



Small Intestinal Motility Changes in Experimentally Induced Diabetes Mellitus and Possible Effects of Garlic Oil Supplementation

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قُلْ لِّمَنِ الشَّيْءُ حَسْبًا

صَدَقَ اللَّهُ الْعَظِيمُ

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List of Contents

	<i>Page</i>
Introduction	1
Aim of the Work	3
Review of Literature	4
Materials and Methods	23
Results	56
Discussion	125
Summary and Conclusion	141
References	146
Arabic Summary	—

List of Abbreviations

- AAP : 4-aminophenazone.
- AGE : Advanced glycation end-products.
- ANOVA: Analysis of variance.
- AR : Analytical reagent.
- AS : Allium Sativum
- B.W. : Body weight.
- BMI : Body mass index.
- CAT : Catalase.
- CCK : Cholecystokinin.
- CHO : Carbohydrates.
- Chol. : Cholesterol.
- CNS : Central nervous system.
- DADS : Diallyl disulfide.
- DAN : Diabetic autonomic neuropathy.
- DHBS : Dichloro -2-hydroxybenzene sulfonic acid.
- DM : Diabetes mellitus.
- DTT : Dithio DL-threitol.
- EDTA : ethylene-diamine-tetraacetic acid.
- ELISA : enzyme immunoassay.
- FBG : Fasting blood glucose.
- GIP : Glucose-dependent insulintropic polypeptide.
- GIT : Gastrointestinal tract.
- GLPs : Glucagon-like-peptides.
- GSH : Glutathione.
- GSH-Px: Glutathione peroxidase.
- HERPES: N-2 Hydroxyethyl piperzine N-2 ethan sulfonic acid.
- HO-1 : Hemeoxygenase-1.

HOMA-IR: homeostasis model assessment of insulin resistance.

Hr : Hours.

i.p. : intraperitoneal.

K-Cal : Kilocalorie.

LI : Lee Index

LSD : least significant difference.

M : Arithmetic mean.

MDA : Malondialdehyde.

MMCs : Migrating motor complexes.

MUF : Monosaturated fatty acids.

NO : Nitric oxide.

NS : Non significant.

O.D. : Optical density.

PBS : phosphate buffered saline.

PMSF : Phenyl methane sulfonyl fluoride.

PUF : Polunsaturated fatty acids.

ROS : reactive oxygen species.

Sat FA : Saturated fatty acid.

SD : Standard deviation.

SEM : Standard error of the mean.

SOD : Superoxide dismutase.

SPSS : Statistical Program for Social Science.

STZ : Streptozotocin.

TBA : Thiobarbituric acid reagent.

TCAA : Trichloroacetic acid.

TMB : Tetramethylbenzidine.

VIP : Vasoactive intestinal peptide.

Lists of Tables

Table no.	Title	Page
1	Mean $\pm$ SEM of duodenal; frequency of contraction (number of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.) in the different studied groups.	57
2	Mean $\pm$ SEM of jejunal; frequency of contraction (number. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min) in the different studied groups.	61
3	Mean $\pm$ SEM of ileal; frequency of contraction (number of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min) in the different studied groups.	65
4	Mean $\pm$ SEM of fasting blood glucose (mg%), fasting insulin level (μ IU/ml), HOMA-IR and HbA1c (gm%) in the different studied groups.	70
5	Mean $\pm$ SEM of intraperitoneal glucose tolerance test in the different studied groups.	73
6	Mean $\pm$ SEM of body mass index (BMI), Lee index and waist circumference in the different studied groups.	76
7	Mean $\pm$ SEM of small intestinal Malondialdehyde (MDA, nmol/gm wet tissue) Level in the different studied groups.	79

8	Mean $\pm$ SEM of Small Intestinal Glutathione peroxidase activity, GSH-PX (U/gm wet tissue) in the different studied groups.	82
9	Mean $\pm$ SEM of Small Intestinal catalase (CAT, U/gm wet tissue) activity in the different studied groups.	85
10	Duodenal motility parameters [frequency of contraction (no. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in control group.	87
11	Duodenal motility parameters [frequency of contraction (no. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in garlic supplemented group.	88
12	Duodenal motility parameters [frequency of contraction (no. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in diabetic group.	89
13	Duodenal motility parameters [frequency of contraction (no. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in garlic oil treated diabetic group.	90
14	Jejunal motility parameters [frequency of contraction (no. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in control group.	91
15	Jejunal motility parameters [frequency of contraction (no. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in garlic oil supplemented group.	92
16	Jejunal motility parameters [frequency of contraction (no. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in diabetic group.	93

17	Jejunal motility parameters [frequency of contraction (no. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in garlic oil treated diabetic group.	94
18	Ileal motility parameters [frequency of contraction (no. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in control group.	95
19	Ileal motility parameters [frequency of contraction (no. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in garlic supplemented group.	96
20	Ileal motility parameters [frequency of contraction (no. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in diabetic group.	97
21	Ileal motility parameters [frequency of contraction (no. of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in garlic oil treated diabetic group.	98
22	Fasting blood glucose (mg%) in the different studied groups.	99
23	Fasting insulin level (μ IU/ml) in the different studied groups.	100
24	HOMA-IR score in the different studied groups.	101
25	HbA1C (gm%) in the different studied groups.	102
26	Intraperitoneal glucose tolerance test in the control group.	103
27	Intraperitoneal glucose tolerance test in garlic oil supplemented group.	104

28	Intraperitoneal glucose tolerance test in diabetic group.	105
29	Intraperitoneal glucose tolerance test in garlic oil treated diabetic group.	106
30	Body mass index (BMI) in the different studied groups.	107
31	Lee index in the different studied groups.	108
32	Waist circumference (cm) in the different studied groups.	109
33	Duodenal tissue malondialdehyde (MDA, nmol/gm wet tissue) level in the different studied groups.	110
34	Jejunal tissue malondialdehyde (MDA, nmol/gm wet tissue) level in the different studied groups.	111
35	Ileal tissue malondialdehyde (MDA, nmol/gm wet tissue) level in the different studied groups.	112
36	Duodenal tissue glutathione peroxidase (GSH-PX) (U/gm wet tissue) in the different studied groups.	113
37	Jejunal tissue glutathione peroxidase (GSH-PX) (U/ gm wet tissue) in the different studied groups.	114
38	tissue glutathione peroxidase (GSH-PX) (U/gm wet tissue) in the different studied groups.	115
39	Duodenal tissue catalase (CAT) activity (U/gm wet tissue) in the different studied groups.	116
40	Jejunal tissue catalase (CAT) activity (U/gm wet tissue) in the different studied groups.	117
41	Ileal tissue catalase (CAT) activity (U/gm wet tissue) in the different studied groups.	118

List of figures

Table no.	Title	Page
1	Changes in duodenal motility parameters [frequency of contraction (number of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in the different studied groups.	58
2	Duodenal motility in the different studied groups.	59
3	Changes in jejunal motility parameters [frequency of contraction (number of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in the different studied groups.	62
4	Jejunal motility in the different studied groups.	63
5	Changes in ileal motility parameters [frequency of contraction (number of contractions / min.), average duration of contraction (sec.), average force of contraction (gm.) and motility index (gm.min.)] in the different studied groups.	66
6	Ileal motility in the different studied groups.	67
7	Changes in fasting blood glucose (mg%), fasting insulin level (μ IU/ml), HOMA-IR and HbA1c (gm%) in the different studied groups.	71
8	Intraperitoneal glucose tolerance test in the different studied groups.	74
9	Changes in body mass index (BMI), Lee index and waist circumference in the different studied groups.	77

10	Changes in Malondialdehyde (MDA, nmol/gm wet tissue) Level in duodenum, jejunum and ileum in the different studied groups.	80
11	Changes in Glutathione peroxidase activity, GSH-PX (U/gm wet tissue) in duodenum, jejunum and ileum in the different studied groups.	83
12	Changes in catalase (CAT, U/gm wet tissue) activity in duodenum, jejunum and ileum in the different studied groups.	86
13	Photomicrograph of histological changes in the duodenum in the different studied groups.	120
14	Photomicrograph of histological changes in the jejunum in the different studied groups.	122
15	Photomicrograph of histological changes in the ileum in the different studied groups.	124

Introduction

Diabetes mellitus (DM) is a metabolic disorder resulting from deficient secretion or action of insulin and is considered as a worldwide problem, still rising and has no definite cure (**Ashour et al., 2011**).

Tiwari and Rao (2002) stated that an estimated 143 million people worldwide were suffering from DM, almost five times more than the estimates before ten years. They, also, reported that patient number might probably be doubled by the year 2030. According to **Younas and Hussain (2014)**, five to ten percent had type-1 DM, which was formerly known as insulin-dependent, and 90% to 95% had type-2 (non–insulin-dependent) DM.

DM could lead to many complications, affecting multiple organs particularly if it persists for a long time independent of its types (**Rodrigues and Motta, 2012**).

Gastrointestinal motility disorders are often present in diabetic patients and were attributed to autonomic neuropathy (**Ojetti et al., 2009**). **Moussa (2008)** reported that persistent hyperglycemia in diabetes caused increased production of free radicals especially reactive oxygen species (ROS). The increased ROS production in diabetic patients could cause injury to the nerves directly, in

addition to disrupted blood supply to the nerves in the gastrointestinal tract (**Kashyap and Farrugia, 2010**).

Because of rising popularity of natural products consumption, there are many studies to combat various physiological threats, including oxidative stress, cardiovascular complexities, cancer insurgence, and immune dysfunction, using natural products. One of the most historically famous natural products is garlic (*Allium sativum* , AS) and it was recognized for its possible therapeutic potential. Researches performed on the health promoting properties of garlic often referred to its sulfur containing metabolites such as allicin and its derivatives which could be used as dietary supplements to promote health (**Chang et al., 2011**). .

This ability of garlic and its oil to scavenge free radicals raises the possibility of its beneficial effects in protecting the membranes from damage and maintaining cell integrity (**Butt et al., 2009**). Therefore, garlic, particularly AS, could be used to protect against free radical-induced cell damage in diabetic subjects. In addition, the garlic major dynamic component, Alliin, could have hypoglycemic activities (**Flora et al., 2009; Omar et al., 2010; Nasim et al., 2011**). Thus, **Chang et al. (2011)** reported that garlic could improve hyperglycemia in diabetic patients.

Aim of the Work

This study was carried out to evaluate the possible therapeutic effect(s) and mechanism(s) of garlic oil supplementation on the small intestinal motility changes in experimentally induced DM, using Streptozotocin, a model of type II diabetic rats.