Beneficial role of quinoa and *Nigella sativa* seeds as antihyperuricemia in rats

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**ABSTRACT**

This research targeted to evaluate the effect of Quinoa seed (QS); *Nigella sativa* seeds (NSS) and their combination on hyperuricemia. Thirty male albino rats assigned to five groups (n=6). The first these fed on the standard diet as normal control rats. The other rats (n=24), received a basal diet including a 20g /kg diet potassium oxonate to create hyperuricemia. Then ill rats divided into four groups. The hyperuricemic control group and three groups treated with added to their diet 10% QS; 4% NSS and mix from10% QS plus 4%NSS respectively. After that, the researcher calculated the biological status and estimated biochemical analysis. The results appear that high uric acid groups, in which feeding remedy diets showed no significant variation in biological parameters compared with the normal rats. The same groups indicated a significant improvement in renal function when compared with the injury group. Likewise, rising kidney tissues antioxidant status "superoxide dismutase; catalase and glutathione transferase" and decrease "malondialdehyde and interleukin-1 (IL-6)". Also, the mixture diet increased antioxidant activity. This study concluded that QS and NSS may improve kidney function and may reduce oxidative stress. This article recommended that special meals of hyperuricemic patients supplemented by a blend of QS and NSS.

Key words: quinoa seed, *Nigella sativa* seed, Hyperuricemia
INTRODUCTION

Hyperuricemia is one of the evident spread of metabolic diseases in populations. It is famous for the rise of uric acid levels in the blood (Chen et al., 2009). This phenomenon may give an increase to problems, like gout (pilling up of uric acid crystals in the joints, especially in toes or fingers) and renal stones or kidney failure (Kaneko et al., 2014). Uric acid is the finished output of purine metabolism. Purines synthesized within the cells of the body. Also, it obtained from foods, which compounds containing nitrogen. Purines perhaps accumulate in tissues, forming crystals. These crystals lead to severe inflammation and cause tissue damage known through articular cartilage ulceration osteophytes and erosive lesions (Corrado et al., 2006).

Some cereals play a primary role in new lifestyles; to face consumer requests due to their physiological and metabolic advantage. Grain consuming has outspread from the breakfast list to any time of the day. These products have become an excellent way to insert functional food into the diet of consumers. Quinoa seed (QS) contains high biologically valuable "proteins, low glycemic index carbohydrates, phytoestrogens, and omega-3 and 6 fatty acids" that are beneficial to human health (Farinazzi-Machado et al., 2012 and Ruini et al., 2015). It has notable nutritional distinctive characteristics; not only from its protein content (15%) but also of its significant balance in amino acids (Abugoch, 2009) with the highest percentage of lysine (5.1% -6.4%) and methionine (0.4% - 1.0%) contents (Jacobsen, 2003 and Jancurova et al., 2009). Some researchers have suggested that QS may increase the secretion of immune substances called cytokines, which can be beneficial for both preventing and treating inflammation (Yao et al., 2014).

Nigella Sativaseed (NSS) is a very rich antioxidants source
ells influences many biological activities (Rahmani and Aly 2015). Thymoquinone is the main active ingredient of NSS; as an antioxidant item and has anti-inflammatory properties (Mahmoud et al., 2019). NSS had numerous biological actions like many anti-cancer, anti-inflammatory, cardiovascular, renal, immunomodulatory, and anti-diabetic properties. Also, it acts as an antimicrobial, parasitic, and an antihypertensive. Besides its widespread use for the treatment of many diseases such as bronchitis, diarrhea, rheumatism and skin disorders (Bamosa, 2015).

The current research is a trial for evaluation of effective role of QS and NSS to mitigation hyperuricemia in experimental rats.

**MATERIALS & METHODS**

**Materials:**

The experimental seeds (QS and NSS) brought from the agricultural research center, Giza, Egypt. Quinoa seeds were washed for 20 minutes with tap water to eliminate toxic saponins and then dried at 45 °C for 12 hours. These seeds were grinded in an electric blender into a fine powder, then packed in plastic bags and stored in the deep freezer until used for diet supplementation.

**Chemicals:**

Potassium oxonate gotten from El-Gomhorya Company, Cairo, Egypt, Kits utilized for biochemical analyses fetched from Gamma Trade Company, Cairo Egypt.

**Animals:**

Thirty male albino rats of Sprague Dawley strain purchased from "Laboratory Animal Colonies, Pharmacology Department Faculty of Medicine, and Mansoura University"; the average weight was 120 ± 10g. Animals fed a standard/basal diet and water ready as needed. The rats left for 7 days to adapt according to (Guidelines for ethical conduct in the care and use of animals in research obtained from the...
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concerned department in Mansoura University).

Standard Diet:
Basal diet was prepared based on AIN 1993 (Reeves et al. 1993).

Methods:
Chemical analysis:
The gross constituents of seeds as moisture, protein, fats and ash were estimated in accordance with (A.O.A.C. 2005) whereas carbohydrates were calculated by deduction. Minerals content including zinc (Zn), iron (Fe), sodium (Na), manganese (Mn), magnesium (Mg), cupper(Cu) and calcium(Ca) were determined according to (Chapman & Pratt, 1978)

The experimental design:
After acclimation on a basal diet for seven days rats classified into two groups. The first (n= 6) left as the normal control group, fed on standard diet. The second group (n= 24) rats were fed on basal diet contains 20g /kg diet potassium oxonate for 42 days to induce hyperuricemia as pointed by Mazzali et al., (2001). The uric acid level was measured for all rats at begin experiment and after six weeks of taking potassium oxonate to confirm the occurrence of hyperuricemia. A high uric acid was found in all rats that took potassium oxonate. Hyperuricemic rats classified into 4 groups as following: Hyperuricemic as a positive control group fed on a standard diet and water ad-libitium. Quinoa seeds group: received a basal diet containing 10% QS according to (Ruales et al., 2002) with an adjustment in the method by half the dose and double the duration. Nigella sativa group: intake on basal diet and 4% NSS. Mixed seeds group: fed on a basal diet containing 10% QS with 4% NSS according to EL-Bahay et al., (2007).

Biological items:
Daily feed intake (FI), protein intake (PI) and weekly body weight gain (BWG) werecalculated. Feed efficiency
ratio (FER) and protein efficiency ratio (PER) were specified according to the method of (Chapman et al., 1959).

At the ending of the trial term (35days), all rats were fasted overnight before sacrificing. Blood samples were taken from hepatic portal vein, one part was used for different determination and the rest blood was left in a centrifuge tube at room temperature for 15 min and then centrifuged at 4000 rpm for 10 min to obtain serum. Serum was separated in plastic vials and stored at -20C until analysis. Then, kidney were taken and homogenized in super cold 0.1M phosphate buffer at pH 8.0 (1: 4 w/v) using a homogenizer. Homogenate kidney was centrifuged at 4000 rpm for 15 min and supernatants were gathered to estimate antioxidants enzyme.

**Biochemical analysis:**

Determination of kidneys function “creatinine, urea and uric acid” were done according to Bonsens and Taussky(1984), Patton and Crouch(1977) and Fossati et al., (1980). Total protein, albumin and globulin were determination as described by method of Weichse Ibauml (1946), Bartholomev and Delany (1966) and Coles (1974) respectively. An antioxidant enzyme in kidney tissue such as “Superoxide dismutase (SOD); glutathione peroxidase (GPXs); glutathione transferase (GST) and catalase (CAT)” estimated as the method mentioned by Beuchamp and Fridovich (1971); Tapple (1978); Moran et al., (1979) and Cohen et al.,(1970). But, malondialdehyde determined according to Uchiyama and Mihara, (1978). Hemoglobin and packed cell volume were determined according to Drabkin, (1949) and McInory (1954). Whilst, immunoglobulin G and M (IgG and IgM) were determined by direct ELISA according to Manohars and Selvakumaran, (2012). Interleukin-6 (IL-6); IL-6 levels in kidney tissue homogenate was determined by using Rat IL-6 Immunoassay kit.
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from R&D Systems Inc. (USA) be of the same mind with Hibi et al., (1996).

Statistical analysis:
Data were analyzed using analysis variance “ANOVA” test; (LSD) at P ≤ 0.05 and Duncan's test as the methods described by Gomez and Gomez, (1984).

RESULTS & DISCUSSION
The chemical composition of QS and NSS explained in table "1". The major constituents of QS and NSS indicated that fat, protein and ash for NSS were higher than QS. Moisture and carbohydrates were the lowest in NSS. The results of the elementary chemical composition of QS were conformable with those stated by Halaby et al., (2017) whose demonstrated that moisture, fat, protein, ash and total carbohydrates were as follows: 9.5; 6.9; 14.2; 3.2 and 63.5 g/100g. Whiles, the results of the chemical components of the NSS were in line with Atta, 2003 as follows; moisture, ash, oil, proteins, and total carbohydrates contents in the range of 3.8-7.0%, 3.7-4.7%, 22.0 to 40.35%, 20.85-31.2%, and 24.9-40.0%, respectively.

Data in Table (2) illustrated some minerals content of QS and NSS. The value of minerals content NSS were displayed in table 2 lower than it’s in QS. These results are congruent, with those acquired by Atta, (2003); Nickavar et al., (2003); Ashraf et al., (2006) and Halaby et al., (2017).

The findings in the third table indicated that the hyperuricemic rats recorded significantly lower results in BWG, FER, and PER than the healthy rats. PI and FI consequences have no significant differences in the positive control group, the negative control group, and all treated groups. The improvement of ill animals fed QS; NSS and mixture them showed significantly higher in BWG, FER, and PER value than a high uric acid group. These outcomes were maybe because
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Three remedy diets showed a significant reduction in renal function in differential to an injury control group. The best improvement was for the group that consumed a mixture of QS with NSS, followed by NSS only then QS. Rising uric acid value in serum could stimulus risk, like renal failure or kidney stones and gout (Wang et al., 2015). The data was in line with Halaby et al., (2017) they concluded that diet fortified QS can improving in the serum uric acid, urea, and creatinine levels.

The results of improvement in kidney function may be attributed to thymoquinone that is the main active compound found in NSS. It has a probable capacity to preserve kidney action, rein the formation of urinary stones, lower retention crystals in the kidney tissue and spur their excretion in urine (Benhelima et al., 2016).

QS or NSS contain some important compounds that help improve renal health as phenolic compounds, flavonoids, minerals, and vitamins. Dietary flavonoids diminish uric acid
levels and keep a safe kidney from damage, the mechanism underlying this effect is probably, due to their molecular structure, these natural antioxidants act as direct superoxide scavengers and xanthine oxidase (XO) inhibitors, resulting in the suppression of Reactive Oxygen Species (ROS) and uric acid formation (Lin et al., 2015).

Table (5) recorded that hyperuricemic rats had significantly lower values of total protein (TP), albumin, and globulin than normal rats. Suffering hyperuricemic rats, which fed on a treated diet with QS or NSS and a mixture of both showed non-significant variation in TP, albumin, and globulin in comparison with normal rats. However, noted these groups a significant increase compared with the hyperuricemic control group. Low blood protein values in rats with elevated uric acid where uric acid is tightly merged to α1-α2 globulin, even though in little amounts (about 0.1-0.2 mg / dl).

The results in table 6 illustrated that the hyperuricemic rats’ had significantly lower SOD, CAT, GPXs, and GST value of kidney tissue while MDA was highly significant compared with normal rats. Hyperuricemia rat groups fed on diet Supported with QS or NSS and together it showed a significant increase of SOD, GPXs, GST, and CAT, however a significant reduction MDA in comparison with hyperuricemic control. One of the main defense systems that reduce the occurrence of toxicity caused by cracks in the body are antioxidants QS is a rich source of flavonoids that improve the biological functions of their antioxidant properties (Abderrahim et al., 2015). The balance between antioxidants...
and free radicals is a necessary and effective process in removing oxidative stress in intracellular organelles. The rats treated by QS plus NSS have shown an increase in the activity of these enzymes, demonstrating their effective ability to prevent the harmful effects of free radicals; thymoquinone is amongst the main antioxidant components of NSS. The intake of NSS in all forms develops the antioxidant defense capacity of the body (Ermumcu and Sanlier 2017). The present results in table 6 has been confirmed by Pasko et al., (2010) who reported that QS can appear like evenly safeguard agents for rats by diminution the lipid peroxidation in plasma and different tissues and rising the antioxidant capacity. Also, the findings are in agreement with Rahmathulla (2013) who mentioned that the first line of cellular defense against oxidative harm is scavenger free radical enzymes like superoxide dismutase, glutathione peroxidase, glutathione transferase, and catalase.

Reduced enzymes may be due to enhanced lipid peroxide.

Table 7 data indicated that a significant reduction for the HB, PCV, IgM, and IgG values; while the interleukin-1 (IL-6) level was highly significant of the hyperuricemic rats. These signs were due to potassium oxonate that caused the hyperuricemia increased oxidative stress; which has a potential effect on the function of cell B in vivo as a result of consequently a decrease in IgM and IgG levels (Ercal, et al., 2000). Groups fed diets with QS / NSS or mix improved IgM and IgG levels due to seeds as an antioxidant and their superior ability to reduce internal oxidative stress. QS and NSS have an anti-inflammation performance to inhibit hyperuricemia from developing into gout and other inflammatory disorders. Gout takes part in many pathogenic with other inflammatory disorders, like a rapid rising in the produce of pro-inflammatory cytokines, including IL-1β, IL-6, and TNF-
CONCLUSION
This study concluded that the results showed that the mixture of QS with NSS improving kidney function and may significantly reduce oxidative stress and boost the antioxidant defense case.

RECOMMENDATION
The research recommended the need to supplement special meals for hyperuricemic patients and humans suffering oxidative stress by a mix of QS and NSS powder.

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Table (1): Elementary Chemical composition of quinoa and *Nigella sativa* seeds -dry weight- (g/100g):

<table>
<thead>
<tr>
<th>Sample</th>
<th>Moisture</th>
<th>Ash</th>
<th>Fat</th>
<th>Protein%</th>
<th>Carbohydrates %</th>
</tr>
</thead>
<tbody>
<tr>
<td>QS</td>
<td>9.62</td>
<td>3.35</td>
<td>7.25</td>
<td>15.85</td>
<td>63.93</td>
</tr>
<tr>
<td>NSS</td>
<td>5.95</td>
<td>4.31</td>
<td>34.6</td>
<td>20.2</td>
<td>34.94</td>
</tr>
</tbody>
</table>

Table (2): Some minerals content of quinoa and *Nigella sativa* seeds -dry weight- (mg/100g):

<table>
<thead>
<tr>
<th>Sample</th>
<th>Zn</th>
<th>Fe</th>
<th>K</th>
<th>Na</th>
<th>Mn</th>
<th>Mg</th>
<th>Cu</th>
<th>Ca</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mg/100g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QS</td>
<td>42.26</td>
<td>67.84</td>
<td>884.97</td>
<td>42.91</td>
<td>31.11</td>
<td>2533.66</td>
<td>17.12</td>
<td><strong>1041.66</strong></td>
</tr>
<tr>
<td>NSS</td>
<td>6.43</td>
<td>9.1</td>
<td>812.32</td>
<td>19.41</td>
<td>8.44</td>
<td>270.87</td>
<td>2.57</td>
<td><strong>590.76</strong></td>
</tr>
</tbody>
</table>
Table (3): Effect of quinoa and Nigella sativa seeds on biological parameters of rats suffering from hyperuricemia

<table>
<thead>
<tr>
<th>Parameters Groups</th>
<th>BWG(g)</th>
<th>PI(g/d)</th>
<th>FI(g/d)</th>
<th>FER</th>
<th>PER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control group</td>
<td>40.86±4.38a</td>
<td>3.01±0.12a</td>
<td>15.04±0.56b</td>
<td>0.078±0.008a</td>
<td>0.388±0.037a</td>
</tr>
<tr>
<td>Hyperuricemia control group</td>
<td>27.03±2.31c</td>
<td>3.04±0.11a</td>
<td>14.59±0.56b</td>
<td>0.053±0.004c</td>
<td>0.255±0.027c</td>
</tr>
<tr>
<td>QS</td>
<td>33.96±1.05b</td>
<td>3.00±0.14a</td>
<td>14.62±0.39b</td>
<td>0.066±0.002b</td>
<td>0.324±0.020b</td>
</tr>
<tr>
<td>NSS</td>
<td>38.20±1.64a</td>
<td>3.06±0.12a</td>
<td>15.17±0.62b</td>
<td>0.072±0.002ab</td>
<td>0.356±0.015a</td>
</tr>
<tr>
<td>QS+NSS</td>
<td>40.32±1.63a</td>
<td>3.11±0.06a</td>
<td>15.40±0.54a</td>
<td>0.075±0.005a</td>
<td>0.371±0.015a</td>
</tr>
</tbody>
</table>

Average values in every column holding unlike superscript (a, b, c) noted significant variation. Means with the same letter are insignificantly different. QS=Quinoa seed  NSS= Nigella sativa seed.

Table (4): Effect of quinoa and Nigella sativa seeds on kidney function of rats suffering from hyperuricemia

<table>
<thead>
<tr>
<th>Parameters Groups</th>
<th>Urea</th>
<th>Uric acid</th>
<th>Creatinine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mg/dl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal control group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyperuricemia control group</td>
<td>35.02±2.61d</td>
<td>3.28±0.46c</td>
<td>0.69±0.027d</td>
</tr>
<tr>
<td>QS</td>
<td>71.63±5.64a</td>
<td>8.37±1.49a</td>
<td>1.74±0.034a</td>
</tr>
<tr>
<td>NSS</td>
<td>47.99±4.23b</td>
<td>5.18±0.68b</td>
<td>0.87±0.029b</td>
</tr>
<tr>
<td>QS+NSS</td>
<td>43.54±3.93bc</td>
<td>4.22±0.14bc</td>
<td>0.75±0.030c</td>
</tr>
<tr>
<td></td>
<td>39.75±1.55cd</td>
<td>3.61±0.25c</td>
<td>0.74±0.048cd</td>
</tr>
</tbody>
</table>

Average values in every column holding unlike superscript (a, b, c) noted significant variation. Means with the same letter are insignificantly different. QS=Quinoa seed  NSS= Nigella sativa seed.
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**Table (5): Effect of quinoa and Nigella sativa seeds on total protein (T.P), albumin and globulin of rats suffering from hyperuricemia**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Groups</th>
<th>TP (mg/dL)</th>
<th>Albumin (mg/dL)</th>
<th>Globulin (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control</td>
<td></td>
<td>7.98±0.35</td>
<td>3.88±0.25</td>
<td>4.10±0.17</td>
</tr>
<tr>
<td>Hyperuricemic control group</td>
<td></td>
<td>5.28±0.15</td>
<td>2.93±0.06</td>
<td>2.35±0.12</td>
</tr>
<tr>
<td>QS</td>
<td></td>
<td>7.77±0.55</td>
<td>3.90±0.21</td>
<td>4.07±0.14</td>
</tr>
<tr>
<td>NSS</td>
<td></td>
<td>7.93±0.38</td>
<td>4.03±0.13</td>
<td>3.79±0.27</td>
</tr>
<tr>
<td>QS+NSS</td>
<td></td>
<td>8.01±0.31</td>
<td>3.96±0.20</td>
<td>4.05±0.17</td>
</tr>
</tbody>
</table>

Average values in every column holding unlike superscript (a, b, c) noted significant variation.
Means with the same letter are insignificantly different.

QS=Quinoa seed  
NSS=Nigella sativa seed  
TP=total protein

**Table (6): Effect of quinoa and Nigella sativa seeds on SOD, GPX, GST, CAT and MDA in kidney of rats suffering from hyperuricemia**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>SOD (μ/mg)</th>
<th>CAT (μ/mg)</th>
<th>GPX (mmol/g)</th>
<th>GST (mmol/g)</th>
<th>MDA (mmol/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control</td>
<td>94.31±4.96</td>
<td>4.47±0.17</td>
<td>94.87±4.28</td>
<td>5.10±0.19</td>
<td>6.55±0.63</td>
</tr>
<tr>
<td>Hyperuricemia control group</td>
<td>43.94±3.04</td>
<td>1.01±0.02</td>
<td>30.57±1.58</td>
<td>2.41±0.24</td>
<td>16.36±0.72</td>
</tr>
<tr>
<td>QS</td>
<td>87.90±7.08</td>
<td>2.43±0.14</td>
<td>67.48±3.34</td>
<td>3.28±0.18</td>
<td>8.79±0.28</td>
</tr>
<tr>
<td>NSS</td>
<td>82.34±5.14</td>
<td>3.21±0.16</td>
<td>83.48±3.56</td>
<td>3.56±0.24</td>
<td>8.60±0.39</td>
</tr>
<tr>
<td>QS+NSS</td>
<td>102.29±4.03</td>
<td>4.15±0.20</td>
<td>90.71±2.26</td>
<td>3.99±0.09</td>
<td>6.63±0.44</td>
</tr>
</tbody>
</table>

Average values in every column holding unlike superscript (a, b, c) noted significant variation.
Means with the same letter are insignificantly different.

QS=Quinoa seed  
NS=Nigella sativa seed

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Beneficial role of quinoa and *Nigella sativa* seeds as antihyperuricemia in rats

El-Kewawy HE¹ and Morsy GM²

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Table (7): Effect of quinoa and *Nigella sativa* seeds on HB, PCV, IgM, IgG and interleukin-1 (IL-6) of rats suffering from hyperuricemia

<table>
<thead>
<tr>
<th>Parameters Groups</th>
<th>HB g/dl</th>
<th>PCV %</th>
<th>IgM (mg/l)</th>
<th>IgG (mg/l)</th>
<th>IL-6(pg/g) Kidney</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control group</td>
<td>13.91±0.25ᵃ</td>
<td>41.80±0.88ᵃ</td>
<td>99.29±5.73ᵃ</td>
<td>198.30±4.74ᵃ</td>
<td>49.58±0.83ᶜ</td>
</tr>
<tr>
<td>Hyperuricemia control group</td>
<td>10.20±0.48ᵈ</td>
<td>30.63±1.59ᵈ</td>
<td>54.91±3.27ᵈ</td>
<td>117.37±5.48ᵉ</td>
<td>83.96±5.11ᵃ</td>
</tr>
<tr>
<td>QS</td>
<td>12.20±0.54ᵇ</td>
<td>36.66±1.59ᵇ</td>
<td>87.06±3.86ᶜ</td>
<td>162.90±5.97ᵈ</td>
<td>64.16±3.98ᵇ</td>
</tr>
<tr>
<td>NSS</td>
<td>11.51±0.48ᶜ</td>
<td>34.70±1.30ᶜ</td>
<td>91.18±2.99ᵇᶜ</td>
<td>170.18±5.20ᶜ</td>
<td>60.06±3.44ᵇ</td>
</tr>
<tr>
<td>QS+ NSS</td>
<td>11.97±0.27ᵇᶜ</td>
<td>36.01±0.81ᵇᶜ</td>
<td>95.56±3.84ᵇᵃ</td>
<td>190.94±3.19ᵇ</td>
<td>52.99±1.62ᶜ</td>
</tr>
</tbody>
</table>

Average values in every column holding unlike superscript (a, b, c) noted significant variation. Means with the same letter are insignificantly different. QS=Quinoa seed  NS=Nigella sativa seed.
الدور الفعال لبذور الكينوا وحبة البركة كمضاد لزيادة حمض اليوريك في الجرذان

هالة عزت مصطفى الكواوي 1 و جيهان محمد محمود مرسي 2

الملخص العربي

أجريت الدراسة حالياً لتقييم الدور العلاجي لبذور الكينوا وحبة البركة وخلطهما على الإصابة بارتفاع حمض اليوريك الناتجة عن تناول أوكسانات البوتاسيوم. أجري البحث على 30 جرذ. قسمت هذه الجرذان إلى مجموعتين أساسيتين: تركت الأولى كفئران طبيعية بمجموعة ضابطة سالبة تحمل على الغذاء القياسي، المجموعة الثانية (24 فار) تم تغذيتها لمدة سبع أسابيع على الوجبة الرئيسية مضافة إليها 20 جرام من أوكسانات البوتاسيوم لأحداث الإصابة. ثم قسمت الجرذان إلى أربع مجموعات، وهي ضابطة موجهة (كنتروال مريض) تغذت على الغذاء الأساسي. ومجموعات معالجة بكل من بذور الكينوا أو بذور حبة البركة أو مجموعة تناولت كلاهما معا. وقد كانت مدة التجربة 35 يومًا. لقد أوضحت النتائج المتصورة أنها يمكن السيطرة على ارتفاع حمض اليوريك من خلال تناول بذور الكينوا وحبة البركة. وقد أظهرت تلك المجموعة أفضل النتائج الدالة على تحسن مستويات كلا من الكرياتينين واليوريا وحمض اليوريك، وذلك بالانخفاض المعنوي، وأيضاً استفرت عن تحسنا في مستويات الجلوتانيون والبروتين الكلية، وذلك بالزيادة المعنوية. وأيضاً أظهرت تحسنا معنوي في كل من الانزيمات مضادة للأسكسيد بزيادة معنوية في مستويات الجلوتانيون ترانسفيراز والجليتانيون، بروكسيد وسور أكسيد ديموتوز و الكاتاليز وانخفاض معنوي في المالونالدالدهي والأنتروكين. وتقوية النشاط ونشاط مضادة للأسكسيد مقارنة بال مجموعة الضابطة الموجهة. من خلال النتائج المتحصل عليها في هذا البحث توصي الدراسة بتحويله كمصدر من خصائص مضادة للأسكسد وكذلك يمكن استخدام مسحوق بذور الكينوا وحبة البركة لعلاج الإصابة بالأخلاط.

الكلمات المفتاحية: بذور الكينوا - بذور حبة البركة - ارتفاع حمض اليوريك