make wise me with your thoughts and views regarding the report. Also, if you wish to enquire about an aspect of my report, I would gladly answer your queries.

Thank you again for your support and patience.

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DEDICATION

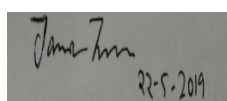
This research work is dedicated to my beloved father **Md. Abdul Wahab Bhuiyan** and mother **Monowara Begum** who gave me the support and courage to fulfill this work successfully.

LETTER OF RECOMMENDATION

This is to certify that the project report entitled “Evaluation of mineral (Calcium, phosphorus, zinc and Magnesium) intake and its association with lipid profile among adults in Dhaka city by dietary approach.” submitted for assessment to the examination committee by MarufaAkter bearing ID: 152-34-414 a student of Department of Nutrition and Food Engineering. I am pleased to declared that this report is entirely written by the author and the all the related research work have been conducted by the researcher under my strong supervision and observation .This is a piece of original work and has neither been submitted to nor been published anywhere before for any other purpose.

I strongly recommend the approval of the approval of the report by the report by the authority and by the same token, I also recommend a positive and fare evaluation of the work.

I wish every success in her life.



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Abstract

The main objective of this study is to evaluate the dietary approach of Ca, P, Zn and Mn and examine the association with blood pressure and blood lipids.

Minerals play an important role in human body. Deficiency and over dose of minerals can cause danger and creates several diseases. For this study we selected a sample size of 100 people aged 35 and above. The study examined the mean Ca intake is 31.71 ± 22.99 in men and 37.24 ± 42.10 in women. Which is very less than recommended intake. The insufficient intake of P, Zn and Mg according to RDA in both adult men and women also examined here. Inadequate intakes of minerals can cause respectively osteoporosis, joint or bone pain, kidney stones, diarrhoea, diabetes, cancer, liver disease, gastrointestinal disorder, heart attack, headache and several diseases. Ca and Mg have a negative correlation with blood pressure and high Ca intake reduce the blood cholesterol. To meet recommended dietary intake among elder adults in Dhaka city and alongside in Dhaka city, it is important to provide a simple approach and make awareness among them.

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CHAPTER-01

INTRODUCTION

1.1 Importance of Minerals for human health

In general human body have small requirement of minerals. Although minerals need in trace amount but its play an important role in regulating and maintaining various physiological functions in the human body. It is important for proper growth, develop and healthy living as well as maintaining proper heartbeat, building strong bone, strong teeth, and emitting nerve pulsation etc. [1].

Minerals are divided into two category macro minerals and trace minerals depending on the body's requirement. Minerals does not produce in human body but it can be intake from several food items. We can get these minerals from nuts, dried fruits, cheese, tofu, dark chocolate, beans and lentils, dark leafy vegetables, seeds, shellfish, whole grains, salmon, mushrooms, yogurt, avocado, beef etc. Absence of these minerals body cannot perform its regular function

[2]. Because of potential issues with an overabundance, should just be taken under a doctor's direction. The significant minerals include: Calcium, Phosphorus, Magnesium, Sodium, Potassium, and Chloride [27].

1.2 Importance of major minerals required by human body

Importance of Calcium

The most top mineral is calcium, it helps to maintaining bone and teeth hygiene. Calcium also play role to prevention of colon cancer and helps to retrenchment of obeseness. Calcium is necessary in our whole life, it helps to children's bone and teeth growth. In our adult life calcium helps to make healthy and strong bone and teeth [1].

Besides build and maintain strong bones and teeth health it helps to muscle control and blood circulation in the people's entire life. On the other hand Vitamin D is necessary for absorption of calcium. [3].

Top 10 Calcium rich foods - for Building strong bones.



Milk



Yogurt



Soya Beans



Orange



Lady's Finger



Cheese



Turnip Greens



Sesame Seeds



Almonds



Cinnamon

Recommended Dietary Allowance for Calcium:-

Males and females aged 9 to 18 years: 1300 mg per day

Males and females aged 19 to 50 years: 1000 mg per day

Males aged 51 to 70 years: 1000 mg per day

Females aged 51 to 70 years: 1200 mg per day

Males and females aged >70 years: 1200 mg per day

Pregnant female 14 to 18 years: 1300 mg per day

Pregnant female 19 to 50 years: 1000 mg per day

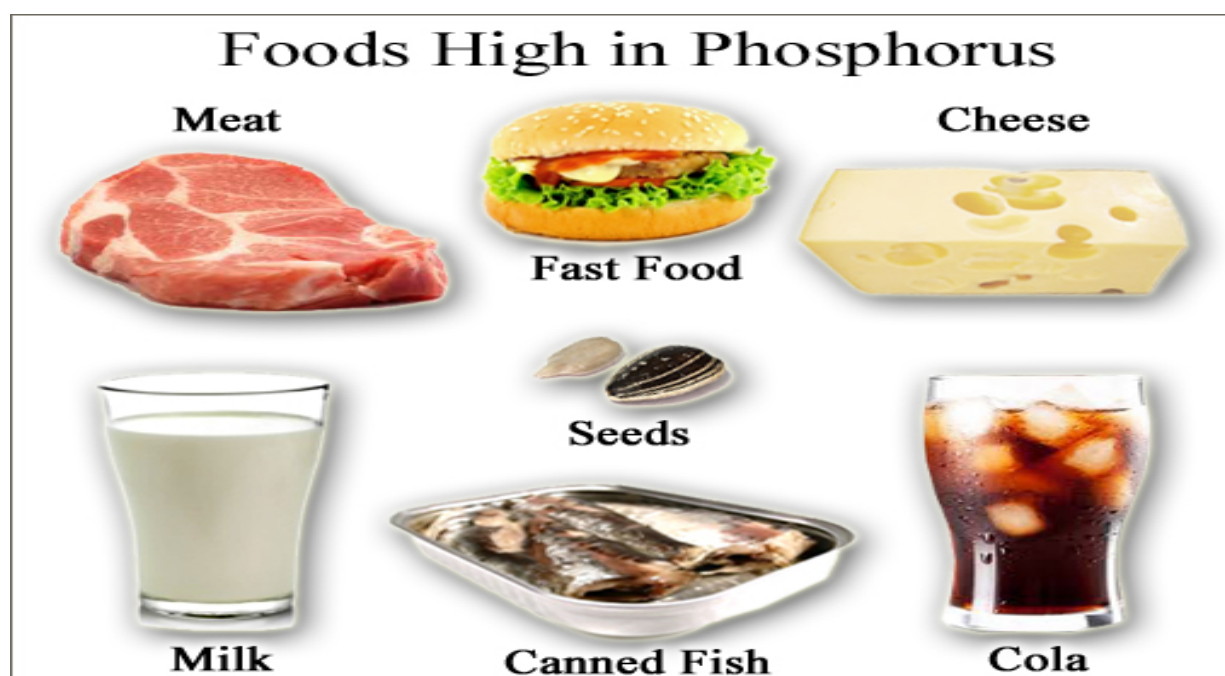
Since calcium is not produce in the body so, if people do not intake enough calcium from their daily diets for the perform bodies daily function, bones become weak and can cause osteoporosis [3].

In the human body calcium is the first most enormous element (10), in the adult's bodies almost 1000g is present. It plays a key role in skeletal mineralization, and a wide range of biologic functions. [4].

Importance of Phosphorus

After calcium Phosphorus is the second most abundant mineral in the human body. It makes almost 1% of total body weight in a human body. Although phosphorus is present in every cell in the human body but it mostly found in the bones and teeth [5].

Phosphorus is essential for the formation of bones and teeth in all vertebrates. It is the main structural component DNA and RNA –which is the genetic building blocks of the body. In the human bodies 20% of the skeleton and teeth are made by calcium phosphate. Phosphorus helps to filter out waste from kidneys. Phosphorus help bodies to store and uses energy from carbohydrates and fats. It's also helps the body to make the protein, ATP for the growth, maintenance, repair cells and tissue and store energy. Phosphorus works with vitamin B, vitamin D and other minerals like- magnesium, zinc and iodine. It also maintain the normal heartbeat, nerve transportation and muscle constriction [6].



Recommended Dietary Allowance for Phosphorus

Males aged 14 to 18 years: 1250 mg a day

Males aged 19 years and older: 700 mg a day

Females aged 14 to 18 years: 1250 mg a day

Females aged 19 years and older: 700 mg a day

Pregnancy 18 years and younger: 1250 mg a day

Pregnancy 19 years and older: 700 mg a day

Breast feeding 18 years and younger: 1250 mg a day

Breast feeding 19 years and older: 700 mg a day [7].

If people do not consume enough phosphorus according to their RDA they may suffer in following symptoms – loss of appetite, fatigue, joint or bone pain, irritability etc.

On the other hand over intake of phosphorus can be toxic for health. It can cause diarrhoea, hardening of organs and soft tissue [6].

Importance of Zinc

Zinc is a trace mineral. It is essential for healthy immune system, enhancing well growth during childhood, proper adjusting DNA and curing injury. Zinc is naturally found in several foods and it also available at dietary supplement. Causes of insufficient zinc in diets people can easily affected to disease and illness. Zinc do some valuable function in the human body. It excited almost 100 different enzymes activity [8].

Zinc is needed a trace amounts every day for maintain health and perform regular activity. Zinc helps to hormone production, improved normal digestion and appropriate growth and repair. Zinc acts as an antioxidant. It fighting against free radicals and helps to slow down cancer cells activity. Zinc also works as therapeutic element for cancer and heart disease [8].

12 Foods High In Zinc



Oysters



Chicken



Cheddar Cheese



Cashews



Watermelon Seed



Almonds



Milk



Red Meat



Yoghurt



Pumpkin Seed



Salmon



Cacao/Cocoa
Dark Choc

Recommended Dietary Allowance for Zinc

Males and females aged 9 to 13 years: 8 mg per day

Males aged 14 to 18 years: 11 mg per day

Males aged 19 years and older: 11 mg per day

Females aged 14 to 18 years: 9 mg per day

Females aged 19 years and older: 8 mg per day

Pregnancy 14 to 18 years: 12 mg per day

Pregnancy 19 years and older: 11 mg a day

Lactation 14 to 18 years and younger: 13 mg a day

Lactation 19 years and older: 12 mg a day [8]

Zinc helps to maintain some hormonal balance like-insulin. Zinc play important role to lowering inflammation and oxidative stress in the cardiovascular systems. Zinc supplement helps cure diarrheal diseases [9].

But insufficient intake of zinc can cause diabetes, cancer, scythe cell disease and liver disease. [8].

Importance of Magnesium

Magnesium is an essential macronutrient. It plays a role to the metabolism of food, synthesis of fatty acids and proteins, and the transmission of nerve impulses. It plays an important roles to bone formation and digest calcium into the bone. On the other hand Vitamin D is necessary for healthy bone. Magnesium helps to functioning Vitamin D in the kidneys. [10].

Adequate intake of magnesium can help prevent problems of bones, cardiovascular system, and diabetes and reduce the risk of osteoporosis in women after menopause. It helps to greater bone density. Without magnesium calcium do not work properly. If the calcium intake is high but the magnesium is absent, it can cause increasing the risk of arterial calcification and cardiovascular disease, as well as kidney stones. [10]

Magnesium helps to metabolism of carbohydrates and glucose. So higher intake of magnesium reduce the risk of diabetes. Magnesium helps to transmitting electrical signal in the body, maintaining the health of muscles and heart. Magnesium helps to prevent headaches and magnesium helps to free from bloating, insomnia, leg swelling, weight gain, and breast tenderness combined with Vitamin B6.[10].

MAGNESIUM RICH FOODS			
SESAME SEEDS			SUNFLOWER SEEDS
SPEARMINT			DILL
WATERMELON SEEDS			BASIL
PINE NUTS			BROCCOLI
ALMONDS			OKRA
PUMPKIN SEEDS			FLAX SEEDS
BRAZIL NUTS			SPINACH
CACAO			CHIVES

Recommended Dietary Allowance for Magnesium

Males aged 14 to 18 years: 410 mg per day Males aged 19 years and over: 400 to

420 mg Females aged 14 to 18 years: 360 mg a day

Females aged 19 years and over: 310 to 320 mg per day

During pregnancy: 350 to 400 mg per

During breast feeding: 310 to 360 mg per day [10]

Lack of magnesium can cause gastrointestinal disorder, heart attack, headache and several disease. [10].

1.3 Association of dietary minerals with lipid profile

A number of epidemiological studies and clinical trials have reported that the intake of calcium and sodium and their metabolism are closely related to the incidence and pathology of cardiovascular diseases, including hypertension, atherosclerosis and dyslipidemia. Although serum fat and lipid metabolism are known to be primarily affected by major nutrients (carbohydrates, lipids and proteins), which provide energy, lipid metabolism is also affected by many of ionic compounds (Ca^+ , K^+ , HPO_4^- , Na^+), which changes cellular function, signaling and absorption of macronutrients. A study on Korean population reported the average intake of calcium, sodium, phosphorus and potassium, and the consumption ratios of these minerals from typical Korean diets. Positive correlations between the calcium-to-phosphorus ratio and serum HDL-cholesterol, between sodium intake levels and serum total cholesterol levels, and between sodium-to-potassium ratio and LDL-cholesterol levels were found. The current pattern of low calcium and high sodium intake in the typical Korean diet acts as negative factors for blood lipids. These results propose strong modifications in food choices to achieve balanced mineral intakes by increasing the calcium-to-phosphorous ratio and decreasing the sodium-to-potassium ratio. Also, rather than a single particular mineral, low calcium-to-phosphorous ratios and high sodium-to-potassium ratios should be taken into account when assessing for nutrients that affect lipid metabolism.

The essential sources for every mineral were: vegetables (24.9%) and fishes (19.0%) for calcium, grains (31.4%) for phosphorus, seasonings (41.6%) and vegetables (27.0%) for sodium, and vegetables (30.6%) and grains (18.5%) for potassium. The relationship investigation, which has been balanced for age, sexual orientation, all out sustenance utilization, and vitality admission, demonstrated altogether positive connections between'sCa/P and serum HDL cholesterol levels.[23]. Lipoprotein variations from the norm have been distinguished among the few chance factors that could represent this expansion in CVD occurrence in diabetes [24]. Patients with type 2 diabetes have low dimensions of high-thickness lipoprotein cholesterol (HDL-c), and raised triglyceride (TG) levels [25].

1.4 Study objectives

Main objective:

To examine the intake of minerals (Magnesium, Phosphorus, Zinc and Calcium) in diet of a selected sample of adults in Dhaka city.

Specific objective

1. Calculate the amount of food intake in grams
2. Calculate the amount of selected nutrient from each kind of food consumed
3. Find association of mineral intake with serum lipid levels (total cholesterol, LDL and HDL levels)

CHAPTER 02

Materials and Methods

2.1 Participants and Demographic characteristics

This study utilizes secondary data obtained from previous surveys conducted at various hospitals in Dhaka city attending outpatient departments. A standardized questionnaire was used to collect information related to demographic characteristics such as age, gender, place of residence, marital status, and average household income. Physical activity was also recorded which was divided into 3 categories according to Centre of Disease Control (CDC) and was categorized as sedentary, moderately active and extremely active. Inclusion criteria of participants consisted of adults, apparently healthy coming for routine check-ups at the selected hospitals in Dhaka. Subjects who were pregnant, lactating and suffering from chronic illnesses (renal or hepatic failure), were not included in the study.

2.2 Anthropometric assessment and biochemical data

Anthropometric assessment such as height and weight were done using standard methods. Height was measured to the nearest centimetre using standard scale. Weight was measured to the nearest kilogram using a weighing scale. Blood pressure, systolic and diastolic, was measured using a sphygmomanometer. Information on biochemical parameters such fasting plasma glucose, fasting plasma insulin, total cholesterol, LDL and HDL was recorded from latest laboratory assessment reports. Height and weight measures were used to calculate BMI which was then classified according to WHO-Asian BMI classification:

1. <18.5 = indicating underweight or undernourished
2. $18.5-22.9$ = normal BMI, indicating well nourishment
3. $23-24.9$ = indicating overweight
4. $25-29.9$ = indicating grade 1 obesity
5. >30 = indicating grade 2 obesity

The formula of calculate BMI: - Weight in kg /height in m^2

2.3 Diet assessment

Food consumption pattern was assessed with the help of a quantitative food frequency questionnaire which included food groups such as cereals, vegetables, fruits, meat, fish, pulses, milk based dishes and beverages. The consumption frequency of each food group was estimated with responses such as daily, weekly, monthly and yearly along with number of times in each case. Intakes of food were converted to g/day and the portion size obtained was further used for nutrient calculation. 24 hour recall survey was also utilized to include any food item that was missed in the questionnaire. Nutrient calculation from raw and cooked foods was based on the nutritive values of Bangladeshi foods. All the food items consumed by each participant were coded as listed in the Food Composition Table for Bangladesh. The amount of minerals such as Ca, P, Zn, Mg was calculated with the following formula

Amount of nutrient = (portion of food consumed * amount of nutrient present per 100 g of food) / 100

2.4 Statistical analysis

Statistical analyses were completed the use of SPSS model thirteen (SPSS Inc., Chicago, IL, USA) software. Continuous variables are supplied as means \pm SD. to check differences in continuous variables among the two organizations the impartial samples t-test (for usually disbursed variables) or the Mann–Whitney U test (if non-parametric checks had been required) was performed.

CHAPTER-03

Results and Discussion

Results

3.1 Characteristics of the study patient

Following the demographic characteristics among the study areas patients we found that the number of male person are 43 among them 2 person are unmarried and 41 persons are married person and 56 person are female and they are married 56 out of 56 female. Most of the person are live in urban areas and most of the person are literate and almost 60% people are educate at tertiary level. In our study population are most of obese and most of the person's average household income are more than 15000 taka but few male and many women are income less than 15000 taka. Table 1 also represent that most of the people's Physical Activity level are sedentary .And some of are moderately active but vigorously active people are less, only 2 out of 56 female are vigorously active.

Table 1: Demographic Characteristics

	Male (n=43)	Female (n=56)
Marriage		
• Unmarried	2	0
• Married	41	56
Place of residence		
• Urban	30	36
• rural	13	20
Academic level		
• illiterate	4	4
• primary	6	18
• secondary	3	12
• tertiary	30	21
BMI Category (WHO Asian BMI classification)		
• underweight	0	1
• normal	6	14
• overweight	9	15
• obese I	22	17

• obese II	5	8
Average household income classification		
• <15000 taka	3	26
• >15000 taka	40	30
Physical Activity		
• sedentary	29	36
• moderate	13	18
• vigorous	0	2

Table 2 represent that in our study peoples most of the peoples have diabetes among them male are 22 and female are 37. Diabetes also absent among some the peoples 5 number of male and 8 number of female are not affected by diabetes. Mean duration of diabetes are respectively male 6.67 ± 6.5 and female 4.87 ± 2.83 . Cholesterol are also present in their blood. The total cholesterol are almost equal among both male and female respectively 204.3 and 202.9. Low Density Lipoprotein are present 129.6 among male that is more than female LDL 94.4 (table 2). On the other hand High density lipoprotein are present 68.3 among female that is more than male HDL 44.9.

Table 2: Biochemical Data

	Male	Female
Presence of diabetes		
• Present	22	37
• Absent	5	8
Mean duration of diabetes	6.67 ± 6.5	4.87 ± 2.83
Total cholesterol	204.3	202.9
LDL	129.6	94.4
HDL	44.9	68.3

Table 3 represents that according to our study peoples P value of Ca is 0.68, mean Ca intake of male is 31.71 ± 22.99 and females mean Ca intake is 37.24 ± 42.10 . Findings the P value of P is 0.057, mean P intake of male is $1.30E2 \pm 102.76$ and females mean P intake is $1.24E2 \pm 68.89$. P value of Zn is 0.025, mean Zn intake of male is 1.25 ± 1.01 and females mean

Zn intake is 1.19 ± 0.60 . And per day Males mean Mg intake is 59.19 ± 53.28 , females mean Mg intake is 58.90 ± 46.77 and both p value is 0.087.

Table 1 MEAN INTAKE OF MINERALS AMONG MALE AND FEMALE SUBJECTS

Nutrient	Male	Female	P value
Ca	31.71 ± 22.99	37.24 ± 42.10	0.68
P	$1.30E2 \pm 102.76$	$1.24E2 \pm 68.89$	0.057
Zn	1.25 ± 1.01	1.19 ± 0.60	0.025
Mg	59.19 ± 53.28	58.90 ± 46.77	0.087

Table 3 summarized the daily mineral intake among male and female subjects. The mean intake Zinc was found to be significantly different between the two groups. The mean intake of other minerals such as Ca, P and Mg were not significantly different.

Table 4 shows the correlation between mineral intake and serum lipid profile of our study subjects. After adjusting for gender, it was found that mean intake of Ca was positively associated with total cholesterol and LDL levels but negatively associated with HDL levels. Mean intake of P and Mg was also found to be significantly correlated with Total cholesterol levels.

Table 2: Correlation of mineral intake with lipid status of subjects

Variables	Total cholesterol (mg/dl)	LDL (mg/dl)	HDL (mg/dl)
Ca	0.353*	0.372*	-0.342*
P	0.292*	0.178	-0.167
Zn	0.223	0.196	-2.53
Mg	0.319*	0.14	-0.172

3.2 Discussion

This study presents an evaluation of mineral intake especially of a group of elderly adult's people who are live in Dhaka city and alongside in Dhaka city. In this study we considered the 100 subjects as a sample where number of female was 44 and number of male was 56 (aged 35 and above). And we mainly determine their daily mean intake of minerals (Ca, P, Zn and Mg). According to the dietary allowance for Bangladesh, male and female both are aged above 35 recommended intake of Ca is 1000mg [3]. Where for male 1000mg and female 1200mg per day recommended Ca intake. In this study the mean intake of Ca was found as 31.71 ± 22.99 mg in men and 37.24 ± 42.10 mg in women, which are below the recommended levels (Table 3).

In 1995 an American Journal of Clinical Nutrition represents that From (FDA) the Total Diet Study of 1982 to 1986, assessed that the average dietary consumption of calcium in ladies 60-65 y old was 507 mg and in men it was 670 mg [13]. Where the recommendation was 800 mg for both men and women.

In the U. S. numerous food are fortified with calcium and nutrient D for make individuals mindful about the significance of these supplements [3].

The Recommended dietary allowance for elderly adult in P is 700 mg [6]. The current study we found that the mean intake of P was $1.30E2 \pm 102.76$ mg in men and $1.24E2 \pm 68.89$ mg in women (Table 3). Which are not expected to recommendation value. This study represents that P makes almost 1% of total body weight in a human body [5]. Where In 1999 report represents that P makes almost 6.5– 11 g/kg body weight in elderly adults [12].

In the human bodies 20% of the skeleton and teeth are made by calcium phosphate [13]. In 1999 report show that in the adult bodies 85 % of the P is in bone, with the rest of the 15 % conveyed inside the flexible tissues [12].

The Recommended dietary allowance in Zn for elderly adult female are 8 mg and male are 11 mg per day [8]. The study information present that men intake 1.25 ± 1.01 mg and women intake 1.19 ± 0.60 mg Zn daily. Which are not similar to the recommendation value.

According to American Journal of Clinical Nutrition, from 1980 to 1989 the RDA was unchanged for elderly adult men and women respectively 15mg/d and 12 mg/d. It's different according to sex difference and body weight [17, 18].

Dietary allowance in Mg for men 400 to 420 mg and women 310 to 320 mg needs per day [10]. But according to our study report men intake 59.19 ± 53.28 mg and women intake 58.90 ± 46.77 mg per day (Table 3). This study is few different from 1995's study.

In 2003 report shows the original intake of magnesium according to western diet (Germany) has been determined around 200 mg for women and 260 mg for men [15].

According to 1995 reports in 1989 the RDA for magnesium for grown-ups of both genders is 4.5 mg/kg body wt., which converts into 350 mg/d for a reference 76-kg male and 280 mg/d for a 62-kg female (18). The 1989 RDA for ladies is marginally lower than the 1980 RDA of 300 mg/d (17). On account of some technical limitation.

Another journal report in 2003 represent the ongoing information about magnesium consumption in the U.S. population. They examined the 24-h dietary review information from 4257 members matured ≥ 20 y from the National Health and Nutrition Examination Survey 1999– 2000. The mean intake of magnesium was 352 mg/d among Caucasian men, mean 278 mg/d among African American men, (330 mg/d) among Mexican American men, mean 256 mg/d among Caucasian ladies, mean 202 mg/d among African American ladies, and mean 242 mg/d among Mexican American ladies [15].

For the reason of low dietary intake of minerals from the RDA of different minerals people can suffer of various disease most likely bone pain, diabetes, cancer, heart attack, and headache etc.

In this study we also examined the correlation between mineral intake and serum lipid profile of our study subjects. After adjusting for gender, it was found that mean intake of Ca was positively associated with total cholesterol and LDL levels but negatively associated with HDL levels. And the mean intake of P and Mg was also found to be significantly correlated with Total cholesterol levels. But the Zn is not so related or associated with lipid profile. (Table 4)

In the 2013 report represent that Ca and Mg have a negative correlation with blood pressure [19]. And particularly Ca is a divalent particle, has been accounted for to limit the absorption of dietary fat and bile acids, being joined with them, so high Ca intake reduce the blood cholesterol [20]. After continuous study found that Ca, Mg related with increase in blood pressure, abnormal lipid metabolism and glucose metabolism [19,21]. Hajjar and Kotchen examined that low intake of Zn, Mg, and Ca are probably going to be related with hypertension prevalence [22].

The another article of Bangladesh also examine that the changes in plasma proteins significantly affected plasma Zn while an enormous day by day portion of Zn had little impact on plasma tested 10 h later. The rate of weight addition of malnourished youngsters was disillusioning amid periods of such high-caloric admission however, this rate was expanded by 74% amid Zn supplementation. The 95% certainty confines emphatically recommend that Zn supplements expanded the rate of weight gain and fundamentally more of the Zn-enhanced youngsters had an ideal weight increase of $> 10 \text{ g} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$. During nourishing restoration, the mean unsupplemented dietary consumption of Zn was just 3.7 mg/d, which is $< 40\%$ the recommended daily allowance (RDA) [26].

So proper amount of mineral intake is important for healthy living, not less or more intake mineral only maintain RDA.

Conclusion

Adequate of dietary minerals is essential for maintenance of blood lipid levels. The selected subjects in our study reported inadequate intake of Ca, Mg, P and Zinc. Future studies should include a variety of subjects and need to look at a longer period of dietary intake. Nutrition education programs are required to increase the intake of these nutrients among adults for better future health.

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