



## Original Article

## Evaluating the effect of Ginger Powder on Bilirubin, Creatinine, Urea and Uric Acid on Experimental Diabetic Wistar Rats in Randomized Control Trial

Maryam Maqsood<sup>1</sup>, Saima Naaz<sup>2</sup>, Huma Bader UI Ain<sup>1\*</sup>, Zunaira Mushtaq<sup>3</sup>, Makia Nasir<sup>4</sup>, Aiza Qamar<sup>5</sup><sup>1</sup>University Institute of Diet and Nutritional Sciences, The University of Lahore, Lahore, Punjab-Pakistan<sup>2</sup>Department of Clinical Nutrition, NUR International University, Lahore, Pakistan<sup>3</sup>Department of Human Nutrition and Dietetics, Riphah International University, Faisalabad, Pakistan<sup>4</sup>College of Nutrition, Multan Medical Dental College, Multan, Pakistan<sup>5</sup>Department of Nutrition and Health Promotion, University of Home Economics, Lahore, Pakistan

## ARTICLE INFO

## Key Words:

Diabetes, Ginger powder, Bilirubin, Creatinine, Urea, Uric Acid

## How to Cite:

Maqsood, M., Naaz, S., Bader UI Ain, H. ., Mushtaq, Z. ., Nasir, M. ., & Qamar, A. . (2022). Evaluating the effect of Ginger Powder on Bilirubin, Creatinine, Urea and Uric Acid on Experimental Diabetic Wistar Rats in Randomized Control Trial : Effect of Ginger Powder on Bilirubin, Creatinine, Urea and Uric Acid on Experimental Diabetic Wistar Rats. *Pakistan BioMedical Journal*, 5(1).

<https://doi.org/10.54393/pbmj.v5i1.325>

## \*Corresponding Author:

Huma Bader UI Ain

University Institute of Diet and Nutritional Sciences,  
The University of Lahore, Lahore, Punjab-Pakistan  
[huma.badar@dnsc.uol.edu.pk](mailto:huma.badar@dnsc.uol.edu.pk)

## ABSTRACT

Today the world is dealing with rapidly increasing cases of diabetes mellitus especially type 2 diabetes which creates insulin resistance. Scientists are working with different nutraceuticals to cure this disease. Objective: Ginger plays an important role in different ailments such as cardiovascular diseases, hypertension, cancers, gastrointestinal functions, and diabetes mellitus. In the present study, ginger powder was analyzed for its anti-diabetic effect. The ginger powder was analyzed for its proximate composition. Methods: The bio-efficacy study was done on Alloxan-induced Wistar rats by feeding them ginger powder at three levels i.e. 1%, 3%, and 5% ginger powder for a period of 4 weeks. There were 4 groups (one was control and the other three getting different percentages of ginger powder), each containing 5 rats. The blood samples were collected at 0 days, 15th day, and 28th day. Blood sugar and insulin levels were measured. The data thus obtained was statistically analyzed to find out the level of significance. Results showed that glucose levels significantly decreased along with a significant increase in insulin levels. This research design concludes that ginger powder has positive effects in lowering blood sugar levels. Hence, the usage of ginger powder and ginger tea should be increased in diabetic patients to reduce hyperglycemia in diabetic patients and overcome high BSL levels in pre-diabetics. Conclusions: Results of this study concluded that in ginger powder 1.7 STD magnesium and 0.3 STD chromium are present. Moreover, this research study also declared that mean values of RFTs i.e. bilirubin, creatinine, urea, uric acid had a significant change in the G4 group as mean results of 0.591±0.032, 0.814±0.058, 0.814±0.058, 0.9508±0.051 respectively.

## INTRODUCTION

Diabetes mellitus (DM) is a typical cat endocrinopathy, which is like human sort 2 diabetes (T2DM) as far as its pathophysiology. T2DM happens because of fringe insulin obstruction and additionally  $\beta$ -cell brokenness [1]. The widespread rate for diabetes mellitus has been determined to quite an extent of epidemic proportions. Diabetic patients are diseased patients who are also characterized as having chronic high blood sugar level which results from impaired insulin levels in blood or impaired secretion of insulin. It has two major types, first is Type 1 and the other one is Type 2. T2DM is major responsible cause of >90% of

diabetes. It has affected 6.4% of people of adult group around the globe in 2010. This also leads to certain unremitting efforts to explore helpful agents for control of this disease [2] Diabetes mellitus is an all-around anticipated danger factor for periodontal infection, and then again, periodontitis is thought to influence the fundamental fiery condition, insulin obstruction, and lipid and glucose digestion (1,2). Being a persistent metabolic sickness, it is brought about by the body's disappointment either to create the insulin chemical or to utilize insulin creation adequately [3]. Ginger (*Zingiber officinale*, Roscoe

zingiberaceae) is known for most consumed spices widely internationally. It was originated in Southeast Asia and is now spread to Europe. Ginger has a great long history of being a useful herbal medicine that benefits in treating a variety of ailments that includes vomiting, pain, heartburn, and cold-induced flu and fever. More recently, it was concluded that ginger also has anti-clotting, anti-cancer, anti-inflammatory, and other analgesic activities. Hence, the main emphasis on the effects of ginger in the management of metabolic diseases and other complications related to Diabetes Mellitus is seen. Evaluation over here tells us that the good effects of ginger on diabetes mellitus have provided an insight into the active constituents and their mechanisms of action [4]. The alterations in the lifestyle of the consumer along with the up-gradation and disease for initiating more search potent and diets are healthy on nutrients that are complementary such as products that are functional [5]. The main objectives of the study were to determine the anti-diabetic effects of *Zingiber officinale* and to further the effective level/dose of ginger powder in lowering the blood glucose levels in alloxan-induced diabetic rats.

## METHODS

Ginger was procured from the Local market, Lahore, then packed in a sealed bag to avoid any further contamination until further analysis at the laboratory facility of the Food department at the University of Lahore. After removing physical contaminants like dirt, dust, and foreign particles, washing with clean water, peeling, and slicing, ginger was dried at 200°C for 10 minutes in a hot air oven. After drying, it was grounded into fine powder by using a commercial blender. The ginger powder was packed in a sealed bag to avoid any further contamination until further analysis at the laboratory facility of the Food department at the University of Lahore. The mineral content of ginger powder was analyzed by using the method of AOAC [5]. All the 20 rats included in the study were given three different levels of ginger powder as detailed in Table 1 showing diet composition. 5 rats of Group I were not given any special diet but were fed on commercial basal feed. The rats were made diabetic by injecting alloxan mixed with 1ml distilled water intraperitoneally at the rate of 65mg/kg of body weight before the start of the experiment. After 7th day of the injection the rats were diabetic for the research purpose [4]. On 8th day which was considered day 0 of the study, the blood samples (1 ml) of the rats were taken. It was then centrifuged at 30000 rpm and serums were stored in refrigerator at 4° C until further analyzed [6]. During the 4 weeks of bio-efficacy study a specified diet considering as 1% Ginger Powder, 3% Ginger Powder, 5% Ginger Powder were given to Group II, Group III, Group IV respectively

throughout the experimental period. The feed and water was given adlib. The rats were kept in standard cages and water was given by bottles. The ginger powder was mixed in diets of three experimental groups very carefully. The diets consumed by the rats of all groups were calculated on weekly basis including the controlled group. 1ml blood from each rat of four groups was collected from azygos vein at the 15th and 30th days. The serum was stored as explained above. The composition of the diet of four groups of rats is given in Table 2 [7]. The blood sugar level profile components of alloxan-induced Wistar rats were analyzed by the usage of blood samples at the specified nanometer level. In order to assess the safety of seeds of Jamun and pumpkin seeds, the following tests will be performed: The serum samples of the experimental rats will be analyzed for urea by glutamate dehydrogenase (GLDH) method, whilst creatinine will be analyzed by the procedure described by Saeed et al. to evaluate the proper functioning of kidney [8]. The data thus obtained is subjected to statistical analysis by using Analysis of variance (ANOVA) in SPSS (Andy Field SPSS) to find out the effect of different percentages of ginger powder on diabetic rats.

## RESULTS

The purpose of this study was to determine major diagnosis if the ginger powder is effective in lowering the effects of diabetes mellitus in Wistar rats or not. First of all, Ginger was peeled off and cut into slices. These slices were then put into a dehydrator to let them get dry. After drying up of ginger slices it was placed in a grinder and ginger powder was made up from those ginger slices. This entire research was conducted in the Food Analysis Labs of UVAS. Mineral analysis of ginger powder indicates the presence of 1.7 STD units of magnesium and 0.03 STD units of chromium (Table 1). The conclusions of the current study were approximately parallel to some previous research which identifies that magnesium was 1.72 STD unit and chromium was 0.031 STD unit in ginger powder [8]. Kidney functioning tests: Bilirubin is the end product in mammals of heme catabolism which is generally regarded as a potentially cytotoxic, lipid-soluble waste product that needs to be excreted ( ). The variance of determination regarding the effect of ginger powder on the bilirubin of diabetic rats is given in (Table 2). The conclusions predict that by consumption of different levels of ginger powder non-significantly affected bilirubin levels as well as the effect of days is significant. The treatment with days interaction was also non-significant for this parameter (Table 2) shows descriptive analysis of ginger powder treatments on bilirubin. The mean treatment for day 0 was  $0.598 \pm 0.042$ , whereas, it was  $0.583 \pm 0.127$  for day 28. Thus, the determination of results in this study, at the end was

significant. (Table 2) shows ANOVA results for ginger powder treatment on bilirubin of male wistar rats.

Sr. No	Mineral	Composition
1	Magnesium	1.7396 STD unit
2	Chromium	0.0367 STD unit

**Table 1:** Mineral Analysis of Ginger

Days	Treatments				Means
	G1	G2	G3	G4	
0 Day	0.593±0.052	0.603±0.043	0.613±0.047	0.582±0.028	0.598±0.042 <sup>a</sup>
28 Day	0.575±0.048	0.580±0.394	0.574±0.032	0.601±0.035	0.583±0.127 <sup>b</sup>
Means	0.585±0.050	0.592±0.218	0.593±0.039	0.591±0.032	

**Table 2:** Mean values for the Effect of Ginger Powder Treatment on Bilirubin of Rats

Days	Treatments				Means
	G1	G2	G3	G4	
0 Day	0.830±0.054 <sup>ab</sup>	0.821±0.043 <sup>ab</sup>	0.839±0.033 <sup>a</sup>	0.818±0.049 <sup>ab</sup>	0.827±0.04 <sup>a</sup>
28 Day	0.811±0.050 <sup>ab</sup>	0.803±0.053 <sup>b</sup>	0.801±0.035 <sup>b</sup>	0.809±0.068 <sup>ab</sup>	0.806±0.052 <sup>b</sup>
Means	0.820±0.052	0.812±0.048	0.819±0.034	0.814±0.058	

**Table 3:** Mean values for the Effect of Ginger Powder Treatment on Creatinine of Rats

Days	Treatments				Means
	G1	G2	G3	G4	
0 Day	31.460±2.93	31.583±2.39	31.339±2.98	31.378±2.67	31.440±2.746
28 Day	30.881±2.55	30.493±2.86	30.961±2.47	31.857±2.69	31.048±2.645
Means	31.171± 2.74	31.038±2.62	31.150±2.72	31.617±2.68	

**Table 4:** Mean values for the Effect of Ginger Powder Treatment on Urea of Rats

Days	Treatments				Means
	G1	G2	G3	G4	
0 Day	0.9603±0.073	0.9516±0.087	0.9391±0.065	0.9487±0.042	0.9499±0.066
28 Day	0.9312±0.069	0.9319±0.049	0.9306±0.037	0.9529±0.061	0.9367±0.054
Means	0.9458±0.071	0.9417±0.068	0.9348±0.051	0.9508±0.051	

**Table 5:** Mean values for the Effect of Ginger Powder Treatment on Uric Acid of Rats

## DISCUSSION

It was found that all the values for treatment, days and treatment into days were significant. In a study, ginger powder enriched diet was given as 100, 200, 400 mg/kg to rats and concluded mean results of bilirubin were 0.42±0.03 mg/dL and then a significant change occurred and mean found was 13.16±0.138 mg/dL [9]. Creatinine: The functioning of kidneys is known by the estimation of filtration rate of glomerular, which is indicated by the term Creatinine. It gives us information of all the blood passages by per minute through glomerular [10]. The mean values of creatinine levels of control and treatment groups are given in the table. The values recorded for creatinine of controlled group is 0.830±0.054 at the 0 day, it was decreased significantly to 0.806±0.052 at the end of study. Similarly, in Group 4 in which 5% ginger powder feed was given to significant changes occurred in this research. The

group which received the highest level of percentage of ginger powder i.e. 5% has shown maximum reduction in creatinine levels of 0.809±0.068. Thus, Table 3 shows descriptive analysis of ginger powder treatment on creatinine. The mean treatment for day 0 was 0.827±0.04, whereas, it was 0.806±0.052 for day 28. According to a research study statistical analysis concluded that extracts of ginger had significant results on creatinine levels. The results showed mean values of 0.83±0.03 mg/dL, 0.81±0.03 mg/dl, 0.80±0.03 mg/dL respectively. While in another research the recorded mean values for creatinine were 0.91±0.03 mg/dL and after treating it with ginger it was lessened to 0.87±0.03 mg/dL and 0.85±0.03 mg/dL. However, in another study the maximum observed levels were 0.96±0.03 mg/dL in control group while slowly the creatinine levels got lowered when conventional extracts of ginger were given, the reduced mean values were 0.90±0.03 and 0.88±0.03 mg/dL. A study also suggested that ginger played such a significant role in reducing creatinine levels that it reduced from 12.1 to 8.87 % [11]. Urea is such a solid which is dissolved in water which is not an acidic or an alkaline liquid. It is colorless and odorless. A solid which is odorless and colorless and can be dissolved in the water easily is known as Urea [12]. The Table 4 of variance in which analysis of urea determine that ginger powder has effect on the diabetic wistar male rats which is given in Table 4. The conclusion of predictive results of ginger powder non-significantly affected the urea levels as the effect of days was also non-significant. For this parameter of urea, the treatment into days interaction was also non-significant. The mean values of urea levels of control and treatment groups are given in Table 4 Group 4 in which 5% ginger powder feed was given and non-significant changes occurred in this research. The recorded values for urea of controlled group 31.460±2.93 at the zero day. It was not decreased and non-significantly went to 31.857±2.69 at the end of the study. Therefore, Table 6 shows ANOVA results for ginger powder treatment on the area of Wistar rats. It was found that all the values for treatment, days and treatment into days were non-significant. These are the following researches that indicate nonsignificant results. In study results of ginger extracts showed that of mean values which involve mean serum urea were 31.45±1.07, 31.09±1.06 and 30.58±1.04 mg/dL. Research related to ginger when conducted concluded the means, were decreased as in the values of Urea in rats from 34.18±1.09 mg/dL to 33.56±1.07 [13]. Uric acid has strong effects as an antioxidant. It is also known as singlet oxygen and radical and is a scavenger. The physiological concentration shows that the oxo-heme oxidant is formed with a hemoglobin peroxide reaction and is responsible for the protection of erythrocyte ghosts for

lipid peroxidation. It also protects erythrocytes from the damage of peroxidation that leads towards lysis [14]. For this parameter, uric acid the mean values of control and treatment groups are given in Table 5. The value of uric acid for the control group was recorded as  $0.9603 \pm 0.073$  at day zero and it was non-significant during the present research work. Even the group which received the maximum amount of ginger powder also showed non-significant results. Table 7 shows a descriptive analysis of ginger powder treatments on uric acid. The mean treatment for day 0 was  $0.9499 \pm 0.066$  whereas it was  $0.9367 \pm 0.054$  for day 28. In research, ginger extracts were used as a treatment for diabetes mellitus and the mean values showed results of deduced non-significant effects were found. Means determining the effect of ginger extracts ( $0.96 \pm 0.03$  mg/dL) and then reduced to ( $0.94 \pm 0.03$  mg/dL) and ( $0.93 \pm 0.03$  mg/dL). In another research, when the subject was treated with ginger the reduction in uric acid occurred from ( $0.96 \pm 0.03$ ) to ( $1.01 \pm 0.03$ ) mg/dL. Study III shows that the highest uric acid content was observed ( $1.07 \pm 0.03$  mg/dL) and ( $1.02 \pm 0.03$  mg/dL). However, research [15] reported that in fatty liver rats after treatment with ginger uric acid dropped from  $37 \pm 2.6$  mg/dL to  $203 \pm 8.6$  and then  $53 \pm 3.6$  mg/dL. Furthermore, another scientist [16] means of uric acid were  $47.3 \pm 2.61$  and  $80.6 \pm 7.77$  mg/dL. After inducing the ginger diet reduction occurred in uric acid and urea levels 6.25, 12.5, and 25 mg/kg and the urea level attained was  $62.5 \pm 6.7$ ,  $53.8 \pm 6.9$ , and  $41.7 \pm 1.8$  mg/dL respectively reducing. Table 5 shows a descriptive analysis of ginger powder treatments on uric acid. The mean treatment for day 0 was  $0.9499 \pm 0.066$ , whereas, it was  $0.9367 \pm 0.054$  for day 28.

## CONCLUSIONS

In this Research study, Mineral analysis tests were performed to identify Minerals of Magnesium and Chromium. Furthermore, RFT's Glucose and Insulin testing were performed on Wistar rats. The results executed were from efficacy trials of 28 days in which 4 groups were given different levels of 1%, 3%, and 5% ginger powder diet respectively to determine the difference in blood glucose and insulin levels. The proximate analysis was performed by following steps of the AOAC method. Mineral Analysis determined by the process of atomic absorption concludes that Magnesium present in ginger powder is 1.7396 STD units and Chromium present in ginger powder is 0.0367 STD units. Ameliorating the conditions by segregation of gingerol by the usage of fat content apparatus called Soxhlet. The extrication yield multiplied with the extend in extraction time. The indices were responsible for antioxidant reduction after a restriction of certain time. The antioxidant which was recorded as maximum for

Soxhlet extraction was at ninety min. In researches considering Vitro and in vivo studies, ginger has following characteristics, 16% in total acidity, 44% discount occurred in gastric juice volume. In paw edema reduction was occurred approximately 20%. Decrease in Bilirubin. Exhaustion occurred in urea, creatinine, uric acid levels. Furthermore, their intake now had not been imparted as any detrimental impact on biochemical markers.

## REFERENCES

- [1] Hong K, Hong J, Chung H, Lee H, Lee H, et al., Monoclonal Gammopathy Associated Scleredema Adulorum of Buschke in a Patient with Diabetes Mellitus Successfully Treated with Intravenous Immunoglobulin and Narrow Band Ultraviolet B Phototherapy-Annals of Dermatology. 2021. 33(6):586. doi:10.5021/ad.2021.33.6.586.
- [2] Arablou T, Aryaeian N, Valizadeh M, Sharifi F, Hosseini A et al., The effect of Ginger Consumption on Glycemic Status Lipid Profile and Some Inflammatory Markers in Patients with Type 2 Diabetes Mellitus-International Journal of Food Sciences and Nutrition. 2014. 65(4):515. doi:10.3109/09637486.2014.880671.
- [3] Stoicescu M, Calniceanu H, Tigi I, Nemeth S, Tent A et al., Romanul. Significant Aspects and Correlation between Glycemic Control and Generalized Chronic Periodontitis in Type 2 Diabetes Mellitus Patients-Experimental and Therapeutic Medicine. 2021. 22(1):1. doi:10.3892/etm.2021.10103.
- [4] Deeds M, Anderson J, Gastineau A, Hiddinga D et al., Kudva. Single dose streptozotocin induced diabetes considerations for study design in islet transplantation models- Journal of Laboratory animals. 2011. 45(3):131. doi:10.1258/la.2010.010090.
- [5] Ferrari C. Functional Foods Herbs and Nutraceuticals towards Biochemical Mechanisms of healthy aging- Bio gerontology. 2004. 5(5):275. doi: 10.3390/nu2060611.
- [6] Al Amin Z, Thomson M, Al Qattan K, Peltonen K, R. Shalaby and Ali M. Anti Diabetic and Hypolipidaemic Properties of Ginger (*Zingiber officinale*) in Streptozotocin Induced Diabetic Rats-British Journal of Nutrition. 2006. 96(4):660-666. doi: 10.1079/bjn20061849.
- [7] Chen Z, Peng C, Jiao R, Wong Y, Yang N et al., Anti-Hypertensive Nutraceuticals and Functional Foods- Journal of agricultural and food chemistry. 2009. 57(11): 4485-4499. doi.org/10.1021/jf900803r.
- [8] Labib M, Sargent E and Kelley SO. Electrochemical Methods for the Analysis of Clinically Relevant Biomolecules-Chemical Reviews. 2016. 116(16):9001-9090. doi.org/10.1021/acs.chemrev.6b00220.

- [9] Afshari AT, Shirpoor A, Farshid A, Saadatian R, Rasmi Y et al., The Effect of Ginger on Diabetic Nephropathy Plasma Antioxidant Capacity and Lipid Peroxidation in Rats-Food Chemistry. 2021. 101(1):148-153. doi:10.1016/j.foodchem.2006.01.013.
- [10] AlHroob A, Abukhalil M, Alghonmeen D and Mahmoud AM. Ginger alleviates Hyperglycemia Induced Oxidative Stress Inflammation and Apoptosis and Protects Rats against Diabetic Nephropathy-Biomedicine & Pharmacotherapy. 2018. 106(381):389. doi: 10.1016/j.biopha.2018.06.148.
- [11] Horwitz W. Official Methods of Analysis of Association of Official Analytical Chemists International-AOAC Press Washington DC USA. 2006.4(18):3. doi:https://academic.oup.com/jaoac/article-acbabstract/65/2/450/5702962.
- [12] Attari V, Mahluji S, Jafarabadi M and Ostadrahimi A. Effects of Supplementation with Ginger Zingiber officinale Roscoe on Serum Glucose Lipid Profile and Oxidative Stress in Obese Women A Randomized Placebo Controlled Clinical Trial-Journal of Pharmaceutical Sciences. 2015. 21(4):184-191. doi:10.15171/PS.2015.35.
- [13] Bhandari U, Kanojia R and Pillai KK. Effect of Ethanolic Extract of Zingiber officinale on Dyslipidaemia in Diabetic Rats-Journal of Ethnopharmacology. 2005. 97(2):227-230. doi.org/10.1016/j.jep.2004.11.011.
- [14] Devasagayam A, Tilak J, Bolor K, Sane S, Ghaskadbi S and Lele RD. Free Radicals and Antioxidants in Human Health Current Status and Future Prospects Enhanced Extraction of Oleoresin from Ginger Zingiber officinale Rhizome Powder Using Enzyme Assisted Three Phase Participation-Food Chem. 2017 27(36):216. doi:10.1016/j.foodchem.2016.07.180.
- [15] Ercan M, Bostanci B, Teke Z, Karaman K, Dalgic T et al.. Predictive Factors for Conversion to Open Surgery in Patients Undergoing Elective Laparoscopic Cholecystectomy-Journal of Laparoendoscopic and Advanced Surgical Techniques 2010. 20(5): 427. doi: 10.1089/lap.2009.0457.
- [16] Ghareib SA, ElBassossy M, Elberry A, Azhar A, Watson M et al., Protective Effect of Zingerone on Increased Vascular Contractility in Diabetic Rat Aorta. Eur. J. Pharm. 2016. 780(174)doi.org/10.1016/j.ejphar.2016.03.046.
- [17] Ilkhanizadeh B, Shirpoor A, Nemati S and Rasmi YE. Protective Effects of Ginger Zingiber officinale Extract Against Diabetes Induced Heart Abnormality in Rats-Diabetes & metabolism journal. 2016. 40(1):46. doi: 10.4093/dmj.2016.40.1.46.
- [18] Kumar GS and Jayaveera N. A Textbook of Pharmacognosy and Phytochemistry S. Chand Publishing. 2014. 3(59): 130 doi :0.5958/0975-4385.2018.00010.9.
- [19] Kostadinova R, Boess F, Applegate D, Suter L, Weiser T, Singer T and Roth AE. A Long Term Three Dimensional Liver Co Culture System for Improved Prediction of Clinically Relevant Drug Induced Hepatotoxicity-Toxicology and applied pharmacology. 2013. 268(1):1-16. doi: 10.1016/j.taap.2013.01.012.
- [20] Jain HV. Screening of Juniperus Communis Linn. Oil for Anthelmintic, Wound Healing and Hepatoprotective Activities in Rats-Doctoral dissertation RGUHS. 2010. 16(1):142doi:10.1177/0748233712469995.