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Biochemical Study to Assess the Level of Galectin-1 in Type Π Diabetic Patients with Renal Failure Undergoing Hemodialysis

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ABSTRACT

Backgrounds: Renal failure is a general problem worldwide as millions of patients are diagnosed each year and many deaths are caused by this disease. Renal failure is the fourth cause of death in the world, in general, it means a deterioration in the ability of the kidneys to perform their functions or a decrease in the glomerular filtration rate. Therefore, wastes accumulate, and symptoms of renal failure appear and are either acute or chronic. The prevalence of kidney failure is estimated at about 16% worldwide and it is believed that the number of injuries reaches 69.9 million in 2025 unless urgent preventive measures are taken. Renal failure is one of the complications of diabetes, as in 50% of people with diabetes it is considered a chronic disease characterized by high glucose sugar in the blood as a result of decrease of insulin secretion or poor mechanical representation or both.
Subjects: The current study included 88 people who were divided into two groups: the first included 50 patients suffering from kidney failure (18 females and 32 males), their ages range between (36-78 years) and they are subject to dialysis, while the second group included 38 individuals (11 females and 27 males) their ages range between (31-64 years), as a control group. **Aim of study**: The current study is designed to find out the levels of Galactin-1 in the sera of study individuals.
Results: The present study shows a significant increase ($p<0.05$) in the levels of Galactin-1 in the diabetic kidney group compared with the healthy group.
Conclusions: Kidney complications of type Π diabetes can develop in the patients regardless their gender or age. Galectin-1 is an excellent diagnostic tool for diagnosing kidney failure caused by the complications of diabetes and for predicting the kidney's efficiency to perform its vital functions.

Keywords: Diabetes patient, Mobile application, Primary health care.

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INTRODUCTION

Galectins were discovered about 1975 based on their galactoside-binding activity, in a quest to find proteins that decode complex cell surface glycans to take part in cell adhesion[1]. They were defined and named in 1994 based on conserved β-galactoside[2]. Galectins are a family of soluble proteins that are widely distributed in nature and bind to a variety of glycoproteins.

They are involved in highly important processes at the molecular and cellular level in human cutaneous and extracutaneous tissues [3], and they exert biological effects of paramount importance through their interaction with cytoplasmic and nuclear proteins and the components of the cell surface and extracellular[4].

The function of galectins varies with their tissue-specific and sub-cellular location, and their binding to carbohydrates makes them key players in several intra- and extracellular processes where they bind to glycosylated proteins and lipids. In humans, there are 12 identified galectins, some with tissue-specific distribution. Galectins are found inside cells and in the nucleus, cytosol, and organelles, as well as extracellularly [5].

Galectin-1 (a non-covalent dimmer) consists of two subunits of 14.5 kDa (135 amino acids) present in a dynamic dimmerization equilibrium [6]. Although this protein binds preferentially to glycol conjugates containing the ubiquitous, disaccharide N-acetyl lactosamine (Gal β1-3/4 GlcNAc), binding to individual lactosamine units is of relatively low affinity[7]. Galectin -1 is released from adipose tissues, stromal cells in the thymus, lymph nodes, endothelial cells, and placenta cells [8].

Galectin -1 is associated with a variety of cellular processes, including cell proliferation, T-cell apoptosis interestingly, in type one diabetes, T-cell-mediated autoimmunity destroys insulin-producing pancreatic β-cells.Galectin-1 is suggested to have a role in improving glucose metabolism in obese people, in addition; galectin-1 level is higher in obese children than in normal-weight children. Galectin-1 has a potential to be used as an inhibitor of inflammation-related diseases such as diabetes[8].

Material and Method

During the extended period from the beginning of August 2019 to the end of January 2020, 88 residents of Al-Najaf Al-Ashraf Governorate were enrolled to participate in the current study. Fifty diabetic patients with renal failure were included in the present work, initial diagnosis of the injury type was completely performed by specialist physicians in Al-Najaf Al-Ashraf Governorateand through several of clinical and laboratory tests.

According to the questionnaire approved in the current work and designed according to the opinion of specialists, which includes information on the following: age, gender, place of residence, the duration of the first symptoms of the diseases, other diseases experienced by patients, treatments used by the patients, and family history. Full information was provided on the patients of the present study through oral interviews with patients and in cooperation with the supervising physicians.

Selection of healthy individuals as a control group (38 individuals) based on several criteria; included: non-smokers, no medical history of any gastrointestinal or

urinary disorder, individuals should not take any medication and have not undergone surgical through last years, and a subjective perception of good health as determined by health questionnaire. More than, control group might at approximate age range with the patient's group, no alcohol drinking, with similar food style to patients' group.

After obtaining the required official approvals and recording the current study in the annual plan of the Ministry of Health, samples of renal failure were collected from patients registered for treatment at the center of kidney disease and transplantation - AL- Sadder dialysis center in Al-Sadder Medical City in al- Najaf after completing the clinical diagnosis process by specialist doctors and during dialysis.While the other infected samples were collected from Al- Hakeem Hospital in Al-Najaf Al-Ashraf Governorate.

The control group samples were collected from the experimental environment after ensuring the adequacy of the criteria specified in this study. Concentration of serum Galectin-1 was measured using Sandwich ELISA method.

Result and Discussion

Galectin-1 concentration was elevated in the patient's group when its level examined in the sera samples of study individuals. Highly significant difference ($p<0.05$) was noticed at the two study's groups were compared together, as illustrated in **Table 1**.

Table 1: Levels (Mean ± S.D.) of Galectin-1Concentration (ng/mL) in the Sera of Tumors Patients and Controls Subjects

Study Groups (n)	Galectin-1 Concentration (ng/mL) Mean ± S.D.	Min.-Max. Range	p-value
Diabetic Patients (50)	10.029±2.118	2.975-21.775 18.8	0.000
Healthy Controls 38	5.006±0.812	2.025-8.250 6.225	

The mean difference is significant at the 0.05 level

Although **Table 2** showed an increase in the concentration of galactin-1 in the subgroup of male patients, the ANOVA test failed to demonstrate a statistically significant difference in the levels of galactin-1 between both sexes in the group of type Π diabetics subjects with renal failure who undergoing dialysis ($p=0.084$) or in a group of healthy individuals($p=0.451$).

Table 2: Levels (Mean±S.D.) of Galectin-1Concentration (ng/mL) in the Samples of Study Individuals

Study Groups (n)	Gender (n)	Galectin-1 Concentration (ng/mL) Mean ± S.D.	Min.-Max. Range	p-value
Diabetic Patients (50)	Male 32	11.525±2.313	3.275-21.775 18.5	0.084 For 1 vs 2 0.000 For 1 vs 3 0.451 For 3 vs 4 0.000 For 2 vs 4
	Female 18	9.547±1.578	2.975-15.6 12.625	
Healthy Controls 38	Male 27	5.787±0.568	2.925-7.475 4.55	
	Female 11	4.285±0.817	2.025-8.25 6.225	

1: Diabetic Male Patients with Renal Failure,2: Diabetic Female Patients with Renal Failure,3: Healthy Male Control, and 4: Healthy Female Control.The Mean Difference is Significant at 0.05 Level

Significant differences were recorded when the individuals with the same sex in the two studied groups were compared together, as illustrated in **Table 2**. Practical observations showed that the lower concentration of galectin-1 (2.025 ng/mL) was recorded in the healthy female with 49 year-old, while the highest concentration of galectin-1 (21.775 ng/mL) was noticed in the sample of women patient at 57 years of age.

Galectins are one of most important members of the lectin families. Among this lectin family, galectin-1 is synthesized and secreted by a number of cells, including activated T cells[9]. Many previous studies indicated that the levels of lectin were investigated in many pathological conditions, and there was a change in the levels of many of them. It was observed that these changes were synchronized with disease progression, patient age, and injury severity [10,11].

In the last decade, the galectin family has received great attention due to its close association with many inflammatory and cancerous diseases, including in particular, as many of them have been recorded as neoplastic functions in a number of cancers[12,13].

Moreover, a recent study showed that galectin-3 in particular has pivotal roles in renal cell carcinoma and renal fibrosis, moreover; cardiac diseases leading to renal impairments, as it was observed that the high levels of galectin-3 coincided with a decrease in the kidney's ability to perform its vital functions with a significant development of ESRD [14]. A recent study proved that galectin-1 is a major contributor to the development of nephropathies in patients with type 2 diabetes [15]. Al-Obaidi and others have found in an independent study that levels of galectin-1 increase in the subcutaneous tissues of patients with type 2 diabetes [16], on the other

hand, galectin-1 was found to have an effective anti-inflammatory role and reduce of oxidative stress [17,18].
Only one study has been performed to evaluate galectine-1 in patients with type diabetes [19], and although the results of this study are consistent with the results of the current study, but Fryk *et al.* study was unable to determine whether the high level of galectin-1 was caused by type II diabetes or as a result of increased fat tissue mass in conjunction with an increase in body mass index, so it get to little about the relationship between galectin-1.
As far as the literature searches, no study was found to include the evaluation of this form of galectin-1 in the sera of patients with renal failure due to complications of type 2 diabetes who are undergoing dialysis.

Conclusions

Kidney complications of type II diabetes can develop in the patients regardless their gender or age. Galectin-1 is an excellent diagnostic tool for diagnosing kidney failure caused by the complications of diabetes and for predicting the kidney's efficiency to perform its vital functions.

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