Diabetology

EFFECT OF ZINC FOOD SUPPLEMENT (CICER ARIETINUM) ON BLOOD GLUCOSE, LIPID PROFILE AND SERUM ZINC AMONG TYPE II DIABETES MELLITUS AT PUDUCHERRY, INDIA.

P.Rajalakshmy*	M.Sc (Food Science and Nutrition), Lecturer in Nutrition, Kasturba Gandhi Nursing College *Corresponding Author
K.Renuka	PhD (Nursing), Principal, Kasturba Gandhi Nursing College
R.Jayanthi	M.Sc (Medical Biochemistry), Tutor, Mahatma Gandhi Medical College Campus,

ABSTRACT

Background: Diabetes is one of the emerging health and development challenges , zinc play a vital role in type 2 DM, in the synthesis, secretion and storage of insulin.

Materials and Method: 60 Participants were allocated randomly into two groups A & B control and experimental respectively, zinc food supplement was given to the group B for the period of 1 month. Blood samples were taken for both the group A & B to assess the FBS, Lipid Profile and Serum Zinc.

Results and Discussion: FBS, cholesterol, LDL were decreased significantly in the Group B after intervention FBS, Cholesterol, LDL, HDL, the level triglycerides and VLDL were also decreased but not significant, and the serum zinc was increased significantly. In Group A the level of FBS, cholesterol, LDL, VLDL, triglycerides was significantly increased FBS, Cholesterol, LDL, VLDL, triglycerides and level of HDL and serum zinc was decreased significantly.

KEYWORDS : Type 2 diabetes mellitus, Bengal gram whole, Serum Zinc, Zinc Supplement.

INTRODUCTION

Diabetes is one of the emerging health and development challenges in the 21st century, it accounts for 12% of worldwide health expenditure; one in 11 adults, or 412 million people has diabetes and it may increase to 642 million by 2040,[1] lower and middle income countries are mostly affected [2] 90% of these patients have type 2 diabetes (T2D), [1] which are associated with hyperglycemia, hyperinsulinemia, hypercholesterolemia and insulin resistance [3,4]. Type 2 diabetes has a combination of resistance to insulin action and an inadequate compensatory insulin secretory response [5]. It is a polygenetic disorder resulting from interaction of both hereditary and environmental factors [6] The Indian population has several unique features, including a young age onset of diabetes, a relatively lower BMI, with high rates of insulin resistance and lower thresholds for the risk factors for diabetes [7].

The DM is a disorder of metabolic abnormality so, minerals as a component of enzymes may be playing an important role in the development and control of diabetes mellitus. Zinc deficiency is associated with a multitude of clinical manifestations [8,9], and may play a role in chronic diseases such as cardiovascular disease (CVD) [10] and type 2 diabetes mellitus (DM) [11]Zinc will also stimulate insulin action and insulin receptor tyrosine kinase activity. The abnormal metabolism of zinc will increase the diabetic complications [12] usually, zinc intakes of the populations of several countries range from 4.7 to 18.6 mg [13]. The 2000–2001 United Kingdom National Diet and Nutrition Survey of adults, aged 19–64 yr, found zinc intakes of 10.775.7 mg (males) and 7.973.5 mg (females) [14].since, Zinc deficiency is more common in developing countries [15], mostly DM patients have deficient in zinc status due to the presentation of higher urinary zinc excretion which lower the serum zinc concentrations [16] reduced serum zinc in DM is associated with a decrease in insulin sensitivity [17] and impaired glucose utilisation [18]. Zinc is important mainly because it plays a major role in the stabilization of insulin hexamers and the pancreatic storage of the hormone [19] it also involved in the biosynthesis, storage and secretion of insulin within the pancreatic b-cells [20] and it may also improve glycemia, and a restored zinc status in patients with type-2 diabetes may counteract the deleterious effects oxidative stress [21]. Leading to several suggestions that oral zinc supplementation may be beneficial in these DM individuals [11].Abnormal zinc and lipid plasma levels occur more frequently in metabolically uncontrolled diabetic patients [22] so, the effect of zinc supplementation in the treatment of diabetes mellitus is controversial.

where diabetes is also an exponential increase in prevalence Human studies have also shown the beneficial effects of Zinc supplementation in both type-1 and type-2 diabetes[23,24] Zinc supplementation also resulted in a significant reduction of plasma total cholesterol, LDL-c

and TAG, while increasing HDL-c levels in patients with type-2 diabetes [25]. Previous research on dietary and supplemental zinc demonstrates a potential protective effect on type 2 diabetes. Analyses from two prospective cohorts show that, the higher the dietary zinc, the lower the risk of type 2 diabetes over subsequent years [26,27] However, only a few studies have examined the relationship between zinc and diabetes in developing countries [28].

In this study we sought to evaluate the effect of zinc rich plant source, Bengal gram whole (*cicer arietinum*) on blood glucose, lipid parameter and serum zinc among type 2 Diabetes Mellitus patients. A secondary objective of the study is to compare all parameters of group A and group B.

METHODS

Sixty patients of 30 males and 30 females with type 2 Diabetes Mellitus patients aged from 35 to 74 years (mean± standard deviation [SD]; 54.9±9.67 years), BMI between 17.2 to 42.4 (mean± S.D; 26.63±4.63 kg/m2) and HBA1c between 5.9 to 15.9 (mean± S.D; 8.87±2.47 mg/dl) were included in this study. All the participants were screened for their overall health status, diet pattern, smoking, alcohol usage, family history, economical status, type & dosage of oral hypoglycemic agent and recent medication or supplementation use.

Participants inclusion criteria were as follows: patients with type 2 DM, age between 30 to 80 years and consuming Metformin 500mg/day.

Patients exhibits disease onset in a state of CKD and other chronic diseases, patients under insulin treatment, allergic to Bengal gram dhal (whole) and participants who consumes alcohol, betal leaves and betal nuts were excluded in this study.

Informed written consent was obtained from all participants before inclusion in this study. The participants were randomly allocated into two groups were 30 participant in the Group A (control) the zinc supplementation is not provided and 30 participants in Group B were the zinc rich plant source was given for the period of 1 month . All participants underwent anthropometric measurement (BMI) and blood samples was collected in the initial period of the study for both Group A and Group B (pre test) to analyse the FBS, (total cholesterol) LDL, HDL & triglycerides, HBA1c and serum zinc. Then the 60gms of Bengal gram whole (*cicer arietinum*) which is low cost and locally available in India, this contain 17.1 gms of protein and 6.1mg of zinc in 100 gms. 60gms has 10.4 gms of protein and 3.6mg of zinc [29] were given in boiled form after 4 hrs of the meal to enhance the absorption, it has been given regularly for the period of 1 month to the Group B (experimental group). After the study period the blood samples was collected (post test) to analyse FBS, (total cholesterol) LDL, HDL & triglycerides, and serum zinc for both Group A and Group B.

2 ml of blood was collected for both pre test and post test in morning after 8hrs of fasting for both Group A and Group B and serum was separated using centrifugation at 3000 rpm, Fasting Blood Glucose (FBG) was estimated by glucose oxidase- peroxidise method, HbA1c was quantities by HPLC method, lipid profile- triacylglycerols in serum was measured by glycerol kinase method, total cholesterol by enzymatic method. HDL cholesterol by polyanion precipitation. LDL cholesterol by friedwald equation, LDL = total cholesterol – (HDL cholesterol + VLDL) where VLDL = TAG/5 and serum zinc was estimated by glycerol kinase method. All the methods used herein were approved by IFCC. Internal quality control was facilitated using board (USA) samples.

Ethical consideration: The study has been approved by the Institutional human Ethical Committee (IHEC) of Kasturba Gandhi Nursing College, Sri Balaji Vidyapeeth, Puducherry,India.

STATISTICAL METHODS
The Descriptive Data are presented as a mean ± SD. Statistical analysis was performed using Microsoft excel. Where normality was checked it shows normal destitution so we applied paired t – test for the further analysis.

RESULTS
All subjects were completed the study, the characteristics and baseline biochemical markers of pre test and post test for both the group were compared.

As being the evidence of previous study's the level of serum zinc among type 2 DM patients is lower than the normal value 60-120 µg/dl ranges between 17 to 106 (mean± S.D; 50.57±17.85) .

TABLE 1: Biochemical Parameters For Control Group pre test and post test.

Control	Pre Test		Post Test		t-test	p-value
	Mean	SD	Mean	SD		
FBS	208.967	82.992	236.567	81.721	5.1091	0.0000
CHOL	167.533	34.633	198.100	33.629	6.8202	0.0000
TG	181.067	93.334	209.000	86.270	4.5828	0.0001
HDL	49.993	11.196	45.867	9.982	7.0877	0.0000
LDL	81.467	35.311	125.267	68.647	2.7128	0.0111
VLDL	36.167	18.718	41.200	17.688	4.7401	0.0001
Zinc	49.967	11.958	44.100	12.335	8.3500	0.0000

Fasting blood sugar (FBS), Cholesterol (CHOL), Triglycerides (TG), High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), Very Low Density Lipoprotein (VLDL).

 As shown in table 1 Group A, Fasting Blood Sugar pre test varied between 124 % and 410 % (mean± S.D; 208.9±82.9) and the post test of Fasting Blood Sugar was significantly higher 142% and 428 % (mean± S.D; 236.56±81.7: p= 000),Total Cholesterol pre test 109 % - 250 % (mean± S.D; 167.53±34.6) post test of Total Cholesterol was significantly higher 124% and 274 % (mean± S.D; 198.10±33.6: p= 0.000), Triglycerides pre test 72 % - 472% (mean± S.D; 181.0±93.3) post test Triglycerides was significantly higher 94%- 405 % (mean± S.D; 209.0±86.27: p= 0.001),HDL pre test 36% - 88 % (mean± S.D; 49.99±11.19) post test of HDL was significantly lower 32% - 72 % (mean± S.D; 45.86±9.98: p= 0.000), LDL pre test 16 % - 157 % (mean± S.D; 81.46±35.31) post test of LDL was significantly higher 22%- 280 % (mean± S.D; 125.26±68.64: p= 0.011), VLDL pre test 14 %- 94 % (mean± S.D; 36.167±18.71) post test of VLDL was significantly higher 14% - 94 % (mean± S.D; 41.20±17.68: p= 0.001), serum zinc pre test 29 % - 75 % (mean± S.D; 49.965±11.95) post test of serum zinc was significantly lower 22% -71% (mean± S.D; 44.10±12.33: p= 0.000).

TABLE 2: Biochemical Parameters For Experimental Group pre test and post test

Exp	Pre Test		Post Test		t-test	p-value
	Mean	SD	Mean	SD		
FBS	201.833	66.185	168.433	84.392	2.8199	0.0086
CHOLES	185.200	35.508	155.667	34.469	7.1601	0.0000
TG	161.600	52.217	153.900	75.508	0.7508	0.4588
HDL	52.367	10.581	48.633	9.565	3.2935	0.0026
LDL	100.467	31.894	76.100	27.142	6.2374	0.0000
VLDL	32.300	10.416	31.967	16.283	0.1418	0.8882
Zinc	51.167	22.462	53.633	23.283	4.1358	0.0003

Fasting blood sugar (FBS), Cholesterol (CHOL), Triglycerides (TG), High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), Very Low Density Lipoprotein (VLDL)

As shown in table 2 ,Group B Fasting Blood Sugar pre test varied between 126% and 242 % (mean± S.D; 201.83±66.18) post test of fasting blood sugar was decreased but not significant 59% - 369 % (mean± S.D; 168.43±84.39: p= 0.008),total cholesterol pre test 106 % - 242 % (mean± S.D; 185.20±35.50) post test of total cholesterol was significantly lower 78% - 229 % (mean± S.D; 155.66±34.46: p= 0.000),triglycerides pre test 64 % - 296% (mean± S.D; 161.60±52.21) post test of triglycerides was decreased but not significant 72%- 472% (mean± S.D; 153.90±75.50: p>0.05),HDL pre test 32% -83% (mean± S.D; 52.36±10.58) post test of HDL was significantly lower 32% -83% (mean± S.D; 48.63±9.56: p= 0.002),LDL pre test 22 % - 155 % (mean± S.D; 100.46±31.89) post test of LDL was significantly lower 17%- 118 % (mean± S.D; 76.10±27.14: p= 0.000), VLDL pre test 13 %- 59% (mean± S.D; 32.30±10.41) post test of VLDL was not significant 12% - 72 % (mean± S.D; 31.96±16.28: p>0.005), serum zinc pre test 17% - 106%(mean± S.D; 51.16±22.46) post test of serum zinc was significantly higher 19% - 112% (mean± S.D; 53.63±23.28: p= 0.003).

The comparison was done between pre test and post test between Group A and Group B, which shows a drastic changes between this groups with and without zinc food supplementation, where the level of FBS, total cholesterol, LDL,HDL and VLDL was raised significantly and the level of serum zinc got decreased in case of Group A where the supplementation was not provided , the level of FBS, total cholesterol, HDL and LDL got decreased significantly in case of group B who were under the supplementation and the level triglycerides and VLDL got decreased but not significant, the level of serum zinc were slightly elevated significantly.

DISCUSSION
In this study, the patients who were undertaken the zinc rich food supplement for the period of 30 days (Group B) has decreased in the level of Fasting Blood Sugar and lipid profile and has elevated serum zinc compared with Group A (without any supplementation) were elevated in the level of FBS and lipid profile and reduced in the level of serum zinc.

The study by Mohammad Afhami et,al showed that Zinc sulphate supplement of 660mg for the six weeks period to the T2DM shows a beneficial effect on blood glucose and lipid parameters than the patient without any supplementation [30].

Prinyanka gunasekara et,al. were Proved the difference between the supplementation of MVM and zinc + MVM 22mg/ day for 4 months to the T2DM were the group with the supplementation of zinc+MVM shows a positive effect on blood glucose, lipid parameter and serum zinc than the group who consume only MVM supplement the study proved that zinc reduces complication of T2DM[31].

Mohd Idreesh Khan et al. in their study they have proved that the level of FBS, PPBS, lipid parameters , HBA1c, serum hs-CRP and microalbumin has reduced in the group who underwent with the supplementation of 50mg of zinc sulphate along with hypogycemic agent for the period of 12 weeks when compared with the group who have underwent only with oral hypogycemic agent has no changes.[32]

Many studies have proved that zinc supplementation has been investigated as a potential adjunct therapy in the management of diabetes mellitus [33]. Since the previous study's in recent decades has proved that the zinc intervention as a beneficial effect towards T2DM with oral supplementation (capsules) in our study the zinc was supplemented through a food source to reduce other side effects. Worldwide the pulses and cereals were used as a major source of zinc for most people [34] usually; pulses are good source of zinc along with protein [13]. Our study has proved that inclusion of zinc rich food supplement in the DM patient diet regularly will shows the beneficial effect on T2DM with hyperlipidimia and also helps them to overcome from the hypozincemia without any side effects. Thus, Bengal gram whole in boiled form about 60 gms may be potential therapeutic target for treatment of T2DM.

CONCLUSION
In summary, the zinc rich food supplement need to be included in the

DM patient's diet, our finding suggested that than the supplementation in the form of capsules or tablets food supplementation rich in essential minerals will enhance the good result and reduce the complication of T2DM.

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