Relationship Between Conductivity Of Erythrocytes Suspension And Some Variable After And Before Treatment With New And Used Antioxidants For Rabbits With Induced Diabetic

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Abstract

Diabetes mellitus (DM) is associated with hyperglycemia and oxidative stress. Oxidative stress which indicates the imbalance between reactive oxygen species (ROS) and defensive antioxidants system. In this work we study the relation between the conductivity of washing solution of erythrocyte membrane with induced diabetic rabbits (n=3) compare with rabbits control (n=3) after and before treatment with following antioxidants aspirin (n=3), Vitamin C (n=3) and with new derivative 4(1,2-di hydro -4,6-dihydroxy pyrimidine -2- yH thio)-3-hydroxy-5-(2,2-dimethyl-1,3-dioxolan-4-yl) furan-2(5H)one (3A) which believed as antioxidants, The results shows the conductivity of washing solution of erythrocyte membrane in diabetic rabbits a significant increased(p<0.000) as compare with control group and a significant decreased in treatment groups with aspirin, GSH, Vit C, and 4(1,2-di hydro -4,6-dihydroxy pyrimidine -2- yH thio)-3-hydroxy-5-(2,2-dimethyl-1,3-dioxolan-4-yl) furan-2(5H)one.

Introduction

Diabetes Mellitus(DM) is not one disease but rather is a heterogeneous group of syndrome characterized by elevation of fasting blood glucose caused by inadequate release in insulin as aggravates by an excess of glucosones (Ameerha et al.,2011). Type 1 diabetes is the consequence of an autoimmune-mediated destruction of pancreatic β-cell, leading to insulin deficiency. Patients require insulin treatment for survival (Ahamed,2005). Type 2 diabetes is characterized by insulin resistance and/or abnormal insulin secretion. Individuals with type 2 are not dependent on exogenous insulin, but may require it for control of blood glucose levels if this is not achieved with diet alone or with oral hyperglycemic agents (Masur et al.,2008). Long term diabetes mellitus, usually associated with a state of chronic hyperglycemia, results in dysfunction and failure of various organs especially the eyes,kidneys,nerves,heart and the blood vessels. This causes dreaded complications which increases the mortality among the diabetes (Ayas et al.,2011). During diabetes persistent hyperglycemia causes increased production of free radicals especially reactive oxygen species(ROS)(Moussa,2008). Oxidative stress defined as a measure of a steady levels of oxygen species (ROS) or oxygen radical in the biological system(Ayas et al.,2011).Reactive oxygen species (ROS) are products of natural oxygen metabolized oxygen. The balance between production and disposal oxidant molecules is essential for tissue homeostasis. Increased rate of free radical production or decreased rate of removal leads to free radical accumulation and cellular damage (Ahmed et al., 2010). Erythrocytes are particulary sensitive to oxidative damage due to presence of fatty acid.

الخلاصة

يربط مرض السكر مع ارتفاع سكر الدم ، دلالة على ارتفاع جهد الأكـسدة والذي يؤدي إلى حالة عدم التوازن بين اصناف الأوكسجين الفعالة وتفاعلات مضادات الأكسدة . تم في هذا البحث دراسة علاقة التوصيلية لعائل كريات الدم الحمراء للازاب المستحث بإث مرض السكر (n=3) مقارنة مع مجموعة السيطرة (n=3). قبل وبعد العلاج بمضادات الأكسدة والتي هي الأسيرين (n=3)، (4(1,2-di hydro -4,6-dihydroxy pyrimidine -2- yH thio)-3-hydroxy-5-(2,2-dimethyl-1,3-dioxolan-4-yl) furan-2(5H)one (3A) وذلك لقياس التأثيرات على كريات الدم الحمراء للازاب المستحث فيها السكر تزداد زيادة ملحوظة مقارنة مع مجموعة السيطرة. (الختام ملحوظ) بعد العلاج بالاسيرين ، وكلوتاثيون، وفيتامين C و المشتق 3-4(1,2-di hydro -4,6-dihydroxy pyrimidine -2- yH thio)-3-hydroxy-5-(2,2-dimethyl-1,3-dioxolan-4-yl) furan-2(5H)one (3A).
content in their membranes and high cellular concentrations of oxygen and hemoglobin. Erythrocyte damage includes changes in membrane protein and lipid structure which in turn induced alterations in external surface of the cell (Jihan et al., 2011). This study is subjected to evaluated the conductivity in diabetic mellitus after and before treatment with aspirin, GSH, Vitamin C and 4(1,2-di hydro -4,6-dihydroxy pyrimidine -2- yH thio)-3-hydroxy-5-(2,2-dimethyl-1,3-dioxolan-4-yl) furan-2(5H)one (3A) new prepared compound, which are used as antioxidant agent in this work (Fairs et al., 2010).

Material and Method:
1-Experiment Animals:
1- Eighteen rabbits (male & female) were selected for the study
2-The rabbits were used in the experiments have weight on an average weight of 1.5 Kg.
3 -Induced Diabetes Mellitus: the rabbits were injected with alloxane (2,4,5,6-tetraoxyhexa hydro pyrimidine Alloxane was freshly prepared (150 mg/Kg), into the vein to induced the diabetes in the rabbits after fasting 12 hr. Alloxane was freshly prepared (150 mg/Kg). The rabbits given oral with 15% glucose solution after (4-6) hr dose of alloxane and the animals had taken 5% glucose with tap water for the first day only. Then left to relief and to eat enough after 72 hr. The rabbits had diabetes were indicated by the positive glucose test in blood glucose more than 200 mg/dL.

2-Experiment Stratage
The rabbits were divided into six groups after to injected with alloxane.
G1 : control group (n=3) was feded to the control diet.
G2 : treatment group (n=3) with induced diabetic.
G3 : treatment (n=3) with aspirin(300mg/kg).
G4 : treatment (n=3) with GSH(50mg/kg).
G5 : treatment (n=3) with vitamin C(50mg/kg).
G6 : treatment (n=3) with 4(1,2-di hydro -4,6-dihydroxy pyrimidine -2- yH thio)-3-hydroxy-5-(2,2-dimethyl-1,3-dioxolan-4-yl) furan-2(5H)one(3A) (8), (50mg/kg).

Blood samples were collected after 8 weeks from the beginning of experiment, with fasting condition and treatment.

3-Determination of Conductivity (Nabila, 2010)
Blood is the most accessible sample one can obtain for analysis. Its consists of 45% cells and 55% plasma. Red blood cells constitute 99% of its cellular components. They mainly govern the blood behavior either rheologically or electrically. RBC is a biconcave enucleated cell containing hemoglobin molecules. Several types of analysis can be used to measure the dielectric properties of cell suspensions.

Procedure:
1-Red blood cells were prepared by centrifugation at 500 X g for 5 min. The plasma and Buffy coat were removed by aspiration.
2-The above solution were washed twice with normal saline (pH=7.4) and separated by centrifugation at 500 X g for 10 min.
3- The red blood cells were resuspended in buffered saline.
4- The samples were incubated in water bath at 37°C for ( 10 min. ), then the conductivity was measured by using the instrument of conductivity (WTW Inolab 740).
5- The conductivity of using conductivity (WTW Inolab 740) the suspension of erythrocyte was measured.
Results and discussion:-
There was listed in table 1 show the conductivity of erythrocyte suspension before and after treatment with aspirin ,GSH ,Vitamin C and 4(1,2-dihydro-4,6-dihydroxy pyrimidine -2- yH thio)-3-hydroxy-5-(2,2-dimethyl-1,3-dioxolan-4-yl) furan-2(5H)one(3A).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean ± S.E</th>
<th>P-value</th>
</tr>
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<tbody>
<tr>
<td>Group 1*</td>
<td>0.4333± 0.18559</td>
<td>0.000</td>
</tr>
<tr>
<td>Group 2**</td>
<td>11.333± 1.85592</td>
<td>0.047</td>
</tr>
<tr>
<td>Group 3</td>
<td>6.9000± 2.1221</td>
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</tr>
<tr>
<td>Group 4</td>
<td>0.7000± 0.25166</td>
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</tr>
<tr>
<td>Group 5</td>
<td>0.8333± 0.11798</td>
<td></td>
</tr>
<tr>
<td>Group 6</td>
<td>2.1667± 0.96751</td>
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</tbody>
</table>

*: mean a significantly related of group 2 or group 3 with group 1.
**: mean a significantly related of group 3 or group 4 or group 5 or group 6 with group 2.

Table 1 shows the level of suspension erythrocyte conductivity of diabetic rabbits comparison with control and treatment groups . There were a significant increased (p< 0.000) as compare with control group and a significant decreased (p<0.047) , (p<0.000) , (p<0.001) in treatment groups with aspirin , GSH ,Vitamin C and with 4(1,2-dihydro-4,6-dihydroxy pyrimidine -2- yH thio)-3-hydroxy-5-(2,2-dimethyl-1,3-dioxolan-4-yl) furan-2(5H)one (3A) respectively as compared with diabetic rabbits. In other study illustrate that the conductivity is significantly increased in the diabetic patients (IDDM,NIDDM) when compared with control subjects. The higher level of conductivity in diabetic rabbits than in control group due to the oxidation of hemoglobin molecules leads to unfolding of the globular protein with the formation of a new group exposed to the surface besides the polar hydrophilic groups and consequently increasing electrical conductivity .This indicates the increase in the overall charge of hemoglobin molecule due to the increase in the free radical production (Moussa,2008) . In 1999 Hillier et al. (Desouky,2009) reported that hypo and hyperglycemia excursion lead to changes in the electrolyte balance in blood cells and interstitial fluid in the healthy subjects and in patients with diabetes. These variations cause changes in the red blood cells membrane potential which can be estimated by determining the conductivity of the cell membranes. (Desouky,2009) , The same results was reported by (Tura et al.,2007) who found that glucose is able to directly affect the impedance of the blood. In this study we use in the treatment GSH, Vitamin C , aspirin and 4(1,2-di hydro -4,6-dihydroxy pyrimidine -2- yH thio)-3-hydroxy-5-(2,2-dimethyl-1,3-dioxolan-4-yl) furan-2(5H)one (which believed as antioxidant according to the results in this study) , which repair the permeability of cell membrane by decreasing the oxidants that is significantly clear in
decreased the level of conductivity after treatment with antioxidants according to the ability of its to scavenge free radicals. Treatment with acetyl salicylic acid (ASA) is accepted therapeutic approach for preventing vascular damage in diabetic mellitus. Antiplatelet agent (ASA) has been documented to exert beneficial effects in the evolution of diabetic retinopathy and to protect against cataract. Anti-inflammatory and Haemostatic (antithrombotic) effects of ASA may be due to inhibition of cyclo oxygenase, increased production of lipoxides, protein acetylation and antioxidative action. In both human and experiment diabetes, ASA has been shown to inhibit protein glycation by acetylation of free amino groups, ASA lower concentration of glucose and attenuated oxidative stress (Zavodnik et al., 2011). In other study was indicated the beneficial effect of ASA on type 1 comparison with untreated rats, ASA treatment was improved blood glucose, insulin secreting, weight, antioxidants system, lipid profile, liver enzyme and respiratory chain complexes (I,II) (Ashori et al., 2009). In this study we found that ASA a significantly decreased (p<0.047) administration conductivity of suspension erythrocytes compare with untreated group.

Vitamin C plays a central role in the antioxidant protective system, protecting all lipids undergoing oxidation and diminishing the number of apoptotic cells. Furthermore, vitamin C regenerates the oxidized vitamin E (Aysel et al., 2009). In other study Borcea et al.,(Nadar et al., 2009), have demonstrated that vitamin C supplementation improves the consumption of glucose in diabetic patients. Additionally, it has been proposed that vitamin C therapy improves \( \beta \)-cell function and tissues, insulin resistance, increase insulin plasma and can lower blood glucose and glycated hemoglobin levels. The vitamin C supplementation may improve the antioxidant defense due to improve the level of blood glucose, (Nadar et al., 2009). In our study we found the treatment with vitamin C lead to a significant decreased (p<0.000) in the level of conductivity of suspension erythrocytes compare with untreated group. Reduced glutathione (GSH): is one of the major constituents of the erythrocytes and plays an important role in providing protecting against oxidative damages. The antioxidant function of the tripepted is related to oxidation of the thio group of its cysteine residue with the formation of disulfide (GSSG). Diabetic state has been shown to be associated with an increased oxidative stress (Rizvi et al., 2001). In this study we found that treatment with GSH was lead to a significantly decreased (p<0.000) in the level of conductivity of suspension erythrocytes of diabetic rabbits compare with untreated group. Also in this study we used 4(1,2-di hydro- 4,6-dihydroxy pyrimidine -2- yH thio)-3-hydroxy-5-(2,2-dimethyl-1,3-dioxolan-4-yl) furan-2(5H)one, in treatment of diabetic rabbit which lead to a significantly decreased (p<0.001) the conductivity of suspension erythrocytes compare with untreated group.

**Conclusion:**

The observation in diabetic rabbits increasment the level of Conductivity is the powerful indicators to evaluate the oxidative stress syndromes in diabetic rabbits induced with alloxane compare than the control rabbits, also we examined in this study we use aspirin, GSH, vitamin C, and 3A as antioxidant for free radicals in the treatment of diabetic rabbits groups, and the level of conductivity is improved after treatment.
Reference