Antioxidant Activity of Spirulina Powder in Male Rate with Adenine–Induced Chronic Renal Failure

Waleed Khaled Yonis[1], Ayyed Hameed Hassan[2]

[1]M.Sc. Student, [2]Prof. Dr., College of Veterinary Medicine, University of Karbala, Karbala, Iraq

Abstract

The present study aimed evaluate the role of spirulina in reduction the ability of adenine induction renal failure and its complication in male rates. Twenty four adult male rats used in the present study and divided into four groups, first group consider as control group, the second group received adenine (100 mg/kg) intraperitoneal, while the third group receive mixed with feed and adenine (100 mg/kg) intraperitoneal combined with spirulina powder (750 mg/kg) and the fourth group receive just spirulina powder (750 mg/kg) also with feed, the result showed experiment blood was collected to assessment kidney function for (KIM-1, Ureaandcreatinine), lipid profile function test for (cholesterol, triglyceride, LDL and HDL). parameter of antioxidant concentration for (SOD,GSH,MAD and ON).in the present study when treated by adenine group that showed increases KIM, Urea and creatinine. the lipid profile results showed significance increase ($p \leq 0.05$) in Cholesterol,TG and LDL in the second group which administrated adenine while HDL was decreased in the same group. . the results showed significance ($p \leq 0.05$) decrease in the GSH, SOD and increase in the MAD and No in the second group. Spirulina powder showed significance enhancement in the most of parameters which studied to return near to the control group.

Keywords: *Spirulina, Antioxidant, adenine–induced chronic renal failure.*

Introduction

Kidneys are efficient organs that represent the main control system to maintain homeostasis of the body. They are affected by various chemicals and drugs that may do effect the functions[1].

Kidney disease is one of the reasons that lead to the reduction quality of individual life in now days[2]. The kidneys of human are mainly participatory in liquidation and concentrating various materials and chemical factors that may reach a rise concentration and turn into toxics[3]. Renal failure (RF) is considered pathologically deadly because of serious hormonal and metabolic disturbances. Whereas some models of animal renal failure are used to evaluate the pathogenic damage of organs pathogenesis[4]. Chronic renal failure (CRF) results from irreversible and progressive damage of wide numbers of functioning nephrons. Renal toxicities, glomerulonephritis, and diabetic nephropathy may promote oxidative conditions, increase susceptibility of acute renal failure.[5] The free radicals one of causes .that lead to kidney failure. Oxidative stress is known as a main pathological process in renal failure which activates various pro-inflammatory cytokines and growth factors, finally leads to glomerulosclerosis, tubule-interstitial fibrosis, tubular cells apoptosis and senescence, as well as deactivated cellular regenerative pathways [6]. Spirulina are indicated to filamentous free-floating microalgae with spiral characteristics of its filaments. It is officially called Arthrosporia sp powderspirulina have anti-oxidant properties and scavenge the free radicals' duo to that effect in hepatic and renal failure induced rats [7].

Corresponding Author:
Waleed Khaled Yonis
M.Sc. Student, College of Veterinary Medicine,
University of Karbala, Karbala, Iraq
e-mail: waleed.k@s.uokerbala.eda

Material and Method

Experimental Design: Using Healthy adult 24 male rats (11-12 weeks old, weighting initially 150-200 gm, divided equally and randomly in to four groups.

The first group (control negative) animal of this group will receive normal saline orally and the second group (control positive) rats in this group will treated with spirulina (750 mg/kg) orally for 30 days and the third group animal of this group will gavage with adenine orally(100mg/kg) for 30 days to induce renal failure and the fourth group animal of this group will co-administrated adenine (100mg/kg) intraperitoneal and spirulina powder (750 mg/kg) orally for 30 days. After 30 days of experiment animals will anesthetized and blood will collect via cardiac puncture then after animal will sacrificed to isolate liver and kidney in order to measure.

Parameter of study was:

Kidney function measured of (KIM-1,Urea and creatinine) according to manufacture (south Korea).

Lipid profile measured of (Cholesterol, TG, LDL and HDL) according to Fasce, 1982.

Liver function parameter of (AST and ALT) is determined by using a special kit (SPECTRUM AST – kit, Egypt- IFUFCC22 andSPECTRUM ALT – kit, Egypt- IFUFCC25).

Antioxidant of parameter (MAD, GSH, SOD and NO) the (MAD) was done according to [9], while parameter done by[8], the parameter done according to[10] and the (SOD) parameter. The procedure was done according to the instructions of the manufacture of ELIZA Kit -Elabscience biotechnology/china.

Result and Discussion

The data was statically analyses by using SPSS program by use one way ANOVA and differences between mean were compared with the least significant difference (LSD).[11]

Table (1): The Effect of spirulina powder on kidney and liver function Parameters in Male Rats with induced chronic renal failure means ± SD

Parameters / Groups	KIM Mg/dL	UEAR Mg/dL	CEART Mg/dL	AST U/ml	ALT U/ml
Control	C116.04±1.998	C21.33±0.881	C0.26±0.043	C95.16±33.408	C45.50±2.77014
Adenine	A395.27±18.78	A71.16±4.26	A3.49±0.20	A325.83±40.21	A102.83±13.961
Spirulina and adenine	B175.86±8,96	B37.16±4.57	B1.81±0.20	B145.16±51.077	B68.33±7.99
Spirulina	C106.10±1.99	C26.50±4.20	B1.47±0.09376	C94.16±46.70	C54.16±5.47
LSD	12.03	6.23	0.46	46.8	12.3

N = 6 significant different between tow groups noted by letters (P≤ 0, 0 5)

A transmembrane protein with 90-kDa molecular whight called Kidney Injury Molecule_ 1 KIM-1. is over expressed found in proximal tubules o f in rat and has an important role in repair epithelial layer of renal tubule in rat kidney with ischemic injury[12,13]. KIM-1 considered a remarkable biomarker for acute renal tubular kidney damage[14]. The existing study accept with other previous studies[15-17] . Aguiar et al.,(2015)[18] who found rise of kim-1 concentration, in induction chronic renal failure in male rats, also[19,20], who reported elevation KIM-1 in patients with CRF in humans by comparison with control groups On the other hand, co-administration of spirulina powder with adenine in the present study causes a significant enhancement of the renal function indicators. Our results in coordinate with that reported by Gargouri et al., (2018)[21] who found that spirulina protects neonate rat from leads-induced nephrotoxicity via its antioxidant properties. This enhancement in KIM, urea and creatinine Might be attributed to ability of phycocyanin (a biliproteins pigment found in spirulina components) to the accelerated regeneration of tubular malfunction that caused by adenine or due to a diuretic activity of the phycocyanin[23]. In addition, Abdel-Daim (2014)[22] reported that the presence potassium in alga which in turn possess a diuretic effect. beside, spirulina alga rich in flavonoids that can demonstrate the increase of diuresis because flavonoids cause polyuria as[24].

Table (2): The spirulina powder Effect on biomarker of lipid profile in Male Rats with induced chronic renal failure means ± SE.

Parameters / Groups	Chloe, (mg`/dL)	Triglycerides,(trig) (mg`/dL)	Low density, lipoprotein, (LDL) `(mg/dl)	High _density lipoprotein, (HDL) (mg/dl)
Control	D115.16±17.96	C46.36±3.59	B110.06±8.33	B31.16±2.023
Adenine	A217.16±13.58	A175.00±11.80	A198.16±10.06	C17.50±2.5
Spirulina and adenine	B171.66±14.63	A167.50±12.15	B107.50±6.91	BC23.09±2.89
Spirulina	C138.33±10.39	B73.83±4.96	C68.00±5.30	A42.11±2.023
LSD	9.74	5.28	4.33	3.45

N=6 Significant different between two groups noted by letters (P≤ 0, 0 5)

Analysis of variance in the found study revealed significant increase in Cholesterol, TG and LDL level in the group of male rats injected intraperitoneally with adenine in comparison with control and other treated groups and our results in agreement with that reported by Ghelani et al., (2019)[25]. Elevation of LDL in serum of rat with adenine induced chronic renal failure, may be resulted from the downregulation of LDL receptors in responses to chronic renal failure[26]

According total cholesterol increment in the present study could be occur as a result of the acceleration biosynthesis of cholesterol throughout the up-regulation of enzyme called HMG-CoA reductase [28] other explanation to rise cholesterol levels is due to a relative decrease of elimination of cholesterol via liver due to down-regulation of enzyme called cholesterol 7 α-hydroxylase (CYP7A1) in animals undergoing chronic kidney disease [30].

Elevation triglyceride in the blood of chronic kidney disease patients are most common among lipid abnormalities[31-33]. In addition, expression and activity of hepatic lipase protein is also reduced in rats with chronic kidney disease[34]. Treatment with spirulina along that showed decreases significantly in serum of LDL,Cholest and Trigly when comparative with group adenine . The HDL level significantly increase when comparative with group adenine .in this study reported with other study(Bhat et al.,2020). The hypo-lipaemic ability of spirulina was also reported in mice with alloxan-induced diabetes represented by reduce triacylglycerol and LDL as well as increase in HDL levels [37]. The enhancement of lipid profile could be occurs secondarily to activation of AMP-activated protein kinase signaling pathway which lead to downregulates the gene expression that involved in synthesis of lipid such as 3-hydroxy-3-methyl glutaryl coenzyme A reductase, Sterol regulatory transcription element binding factor-1c, and acetyl CoA carboxylase [35]. Moreover, spirulina has ability to change alter microbiota of gut to lowering effects of lipid via increase count. Studies have revealed an increase in abundance of Prevotella, which in turn increases metabolism of bile leading to reduce lipid levels in the blood. Formicates are another group of bacteria which have ability to reduce serum LDL concentrations, which improved with spirulina supplementation.

Table (3): The Effect of spirulina powder on Antioxidant Activity liver of Male Rats with induced chronic renal failure means ± SD

Parameters / Groups	GSH Ng/ml	SOD Ng/ml	MAD µM/l	No. µM/l
Control	A9.82±1.13	A41.43±8.12	C82.44±12.21	C170.15±27.16
Adenine	C6.27±1.08	C24.83±4.53	A118.61±18.13	A195.27±11.92
Spirulina and adenine	B8.19±0.21	B34.64±3.68	B100.23±22.09	B181.42±13.12
Spirulina	A10.16±1.23	A38.90±4.51	C79.86±19.65	C171.83±10.21
LSD	1.21	4.11	13,74	9.18

N-6

Superoxide dismutases (SOD) is actually the firs`t detoxifying enzymes in the cell and therefore the most effective antioxidants. It is considered as an The endogenous antioxidant enzyme is essential,which acts as First line part protection mechanism against reactive oxygen species ROS[39-40].

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Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the College of veterinary Medicine and all experiments were carried out in accordance with approved guidelines.

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