International Research Journal of Natural Sciences
Vol.4, No.1, pp.1-8, February 2016
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# EFFECT OF ZINC SUPPLEMENTATION ON THYROIDS HORMONES IN SERA OF DIABETIC PATIENTS TYPE 2

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**ABSTRACT:** *This study was carried out to investigate the effect of Zinc supplementation on the serum levels of TT4 and TT3 . Zinc concentration was determined by atomic absorption spectroscopy in sera of diabetic patients' type (2) and healthy individuals. The results show a high significant deficiency of zinc concentration (P < 0.001) in diabetic patients when comparison with healthy group. In addition ,our study investigates the effect of zinc oral supplementation on thyroids hormones in diabetics (Type 2) by the use of two control groups ( A:Healthy control ) , and ( B : Diabetic control ) , and C-group treated with zinc supplements for 10 weeks period .The results shows that the elevation of TT4 and TT3 level in C group after the intake of zinc supplementation and this elevation was highly significant (P< 0.001) .*

**KEYWORDS:** Diabetes Mellitus , Zinc, Thyroxine , Triiodothyronine

## INTRODUCTION

Diabetes mellitus is a chronic disease characterized by either a relative or complete lack of insulin secretion by the β- cell of pancreas or by defect of cell insulin receptors , or resistance to the action of insulin , which result in disturbances of carbohydrate , protein , and lipid metabolism [1].

Direct association of trace elements in both type 1 and type 2 has been observed in many research studies. An alteration in the metabolism of these minerals has been demonstrated diabetes . These studies shown the low levels of zinc , magnesium , and chromium in serum in diabetic patient, especially in type 2 diabetes [2],[3].

Decreased serum zinc and hyperzincuria occur in some diabetic patients with Type 2 diabetes [4] . Zinc status in patients with Type 1 diabetes is significantly lower than healthy controls [5].

Besides iodine , thyroid function can be effected by a number of nutrients , including zinc and selenium [6] ,[7] . Zinc is crucial for proper thyroid hormone metabolism , zinc deficiency may result in decreased thyroid hormone levels and resting metabolic rate ( Rmr) , this case can be treated by supplementing with zinc . Zinc supplementation appeared to have a favorable effect on thyroid hormone levels particularly total T3 and Rmr [8] , [9] .

In animals studies shown that zinc deficiency was associated with decreased concentration of T3 and free thyroxin in serum by approximately 30 percent when compared with zinc adequate [10] . Zinc may play a centr role in thyroid hormone metabolism in patients with low T3 and may control conversion T4 to T3 in humans [11] . The aim of this study evaluate

the effect of zinc supplementation on thyroids hormones in diabetics patients and comparison with diabetics patients without intake of these supplements .

## Expermintal

### Materials

This study used the following chemicals, Hydrochloric acid and Nitric acid have been supplied by BDH and Fisher respectively , and perchloric acid , and zinc matel have been supplied by Fluka Company . the diagnostic kit used in the study ( T4 –ELAT , and T3-ELAT kit ) supplied by Bio –check company from French .

### Sampling

The studied sample including 50 diabetics patients of Type II (25 males , and 25 females ) and controlled with ( 30 ) healthy individuals (15 males , and15 females ). All samples were centrifuged in 402 Xg for 10 minutes . The serum samples were digested by adding 2 ml of Conc. HNO3 and 1 ml of Conc. $HClO_4$ to 0.5 ml serum in Pyrex tube . Heated for 1 hour at 160 ˚C using oil bath , then samples were cooled , and the volume were completed to 10 ml by ( 0.3N HCl ) [12] . The zinc concentration were determined in standard solution and digested samples by flame atomic absorption . The flame used consist of ( air–acetylene ) and used Phoenix - 986 Atomic Absorption spectrophotometer.

The another part of the study consist effect of zinc supplementation including three sampling groups A healthy people , B and C groups are patients suffering from type 2 diabetes .

- Group A : contain 20 healthy people (10 males , and 10 females)
- Group B : contain 20 diabetics patients ( 10 males , and 10 females )
- Group C : contain 25 diabetics patients ( 12 males , and 13 females ) ,this group taken zinc supplementation as zinc sulfate , ( 50 mg/ day ) for two months .

The samples collected from fasting volunteers of three groups at zero time and after 2,4,6,8,10 weeks of intakes of the supplements . Serum samples used to determination of thyroids hormones . The total thyroxine hormone (T4) and tiiodothyronin were determined by enzyme immunoassay methods ( ELISA ) [13] and [14] .

### Statistical Analysis

The results of the present study were analyzed by univarate analysis of variance. The data were expressed as mean±standard deviation (mean±SD) . Least significant different test (LSD) was used to test the. difference between means (groups) by using statistical program for social science SPSS, $p<0.05$ was considered significant.

## RESULTS

The results show that the zinc levels in diabetics patients is lower than the zinc levels in the healthy individuals ( control group ) , and the variance between diabetic and control group is ( < 0.001) it is high significantly . Thyroid hormones (TT4 and TT3 ) in diabetic patients in groups B and C at zero times appears lower levels comparison with healthy control represented by A group , and the variances between these groups is highly significant ( < 0.001) .The levels of (TT4) hormone are elevation highly significant ( < 0.001) after 2,4,6,8,10 weeks of intake zinc supplements , while TT3 hormone are elevation highly significant ( < 0.001) after 6,8,10 weeks of intake zinc supplements as shown in tables 1 , 2 and 3 .

**Table (1) : Contents of zinc in diabetics patients and control groups**

| | control | D.M | P- value |
|---|---|---|---|
| **Total No.** | **30** | **50** | |
| **Zinc (mean ± SD) ppm** | **0.877 ± 0.12** | **0.491 ± 0.21** | **< 0.001** |

**Table ( 2 ) : levels of thyroxine hormone (T4 ) in A , B , and C groups**

| Time / Group | $t_0$ | After 2 weeks | After 4 weeks | After 6 weeks | After 8 weeks | After 10 weeks |
|---|---|---|---|---|---|---|
| **A group** | **10.37** | **10.00** | **10.20** | **10.16** | **10.10** | **10.17** |
| **N= 20** | **± 0.47** | **± 0.43** | **± 0.38** | **± 0.43** | **± 0.44** | **± 0.39** |
| **B group** | **7.02** | **6.94** | **6.80** | **6.87** | **7.07** | **6.96** |
| **N = 20** | **± 0.27** | **± 0.25** | **± 0.28** | **± 0.25** | **± 0.28** | **± 0.27** |
| **C group** | **7.05** | **8.48** | **8.94** | **9.35** | **9.72** | **9.77** |
| **N = 25** | **± 1.00** | **± 0.86** | **± 1.02** | **± 0.96** | **± 1.02** | **± 0.85** |
| **p-value** | **>0.05** | **< 0.001** | **< 0.001** | **< 0.001** | **<0.001** | **< 0.001** |

N= Number , A=Healthy control ,B=Diabetic control ,C= Diabetic group intake Zn-suppl.

**Table (3) : Levels of triiodothyronine hormone ( T3 ) in blood of A , B , and C groups**

| Time / Group | t0 | After 2 weeks | After 4 weeks | After 6 weeks | After 8 weeks | After 10 weeks |
|---|---|---|---|---|---|---|
| **A group** | **1.60** | **1.64** | **1.66** | **1.57** | **1.62** | **1.61** |
| **N= 20** | **± 0.47** | **± 0.43** | **± 0.38** | **± 0.43** | **± 0.44** | **± 0.39** |
| **B group** | **0.81** | **0.79** | **0.81** | **0.83** | **0.80** | **0.84** |
| **N = 20** | **± 0.27** | **± 0.25** | **± 0.28** | **± 0.25** | **± 0.28** | **± 0.27** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **C group** | **0.83** | **0.92** | **0.96** | **0.99** | **1.12** | **1.17** |
| **N = 25** | **± 1.00** | **± 0.86** | **± 1.02** | **± 0.96** | **± 1.02** | **± 0.85** |
| **p-value** | **> 0.05** | **<0.05** | **< 0.01** | **< 0.001** | **< 0.001** | **< 0.001** |

N= Number , A=Healthy control ,B=Diabetic control ,C= Diabetic group intake Zn-suppl.

## DISCUSSION

The results in table (1) show that the zinc concentrations in diabetics patients are lower than the concentrations in healthy individuals (control group ) , and the variance between diabetics and control groups are ( < 0.001) it is high significantly .

Meltzer *et.al.*,1974 , consider the first study that discussed the urinary excretion of trace elements in diabetes mellitus, other studies how observed the excretion of zinc in urine in diabetics [16] , [17] .The exact cause of hyperzincuria is not known , disturbed metabolism of zinc metalloenzymes and abnormal binding of zinc to tissue proteins have been suggested as possible causes .

The mean plasma , leukocyte, and erythrocyte zinc levels are significantly lower in diabetics than in non-diabetics [17].The low plasma zinc levels in diabetics suggest that the hyperzincuria is of renal origin . Renal tubular defect in handling zinc and glucose –induced, osmotic diuresis are possibilities[18] .

Anderson et.al , 2001 studied on (110) Type 2 diabetic patients ,his results revealed that more than 30 % of the subjects may have been zinc deficient [19] .

Table (2) show the levels of total thyroxin hormone (T4) in A , B , and C groups **.**In diabetics patients the zinc deficiency is most common [16] , zinc element has important role in thyroid metabolism [17] ,[18] . Lower serum zinc element concentrations have been described in untreated hypothyroidism patients [19].

In animals studies , single and multiple deficiencies of iodine , selenium and zinc have distinct effect on thyroid hormone metabolism and structure [23] . In other studies were observed the deficiency in zinc element was associated with decreased free thyroxine hormone levels in serum by approximately 30 % when compared with zinc adequate[10].Zinc has a fundamental role in protein synthesis [21] and participates in the formation and mechanism of action of TRH [24] .

Zinc supplementation has been shown to modify thyroid hormone metabolism and re-establish of thyroid function in hypothyroidism patients who were zinc deficient [11].

Zinc supplements in our study has important role to increase of zinc concentration , and consequently effect on thyroid hormone metabolism. In both rats and humans , zinc deficiency has been reported to decreased iodothyronine levels (it is precursor of thyroid hormone) [25].

Several studies used zinc supplements and observed the effect on thyroid hormones, one of these studies appears effect of zinc supplement on thyroid hormone metabolism was

evaluated in adolescents with Down syndrome, who were randomized treatment with (30 mg/day) for 4 weeks. Serum concentration of T4 hormone before and after zinc supplementation were ( 1.26 ± 0.20) and (1.54 ± 0.63 pg/ml) respectively [9].

Another study observed the effect of zinc supplementation on thyroid hormones acts by Kaya ,*et . al* .2001, on animals model used 65 brown laying hens and divided into five zinc treatment groups ( 0, 25 , 50 , 100, and 200 mg of zinc / Kg of diet ) , it was observed that plasma T4 affected by zinc supplements [26] .

Table (3) show the levels of triiodothyronin hormone (T3) in A , B , and C groups **.**

The positive association found between free triiodothyronine (FT3) and zinc blood levels supports the hypothesis that a lower availability has a role in decreased serum FT3 levels [27].

Zinc as co-enzyme factor for many enzymes involved in metabolism . In addition , zinc may be essential for sensitizing the tissues of the body to thyroid hormone [28] . Zinc is also a co-factor for iodothyronine iodinase ( IDI) enzyme , the enzyme that convert T4 hormone to T3 [29] , as well as zinc may play a role in thyroid hormone metabolism in patients with low levels of T3 hormone and may control the conversion of T4 to T3 in human[11] . It has been reported that zinc in addition to its participation in protein synthesis , is involved in T3-binding to its receptor [30].

Zinc play important roles in formation and action of thyrotropin –releasing hormone (TRH)[21] , reported that the processing of prepro-TRH to form TRH it is zinc dependent via post translation processing enzymes such as carboxy peptidase AA [31] .

Zinc supplementation has also been shown to prevent a decreased in thyroid hormones levels after exercise [32] . El-sisy *et.al* .study the effect of zinc supplementation on male baladi goats , used 40 ppm zinc methionine for one week , they observed a significant increased of T3 concentration after take zinc supplementation [33] .

Christy and Stella study the effect of zinc supplementation on thyroid hormone function , a case study of tow college females . Two zinc deficient females college students (ZD1 and ZD2) were supplemented with (26.4 mg/day ) of zinc as zinc gluconate for 4-months .At 4-months, total T3 concentration increased in ZD1 ,while all thyroid hormone concentration increased in ZD2 .The study concluded , zinc supplementation appeared to have a favorable effect on thyroid hormone levels , particularly total T3 [8] .

## CONCLUSION

The zinc concentration in diabetic patients is lower than healthy individuals , this cases of reduction thyroids hormones in diabetics , while after intake of zinc supplementation thyroids hormone were elevation **.**

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