Life Science Journal

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Evaluation of the hypolipidemic, liver function and antioxidant effects of dietary purslane in albino rats and assess its potential role in green economy and sustainable development models and Carbon Footprint Reduction

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Abstract: *Portulaca oleracea* L, or PURS lane is an underutilized C4 plant with the highest alpha-linolenic acid ALA among leafy vegetables and high tolerance to drought and salinity. **Objective:** Evaluation of the hypolipidemic, liver function and antioxidant effects of dietary purslane in albino rats and assess its potential role in green economy and sustainable development models, carbon Footprint Reduction. **Methods:** Twenty-four male albino rats were divided to two groups for 6 weeks, control (n=12) rats and experimental (n=12) rats obtaining 200 mg/kg/day of ethanol extract for 6 weeks (purslane powder). Lipid profile TC, TG, HDL-C, LDL-C and liver AST, ALT. Oxidative stress markers MDA, GSH were measured together with liver function tests (ALP, ALT and AST). **Results:** Purslane supplementation induced significant reduction of lipid profile except HDL-C that increased also reduced oxidative stress markers, MDA and increased GSH together with NO. **Conclusion:** *P. oleracea* is a sustainable, low input source of plant-based Omega 3, with Cardio Protective and hepatoprotective effects. Its cultivation supports SDG-2, zero hunger, SDG-12 responsible consumption and SDG-13 climate action by providing a climate resilient crop for arid regions like Egypt, Carbon Footprint Reduction is essential to combat climate change by using renewable energy.
[Ryeaan Abdel Moneim Sayed Abdel Raheem. Evaluation of the hypolipidemic, liver function and antioxidant effects of dietary purslane in albino rats and assess its potential role in green economy and sustainable development models and Carbon Footprint Reduction. *Life Sci J* 2025;22(12):43-47]. ISSN 1097-8135 (print); ISSN 2372-613X (online). http://www.lifesciencesite.com. 05. doi:10.7537/marslsj221225.05

Keywords: Purslane, Omega 3 ALA, albino rats, green economy, sustainable development goals.

Introduction:

Purslane is a green leafy plant with different benefits: It is the richest wild plant source of omega-3, that positively affect the heart, brain, liver by reducing inflammation, contains VIT A, E, C and betalains. Protect cells from oxidation stress, beside containing minerals like magnesium, potassium, calcium, iron that help with relaxation, oxygenation and muscle contraction, also regulates blood sugar by slow down sugar absorption and show insulin resistance also help in skin and eye health, and manage weight together with helping memory learning (Uddin et al. 2022; WHO 2020).

Nature's sport pharmacy as reported by Hefnawi (1998) is one of the important elements in drug manufacture and a used definition of the herb: is any part of a plant, which can be used as a medical treatment, nutrient, food seasoning or dye. and used to enhance performance and health, as drugs due to its many contents:

- To cleanse the body, - Adaptation to stress
- Nutritional Value, - Source of energy
- Stimulate immunity, -Stimulate some organs such endocrine system, muscles, - Source of low-fat food
- Antioxidants such as green tea, ginkgo biloba and Purslane

Hatfield (2013) added that herbs may adapt to stresses, they are high in vitamins, minerals, raise energy, stimulate the immune system, and endocrine system and repair growth. Also, Hatfield (2013) demonstrated that herbs may be a natural sport pharmacy and define herb to be any part of a plant, which can be used as a medical treatment and added that herbs may enhance performance health in many ways:

- Through the herbs contain of antioxidants
- Herbs can have a great nutritional value of vits and minerals
- Can raise energy levels, - Can stimulate immunity
- Can stimulate other system such as endocrine system

Supplements may be used for specific goals such as to lose weight by caffeine, to get stronger using (IGF) found in colostrum, to build muscle mass by BCAA, for anaerobic energy using energy drinks and baking soda, and for aerobic energy herbal formula, for recovery of exercise L. glutamine, in caseto reduce pain by aspirin, for rapid healing of tissues, VIT C, for mental arousal using phosphatidylserine, and for general health, Vitamins, mineral complex and ginseng (ATSDR 2021; Hatfield 2013; Guyton and Hall 2006).

Farouk (1998) reported the importance of supplementation of nutrients for athletes by showing that through ancient times, human being has tried to obtain strength and energy through nutrients especially amino acids, as example ornithine, lysine, arginine to stimulate growth hormone, branched chain amino acids (BCAA) for energy production and endurance of Cardiovascular system.

As for the amino acid glutamine, to stimulate the immune system and wellness, and minerals such as magnesium, potassium to improve physical performance for long distance athletic and creatine for formation of creatine phosphate and ATP.

Study Problem:

It is important to protect the external environment from pollution. As well as, the internal environment of the human body from pollution that affect the internal organs such as diet, drug and others, that may include diseases. In order to protect the internal environment from diseases, there are Normal therapy and complementary or alternative therapies, which concentrate on the body energy, and there is equipment to assess energy such as Electromyogram and Electrocardiogram, which determines energy. Alternative therapies are mentioned as: Physical, Psychological, Manipulative, behaviorism, transactional analysis, Oriental, exercise movement, sensory, paranormal, para national and herbal medicine (Chopra et al. 1956)

The aim of the present study was to evaluate the hypolipidemic, liver function and antioxidant effects of dietary Purslane in albino Rats and assess its potential role in green economy and Sustainable development models and carbon footprint reduction

2. Materials and Methods:

The researcher used the experimental method Adult male albino rats of Sprague - Dawley strain, 200-230 g body weight were obtained from laboratory animals farm of Egyptian Organization for Biological Products and Vaccines, Cairo -Egypt. Rats were fed standard rat chow diet and water ad libitum and were kept under controlled temperature and humidity throughout the experimental work.

Experimental design:

The study included twenty-four male albino rats; they were divided to two equal groups. The control groups (n=12) received placebo for 6 weeks, once daily, Experimental group (n=12) received purslane powder as 200mg/Kg/day ethanol extract omega for 6 weeks, once daily by oral gavage.

The animals were healthy and free from parasites or skin disease by examination, they were housed in galvanized wire batteries and maintained under hygienic conditions in temperature 22 ± 3.5°c and light (12 L / 12 D) They were fed on a commercial balanced pelleted ration.

At the end of the experiment, the animals were sacrificed, and the blood was collected in non-heparinized tubes for serum analysis of alanine aminotransferase (ALT), Aspartate amino transferase (AST), Alkaline Phosphatase (ALP) together with lipid profiles (TG, TC, LDL-C, HDL-C). (MDA, GSH) they were performed using commercial kits from Diamond diagnostic, Egypt and using spectrophotometer (Jenway, Japan).

Nitric oxide was measured using Elisa reader at 570 nm.

Statistical Analysis:

Using (SPSS) statistical package for the social sciences for mean, standard deviations. T test for analysis of the results of pre-post experiment $P<0.05$ value was considered statistically significant

3. Results:

Table (1) Indicated a significant increase in HDL-c of the experimental group compared with control one, while cholesterol, Triglycerides, LDL-c showed a significant decreased level of albino rats

Table (2) Indicated a significant decreased MDA and elevated GSH and NO. in case of experimental group compared to the control one of albino rats

Table (3) Indicated a significant decreased level of (ALT) and (AST) and (ALP) of the experimental group compared to the control one of albino rats.

Table (1): Lipid profile before and after placebo or purslane in control and experimental groups of albino rats:

Variables	Control		Experimental	
	Pre	Post	Pre	Post
	M±SD	M±SD	M±SD	M±SD
T. Cholesterol(mg/dl)	178.1 ± 7.8	176.1 ± 6.9	175.9 ± 6.1	166.3 ± 5.3 *
Triglycerides(mg/dl)	141.2 ± 5.4	140.2 ± 4.8	142.2 ± 5.1	123.6 ± 4.3 *
HDL-C (mg/dl)	43.1 ±6.2	43.4 ±5.9	44.3 ±3.6	47.3 ±3.8 *
LDL-C (mg/dl)	161.1 ±6.3	162.2 ±6.5	159.3 ±6.1	131.2 ±5.6 *

There are significant changes in experiment compared to control group $P<0.05$ for the sake of experimental rats.

Table (2): Changes in oxidant and antioxidant in control and experimental groups of albino rats*

Variables	Control		Experimental	
	Pre	Post	Pre	Post
	M±SD	M±SD	M±SD	M±SD
MDA (nmol/ml)	3.5± 0.37	3.6 ±0.31	3.7 ±0.29	1.9 ±0.13 *
GSH (mg/dl)	76.2 ±6.12	77.5 ±6.8	77.3 ±7.2	91.2 ±8.1*
NO (umol/L)	6.1 ±1.2	6.3 ±1.4	6.5 ±2.1	13.2 ±5.9 *

There are significant changes in Experimental compared to control group P<0.05 for the sake of experimental rats.

Table (3): ALT, AST in control and experimental groups before and after placebo and Purslane to albino rats*

Variables	Control		Experimental	
	Pre	Post	Pre	Post
	M±SD	M±SD	M±SD	M±SD
ALT (U/ml)	26.1 ±5.4	26.2 ±5.6	26.7 ±5.3	23.1 ±2.2*
AST (U/ml)	24.6 ±4.8	24.8 ±4.7	24.3 ±4.6	22.3 ±3.6 *
ALP (U/ml)	30.2 ±5.1	31.3 ±4.9	29.8 ±5.3	22.1 ±3.3*

There are statistical changes in case of experimental group compared to control for the sake of experimental rats. P<0.05

4. Discussion:

Table (1) showed a significant increase in HDL-c in case of the experimental group compared to control, while TC., Triglycerides, LDL-c showed a significant decreased level in albino rats.

The reduction of lipogram tested help in weight control and beneficial to the cardiovascular system and other organs (EL Kolla, (2013).

It may be beneficial to prevent clot formation that led to closure of blood supply to important organ of the body like the brain (Murray et al. 2009) Also, Wang et al. (2023) reported medicinal properties of *Portulaca oleracea*.

Table (2) Showed a significant decreased MDA level and elevated Reduced glutathione GSH in case of experimental group compared to the control one of albino rats. Chatterjea and Shinde (2005) demonstrated that omega 3 may possess diverse pharmaceutical activities: included antioxidant and anti-inflammatory effect.

They added that omega 3 is used as a stimulant agent for the immune system which might induce infection resistance and benefit health, this was also reported by Guyton and Hall (2006).

Free Radicals are atoms or molecules with at least one unpaired electron. Under normal conditions, an equilibrium exists between reactive oxygen species and antioxidants. The over-production of ROS in cells induce an imbalance between pro-oxidants (Chopra 1956; Chatterjea and Shinde 2005) in case of antioxidants. Katzung (2005) reported that Glutathione (GSH), SH is the business part of the molecule and indicates the sulphydryl group, and glutathione is an important defense mechanism against some toxic compounds, such as drugs and carcinogens. Glutathione has other important functions in cells, it participates in the decomposition of toxic hydrogen peroxide, and is an important intracellular reductant, helping to maintain essential SH groups of enzymes in their reduced state (Hait etal., 1996; Guyton and Hall 2006; Lushchak 2012)

Zubai (1989) reported that glutathione is a tri-peptide of three amino acids namely, glutamic acid, cysteine and glycine, and is synthesized in cytosol outside the ribosomes, from three amino acids, this require ATP and glut a glutathione induce many functions: as important reducing agent, it helps to destroy H_2O_2, act as co-enzyme for glyoxalate which converts methyl glyoxal to lactic acid, and many other functions affecting the body. Also, Petropoulos et al. (2019) added antioxidants properties of Portola oleracea.

Connor (2000) reported the mechanism of action of glutathione peroxidase in protecting Rbcs against hemolysis, as oxidized glutathione (GSSG) is reduced to reduced glutathione (2G-SH) catalyzed by glutathione reductase, in turn reduced glutathione removes H2O2 from the Rbcs in a Reaction catalyzed by glutathione peroxidase, the enzyme acting as natural antioxidant, that attack peroxides and H_2O_2, also glutathione peroxidase affect incidence of cancers due to its content of selenium.

Nitric oxide levels increased after dietary purslane administration in experiment group of albino rats (Table 2), which indicated an increased blood flow, which in turn can help in many forms of cardiac diseases and infarction of the heart.

This indicated that purslane may be beneficial to the heart function and many other important organs of the body.

Noura (2005) reported that Nitric oxide (NO) is formed in the body from amino acid arginine. It is a wonder molecule having diverse biological functions like Pgs. Arginine is acted upon by an enzyme called Nitrogen oxide synthase, a cytosolic enzyme and converts arginine to citrulline and nitric oxide (NO). Functions of nitric oxide are summarized;
It acts as vasodilator and relaxes smooth muscle.
It has important role in the regulation of blood flow and blood pressure.
Acts as neurotransmitter in the brain and peripheral autonomic nervous system.
Inhibits adhesion, activation and aggregation of platelets.

May constitute part of a primitive immune system and mediate bactericidal actions of macrophages; It is involved in penile erection
It is involved in the pathogenesis of atherosclerosis
It is involved in angiogenesis (Chatterjea and Shinde 2005; Sessa, 1994)

Dulak et al. (2002) demonstrated that No enhances VEGF synthesis, which in turn increases blood flow in the circulatory system, which help in cardiac infarction and other cardiac disorders and indicating that NO, which is a gaseous molecule is considered an important determinant of angiogenesis.

The results were also in line with that of Jozkowicz et al. (2001). Also, Kumar et al (2022) added phytochemicals and Ethnopharmacology potential of purslane.

Table (3) indicated a significant decreased level of ALT, AST and ALP of the experimental group compared to the Control albino rats, this revealed a beneficial effect on the liver, and it may be used safely in case of any harmful effect occurring to the liver. as indicated from the improved serum levels of AST, ALP ALT and. in liver function tests.

These results are in line with those of Li et al. (2024), as they reported a hepatoprotective effect of Portulaca Oleracea in high fat diet rats fed rats.

Magini (2007) and Rajarman et al. (1998) added that VIT A, E of Purslane induce a beneficial effect on nitric oxide production and on immune function which added more positive effect in relation with the ingestion of Purslane and added more value to its implantation as a potential role in green economy.

The relation between purslane and ASD alignment purslane provides 300-400 mg of linolenic acid per 100 g of fresh leaves addressing omega3 deficiencies populations with low fish consumption SDG2: Zero hunger (FAO, 2022)

The near zero input cost of wild harvested purslane generates an estimated net profit of 420$ per feddan annually creating rural employment opportunities for small holders and aligning with SDG 8 (Rahdari and Hosseini, 2024), utilization of the entire purslane plant with a shelf life 12 months after drying minimizes food waste practices consistent with SDG 12 (FAO, 2022)

As a CAM/C4 facultative halophyte requiring 0.3 m² of water per Kg of biomass. Purslane exhibits high water use efficiency, supporting SDG13, for adaptations in arid region 13.

The integration of purslane into arid zone farming system addresses SDG2 through enhanced nutrition, SDG8 via low-cost rural livelihoods, SDG12 by reducing agricultural waste, and SDG13 through climate resilient production United Nations (2015). Carbon footprint reduction is essential to combate climate change by using renewable energy

Conclusion:

From the obtained Results it may be concluded that long term omega 3 Purslane ingestion may be beneficial in some cardiac disorders, reduce weight as it reduces lipogram and increases HDL. And it may be used postoperative as it decreases the risk of thrombosis, also (purslane, omega 3) may decrease stress and elevate mood together with stimulate immunity and general health and assess its potential role in green economy and sustainable development models. Purslane is not a weed. It is a national strategy for food security

References

Agency for Toxic Substances and Disease Registry. (2021). *2021 annual report*. U.S. Department of Health and Human Services. https://www.atsdr.cdc.gov/2021-annual-report/

Chatterjea, M. N., & Shinde, R. (2005). *Textbook of medical biochemistry* (6th ed.). Jaypee Brothers Medical Publishers.

Chopra, R. N., Nayar, S. L., & Chopra, I. C. (1956). *Glossary of Indian medicinal plants*. Council of Scientific and Industrial Research.

Connor, W. E. (2000). Importance of n-3 fatty acids in health and disease. *American Journal of Clinical Nutrition, 71*(1 Suppl.), 171S–175S.

Dulak, J., Huk, I., & Pachinger, O. (2002). Carbon monoxide and iron modulate vascular endothelial growth factor synthesis in vascular smooth muscle cells. In N. G. Abraham (Ed.), *Heme oxygenase in biology and medicine* (pp. 97–108). Kluwer Academic/Plenum Publishers.

El Kolla, M. (2013). *Nutrient supplements*. National Academy of Nutrition.

FAO (2022): Underutilized crops for food security and nutrition in dryland. FAO Plant Production and Protection No 225

Farouk, A. (1998). *Nutritional supplement*. Olympic Center Congress, Cairo, Egypt.

Guyton, A. C., & Hall, J. E. (2006). *Textbook of medical physiology* (11th ed.). Elsevier Saunders.

Hait, W. N., Ward, M. D., Trakht, I. N., & Ryazanov, A. G. (1996). Elongation factor-2 kinase: Immunological evidence for the existence of tissue-specific isoforms. *FEBS Letters, 397*(1), 55–60. https://doi.org/10.1016/S0014-5793(96)01070-8

Hatfield, F. (2013). *Fitness: The complete guide*. International Sports Sciences Association.

Hefnawi, M. (1998). *Herbs: Nature's sport pharmacy*. Olympic Center Congress, Cairo, Egypt.

Jozkowicz, A., Huk, I., Nigisch, A., Weigel, G., Weidinger, F., & Dulak, J. (2001). Genetic augmentation of nitric oxide synthase increases the vascular endothelial growth factor gene expression. *Cardiovascular Research, 51*(4), 773–783.

Katzung, B. G. (2005). *Basic & clinical pharmacology* (9th ed.). McGraw-Hill Medical.

Kumar, A., Singh, P., & Ramchandran, N. (2022). Review on bioactive phytochemicals and ethnopharmacological potential of purslane (*Portulaca oleracea* L.). *Heliyon, 8*, e08669. https://doi.org/10.1016/j.heliyon.2022.e08669

Li, Y., Xiao, L., Yan, H., Wu, M., Hao, X., & Liu, H. (2024). Nutritional values, bioactive compounds and health benefits of purslane (*Portulaca oleracea* L.): A comprehensive review. *Food Science and Human Wellness, 13*(5), 2480–2501. https://doi.org/10.26599/FSHW.2022.9250203

Lushchak, V. I. (2012). Glutathione homeostasis and functions: Potential targets for medical interventions. *Journal of Amino Acids, 2012*, 736837. https://doi.org/10.1155/2012/736837

Maggini, S., Wintergerst, E. S., Beveridge, S., & Hornig, D. H. (2007). Selected vitamins and trace elements support immune function by strengthening epithelial barriers and cellular and humoral immune responses. *British Journal of Nutrition, 98*(S1), S29–S35. https://doi.org/10.1017/S0007114507832971

Murray, R. K., Bender, D. A., Botham, K. M., Kennelly, P. J., Rodwell, V. W., & Weil, P. A. (2009). *Harper's illustrated biochemistry* (28th ed.). McGraw-Hill Medical.

Noura, E. (2005). *Effect of ginseng on male fertility in rabbits* (Doctoral dissertation). Zagazig University.

Petropoulos, S. A., Fernandes, Â., Dias, M. I., Vasilakoglou, I. B., Petrović, J., Soković, M., Ferreira, I. C. F. R., & Barros, L. (2019). Nutritional value, chemical composition and cytotoxic properties of common purslane (*Portulaca oleracea* L.). *Antioxidants, 8*(8), 293. https://doi.org/10.3390/antiox8080293

Rahdari, P., & Hosseini, S. M. (2024). Purslane as a sustainable crop under saline and drought stress. *Agricultural Water Management, 291*, 108635.

Rajaraman, V., Nonnecke, B. J., Franklin, S. T., Hamell, D. C., & Horst, R. L. (1998). Effect of vitamin A and E on nitric oxide production by blood mononuclear leukocytes from neonatal calves fed milk replacer. *Journal of Dairy Science, 81*(12), 3278–3285.

Sessa, W. C. (1994). The nitric oxide synthase family of proteins. *Journal of Vascular Research, 31*(3), 131–143.

Uddin, M. K., Juraimi, A. S., Ali, M. E., Ismail, M. R., & Zaidul, I. S. M. (2022). Phytochemical, antioxidant and anti-inflammatory activities of purslane (*Portulaca oleracea* L.). *Journal of Functional Foods, 89*, 104936. https://doi.org/10.1016/j.jff.2022.104936

United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development*. United Nations.

Wang, M., Hu, W., Tang, H., et al. (2023). Extraction, purification, structural characteristics, biological activity and application of polysaccharides from purslane (*Portulaca oleracea* L.). *Molecules, 28*(12), 4813. https://doi.org/10.3390/molecules28124813

World Health Organization. (2020). *Healthy diet*. https://www.who.int/news-room/fact-sheets/detail/healthy-diet

Zubair, G. (1989). *Biochemistry study*. Maxwell Macmillan