IOSR Journal Of Pharmacy And Biological Sciences (IOSR-JPBS)
e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 14, Issue 4 Ser. III (Jul – Aug 2019), PP 27-33
www.Iosrjournals.Org

Promoting therapeutic outcomes in the management of Diabetes with Lycopene and VitaminE

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Abstract: *An association exists between diabetes and liver injury. Liver pathology among diabetics is similar to that of alcoholic liver disease and cirrhosis. Elevated serum activity of aspartate (AST), and alanine aminotransferase (ALT) are frequently found in diabetics; both in human and experimental diabetes. This liver toxicity is partly caused by free radicals. The aim of this study is to evaluate the benefits of antioxidants Lycopene and Vitamin E in the management of diabetes. The experimental Albino rats used were divided into nine groups. The first and the second groups were controls; eight out of the nine groups were made diabetic with alloxan. The rats were treated accordingly with three concentrations of lycopene and vitamin E for four weeks. The increased level of glucose and liver markers were significantly reduced by the administration of Lycopene and Vitamin E especially with increasing doses.Lycopene and Vitamin E will be useful to promote therapeutic outcome in the management of diabetic patents.*

Keywords: *Diabetes mellitus,Hepatocarcinoma, Lycopene, Vitamin E*

Date of Submission: 03-08-2019 Date of Acceptance: 19-08-2019

I. Introduction

Diabetes mellitus(DM) an endocrine chronic disease characterized by hypoglycemia, hyperlipemia, negative nitrogen balance and sometimes ketonemia[1], clearly indicating in recent data as a risk factor of hepatocarcinoma [2,3].Its incidence is increasing with the improving living standard, the change of eating habits and rapid development of medical examination technology, with an estimationof 323 million adultsbeing affected and 5.1 million death recorded[4].In DM high level of glucose hyperglyceamia can lead to oxidative stressvia glucose auto-oxidation and can damage various organs[4].

The oxidative damage is kept in check by complex network of antioxidants defense and repair system, which could be could be synthesized in the body or obtained from diet with Vitamin E being one of the best[5].

Health and economic burden of diabetes has become critical to warrant urgent prevention and treatment. In all, with specific components of vegetable and functional foods having proven health values,dietary intervention may become valuable in the management of diabetic patients[4].

Lycopene an antioxidant in red fruit and vegetable such as watermelon, tomatoes and grapes[6] have shown to have a potent antioxidant properties[7].It has been suggested that antioxidants reduce oxidative stress and scavenge free radical in diabetes[4].It is therefore speculated that lycopene capability to lower blood glucose, improves insulin resistance and lipid metabolism are due to improvement of oxidative damage and scavenge free radical[4]. It is reported that Lycopene therapy significantly improves the blood glucose levels and body weight of diabetic rats[8].Moreover, scientific studies provided by extensive literature survey reveals the lycopene antioxidant and anti-diabetic activities.[9, 10] .

There are considerable epidemiological evidence favouring an inverse relationship between Vitamin E intake and cardiovascular disease as well as convincing observation in vitro and in vitamin E-supplemented animal modelswith a report that the evaluation of the vitamin E status of high-risk populations with oxidative stress has been limited to the determination of total plasma levels showing its ability to block the oxidative stress [11].Moreover, there is clinical evidence that high intake lycopene and vitamin E may be associated with a decrease risk of coronary heart disease[12].However the effects of Lycopene and Vitamin E supplementation in Diabetes therapy are rarely reported.

II. Materials and Methods.

2.1 Animals

The 72 albino rats used in this research were obtained from the department of Veterinary Science, University of Nigeria, Nsukka. The rats were 6-10 weeks old and weighed between 200-320g. The rats were

allowed to adapt to their environment for 2 weeks before full commencement of the experiment. They were fed with feeder's chow obtained from Bendel feeds and Flour mill Ltd .

2.2 Proximate composition of rat diet

The rats were fed with palletized Guinea Grower's mash from Bendel Feed and Flour mill Limited, Nigeria. The proximate composition of rat diet was:
Crude protein - 14.5%, Crude Fat - 4.8%, Crude Fibre - 7.2%, Crude Ash - 8%,
Calcium - 0.8%, Phosphorus- 0.62%, Lysine - 0.60%, Methionine - 0.31%, Cystine- 0.31%, Vitamin A, - 8,000 I.U,Vitamin D -2,400 I.U.,Vitamin E -15mg, Vitamin B -4mg, Vitamin C - 50mg, Manganese-30mg, Zinc - 30mg, Sodium - 0.15%.

2.3Drugsused

Lycopene, Vitamin Eand Alloxan

2.4 Animalstreatment and drug administration

The rats were divided into nine groups. Eight of the nine groups were made diabetic by injecting 50mg/kg body of alloxan (BDH.). Development of diabetes was allowed for 3 days at the end of which the hyperglycemic blood level were measured. Then the diabetic animals were treated with Lycopene and Vitamin E as follows.
Group 1: Normal Control; Non – diabetic and No Treatment with Lycopene and Vitamin E.
Group 2: - Diabetic control - Diabetic and No Treatment with Lycopene and Vitamin E
Group 3 - Diabetic and Treated with Lycopene(80mg/kg)
Group 4: - Diabetic and treated with Lycopene (90mg/kg)
Group 5 :- Diabetic and treated with Lycopene (100mg/kg)
Group 6: - Diabetic and treated withVitamin E(0.1mg/kg)
Group 7: - Diabetic and treated with Vitamin E (0.2gm/kg)
Group 8: - Diabetic and treated with Vitamin E (0.3mg/kg)

2.5 Collection of blood samples

The rats were sacrificed painlessly under chloroform anesthesia. Blood was collected at weekly intervals by cardiac puncture, centrifuged at 3000rpm for 10minutes and serum was collected for further analysis.

2.6 Determination of biological variables

The serum activities were determined by spectrophotometric methods forGlucose test using glucose oxidase-peroxidase method described by Monica [13], alanine aminotransferase (ALT) and aspartate aminotransferase(AST) using the method of Reitman and Frankel [14], Alkaline phosphatase (ALP) GSCC [15], direct and total bilirubin using the Jendrassik and Grof [16] and gama-glutamyltransferase using Szasz method [17]were monitored after 1, 2, 3 and 4^{th} week of treatment with the methods of respectively.

2.7 Statistical Analysis

The data obtained were expressed as mean + SEM. The significance of difference among the various treated groups and control group were analyzed by means of one-way analysis of variance ANOVA followed by Dunnett's multiple comparison test using Graphat instant Software(San Diego, CA.USA). The level of significance was set at $p < 0.05$.

III. Results

Table 1 shows that Alloxan diabetes significantly ($p < 0.05$) increased the glucose level. Lycopene and Vitamin E at (100mg/kg body weight) significantly decreased the glucose level.Alloxan diabetes also increased AST and ALT levels significantly.

Table 2 shows that the ALT level was increased to a diabetic level on the administration of Alloxan and was decreased by the administration of Lycopene and Vitamin E progressively ad doses increases.

Table 3 shows the effect of Lycopene and Vitamin E producing significant decrease in the increased Aspartate aminotransferase level that was increased by the Alloxan administration especially at increasing doses.

Table 4 shows the effect of Lycopene and Vitamin E on Alkaline phosphatase enzymes. The increase enzyme level was significantly ($p < 0.05$) reduced by administration of Lycopene and Vitamin E especially with increasing doses.

Table 5 shows the effect of Lycopene and Vitamin E on Gamma GT. The increase enzyme level was significantly ($p< 0.05$) reduced by administration of Lycopene and Vitamin E especially with increasing doses.

Table 6 shows the effect of Lycopene and Vitamin E on Total Bilirubin. The increase enzyme level was significantly ($p< 0.05$) reduced by administration of Lycopene and Vitamin E especially with increasing doses.

Table 7 shows the effect of Lycopene and Vitamin E on Direct Bilirubin. The increase enzyme level was significantly ($p< 0.05$) reduced by administration of Lycopene and Vitamin E especially with increasing doses.

Table 1. Effects of Lycopene and Vitamin E on Glucose Level (mg/dl) in Alloxan Diabetes After Four Weeks of Treatment in Albino Rats.

TREATMENT	Wk1	WK 2	Wk 3	Wk4
NOMAL	66.39	76.78	73.89	80.14
	$\pm$3.564^{ab}	$\pm$4.734^{ab}	$\pm$1.504^{ab}	$\pm$9.152^{ab}
ALLOX-INDUCED	175.00	180.10	169.00	173.67
	$\pm$6.027^{ab}	$\pm$5.351^{ab}	$\pm$1.000^{ab}	$\pm$1.855^{ab}
LYCO(80mg/kg)	117.78	117.28	117.07	116.94
	$\pm$.031^{ab}	$\pm$.049	$\pm$.028^{ab}	$\pm$.026^{ab}
LYCO(90mg/kg)	117.53	117.39	116.84	116.27
	$\pm$.063^{ab}	$\pm$.165^{ab}	$\pm$.031^{ab}	$\pm$.020^{ab}
LYCO(100mg/kg)	116.05	115.81	115.54	115.21
	$\pm$.026^{ab}	$\pm$.043^{ab}	$\pm$.061^{ab}	$\pm$.038^{ab}
VIT E(0.1mg/kg)	117.85	117.32	117.05	116.68
	$\pm$.023^{ab}	$\pm$.063^{ab}	$\pm$.026^{ab}	$\pm$.026^{ab}
VIT E(0.2mg/kg)	116.67	116.19	115.76	115.43
	$\pm$.031^{ab}	$\pm$.011^{ab}	$\pm$.023^{ab}	$\pm$.023^{ab}
VIT E(0.3mg/kg)	116.16	115.53	115.33	114.81
	$\pm$.008^{ab}	$\pm$.174^{ab}	$\pm$.020^{ab}	$\pm$.020^{ab}

Result Represents Mean $\pm$SEM of Triplicate Sample. Least Significant Difference (LSD) was used to compare the means. Values were considered significant at $p<0.05$ and superscripts in the same row with the same letters are not significant.

a = Significant Difference when each Concentration is considered with Normal Level first control

b= Significant Difference when each Concentration is considered with Normal Level first control

c = Significant increase when the concentrations are compared with each other.

Table 2 Effects of Lycopene and Vitamin E on Alanine Transferase(mg/gl) in Alloxan Diabetes After Four Weeks of Treatment in Albino Rats.

TREATMENT	Wk1	WK 2	Wk 3	Wk4
NOMAL	6.80	4.35	5.85	6.50
	$\pm$.115^{ab}	$\pm$.0754^{ab}	$\pm$.202	$\pm$.346
ALLOX-INDUCED	48.66	54.66	45.66	55.00
	$\pm$1.333^{ab}	$\pm$3.929^{ab}	$\pm$7.512	$\pm$.577
LYCO(80mg/kg)	16.51	14.84	13.47	13.88
	$\pm$.109^{abc}	$\pm$.005^{abc}	$\pm$.271^{ab}	$\pm$.026
LYCO(90mg/kg)	15.51	14.27	12.40	11.54
	$\pm$.139^{abc}	$\pm$.081^{abc}	$\pm$.108	$\pm$.075
LYCO(100mg/kg)	13.44	13.07	12.57	11.49
	$\pm$76.002^{ac}	$\pm$53.16^{ac}	$\pm$.333^{ab}	$\pm$.032
VIT E(0.1mg/kg)	12.26	11.65	10.36	10.05
	$\pm$.072	$\pm$.066^{ab}	$\pm$.072	$\pm$.006
VIT E(0.2mg/kg)	11.50	10.12	9.43	8.41
	$\pm$.141^{ab}	$\pm$.058^{ab}	$\pm$.030	$\pm$.153
VIT E(0.3mg/kg)	10.31	8.50	7.45	6.32
	$\pm$.124^{abc}	$\pm$.017^{a}	$\pm$.162	$\pm$.491

Result Represents Mean $\pm$SEM of Triplicate Sample. Least Significant Difference (LSD) was used to compare the means. Values were considered significant at $p<0.05$ and superscripts in the same column with the same letters are not significant.

a = Significant Difference when each Concentration is considered with Normal Level first control

b = Significant Difference when each Concentration is considered with Normal Level first control
c = Significant increase when the concentrations are compared with each other.

Table 3 Effects of Lycopene and Vitamin E on Aspartate Aminotransferase (mg/dl) in Alloxan Diabetes after FourWeeks Treatment in Albino Rats.

TREATMENT	Wk1	WK 2	Wk 3	Wk4
NOMAL	9.85	11.03	11.11	10.83
	±.577^{ab}	±.158^{ab}	±.655^{ab}	±.384^{ab}
ALLOX-INDUCED	57.33	58.00	59.67	54.00
	±1.333^{ab}	±6.92^{ab}	±6.88^{ab}	±.6.658^{ab}
LYCO(80mg/kg)	24.37	23.34	22.36	23.41
	±0.057^{ab}	±.98^{ab}	±.31^{ab}	±1.93^{ab}
LYCO(90mg/kg)	23.97	21.25	20.52	20.62
	±0.636^{ab}	±0.063^{ab}	±0.63^{abc}	±0.60^{abc}
LYCO(100mg/kg)	23.51	20.31	19.26	19.86
	±.158^{ac}	±0.167^{ab}	±.034^{ab}	±.066^{ab}
VIT E(0.1mg/kg)	18.34	17.40	16.54	15.35
	. ±.101^{ab}	±.017^{ab}	±.112^{ab}	±.115^{ab}
VIT E(0.2mg/kg)	16.47	16.08	15.49	14.02
	±.017^{ab}	±.020^{ab}	±.086^{ab}	±.580^{ab}
VIT E(0.3mg/kg)	15.72	13.67	12.93	12.41
	±.051^{ab}	±.101^{ab}	±.026^{ab}	±.112^{ab}

Result Represents Mean ±SEM of Triplicate Sample. Least Significant Difference (LSD) was used to compare the means. Values were considered significant at p<0.05 and superscripts in the same column with the same letters are not significant.
a = Significant Difference when each Concentration is considered with Normal Level first control
b = Significant Difference when each Concentration is considered with Normal Level first control
c = Significant increase when the concentrations are compared with each other.

Table 4 Effects of Lycopene and Vitamin E on Alkaline Phosphatase in Alloxan Diabetes After Four Weeks of Treatment in Albino Rats.

TREATMENT	Wk1	WK 2	Wk 3	Wk4
NOMAL	11.41	10.26	9.50	11.50
	±.015^{ab}	±.005^{ab}	±.228^{ab}	±130^{ab}
ALLOX-INDUCED	29.68	30.52	31.58	31.35
	±.038^{ab}	±.020^{ab}	±.024^{ab}	±.006^{ab}
LYCO(80mg/kg)	23.68	20.71	18.64	17.55
	±.735^{a}	±.072^{ac}	±.058^{ab}	±.184^{ab}
LYCO(90mg/kg)	20.56	19.35	18.55	17.41
	±.245^{a}	±.095^{ac}	±.130^{ab}	±.038^{ab}
LYCO(100mg/kg)	18.75	15.67	15.42	13.92
	±.101^{a}	±.334^{ac}	±.320^{ab}	±.032^{ab}
VIT E(0.1mg/kg)	15.59	14.41	13.50	12.70
	±.176^{ab}	±.011^{ab}	±.029^{ab}	±.090^{ab}
VIT E(0.2mg/kg)	13.43	13.61	12.79	12.13
	±.005^{ab}	±.057^{ab}	±.029^{ab}	±.049^{ab}
VIT E(0.3mg/kg)	12.83	12.73	11.73	11.18
	±.035^{ab}	±.077^{ab}	±.018^{ab}	±.023^{ab}

Result Represents Mean ±SEM of Triplicate Sample. Least Significant Difference (LSD) was used to compare the means. Values were considered significant at p<0.05 and superscripts in the same column with the same letters are not significant.
a = Significant Difference when each Concentration is considered with Normal Level first control
b = Significant Difference when each Concentration is considered with Normal Level first control
c = Significant increase when the concentrations are compared with each other.

Table 5. Effects of Lycopene and Vitamin E on Gamma GT (mg/dl) in Alloxan Diabetes After Four Weeks of Treatment in Albino Rats.

TREATMENT	Wk1	WK 2	Wk 3	Wk4
NOMAL	13.19	14.02	11.20	14.52
	$\pm.314^{ab}$	$\pm.113^{ab}$	$\pm.046^{ab}$	$\pm.058^{ab}$
ALLOX-INDUCED	21.28	23.38	24.37	25.47
	$\pm.102^{ab}$	$\pm.133^{ab}$	$\pm.029^{ab}$	$\pm.153^{ab}$
LYCO(80mg/kg)	19.40	18.56	18.39	17.58
	$\pm.056^{ab}$	$\pm.020$	$\pm.130^{ab}$	$\pm.199^{ab}$
LYCO(90mg/kg)	18.18	17.30	17.18	16.12
	$\pm.098^{ab}$	$\pm.156^{ab}$	$\pm.015^{ab}$	$\pm.469^{ab}$
LYCO(100mg/kg)	17.34	16.71	15.46	15.90
	$\pm.109^{ab}$	$\pm.055^{ab}$	$\pm.359^{ab}$	$\pm.346^{ab}$
VIT E(0.1mg/kg)	16.23	15.46	14.81	14.32
	$\pm.043^{ab}$	$\pm.214^{ab}$	$\pm.011^{ab}$	$\pm.176^{ab}$
VIT E(0.2mg/kg)	15.35	15.02	14.60	13.36
	$\pm.270^{ab}$	$\pm.008^{ab}$	$\pm.062^{ab}$	$\pm.055^{ab}$
VIT E(0.3mg/kg)	14.54	14.40	13.58	12.31
	$\pm.101^{ab}$	$\pm.137^{ab}$	$\pm.095^{ab}$	$\pm.012^{ab}$

Result Represents Mean ±SEM of Triplicate Sample. Least Significant Difference (LSD) was used to compare the means. Values were considered significant at $p<0.05$ and superscripts in the same row with the same letters are not significant.

a = Significant Difference when each Concentration is considered with Normal Level first control

b = Significant Difference when each Concentration is considered with Normal Level first control

c = Significant increase when the concentrations are compared with each other.

Table 6. Effects of Lycopene and Vitamin E on Total Bilirubin (mg/dl) in Alloxan Diabetes After Four Weeks of Treatment in Albino Rats.

TREATMENT	Wk1	WK 2	Wk 3	Wk4
NOMAL	0.05	0.39	0.05	0.08
	$\pm.012^{ab}$	$\pm.000^{ab}$	$\pm.008^{ab}$	$\pm.006^{ab}$
ALLOX-INDUCED	0.54	0.65	0.62	0.18
	$\pm.070^{ab}$	$\pm.000^{ab}$	$\pm.041^{ab}$	$\pm.005^{ab}$
LYCO(80mg/kg)	0.21	0.18	0.16	0.13
	$\pm.003^{ab}$	$\pm.003^{ab}$	$\pm.005^{ab}$	$\pm.008^{ab}$
LYCO(90mg/kg)	0.18	0.16	0.12	0.11
	$\pm.003^{ab}$	$\pm.008^{ab}$	$\pm.008^{ab}$	$\pm.008^{ab}$
LYCO(100mg/kg)	0.80	0.11	0.09	0.08
	$\pm.005^{ab}$	$+.005^{ab}$	$\pm.003^{ab}$	$+.003^{ab}$
VIT E(0.1mg/kg)	0.09	0.11	0.08	0.05
	$\pm.021^{ab}$	$\pm.007^{ab}$	$\pm.006^{ab}$	$\pm.006^{ab}$
VIT E(0.2mg/kg)	0.09	0.07	0.06	0.04
	$\pm.003^{ab}$	$\pm.005^{ab}$	$\pm.003^{ab}$	$\pm.003^{ab}$
VIT E(0.3mg/kg)	0.08	0.06	0.05	0.03
	$\pm.008^{ab}$	$\pm.005^{ab}$	$\pm.008^{ab}$	$\pm.008^{ab}$

Result Represents Mean ±SEM of Triplicate Sample. Least Significant Difference (LSD) was used to compare the means. Values were considered significant at $p<0.05$ and superscripts in the same row with the same letters are not significant.

a = Significant Difference when each Concentration is considered with Normal Level first control

b = Significant Difference when each Concentration is considered with Normal Level first control

c = Significant increase when the concentrations are compared with each other.

Table 7. Effects of Lycopene and Vitamin E on Direct Bilirubin (mg/dl) in Alloxan Diabetes After Four Weeks of Treatment in Albino Rats.

TREATMENT	Wk1	WK 2	Wk 3	Wk4
NOMAL	0.08	0.10	0.14	0.12
	$\pm.020^{ab}$	$\pm.017^{ab}$	$\pm.029^{ab}$	$\pm.003^{ab}$

ALLOX-INDUCED	0.48	0.52	0.54	0.68
	$\pm.005^{ab}$	$\pm.009^{ab}$	$\pm.104^{ab}$	$\pm.031^{ab}$
LYCO(80mg/kg)	0.13	0.42	0.35	0.31
	$\pm.018^{ab}$	$\pm.003^{ab}$	$\pm.010^{ab}$	$\pm.005^{ab}$
LYCO(90mg/kg)	0.15	0.39	0.35	0.32
	$\pm.025^{ab}$	$\pm.003^{ab}$	$\pm.003^{ab}$	$\pm.006^{ab}$
LYCO(100mg/kg)	0.16	0.28	0.25	0.21
	$\pm.008^{ab}$	$\pm.007^{ab}$	$\pm.006^{ab}$	$\pm.003^{ab}$
VIT E(0.1mg/kg)	0.16	0.21	0.16	0.14
	$\pm.015^{ab}$	$\pm.008^{ab}$	$\pm.012^{ab}$	$\pm.008^{ab}$
VIT E(0.2mg/kg)	0.16	0.12	0.09	0.07
	$\pm.017^{ab}$	$\pm.008^{ab}$	$\pm.003^{ab}$	$\pm.003^{ab}$
VIT E(0.3mg/kg)	0.08	0.07	0.05	0.04
	$\pm.006^{ab}$	$\pm0.003^{ab}$	$\pm.005^{ab}$	$\pm.012^{ab}$

Result Represents Mean ±SEM of Triplicate Sample. Least Significant Difference (LSD) was used to compare the means. Values were considered significant at p<0.05 and superscripts in the same row with the same letters are not significant.

a = Significant Difference when each Concentration is considered with Normal Level first control

b = Significant Difference when each Concentration is considered with Normal Level first control

c = Significant increase when the concentrations are compared with each other.

IV. Discussion

The significant increase in the glucose levels of the experimental animals is an indication of diabetic conditions of the experimental animals (Table 1-7) after the treatment with Alloxan, a carcinogen and cytotoxic glucose analog used as a common diabetogenic agents to assess the antidiabetic potential of compounds[18]. Alloxan-induced diabetes is a form of insulin-dependent diabetes mellitus induced liver disease significantly (p<,0.05) after four days and raised ALP level as a result ofpartial degradation of the beta (β) cells of the pancreatic islets and subsequent compromise in the quality and quantity of insulin produced by the cells.[19].The administration of Alloxan to the experimental animals shows increases in the levels of liver markers indicating liver damage, a complication in diabetic patients (Table 1-7) which is consistent with the report of literature [18].

There was significant decrease with the administration of doses of Lycopene and Vitamin E on Liver Function Enzymes in Alloxan induced Diabetic Rats ofALP level in the first week,with a further decrease in the fourth week. Vitamin E significantly decreased the ALP level which is highly significant (p<.05).This is consistent with the report of Videla [20],indicating a rapid mobilization of liver-ALP in blood, resulting increase serum levels at early stages of liver damage.

Lycopene and Vitamin E on administration decreases the elevated Alanine Transferase Level. This is attributed to the to the ability of the antioxidant supplement to balance off free radicals generated hence preventing peroxidation of the lipid components of the cell membrane. Disruption of membrane integrity is a common causative factor attributed to increase release or leakage of cellular contents [21].This finding is was consistent with the reports of Li et al. [22].

Also Lycopene and Vitamin E exhibited inhibition of liver damage as inferred by the action on Aspartate Transferase Level (U/L) in Alloxan–induced Liver Diseaseafter four Weeks of Treatment in Albino Rats.There was significant decrease(p<.05) in the AST level This is attributed to the to the ability of the antioxidant supplement to balance off free radicals generated hence preventing peroxidation of the lipid components of the cell membrane. Disruption of membrane integrity is a common causative factor attributed to increase release or leakage of cellular contents [21].This finding is was consistent with the reports of Li et al. [22].

The effects of Lycopene and Vitamin E on Gama- GT Level in Alloxan–Induced Liver disease after four Weeks of Treatment in Albino Rats (Table 5) shows significant decrease (p<.05). This study is consistent with the report on the gamma-glutamyltransferase elevation [23] and the antioxidant effect on hepatotoxicity[24].

Bilirubin areproducts of the breakdown of the heme component of the heamoglobinwhose elevation is a function of the rate of red cell destruction and the capacity of the liver to excrete the newly formed biluribin [1]. In this study, the raised level of total and direct bilirubin by the administration of Alloxan indicative ofliver damage was disease significantly (p< 0.05) especially after four days of administration of Lycopene and Vitamin E. The is attributed to theability of Lycopene and Vitamin E to reduce the breakdown of the heme components of the heamoglobin over the duration of the study, which is consistent the report of Tripathi [1]

V. Conclusion

In conclusion, the use of lycopene at 100mg/kg body weight and vitamin E has shown to decrease significantly ($p < .05$) both the high glucose level and liver function parameters associated with diabetic liver disease. Lycopene and Vitamin E will promote therapeutic outcomes in the management of diabetic patients.

Acknowledgements

This work was done in the Biochemistry Department of the Madonna University, Elele, We are grateful to Prof C.C.Monago-Ighorodje for her supervision of this work. The authors are thankful to all members of Staff associated with this work.

Conflict of interest

No conflict of interest associated with this work.

Contribution of authors

The authors declare that work was done by the authors named in this article and all liabilities pertaining to the claims relating to the content of this article will be borne by the authors.

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Joseph C Ndefo" Promoting therapeutic outcomes in the management of Diabetes with Lycopene and VitaminE"IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS) 14.4 (2019): 27-33.