Effect of Ginger and its Extract on Blood Sugar and on Kidney Function of Type I Diabetic Rats

Abdulsalam, K.A.
El gabry, E.K.
Alkalifa, A.S

Department of Food Science and Nutrition
College of Food and Agriculture Sciences
King Saud University
Saudi Arabia

Correspondence:
Abdulsalam, K.A.
Department of Food Science and Nutrition
College of Food and Agriculture Sciences
King Saud University
Saudi Arabia
Email: kalabulsalam@gmail.com

Abstract

Diabetes is one of the high-risk diseases; one of its complications is nephropathy. This can be reduced by eating some foods. The goal of this study was to study the effect of different concentrations of ginger and its extracts on kidney functions and glucose in rats (2010-2011) at King Saud University in Riyadh. Six weeks Wister Albino rats were divided into six groups each of ten rats: control group (C) , diabetic group (DC), while other groups were fed by addition of ginger Freeze-dried or extract concentration (0.5% - 2%) respectively (DGL, DGH, DGEL, DGEH). Diabetes was induced by an intraperitoneal injection of streptozotocin (50 mg/kg of body weight). The results showed that DGH, DGEL and DGEH groups had less weight than the two control (C, DC) groups. The DGEL and DGEH group showed statistically lowered food intake compared with the C and DC group. Ginger and its extracts caused an increase in glucose level. With regard to nitrogen blood urea (NBU) and urea, the DGL, DGEL and DGEH groups had no significant differences when compared with the C and DC groups. With regard to creatinine and uric acid there were no significant differences among all groups. This study recommends intake of the low dose of ginger (0.5%) and the high dose of the ginger extract (2%) for improvement of the kidney tissue of diabetic patients.

Key words: diabetes, rats, ginger, ginger extract, glucose, kidney function, kidney tissue.

Introduction

Diabetes causes many complications with the highest kidney failure caused by sorbitol accumulation in the kidney. The sorbitol is produced by enzyme aldose reductase and the sorbitol is converted to fructose by sorbitol dehydrogenase.

This enzyme is absent in the kidney tissue when the glucose level becomes high and aldose reductase sufficient so that the sorbitol becomes high and accumulates in kidney and causes kidney failure (5).

The high blood glucose in the blood leads to elevation of sorbitol which is one of the causes of kidney failure in the diabetic patient. We have to study some kinds of food like ginger which might affect kidney function and tissues. The research goals are: Study the effect of fresh ginger and its extract (zingeron) on the body weight and food intake. Study the effect of fresh ginger and its extract (zingeron) on the blood sugar in the diabetic rats type one;. Study the effect of fresh ginger and its extract (zingeron) on the function of kidney and tissue in type one diabetic rats.

Ingredients of diet (g/1000g for diet)

Ingredient	g/kg DGEH	g/kg DGEL	g/kg DGH	g/kg DGL	g/kg DC	g/kg C
Casein, High Nitrogen	200	200	200	200	200	200
L-Cystine	3	3	3	3	3	3
Sucrose	100	100	100	100	100	100
Cornstarch	377.486	392.486	377.486	392.486	397.486	397.486
Dyetrose	132	132	132	132	132	132
Soybean Oil	70	70	70	70	70	70
t-Butylhydroquinone	0.014	0.014	0.014	0.014	0.014	0.014
Cellulose	50	50	50	50	50	50
Mineral Mix #210025	35	35	35	35	35	35
Vitamin Mix # 310025	10	10	10	10	10	10
Choline Bitartrate	2.5	2.5	2.5	2.5	2.5	2.5
Ginger	-	-	20	5	-	-
Ginger extracted	20	5	-	-	-	-
	1000	1000	1000	1000	1000	1000

Materials and Research Methods

We used 60 adult rats type Wister albino, average weight 185 ± 30 g ,divided into two groups. One control group had ten rats the (C) the other one had fifty rats injected with streptozotocin to make them diabetic rat type one (magnitude 50mg/kg by body weight). All experimental procedures and protocols in this study including euthanasia were conducted in accordance with the National Institute of health guide for the care and use of laboratory animals, Institute for laboratory animal research (NIH publications No80-23; 1996) as well as the ethical guidelines of the experimental animal care center, college of Medicine, King Saud university, Riyadh, Saudi Arabia. The diabetic group was divided into five groups, each one had ten rats. The second diabetic group (DC) , the third one diabetic and ate 0.5% ginger in diet (DGL), the fourth one diabetic and ate 2% ginger in diet (DGH), the fifth one diabetic and ate 0.5% ginger extract (zingeron) in diet (DGEL), the sixth one diabetic and ate 2% ginger extract(zingeron) in diet (DGEH). At the end of the six weeks of experiment the rats were fasted and anesthetized to pull the blood and the kidney was saved in formalin to study the tissues. The glucose was measured by fluorometric enzymatic analysis (15) and the kidney function urea by (7) , creatinine (7), uric acid (4). We used spectrophotometer model Ultrospec 2100 pro from (Amersham Biosciences, San Francisco, CA, USA). For the kidney tissues we used Automated tissue processer by company Lecia model LEICA TP 1020 from Germany (6). We used statistical analysis average and standard deviation (means± SD). We analyzed the transactions to see the differences between the average measurements of the transactions and conducted analysis of variance (One Way ANOVA)and Duncan test using statistical analysis software(12).

Results and Discussion

The result shown in Figure 1, the diabetic control group (DC) showed no significant effect on weight but in (DGH, DGEL, DGEH) showed decrease in comparison with the (C, DC) groups (P≤0.05). Our study was inconsistent with the study (8) that showed lower weight in diabetic control rats and our study agreed with (13) which showed it caused lower weight in a group of rats that ate ginger compared with the diabetic group. Food intake in (figure 2) we see in a groups (DGEL, DGEH) low in statistical analyses compared to the (C, DC) groups and our study was inconsistent with this study (11) where there was no significant difference in the food intake in all groups. For this study, the reason for the low food intake may return to the diet because it contains fibre and gives feeling of fullness. The glucose in (figure3)of the ginger and its extracts led to a rise in glucose results of this study is inconsistent to another study (14), that found very small amounts of ginger juice lowered blood sugar significantly in control and diabetic rats. Our results agree with this study (9), which explained that ginger leads to inhibition of the enzyme aldose reductase and reduces the level of sorbitol and raises the level of blood glucose. Ginger and extract did not affect all blood nitrogen urea, urea and Uric acid (figure 4, 5 and 7), but led to a rise in creatinine (figure 6). Inconsistent with our results was a study (1) that found giving ginger oil returned the kidney function to normal urea, uric acid and creatinine. In another study, the cause of creatinine rise was an increase in demolitions in both the liver and protein in blood giving glucose from non-carbohydrate sources(2).

Kidney section under the microscope showed tube and Glomeruli (Photo 8.B). Glomerulus contains intermediate cells (Photo 8.A). Group DGL and DGEH compared to control group in glomeruli tissue (Photo 10.A) and (Photo A.13) is healthy and there is no fibrosis or inflammatory activity in the renal tubules. Both groups showed some tubule atrophy and swelling in (Photo B.10) and (Photo B.13). There was found an increase in the size and number of intermediate cells in (CD, DGH, DGEL) in (Photo A.9) , (Photo A.11) and (Photo B.12) and atrophy of the tubules and cellular fibrosis (Photo B.9) , (Photo B.11) and (Photo A.12). Our result is contrary to the results of this study (3) that found a significant change among diabetic people in kidney tissues treated with ginger. Our result agrees with the study (10), where there has been a very simple change in all groups.

Compare the Groups

Group	Food intake (g)	Ureic acid (mg/dl)	Urea (mg/dl)	Blood urea nitrogen (mg/dl)	Creatinine (mg/dl)	Glucose (mg/dl)	Body weight (g)
C	a 0.14±0.01	a 3.14±0.71	b 27.92±2.55	b 13.04±1.19	a 2.51±0.72	c 117.9±2.3	a 338.6±9.3
DC	b 0.05±0.02	a 4.05±0.96	b 31.53±3.89	b 14.72±1.82	a 1.40±0.59	b 370.8±68.9	b 227.0±24.9
DGL (0.5%)	bc 0.036±0.02	a 3.85±0.57	ab 36.3±4.48	ab 16.94±2.09	a 0.86±0.62	a 506.6±39.4	bc 186.6±24.5
DGH (2%)	bcd 0.016±0.01	a 2.30±0.56	a 51.02±8.85	a 23.86±4.12	a 2.34±0.73	a 573.5±16.6	c 140.1±11.5
DGEL (0.5%)	d -0.016±0.01	a 2.86±1.14	b 24.73±1.73	b 11.54±0.81	a 1.03±0.24	a 535.8±26.7	c 169.7±13.3
DGEH (2%)	cd -0.006±0.01	a 4.40±2.33	ab 36.89±6.66	ab 17.22±3.11	a 1.63±0.39	a 560.6±12.0	c 145.2±13.2

Different groups of rats during the experimental period. Data are mean ± SD values animals. Different letters are for those significantly different from the other groups of animals (P <.05). C, control; DC, diabetic control; DGL, diabetic of low ginger dose; DGH, diabetic of high dose; DGEL, diabetic of low ginger extract dose; DGEH, diabetic of high ginger extract dose

Figure 1: Comparison of groups in terms of weight

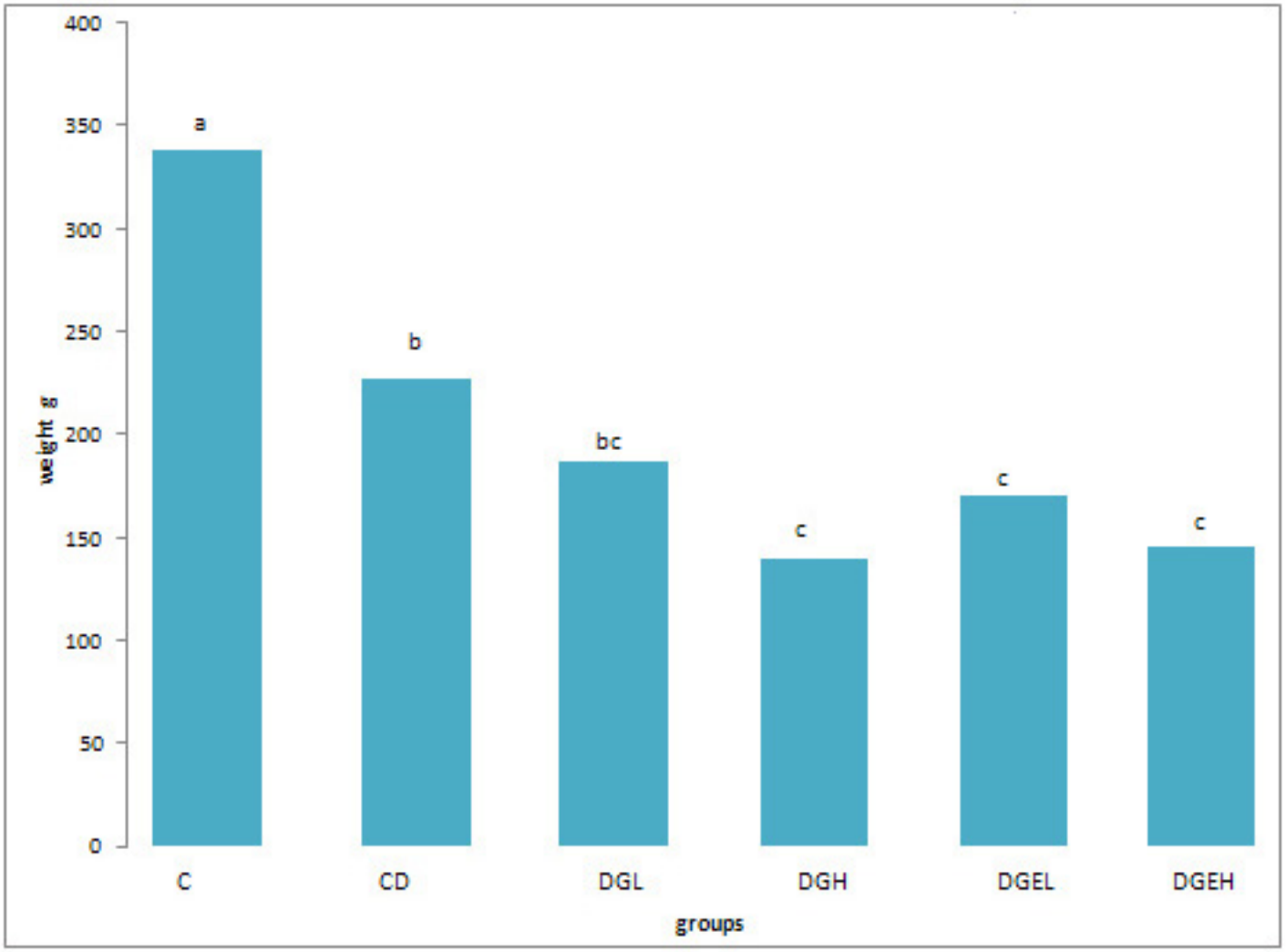


Figure 2: Comparison of groups in terms of glucose

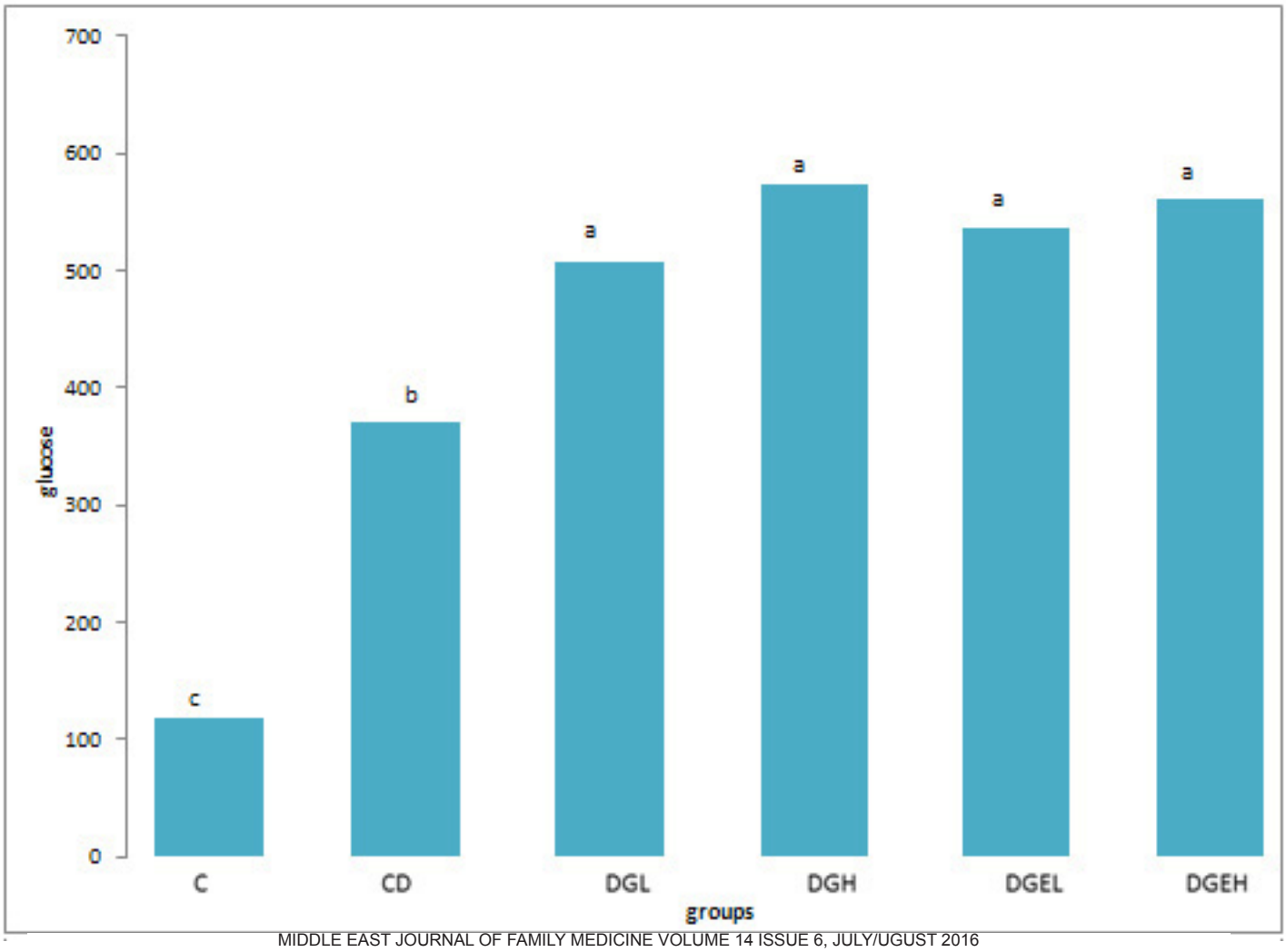


Figure 3: Comparison of groups in terms of creatinine

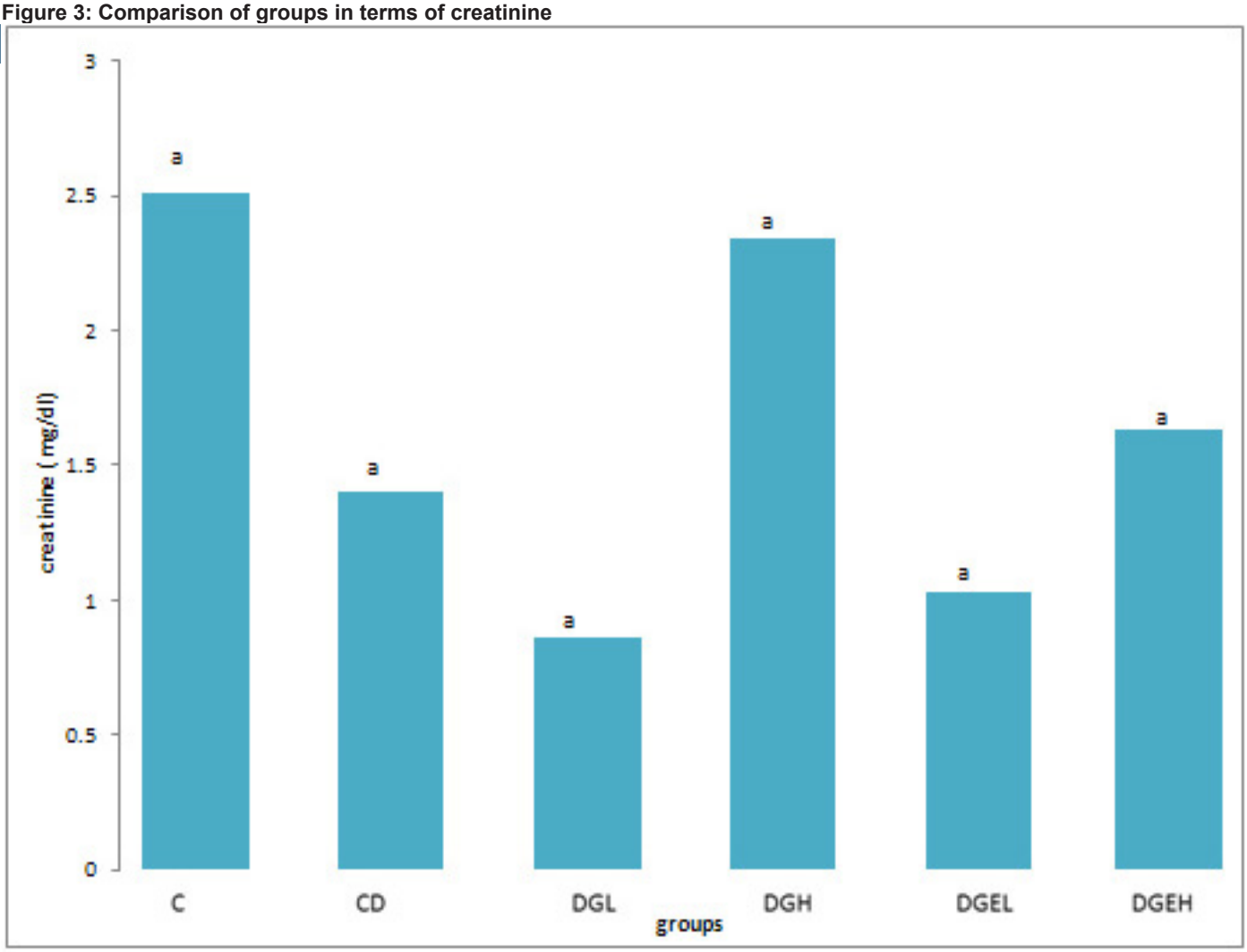


Figure 4: Comparison of groups in terms of blood urea nitrogen

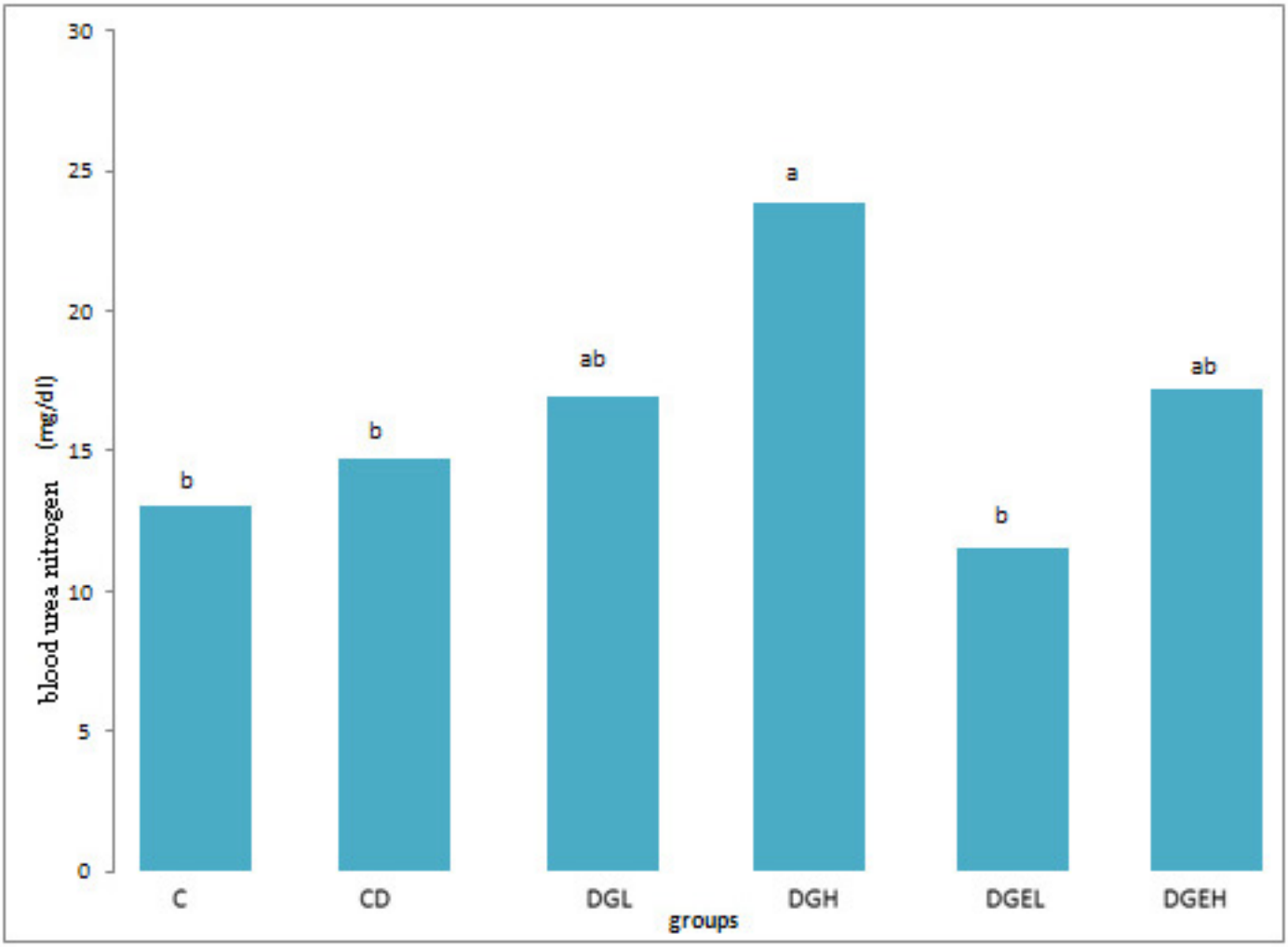


Figure 5: Comparison of groups in terms of urea

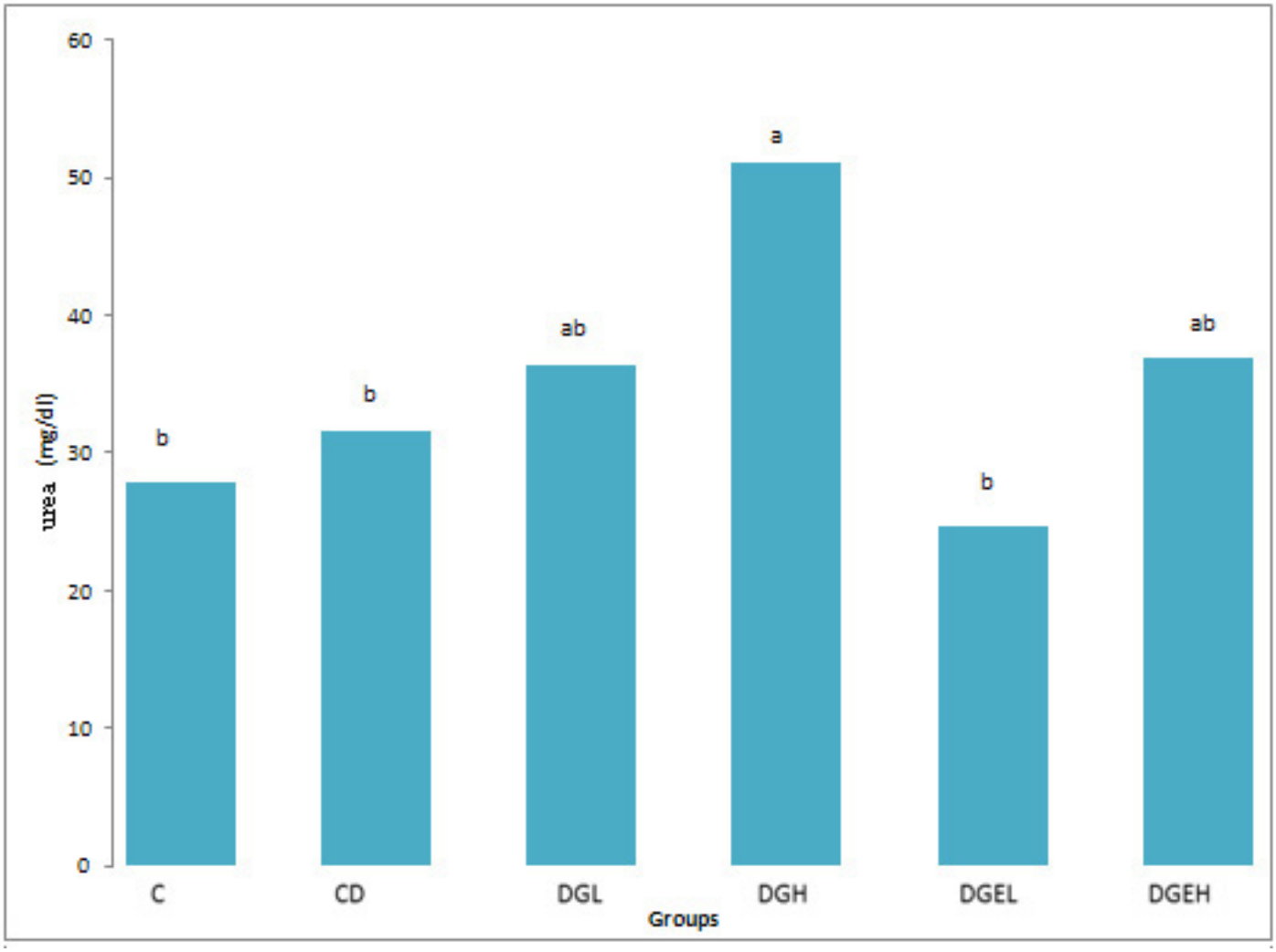


Figure 6: Comparison of groups in terms of uric acid

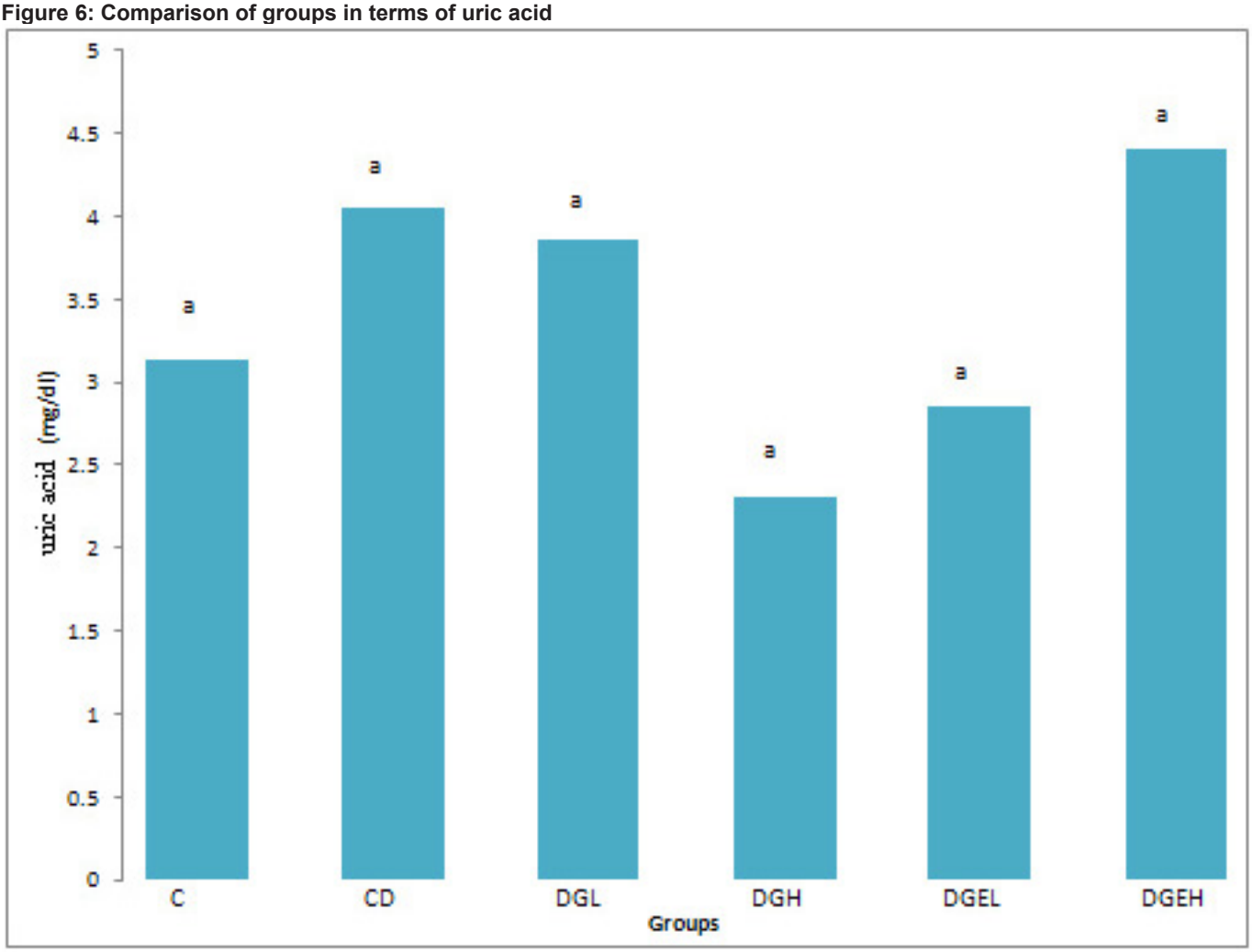
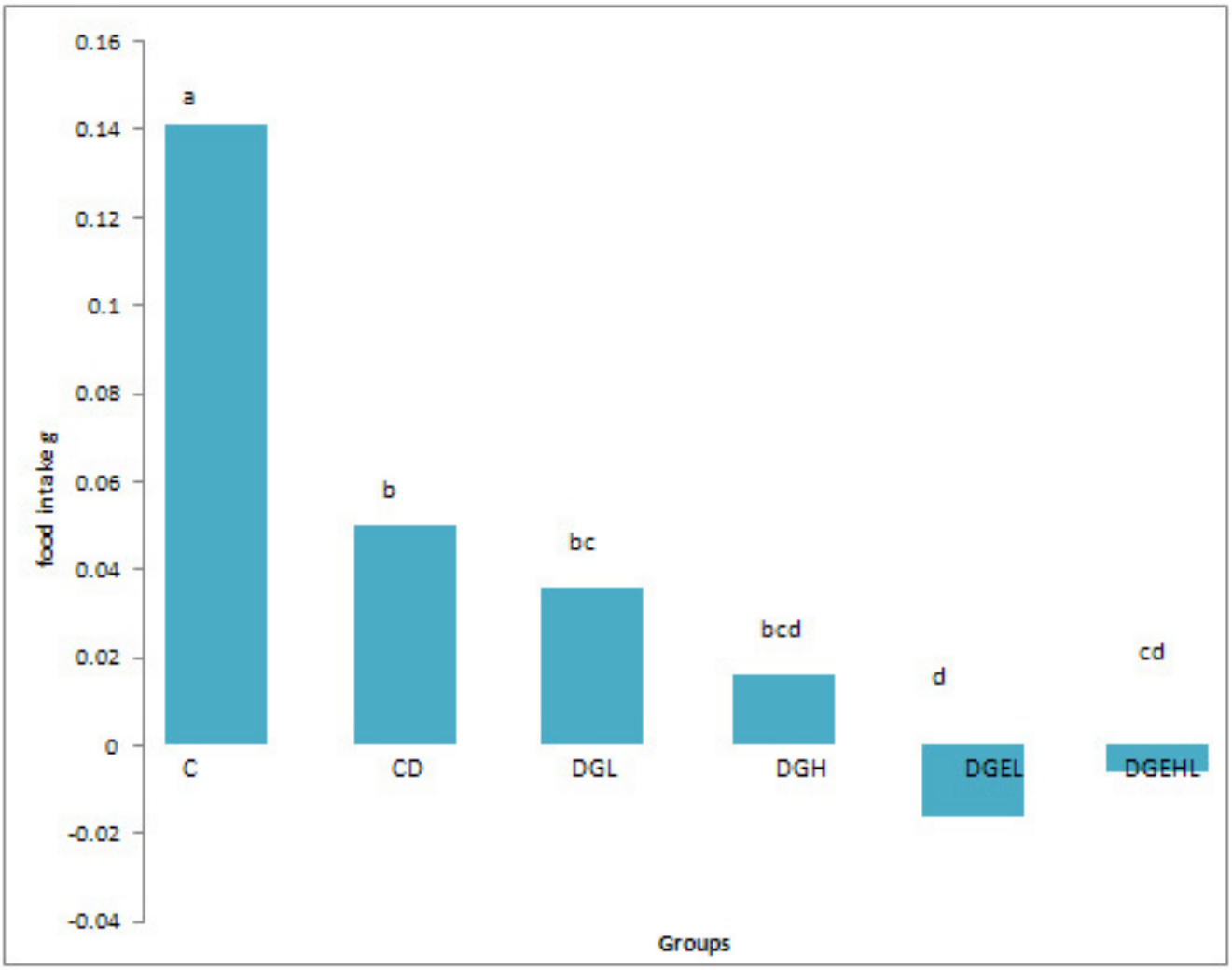


Figure 7: Comparison of groups in terms of food intake



Recommendations

1) We recommend doing this study longer and in different concentrations in extracting: gingerol, shogaol, paradol and zingerone in human and rats.
2) We recommend to measure many things like sorbitol, enzyme aldose reductase, enzymes of kidney and urea protein.

Conclusions

Ginger and its extract did not implement any change in blood glucose and kidney function but the low dose of ginger and the high dose of ginger extract caused improvement in the tissue of the kidney.

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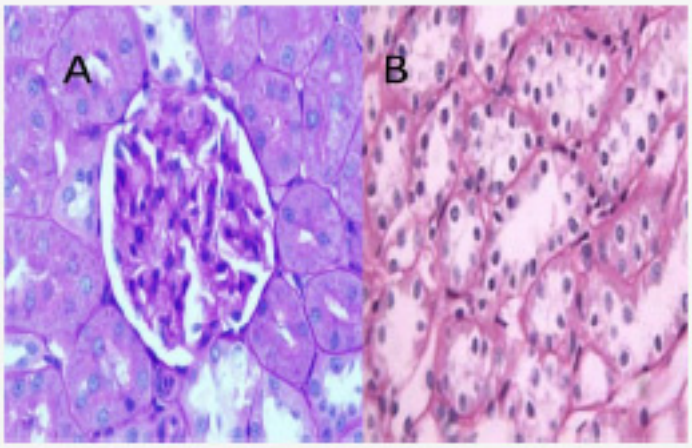
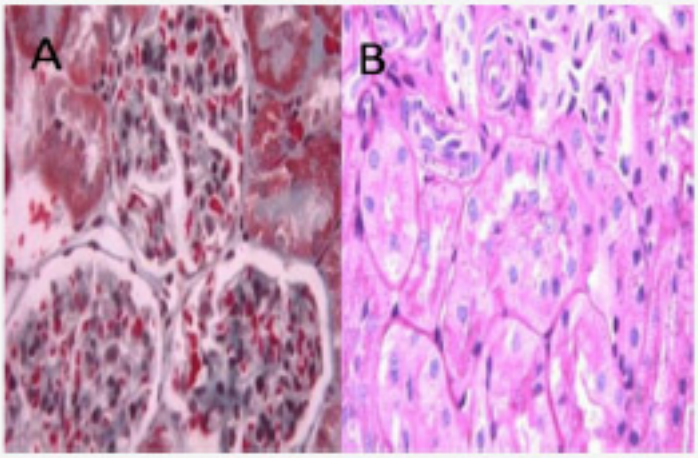
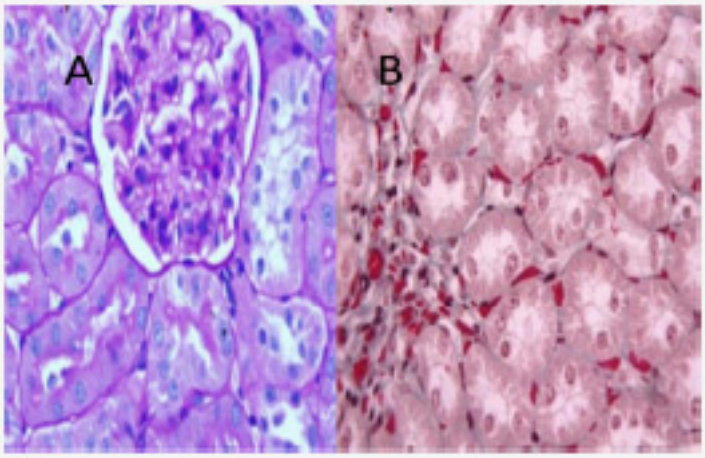
control group (C) photo 8



diabetic group (DC) photo 9



diabetic and eat 0.5% ginger in diet (DGL) photo 10



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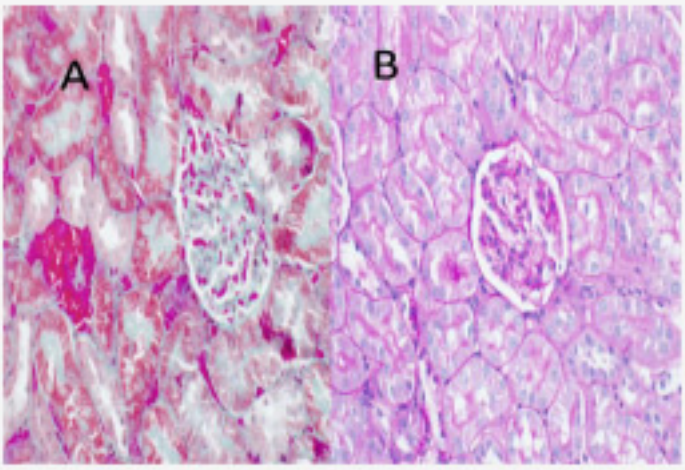
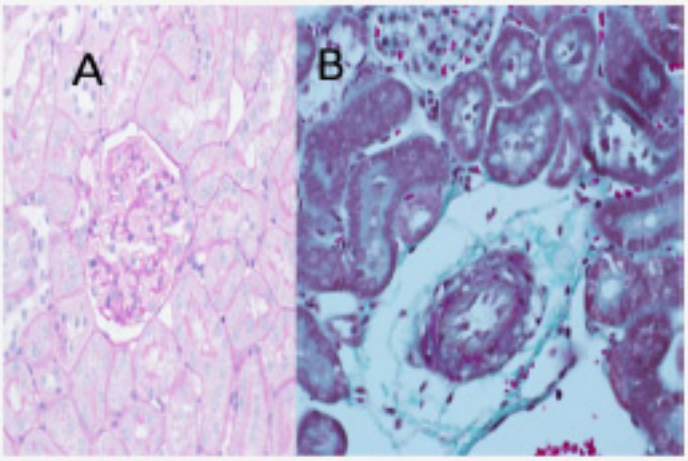
diabetic and eat 2% ginger in diet (DGH) photo 11



diabetic and eat 0.5% ginger extract (zingeron) in diet (DGEL) photo 12



diabetic and eat 2% ginger extract(zingeron) in diet (DGEH) photo13