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The effect of *Rumex nervosus* Vahl leaves on high fat diet-induced hyperglycemia and hyperlipidemia in albino rats

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Abstract
In the present study, the antiobesity potential of *Rumex nervosus Vahl* leaves was studied against high fat diet-induced obesity in female rats. In this study, administration of high fat diet in rats produced hyperglycemia and hyperlipidemia, which led to an increase in the body weight compared to control rats. In high fat diet, treated rats with the *Rumex nervosus Vahl* leaves powdered mixed with the diet at 10% of the diet reduced the body weight and produced signs of recovery in body weights to the level of normal control group. Treatment of high fat diet rats with *Rumex nervosus Vahl* leaves powdered did not appaerencally effect rats food or water intake through the 8 weeks of the treatment. After 8 weeks of treatment, the high fat diet that received *Rumex nervosus Vahl* had lower blood glucose concentrations compared with high fat diet group. At week, 8 of treatment plasma triglycerides and low density lipoprotein cholesterol levels of high fat diet treated rats were lower compared to high fat diet group. On the other hand, no significant changes in plasma high-density lipoprotein cholesterol in treated groups compared to high fat diet group at week 8. Administration of *Rumex nervosus Vahl* leaves powdered to high fat diet rats caused reversal of the elevations in alanine aminotransferase and Gamma-glutamyl transferase that were elicited by high fat diet and the values were nearly to the levels shown by normal control group. Creatinine levels were not affected by high fat diet nor by the treatment. Urea levels were significantly higher in high fat diet group compared to normal control group. In conclusion it is illustrated that the *Rumex nervosus Vahl* leaves powdered showed prevention effect on high fat diet-induced hyperglycemia and hyperlipidemia in female Albino rats thus, its prevent effect without showing any toxic effect.

Keywords: *rumex nervosus* vahl, antiobesity, high fat diet, Yemen

1. Introduction
Obesity is a disease with serious public health implications, associated with insulin resistance, type 2 diabetes, hypertension, dyslipemia and atherosclerosis [1]. Due to the side effects associated with the currently available anti-obesity medications and limited efficacy, much attention has been focused on developing new antiobesity agents through herbal medicines that would minimize the side effects. Several animal studies and clinical studies with many herbal medicines have been performed, and some studies reported significant improvements in controlling body weight without any noticeable adverse effects [2, 3, 4].
It was reported that the Rumex genus includes more than 200 species, distributed in temperateregions particularly in the northern areas of both parts of the world [5]. In different countries Rumex species have been used traditionally as antibacterial, anti-inflammatory, antitumor, anti-dermatitis, diuretic, tonic, laxative, astringent in hemorrhoids bleeding, anti-rheumatic, hepatoprotective, analgesic, antipyretic, purgative and anthelmintic [6, 7].
Rumex nervosus Vahl grows wildly in many regions of Yemen In addition, it is consumed freshly by many people in Yemen and it has been used traditionally for treatment of inflammatory diseases, diarrhea, wounds, typhus, rabies and skin disorders [8, 9]. It was investigated that the methanolic extract of *Rumex nervosus Vahl* produced an important peripheral analgesic effect, with a power of protection against the abdominal cramp, via oral pathway [10]. In our previous study, Rumex nervosus Vahl methanolic leave extract showed antioxidant activity and antimicrobial activity against the Micrococcus litius, Bacillus subtilis and Salmonella choleraesuis [11].
In many places in Yemen the leaves of *Rumex nervosus Vahl* plant are usually consumed to reduce body weight, since, there is no study to substantiate the traditionally claimed of the activity of the *Rumex nervosus Vahl* leaves (RNVL) in reducing body weight the present study was undertaken to evaluate the effect of RNVL on reducing body weight in high fat diet-induced hyperglycemia and hyperlipidemia in female Albino rats.

2. Materials and Methods
2.1 Plant Collection
The RNVL was collected from Taiz city in Yemen, in 2015 The plant was identified and authenticated by a plant taxonomist at Department of Botany, Faculty of Agriculture, Sana`a University, Yemen. The leaves were separated from the plant, dried in open air, stored and protected from light prior to further use.

2.2 Diet Preparation
The diet ingredients that used in the experiment is shown in

Table 1. Diet was mixed and prepared in the laboratory of Food Sciences and technology, Faculty of Agriculture, Sana`a University

Table 1: Diet ingredient prepared for the experimental rats

Diet formulation of experimental rats		
Ingredient	**Normal Diet g/kgdiet**	**HFD Diet g/kgdiet**
Casein	148	148
Sucrose	200	100
Starch	482	382
Cellulose	50	50
Fat	100	300
Vitamin Mix	10	10
Mineral Mix	10	10
Total	1000	1000

2.3 Animal Study

Females Albino rats weighing between 100-150 were used. The animals were maintained at Animal House, School of Agriculture, Sana`a University prior to study. The animals were fed with standard diet and water libitum during the maintenance period. The experimental protocols were approved by the Animal Ethics Committee of Agriculture Faculty, University of Sana`a.

The experiment was carried out from May 5th 2015 to July 5th 2015 in Animal house unit located in Faculty of Agriculture, Sana`a University, Yemen. This experiment uses three groups of animals: (1) normal rat diet, (2) high fat diet (HFD), (3) HFD+1% *Rumex nervosus* Vahl *leaves powdered* (RNVLP) with six (6) animals per group for 8 weeks.. Body weight, food and water intake were measured weekly. At the end of the experiment week 8, animals were anticipated euthanizing under fasting conditions with collection of blood. Plasma was analyzed for glucose, Total Cholesterol (TC), Low Density Lipoprotein (LDL) cholesterol, High Density Lipoprotein (HDL) cholesterol and Triglycerides (TG). Liver enzymes, namely alanine aminotransferase (ALT) and Gamma-glutamyl transferase (GGT) were determined using their serum blood. All the blood analysis were carried out in Alulaqi Specials Med. Lab in Sana`a Yemen.

3. Results

3.1 Body weight, food and water intake

Administration of HFD to the rats for 8 weeks caused increase in the body weight (Table 2). On the another hand, in HFD treated rats with RNVLP the body weight was reduced and produced signs of recovery to the weights of normal control group. The HFD control rats consumed less food (Table 2) compared to the normal group. Treatment of HFD rats with RNVLP did not appaerencally effect rats food or water intake through the 8 weeks of the treatment.

Table 2: Body weight, food and water intake, in experimental rats at 8 weeks

	NC	**HFD**	**HFD+ RNVLP**
Body weight (g)	159 ± 2.4	202 ± 3.1	145 ± 2.7
Food intake (g)	64 ± 3.7	41 ± 2.6	40 ± 3.1
Water Intake (ml)	105 ± 1.9	100 ± 2.2	110 ± 2.7

All values are expressed as Mean ± SEM, (*n*=6),
Where the NC= Normal Group
HFD= High fat diet group
HFD+ RNVLP = High fat diet group+ *Rumex Nervosus Vahl* leaves powdered at 1% diet

2.3 Glucose levels

Plasma glucose levels of the experimental period is shown in Table 3. The HFD control rats and normal control rats had comparable levels of blood glucose. The HFD control group had higher of serum glucose level compared to normal group. After 8 weeks of treatment, the HFD that received RNVLP had reduced blood glucose concentrations compared with HFD control group.

2.4 Lipid profile

As shown in Table 3. HFD rats had higher levels of plasma TC and TG at the end of the experiment (week 8). At week, 8 of treatment plasma TG levels and LDL-C levels of HFD treated rats with RNVLP were lower compared to HFD group. On the other hand, no changes in plasma HDL-C in treated group with RNVLP compared to HFD group at week 8 of the experiment.

Table 3: Plasma glucose level TC, LDLC, HDLC, TG, levels in experimental rats at week 8 of the experiment

	NC	**HFD**	**HFD+ RNVLP**
Glucose level (mg/dl)	148.33±5.4	217.2±7.3	91.50±4.7
Total Cholesterol (mg/dl)	69.67±2.20	98±1.31	72.50±1.45
LDL-C (mg/dl)	13.8±0.76	19.25±0.56	15.33±0.84
HDL-C (mg/dl)	52.67±1.34	54±1.07	51.33±2.31
TG (mg/dl)	61.50±2.9	259.2±6.43	208.17±5.9

All values are expressed as Mean ± SEM, (*n*=6),
Where the NC= Normal Group, HFD= High fat diet group
HFD+ RNVLP = High fat diet group+ *Rumex Nervosus Vahl* leaves powdered at 1% diet.

3.5 ALT, GGT, creatinine and urea levels

The HFD control group showed elevations in ALT and GGT levels compared to normal control group (Table 4). Administration of RNVLP to HFD rats caused reversal of the elevations in ALT and GGT were elicited by HFD and the values were in the levels shown by normal control group. Creatinine levels were not affected by HFD nor by RNVLP treatment. Urea levels were higher in HFD group compared to normal control group.

Table 4: ALT.GGT. Creatinine and urea levels in experimental rats at 8 weeks

	NC	**HFD**	**HFD+ RNVLP**
ALT U/L	145.67±1.9	472±2.9	159.17±2.25
GGT U/L	45.83±1.02	409.4±1.5	40.17±1.7
Creatinine (mg/dl)	0.77 ±0.08	0.88±0.09	0.76±0.12
Urea (mg/dl)	20.67±0.82	32.80±0.50	26.25±0.76

All values are expressed as Mean ± SEM, (*n*=6),
Where the NC= Normal Group
HFD= High fat diet group

HFD+ RNVLP = High fat diet group+ *Rumex Nervosus Vahl* leaves powdered at 1% diet.

4. Discussion

In our experiment, 1% RNVLP that mixed with the HFD was safe and nontoxic. Previous experiments have reported the anti-inflammatory, antitumor, anti-dermatitis, diuretic, tonic, laxative, astringent in hemorrhoids bleeding, anti-rheumatic, hepatoprotective, analgesic, antipyretic, purgative and anthelmintic [6, 7]. However, no evidences are available for antiobesity potential of RNVLP. Hence, this study has been designed to demonstrate the effect of RNVLP on high fat diet-induced obesity.

Obesity is associated with various medical ailments [12]. High fat diet-induced obesity has been considered as a model among researchers due to its high similarity of mimicking the usual route of obesity episodes in human [13].

Human studies have revealed that increased fat intake is associated with body weight gain, which can lead to obesity and other related metabolic diseases. This study thus proved that rats exposed to high fat diet for 8 weeks cause increase of animals' body weight, thus verifying the obese status [14]. Although there was difference in the body weights between the high fat and normal diet groups, no difference was observed in the daily food intake of animals. This observation provides us with the fact that an increase in body weight is independent of the amount of food consumed by the animals. Treatment of HFD rats with RNVLP causes a remarkable reduction of body weights when compared to the high fat diet administered rats. The result also suggests that RNVLP supplementation at 1% diet are capable of preventing body weight gain, concomitantly helping in maintaining the current body weight. Further, dyslipidemia is another important hallmark in the pathogenesis of obesity characterized by hypertriglyceridemia [15, 16]. In the present, study apart from reduction in weight, supplementation with RNVLP was observed to attenuate the levels of total TG and LDL in rats feed with HFD.

HFD intakes were shown to contribute to syndromes such as hyperlipidemia, glucose intolerance, hypertension, and atherosclerosis. Numerous evidences indicated that in experimental animals, high fat diet resulted in disturbance in glucose metabolism and impaired glucose tolerance [17, 18], and the present study demonstrate the reduction in blood glucose level those treated with RNVLP.

The literature review revealed that high fat diet induced obesity and abnormal lipid metabolis mall collectively are associated with inflammation, congestion, and nonalcoholic fatty liver disease (NAFLD) leading to hepatic failure causing a boost in ALT, GGT, and total bilirubin level in the serum [19, 20]. Elevated levels of liver enzymes are a monitor of hepatocellular damage and correlate with increased liver weight [21]. The results obtained in the present study established that high fat diet causes hepatocellular damage, as clearly seen by the marked elevation of serum enzymes (ALT, GGT) activities. However, treatment with RNVLP causes a momentary reduction in the enzyme levels, showing the role of RNVLP in preventing liver damage caused by high fat diet Phytochemical studies of the extract of RNVLP showed the presence of three flavanoids; kaempferol, quercetin and isohamnetin In addition to flavonoids, it contains tannins, alkaloids, saponins, amino acid amino acids), [22] that make the RNVLP act as a good source of natural antioxidant due to the presence of various types of antioxidant compounds, flavonoids and phenolic. The antiobesity potential is associated maybe with the presence of flavanoids; therefore, further study needs to be carried out for identification of specific constituents present in RNVLP for its observed effects.

5. Conclusion

From the above findings it is illustrated that the RNVLP showed prevention effect on high fat diet-induced hyperglycemia and hyperlipidemia in female Albino rats thus, its prevent effect without showing any toxic effect. The non-toxic effect of RNVLP provide support to use the plant and it can be recommended for use as a nutritional supplement, health food and adjuvant in the weight management, which supports its traditional claim. Further, studies are carried out in order to determine the active principle of this plant, followed by the identification of the mechanistic approach of RNVLP that helps in weight management.

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7. References

1. Hong JW, Park KW. Further understanding of fat biology: lessons from a fat fly. Exp Mol Med. 2010; 42:12-20.
2. Xiong Y, Shen L, Liu KJ, Tso P, Xiong YQ, Wang GJ, *et al*. Antiobesity and antihyperglycemic effects of Ginsenoside Rb1 in rats. Diabetes. 2010; 59(10):2505-2512.
3. Christine L, Chichioco H, Finella MG. Weight-lowering effects of Caesalpinia pulcherrima, Cassia fistula and Senna alata leaf extracts. J Med Plants Res. 2011; 5(3):452-455.
4. Han LK, Sumiyoshi M, Zhang J, Liu MX, Zhang XF, Zheng YN, *et al*. Anti-obesity action of Salix matsudana leaves (Part 1). Anti-obesity action by polyphenols of Salix matsudana in high fat-diet treated rodent animals. Phytotherapy Res. 2003; 17:1188-1194.
5. Rechinger KH. Rumex L. (Polygonaceae). In: Ali SI and Qaiser M, ed. Flora of Pakistan. No. 205, Department of Botany, University of Karachi and Missouri Botanical Garden, St. Louis, Missouri, U.S.A. 2001, 4-164.
6. Fatima N, Zia M, Rehman R, Rizvi Fatima N, Zia M, Rehman R, *et al*. Biological Activities of Rumex dentatus L: Evaluation of Methanol and Hexane Extracts. African Journal of Biotechnology. 2009; 8(24):6945-6951.
7. Humeera N, Kamili AN, Bandh SA, Lone BA, Gousia N. Antimicrobial and antioxidant activities of alcoholic

extracts of Rumex dentatus L. Microbial pathogenesis. 2013; 57:17-20.
8. Rahman AHMM, Anisuzzaman M, Haider SA, Ahmed F, Islam AKMR, Naderuzzaman ATM. Study of Medicinal Plants in the Graveyards of Rajshahi City. Research Journal of Agriculture and Biological Sciences. 2008; 4(1):70-74.
9. Getie M, Gebre-Mariam T, Rietz R, Ho¨hne C, Huschka C, Schmidtke M, *et al*, Evaluation of the anti-microbial and anti-inflammatory activities of the medicinal plants Dodonaea viscosa, Rumex nervosus and Rumex abyssinicus. Fitoterapia. 2003; 74:139-143
10. Alwashli A, Al Sobarry M, Cherrah Y, Alaoui K. Toxicité aiguë et activité analgésique de l'extrait méthanolique de Rumex nervosus Vahl. Phytothérapie. 2012; 10(5):293-297.
11. Ghanya Al-Naqeb. Antioxidant and Antibacterial Activities of Some Yemeni Medicinal Plants. International Journal of Herbal Medicine. 2015; 3(3):06-11.
12. Wang Y, Lobstein T. Worldwide trends in childhood over-weight and obesity, International Journal of Pediatric Obesity. 2006; (1)1:11-25.
13. Buettner R, Sch¨ olmerich J, Bollheimer LC. High-fat diets: modeling the metabolic disorders of human obesity in rodents, Obesity. 2007; 15(4):798-808.
14. Neyrinck AM, Bindels LB, De Backer F, Pachikian BD, Cani PD, Delzenne NM. Dietary supplementation with chitosan derived frommushrooms changes adipocytokine profile in diet-induced obese mice, a phenomenon linked to its lipid-lowering action. International Immuno pharmacology. 2009; 9(6):767-773.
15. Haley AP, Gonzales MM, Tarumi T, Tanaka H. Dyslipidemia links obesity to early cerebral neurochemical alterations,"Obesity. 2013; 21(10).
16. Klop B, Elte JWF, Cabezas MC. Dyslipidemiain obesity: mechanisms and potential targets, Nutrients. 2013; 5(4):1218-1240.
17. Vessby B. Dietary fat and insulin action in humans, British Journal of Nutrition. Supplement. 2000; 83(1):S91-S96.
18. Lichtenstein AH, Schwab US. Relationship of dietary fat to glucose metabolism," Atherosclerosis. 2000; 150(2):227-243.
19. Altunkaynak Z. Effects of high fat diet induced obesity on female rat livers (a histochemical study), European Journal of General Medicine. 2005; 2(3):100-109.
20. Kameshwaran S, Jothimanivannan C, Senthilkumar R, Kothai AR. Anti-obesity andhypolipidemic activity ofmethanol extract of tecoma stans flowers on atherogenic diet induced obesity in rats, Pharmacologia. 2013; 4(2):77-81.
21. Reddy JK, Rao MS. Lipid metabolism and liver inflammation. II. Fatty liver disease and fatty acid oxidation," The American Journal of Physiology—Gastrointestinal and Liver Physiology. 2006; 290(5):G852-G858.
22. Lutterodt GD. Inhibition of gastrointestinal release of acetylcholine by quercet in J Ethnopharmacol. 1989; 25:235-24.