دراسات كيميائية وتغذوية صحية على الفئران المصابة بالسمنة باستخدام أعشاب الراوند والقتاده

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مجلة البحوث في مجالات التربية النوعية

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Chemical and Nutraceutical Studies of Obese Rats Using Rhubarb and Astragalus Herbs

Abstract

This investigation aimed to evaluate the effect of Rhubarb, Astragalus and Mixture of both on male obese rats. Thirty (30) adult male Sprague Dawley rats were divided into five groups. Group (1): Normal rats fed on basal diet as control negative (C-), Group (2): Control positive (C+) (untreated group). Group (3): Obese rats fed on basal diet and rhubarb (5%). Group (4): Obese rats fed on basal diet and astragalus (5%). Group (5): Obese rats fed on basal diet and mixture of both (5%). At the end of experiment, after 28 days of feeding, all serum samples were analyzed for biochemical parameters. Obese rats caused a significant decrease in the level of Hb, Ht, RBC, WBC, Neutrophils, Lymphocytes, Monocytes, Eosinphils and Basophils while a significant increase was recorded in TC, TG, VLDL, LDL, AI, U.A, Creatinine, Urea, GOT, GPT, ALP, Glucose and Plt. Obese rats treated with various diets, showed the improvement in all previous parameters.

Key words: Obesity, Rhubarb, Astragalus and Mixture of both.

Introduction

Rhubarb is a collective name of various perennial plants of the genus *Rheum L.* from Polygonaceae family. This plant has important economic value, not only referred to a few edible rhubarbs (Yi, 2010), but also used as purgative drug in China since the third millennium BC (Barceloux, 2009), firstly recorded in Shen Nong’s Herbal Classic. Rhubarb has been suggested to exert eliminating heat, purging fire, cooling blood, dispersing blood stasis, dredging collateral antidotal and purgative effects, used to treat constipation, diabetic nephropathy, chronic renal failure, acute pancreatitis, gastrointestinal bleeding and other diseases (Jiao and Du, 2000).

Phytochemical investigation on rhubarb has proved major bioactive ingredients are phenolic compounds in six skeletal type including anthraquinones (physcion, chrysophanol, emodin, aloe-
emodin and rhein and their glucosides), anthocyanins (cyanidin 3-rutinoside and cyanidin 3-glucoside), flavonoids (catechin, quercetin 3-Orhamnoside, quercetin3-O galactoside, and quercetin 3-O-rutinoside), stilbene (trans-rhapontigenin and desoxyrhapontigenin (cis-rhapontigenin, resveratrol and piceatannol) (Gao et al., 2011).

Astragalus is a medicinal herb which has been used in traditional Chinese medicine for many years. Specifically, the root of the plant is made into many different forms of supplements, including liquid extracts, capsules, powders and teas. Its root contains many active plant compounds, which are believed to be responsible for its potential benefits. Saponins, polysaccharides, amino acids, flavonoids, organic acid, glycosides, alkaloid, and trace elements (Shahrajabian et al., 2019).

In Traditional Chinese Medicine, Astragalus considers to use in the treatment of diabetes mellitus, nephritis, leukemia, uterine cancer, besides its tonic agent and diuretic effects. Astragalus polysaccharide, the active component extracted from Astragali radix which is the root of Astragalus membranaceus Bunge. Some uses of astragalus are in kidney and urinary problems, digestion, liver problems, female reproductive system problems, muscular, skin problems, cardiovascular and blood, immune and lymphatic system, nervous system, respiratory system, and for some specific disease. It helps protect the body against various types of stress such as physical and emotional stress. Astragalus root including anti-aging properties, and also helping to prevent bone loss. It contains astragalosides (antioxidants), which support the integrity of the respiratory tract. In addition, the polysaccharides found in astragalus are known for their immune supporting properties. Astragalus herb also supports deep immune function by promoting normal levels of specific immune cells and aids in their function. Astragalus appears especially effective when immune function is stressed by environmental or endogenous challenges. Astragali radix, the root of Astragalus membranaceus Bunge, has been reported to exert hepatoprotective effects, antioxidative effects, antiviral activity, anti-oxidative effects,
Materials and Methods

Materials:
Rhubarb (*Rheum palmatum*) and astragalus (*Astragalus kahiricus*) were obtained dry from herb shop in Cairo, Egypt.

Animals:
Thirty (30) adult male Sprague Dawley rats, average body weight (150± 10 g) about 7 weeks old, were used in this study. Rats were obtained from Research Institute of Ophthalmology, Medical Analysis Department, Giza, Egypt.

Methods:

Basal Diet Composition of Tested Rats:
The basal diet in the experiment consisted of casein (12%), corn oil (10%), mineral mixture (4%), vitamin mixture (1%), cellulose (5%), chorine chloride (0.2%), methionine (0.3%) and the remained is corn starch (67.5%) according to AIN (1993).

To indicate obesity rats fed on high-fat diet (HFD) for 6 weeks according to Liu et al., (2004). The composition of HFD was as follows (%): Casein 25, Corn oil 1, Saturated fat (shep tail fat) 19, Choline chloride 0.25, Vit- Mix 1, Salt Mix 3.5, Cellulose 5, L. Cystine 0.18, Sucrose 10 and Corn Starch 35.07.

Preparation of Materials:
All materials were milled to soft powder by using electric grinder and kept in dusky stoppered glass bottles in a cool and dry location till use according to Russo (2001).

Experimental Design and Animal Groups:
Rats were housed in wire cages under the normal laboratory condition, and were fed on basal diet for a week as an adaptation period. The rats were divided into 5 groups each of 6 rats. All groups of rats were housed in wire cages at room temperature 25 °C0, and kept under normal healthy condition. Rats were divided into the following groups:

Group (1): Control negative group (-), in which normal rats were fed on basal diet.
Group (2): Control positive group (+), in which obese rats were fed on basal diet.

Group (3): Obese rats fed on rhubarb 5% diet.

Group (4): Obese rats fed on astragalus 5% diet.

Group (5): Obese rats fed on mixture of both 5% diet.

Determination of Biochemical Blood Parameters:

Blood samples were collected after 12 hours fasting at the end of experiment using the abdominal aorta. The rats were scarified under ether anaesthesia. Blood samples were received into in clean dry centrifuge tubes, in which blood was left to clot at room temperature, and then centrifuged for 10 minutes at 3000 r.p.m to separate the serum. Serum was carefully aspirated and transferred into clean cuvette tubes and stored frozen at -20°C for biochemical analysis as described by Schermer (1967). All serum samples were analyzed for determination the following parameters:

Urea was determined according to the enzymatic method of Patton and Crouch (1977), creatinine was determined according to kinetic method of Henry (1974) and uric acid was according to the enzymatic colorimetric test of Fossati and Prencipe (1980). Aspartate amino transaminase (AST) and alanine amino transferase (ALT) activities were carried out according to the method of Yound (1975) and Tietz (1976). Alkaline phsphatase (ALP) was determined according to Belfield and Goldberg (1971). Total cholesterol (TC) was determined according to Allain (1974), and high density lipoprotein cholesterol (HDL-c) according to Lopez (1997). The calculation of low density lipoprotein cholesterol (LDL-c) was carried out according to the method of Lee and Nieman (1996), atherogenic index (AI) was calculated according to Kikuchi et al., (1998) and triglycerides as Fossati and Prencipe (1982). Serum glucose determined according to Kalpan (1984).

Statistical Analysis:

The data were statistically analyzed using a computerized Costat Program by one way ANOVA using a Completely Randomized Factorial Design (SAS, 1988) when a significant mean effect was detected, the means were separated with the
Duncan's Multiple Range Test. Differences between treatments at \( P \leq 0.05 \) were considered significant. The results are presented as mean ± SD.

**Results and Discussion:**

Data presented in table (1) illustrate the effect of rhubarb, astragalus and mixture of both on BWG, FI and FER of obese rats. It could be observed that the mean value of (BWG) of control (+) group was higher than control (-) group, being 2.46±0.001 and 0.86±0.009 g respectively. The best (BWG) level showed for groups 5 (rats fed on basal diet containing 5% mixture of both) when compared to control (+) group.

It could be noticed that the mean value of FI of control (+) group was higher than control (-) group, being 24.12±0.009 and 19.75±0.001 g respectively. The best (FI) level was showed for group 5 (rats fed on basal diet + 5% mixture of both) when compared to control (+) group.

Also, data of table (1) observed that the mean value of (FER) of control (+) group was higher than control (-) group, being 0.102±0.0008 and 0.044±0.0002 respectively. The best FER was shown for group 5 (rats fed on basal diet + 5% mixture of both) when compared to control (+) group.

Qu *et al.*, (2001) investigated that compound rhubarb preparation (40 mg·100 g⁻¹ body weight·d⁻¹) can lower body weight in obese rats. The mechanism might involve the decrease in adipocyte leptin expression.

Zhang *et al.*, (2019) reported the neuroprotective effects of Astragalus polysacharin APS (20 mg/kg) on diabetes-induced memory impairments in Sprague-Dawley (SD) rats and the reduced body weight.

**Table (1): Effect of rhubarb, astragalus and mixture of both on body weight gain (BWG), feed intake (FI) and feed efficiency ratio (FER) of obese rats**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameters</th>
<th>BWG (g) Mean ± SD</th>
<th>FI (g) Mean ± SD</th>
<th>FER (%) Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1: Control –ve</td>
<td>BWG</td>
<td>0.86c±0.009</td>
<td>19.75c±0.001</td>
<td>0.044d±0.0002</td>
</tr>
</tbody>
</table>

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Data presented in table (2) show the effect of rhubarb, astragalus and mixture of both on total cholesterol and triglycerides of obese rats. It could be observed that the mean value of total cholesterol (TC) of control (+) group was higher than control (-) group, being 206±2.09 and 98±2.75 mg/dl respectively. The best serum (TC) level showed for groups 5 (rats fed on basal diet containing 5% mixture of both) when compared to control (+) group.

It could be observed that the mean value of triglycerides TG of control (+) group was higher than control (-) group, being 208±2.81 and 97±2.05 mg/dl respectively. The best serum (TG) level was showed for group 5 (rats fed on basal diet + 5% mixture of both) when compared to control (+) group.

Gholami et al., (2015) found that extract of rhubarb at doses of 666 and 1000mg/kg BW decreases the total cholesterol in rats fed high cholesterol diet.

Chen et al., (2018) reported that astragalus polysaccharides (APS) reduced total cholesterol and triglycerides in hyperlipidemic rats.

**Table (2): Effect of rhubarb, astragalus and mixture of both on total cholesterol (TC) and triglycerides (TG) of obese rats**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameters</th>
<th>TC (mg/dl) Mean ± SD</th>
<th>TG (mg/dl) Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1: Control –ve</td>
<td></td>
<td>98d± 2.75</td>
<td>97c± 2.05</td>
</tr>
<tr>
<td>G2: Control +ve</td>
<td></td>
<td>206a± 2.09</td>
<td>208a± 2.81</td>
</tr>
</tbody>
</table>

Values in each column with different letters are significantly different (P<0.05).
Values in each column with different letters are significantly different (P<0.05).

Data presented in table (3) illustrate the effect of rhubarb, astragalus and mixture of both on HDLc, LDLc, VLDLc & AI of obeses rats.

It could be noticed that the mean value of (VLDLc) of control (+) group was higher than control (-) group, being 41.6±1.26 and 19.4±1.15 mg/dl respectively. The best serum VLDLc was shown for group 5 (rats fed on basal diet + 5% mixture of both) when compared to control (+) group.

It could be shown that the mean value of (HDLc) of control (-) group was higher than control (+) group, being 52±1.11 and 35±2.77 mg/dl respectively. The best serum HDLc was shown for group 5 (rats fed on basal diet containing 5% mixture of both) when compared to control (+) group.

The same table indicated that the mean value of (LDLc) of control (+) group was higher than control (-) group, being 129.4±0.93 and 26.6±1.22 mg/dl respectively. The best serum LDLc was shown for group 5 (rats fed on basal diet +5% mixture of both) when compared to control (+) group.

Also, data of table (4) observed that the mean value of (AI) of control (+) group was higher than control (-) group, being 4.89±0.009 and 0.89±0.001 respectively. The best AI was shown for group 5 (rats fed on basal diet +5% mixture of both) when compared to control (+) group.

Wang et al., (2015) indicated that rhubarbs from different regions reduced low density lipoprotein and increased high density lipoprotein of hyperlipidemia rats.

Chen et al., (2018) reported that astragalus polysaccharides (APS) at 700 mg/(kg·d) for 8 weeks reduced low density
lipoprotein and increased high density lipoprotein in hyperlipidemic rats.

Table (3): Effect of rhubarb, astragalus and mixture of both on (VLDLc), (HDLc), (LDLc) (mg/dl) and Atherogenic index (AI) of obese rats

<table>
<thead>
<tr>
<th>Parameters</th>
<th>VLDL (mg/dl) Mean ± SD</th>
<th>HDL (mg/dl) Mean ± SD</th>
<th>LDL (mg/dl) Mean ± SD</th>
<th>AI Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control –ve</td>
<td>19.4 ± 1.15</td>
<td>52 ± 1.11</td>
<td>26.6 ± 1.22</td>
<td>0.89 ± 0.001</td>
</tr>
<tr>
<td>G2:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control +ve</td>
<td>41.6 ± 1.26</td>
<td>35 ± 2.77</td>
<td>129.4 ± 0.93</td>
<td>4.89 ± 0.009</td>
</tr>
<tr>
<td>G3:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhubarb (5%)</td>
<td>28.6 ± 1.48</td>
<td>41 ± 1.58</td>
<td>47.4 ± 0.88</td>
<td>1.85 ± 0.005</td>
</tr>
<tr>
<td>G4:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astragalus (5%)</td>
<td>23.6 ± 1.72</td>
<td>47 ± 1.42</td>
<td>34.4 ± 1.29</td>
<td>1.23 ± 0.002</td>
</tr>
<tr>
<td>G5:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixture of both (5%)</td>
<td>20.4 ± 1.48</td>
<td>48 ± 1.39</td>
<td>22.6 ± 0.97</td>
<td>0.90 ± 0.006</td>
</tr>
<tr>
<td>LSD</td>
<td>2.60</td>
<td>3.19</td>
<td>1.95</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Values in each column with different letters are significantly different (P<0.05).

Data of table (4) indicate the effect of rhubarb, astragalus and mixture of both on serum levels of AST, ALT, ALP enzymes & (AST/ALT) ratio of obese rats.

It could be observed that the mean value of AST enzyme of control (+) group was higher than control (-) group, being 49±1.25 and 30±0.98 (U/L) respectively. The best treatment was observed for group 5 (basal diet containing 5% mixture of both) when compared to control (+) group.

It could be noticed that the mean value of ALT enzyme of control (+) group was higher than control (-) group, being 102±1.83 and 28±0.25 (U/L) respectively. The best treatment was observed for group 5 (basal diet containing 5% mixture of both) when compared to control (+) group.

Data of the same table (4) show the mean value of ALP enzyme of control (+) group was higher than control (-) group,
being 256±1.81 and 177±1.08 (U/L) respectively. Group 5 showed the lowest mean value of ALP enzyme level as compared to control (+) group which and recorded the best result.

Also, it could be noticed that the mean value of (AST/ALT) of control (-) group was higher than control (+) group, being 1.07±0.007 and 0.48±0.004 respectively. The best treatment was observed for group 5 when compared to control (+) group.

Dang et al., (2008) reported that odin and astragalus polysaccharides (APS) in a rat model of chronic hepatic injury reduced aspartate aminotransferase (AST) and alanine aminotransferase (ALT).

Chen et al., (2009) found that (3’, 5-dihydroxy-4’-methoxystilbene 3-Obeta-D-glucopyranoside) from extracts of rhubarb rhizomes decreased aspartate aminotransferase (AST) and alanine aminotransferase (ALT) in streptozotocin (STZ)-induced type 1 diabetic rats.

Table (4): Effect of rhubarb, astragalus and mixture of both on AST, ALT, AST/ALT and ALP (U/L) of obese rats

<table>
<thead>
<tr>
<th>Parameters</th>
<th>AST (U/L) Mean ± SD</th>
<th>ALT (U/L) Mean ± SD</th>
<th>AST/ALT Mean ± SD</th>
<th>ALP (U/L) Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1: Control –ve</td>
<td>30±0.89</td>
<td>28±0.25</td>
<td>1.07±0.007</td>
<td>177±1.08</td>
</tr>
<tr>
<td>G2: Control +ve</td>
<td>49±1.26</td>
<td>102±1.83</td>
<td>0.48±0.004</td>
<td>265±1.81</td>
</tr>
<tr>
<td>G3: Rhubarb (5%)</td>
<td>36±0.76</td>
<td>35±0.42</td>
<td>1.03±0.003</td>
<td>204±1.62</td>
</tr>
<tr>
<td>G4: Astragalus (5%)</td>
<td>34±0.33</td>
<td>33±0.58</td>
<td>1.03±0.006</td>
<td>200±1.25</td>
</tr>
<tr>
<td>G5: Mixture of both (5%)</td>
<td>32±0.22</td>
<td>30±0.36</td>
<td>1.07±0.009</td>
<td>199±1.76</td>
</tr>
<tr>
<td>LSD</td>
<td>1.43</td>
<td>1.64</td>
<td>0.011</td>
<td>2.79</td>
</tr>
</tbody>
</table>

Values in each column with different letters are significantly different (P<0.05).

Data presented in table (5) show the effect of rhubarb, astragalus and mixture of both on serum glucose of diabetic rats. It
could be noticed that the mean value of glucose of control (+) group was higher than control (-) group, being 296±3.74 and 135±1.89 (mg/dl) respectively. The best serum glucose was observed for group 5 (basal diet containing 5% mixture of both) when compared to control (+) group.


Dun et al., (2016) found that astragalus polysaccharides (APS) after 8-week reduced serum fasting glucose in diabetic rats.

Table (5): Effect of rhubarb, astragalus and mixture of both on serum glucose (mg/dl) of obese rats

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameters</th>
<th>Glucose (mg/dl) Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1: Control –ve</td>
<td></td>
<td>135± 1.89</td>
</tr>
<tr>
<td>G2: Control +ve</td>
<td></td>
<td>296± 3.74</td>
</tr>
<tr>
<td>G3: Rhubarb (5%)</td>
<td></td>
<td>158± 1.36</td>
</tr>
<tr>
<td>G4: Astragalus (5%)</td>
<td></td>
<td>141± 1.61</td>
</tr>
<tr>
<td>G5: mixture of both (5%)</td>
<td></td>
<td>138± 1.81</td>
</tr>
<tr>
<td>LSD</td>
<td></td>
<td>3.77</td>
</tr>
</tbody>
</table>

Values in each column with different letters are significantly different (P<0.05).

Results of table (6) show the mean value of serum creatinine, urea and uric acid (mg/dl) on obese rats fed on various diets.

It could be observed that the mean value of uric acid of control (+) group was higher than control (-) group, being 6.87±0.001 and 2.31±0.004 mg/dl respectively. Group 5 (basal diet containing 5% mixture of both) recorded the best result as compared to control (+) group.

The same table (6) results illustrate that mean value of creatinine of control (+) group was higher than control (-) group, being 1.74±0.005 and 0.52±0.002 mg/dl respectively. In concern to creatinine the best treatment was recorded for the group 5 (rats fed on basal diet +5% mixture of both) when compared to control
It could be noticed that the mean value of urea of control (+) group was higher than control (-) group, being 62±1.68 and 29±1.89 mg/dl respectively. Group 5 (rats fed on basal diet +5% mixture of both) recorded the best result as compared to control (+) group.

Xiao et al., (2015) found that astragalus saponin extracts (AS) reduced serum creatinine (Scr) and uric acid (UA) in diabetic rats induced by streptozotocin (STZ).

Deng et al., (2018) reported that rhubarb reduced serum creatinine in the renal toxicity of rats.

Table (6): Effect of rhubarb, astragalus and mixture of both on uric acid (U.A), creatinine and urea (mg/dl) of obese rats

<table>
<thead>
<tr>
<th>Parameters</th>
<th>U.A (mg/dl) Mean ± SD</th>
<th>Creatinine (mg/dl) Mean ± SD</th>
<th>Urea (mg/dl) Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1: Control –ve</td>
<td>2.31±0.004</td>
<td>0.52±0.002</td>
<td>29±1.89</td>
</tr>
<tr>
<td>G2: Control +ve</td>
<td>6.87±0.001</td>
<td>1.74±0.005</td>
<td>62±1.68</td>
</tr>
<tr>
<td>G3: Rhubarb (5%)</td>
<td>5.92±0.008</td>
<td>0.75±0.007</td>
<td>45±1.06</td>
</tr>
<tr>
<td>G4: Astragalus (5%)</td>
<td>5.87±0.006</td>
<td>0.73±0.003</td>
<td>43±1.15</td>
</tr>
<tr>
<td>G5: Mixture of both (5%)</td>
<td>5.20±0.009</td>
<td>0.61±0.001</td>
<td>37±1.34</td>
</tr>
<tr>
<td>LSD</td>
<td>0.011</td>
<td>0.008</td>
<td>2.65</td>
</tr>
</tbody>
</table>

Values in each coloum with different letters are significantly different (P<0.05).

Data presented in table (7) show the effect of rhubarb, astragalus and mixture of both on Hb, Ht, RBC, PLt and WBC of obese rats.

It could be observed that the mean value of (Hb) of control (-) group was higher than control (+) group, being 19.80±0.009 and 12.87±0.002 g/dl respectively. The best Hb was shown for
group 5 (rats fed on basal diet + 5% mixture of both) when compared to control (+) group.

It could be observed that the mean value of (Ht) of control (-) group was higher than control (+) group, being 49±1.15 and 39±1.78 % respectively. The best Ht was shown for group 4, 5 (rats fed on basal diet containing 5% astragalus and mixture of both) when compared to control (+) group.

The same table indicated that the mean value of (RBC) of control (-) group was higher than control (+) group, being 5±0.25 and 3±0.25 (10⁶/µL) respectively. The best RBC was shown for group 4, 5 (rats fed on basal diet +5% astragalus and mixture of both) when compared to control (+) group.

Also, data of table (7) observed that the mean value of (Plt) of control (+) group was higher than control (-) group, being 618±2.71 and 446±0.89 (10³/µL) respectively. The best AI was shown for group 5 (rats fed on basal diet + 5% mixture of both) when compared to control (+) group.

It could be noticed that the mean value of (WBC) of control (-) group was higher than control (+) group, being 10.7±0.07 and 7±0.35 (10³/µL) respectively. Group 5 (rats fed on basal diet +5% mixture of both) recorded the best result as compared to control (+) group.

Lv et al., (2005) reported that Astragalus membranaceus injection (AMI)(500 mg/kg, 1000 mg/kg) increased red blood cells and hemoglobin on hematopoiesis in anemic mice.

Zhang et al., (2016) found that butanol extract of rheum from rhubarb increased hematocrit and red blood cell count of chronic renal failure in rats.

Table (7): Effect of rhubarb, astragalus and mixture of both on Hb, Ht, RBC, PLT and WBC of obese rats

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Groups</th>
<th>Hb (g/dl)</th>
<th>Ht (%)</th>
<th>RBC (10⁶/µL)</th>
<th>PLT (10³/µL)</th>
<th>WBC (10³/µL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean ±SD</td>
<td>Mean ±SD</td>
<td>Mean ±SD</td>
<td>Mean ±SD</td>
<td>Mean ±SD</td>
</tr>
<tr>
<td>G1: Control – ve</td>
<td>19.80±0.009</td>
<td>49±1.15</td>
<td>5.0±0.25</td>
<td>446±0.89</td>
<td>10.7±0.07</td>
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<tr>
<td><strong>G2</strong>: Control+ve</td>
<td>12.87± 0.002</td>
<td>39±1.78</td>
<td>3.0±0.25</td>
<td>618±2.71</td>
<td>7.0±0.35</td>
<td></td>
</tr>
<tr>
<td><strong>G3</strong>: Rhubarb (5%)</td>
<td>17.73± 0.001</td>
<td>43c±1.65</td>
<td>4.4±0.09</td>
<td>510b±1.16</td>
<td>9.5c±0.08</td>
<td></td>
</tr>
<tr>
<td><strong>G4</strong>: Astragalus (5%)</td>
<td>18.80± 0.007</td>
<td>57a±1.59</td>
<td>4.8±0.04</td>
<td>450c±0.62</td>
<td>11.0ab±0.43</td>
<td></td>
</tr>
<tr>
<td><strong>G5</strong>: Mixture of both (5%)</td>
<td>18.84b± 0.005</td>
<td>57a±1.33</td>
<td>4.8a±0.01</td>
<td>448cd±0.54</td>
<td>11.3a±0.02</td>
<td></td>
</tr>
<tr>
<td><strong>LSD</strong></td>
<td>0.01</td>
<td>2.76</td>
<td>0.29</td>
<td>2.59</td>
<td>0.46</td>
<td></td>
</tr>
</tbody>
</table>

Values in each column with different letters are significantly different (P<0.05).

Data presented in table (8) illustrate the effect of rhubarb, astragalus and mixture of both on Neutrophils, Lymphocytes, Monocytes, Eosinophils and Basophils \((10^9/L)\) of obese rats.

It could be noticed that the mean value of (Neutrophils) of control (-) group was higher than control (+) group, being 4.51±0.009 and 2.95±0.001 respectively. The best Neutrophils was shown for group 5 (rats fed on basal diet + 5% mixture of both) when compared to control (+) group.

It could be observed that the mean value of (Lymphocytes) of control (-) group was higher than control (+) group, being 4.97±0.009 and 3.25±0.002 respectively. The best Lymphocytes was shown for group 5 (rats fed on basal diet containing 5% mixture of both) when compared to control (+) group.

The same table revealed that the mean value of (Monocytes) of control (-) group was higher than control (+) group, being 1.02±0.001 and 0.67±0.008 respectively. The best Monocytes was shown for group 5 (rats fed on basal diet containing 5% mixture of both) when compared to control (+) group.

Also, data of table (9) showed that the mean value of (Eosinophils) of control (-) group was higher than control (+) group, being 0.15±0.002 and 0.10±0.009 respectively. The best Eosinophils was shown for group 4 (rats fed on basal diet + 5% astragalus) when compared to control (+) group.
It could be noticed that the mean value of (Basophils) of control (-) group was higher than control (+) group, being 0.06±0.006 and 0.04±0.009 respectively. Group 4, 5 (rats fed on basal diet +5% astragalus and mixture of both) recorded the best result as compared to control (+) group.

It may be concluded that both rhubarb and astragalus 5% diets, within about 1 month of feeding could combat the side effects induced by obesity.

Table (8): Effect of rhubarb, astragalus and mixture of both on Neutrophils, Lymphocytes, Monocytes, Eosinophils and Basophils (10⁹/L) of obese rats

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Neutrophils Mean ± SD</th>
<th>Lymphocytes Mean ± SD</th>
<th>Monocytes Mean ± SD</th>
<th>Eosinophils Mean ± SD</th>
<th>Basophils Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1: Control – ve</td>
<td>4.51±0.009</td>
<td>4.97±0.009</td>
<td>1.02±0.001</td>
<td>0.15±0.002</td>
<td>0.06±0.006</td>
</tr>
<tr>
<td>G2: Control+v e</td>
<td>2.95±0.001</td>
<td>3.25±0.002</td>
<td>0.67±0.008</td>
<td>0.10±0.009</td>
<td>0.04±0.009</td>
</tr>
<tr>
<td>G3: Rhubarb (5%)</td>
<td>4.0±0.2</td>
<td>4.41±0.008</td>
<td>0.90±0.005</td>
<td>0.13±0.001</td>
<td>0.06±0.001</td>
</tr>
<tr>
<td>G4: Astragalus (5%)</td>
<td>4.63±0.006</td>
<td>5.10±0.005</td>
<td>1.05±0.004</td>
<td>0.15±0.005</td>
<td>0.07±0.008</td>
</tr>
<tr>
<td>G5: mixture of both 5%</td>
<td>4.76±0.004</td>
<td>5.24±0.007</td>
<td>1.07±0.007</td>
<td>0.10±0.008</td>
<td>0.07±0.004</td>
</tr>
<tr>
<td>LSD</td>
<td>0.20</td>
<td>0.01</td>
<td>0.01</td>
<td>0.012</td>
<td>0.011</td>
</tr>
</tbody>
</table>

Values in each column with different letters are significantly different (P<0.05).
References:
Stress in Wistar Male Rats. International Medical Journal, 22:(2).


Shahrajabian, M. H.; Sun, W. and Cheng, Q. (2019). Astragalus, an ancient medicinal root in traditional Chinese medicine, a gift
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دراسات كيميائية وتغذوية صحية على الفئران المصابة بالسمنة

د.مني علي اليماني

المملوء العربي


الكلمات المفتاحية: مرض السمنة ، عشبة الراوند ، عشبة الاقتاده والخليط من الاثنين معا.