Original Article

# Effect of Pumpkin Seed Oil against High Fat Diet Induced Hyperlipidemia in Wistar Albino Rats



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## ABSTRACT

**Objective:** To study and analyze the lipid lowering and anti – obesity effect of Pumpkin seed oil (PSO) against high fat diet induced hyperlipidemia in Wistar Albino male rats.

**Study Design:** Experimental study

**Place and Duration of Study:** This study was conducted at the Suleman Roshan Medical College, Tando Adam and Animal House of the Sindh Agriculture University, Tando Jam from April 2021 to September 2021 for a period of six months.

**Materials and Methods:** Sixty male Wistar albino rats were included in experiment according to the inclusion criteria. Rats were kept in animal house as per standard protocol of animal handling in Laboratory (NIH), USA guidelines. HFD was prepared as described previously. Rats were divided into four groups (A to D), each group comprised 15 rats. Pumpkin seed oil (PSO) was purchased from market. After the experiment, blood samples were collected for blood lipids biochemical analysis. Data was analyzed on SPSS 21.0 ver. (IBM, Incorporation, USA) using 1– way ANOVA, descriptive and Post – Hoc LSD at 95% confidence interval ($P<0.05$).

**Results:** Six weeks PSO therapy decreased the body weight and exerted lipid lowering potential. Serum triglycerides (TAGs), total cholesterol (TC), serum LDL cholesterol (LDLc) and serum HDL cholesterol (HDLc) shows significant reduction compared to positive control group B ($P<0.05$).

**Conclusion:** The present study concludes the pumpkin seed oil shows lipid lowering and anti – obesity potential hence it may be used for clinical purpose of treating hyperlipidemia


**Key Words:** Pumpkin seed oil, Hyperlipidemia, Lipid lowering, Rats

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## INTRODUCTION

Hyperlipidemia is a part of metabolic syndrome characterized by high circulating levels of various lipid fractions (VLDL, Chylomicron, LDL and HDL) in the blood circulation.[1] Hyperlipidemia increases the levels of free fatty acids (FFA) in blood that often evoke an inflammatory reaction causing release of cytokines resulting neutral fat deposition in liver parenchyma and arteries. This is the beginning lesion of atherosclerosis. Fatty liver indicates insulin resistance and development of future diabetes mellitus. Blood lipid (VLDL, Chylomicron, LDL and HDL) fractions are often disturbed in obese patients. Hence, the hyperlipidemia is a fore runner of fatty liver, insulin resistance, diabetes mellitus, atherogenesis, ischemic arterial disorders, etc.[1] Currently; many herbs are being evaluated of their lipid lowering potential to overcome above morbid conditions. Many natural herbs had been used in Ayurveda, Chinese traditional medicine (CTM), Western countries and other oldest traditional systems. [2] Pumpkin (Curcurbita maxima L) is one of herbs that is cultivated at high altitudes and near sea levels. Seeds of pumpkin are edible and contain essential oils. Seeds are protein rich and low neutral fats. [3,4] Pumpkin fruit is rich in β-carotene, minerals, poly unsaturated essential fatty acids (PUFA), carbohydrates, vitamins, etc. Pumpkin is rich source of oleic acid.[3-5] Pumpkin is enriched with fixed oils, PUFA, essential amino acids, peptides, Lutein, zeaxanthin, para-amino benzoic acid (PABA), lutein and g-amino butyric acid (GABA), etc. Chromium, manganese, copper, magnesium, selenium, zinc, and molybdenum are also found in pumpkins.

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Some lipid lowering, insulin secretagogue and insulin sensitizing activity has been identified. Anti – fungal and anti – microbial peptides have been identified in pumpkin. This proves the pumpkin is of medicinal value. It has been used in traditional medicine since centuries back. Pumpkin seed oil (PSO) is also enriched in carotene, carotenoids, vitamins, phenolic compounds, riboflavin, thiamine, folic acid, proteins, fibers, poly unsaturated fatty acids (PUFA), α-tocopherol, γ-tocopherol, selenium, zinc (Zn), molybdenum, manganese (Mn), copper, magnesium, chromium, etc. PSO protects against cardiac and prostate diseases, cancers and inflammatory effect.[5,6] Currently, the hyperlipidemia is increasing in the individuals of urban society due to over eating, sedentary life style and obesity[7] hence it is needed to analyze simple herbs of their lipid lowering potential. PSO is easily available herbal essential oil; hence, the research protocol was designed of its hypolipidemic effects. Aim of research was to compare preventive and curative lipid lowering effects of PSO in a high fat fed induced hyperlipidemia animal model of Wistar Albino rats.

# MATERIALS AND METHODS

The present experimental study was conducted at the Department of Anatomy, Pathology and Pharmacology, Suleman Roshan Medical College, Tando Adam, Sindh. Written permission of conducting experiment according to animal ethics was taken from the institute. The animals were housed and experiment was performed at the Animal House of the Sindh Agriculture University, Tando Jam. Study was conducted over six months from April 2021 to September 2021. Sixty male Wistar albino rats were included in experiment according to the inclusion criteria of; normal health moving and eating male rats, body weight 120 – 180 grams with successful induction of hyperlipidemia in experimental groups. Rats of other gender, inactive and not feeding well, non – successful induction of hyperlipidemia, and moribund rats. Rats were kept in animal house as per standard protocol of animal handling in Laboratory (NIH), USA guidelines in stainless cages, normal and high fat diet (HFD). HFD was prepared as cited previously.[8,9] Water and food was used for drinking and eating available free (ad libitum). Sixty rats were divided into four groups, each group comprised 15 rats. Negative control (Group – A) were given normal diet (70% Carbs, 20% proteins and 10% fats),[8] Positive controls (Group – B) were given HFD (60% fats, 20% proteins and 20% carbs),[9] Experimental Preventive (Group C –) HFD + Pumpkin seed oil (PSO) in dose of 100 mg/Kg (bwt) for three months (concomitantly),[8,9] and Experimental Curative (Group D) was induced hyperlipidemia with HFD followed by PSO in dose of 100 mg/Kg bwt for three months.[8,9] Hyperlipidemia was induced by feeding HFD for six weeks in the curative group D.[10] Pumpkin seed oil (PSO) was purchased from market. After the experiment, body weight was measured on electronic weigh scale and the blood samples were collected from the retro – orbital venous plexus using a capillary tube inserted behind the eye ball carefully. Blood samples were stored at -20$^0$C for later biochemical analysis. Total cholesterol (TC), TAGs, LDL and HDL were detected by standard methods. Data was analyzed on SPSS 21.0 ver. (IBM, Incorporation, USA). One – way analysis of variance, descriptive and Post – Hoc LSD estimated the continuous variables of blood lipids levels in control and experimental rats. Lipid fractions were tabulated as mean+/- SD. 95% confidence interval ($P<0.05$) was taken statistically significant.

# RESULTS

Table – 1 shows the baseline and post – experiment body weight of study rat groups. Results of body weight show the Pumpkin seed oil (PSO) decreases the body weight and possess lipid lowering potential as shown in table – 2. Serum triglycerides (TAGs), total cholesterol (TC), serum LDL cholesterol (LDLc) and serum HDL cholesterol (HDLc) shows significant reduction compared to positive control group B ($P<0.05$).

**Table No.1: Body weight in study rat groups**

| Groups | Body weight (grams) | |
|---|---|---|
| | Baseline | After Experiment |
| Group A. -ve control | 181.5±7.5 | 237.0±10.5 |
| Group B. +ve control | 135.1±10.3 | 287.3±11.2 |
| Group C. Preventive group | 131.3±3.3 | 201.2±9.6 |
| Group D. Curative group | 130.2±5.5 | 219.69±6.17 |
| **P-value** | 0.0001 | 0.0003 |

**Table No.2: Blood lipids in study rat groups**

| Groups | TAGs | Cholesterol | LDLc | HDLc |
|---|---|---|---|---|
| Group A. -ve control | 134.7±8.03 | 111.3±7.3 | 97.3±8.2 | 40.3±3.5 |
| Group B. +ve control | 312.3±10.5 | 289.5±9.1 | 189.3±7.3 | 25.7±2.1 |
| Group C. Preventive group | 230.3±9.7 | 267.1±9.7 | 150.1±5.1 | 37.1±3.2 |
| Group D. Curative group | 239.5±7.8 | 259.3±8.5 | 147.5±9.3 | 38.1±5.9 |
| **P-value** | 0.0001 | 0.0003 | 0.0009 | 0.0005 |

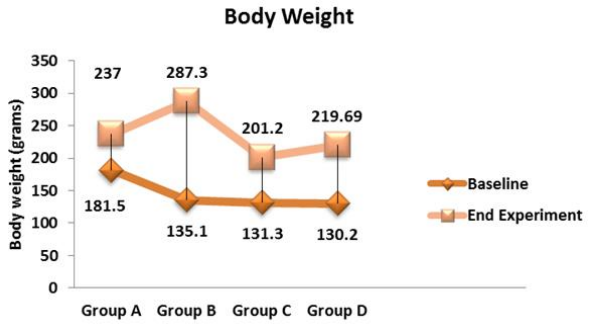


**Figure No.1: Body weight in study rat groups (Baseline and end experiment period)**

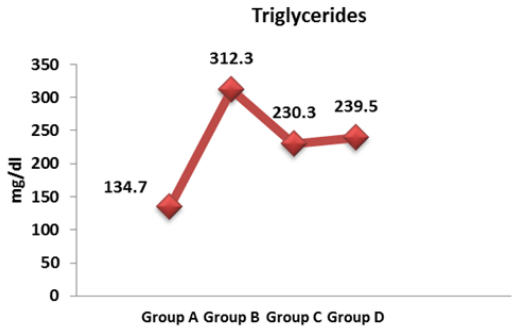


**Figure No.2: Serum triglycerides (mg/dl) in study rat groups**

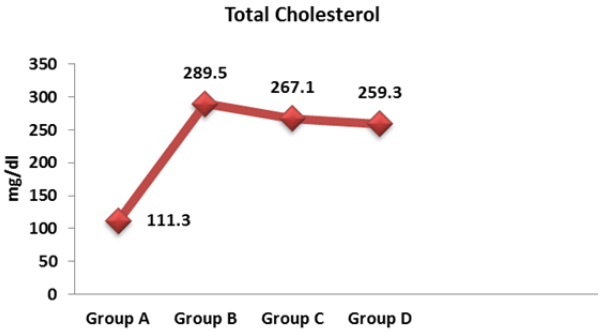


**Figure No.3: Serum cholesterol in study rat groups**

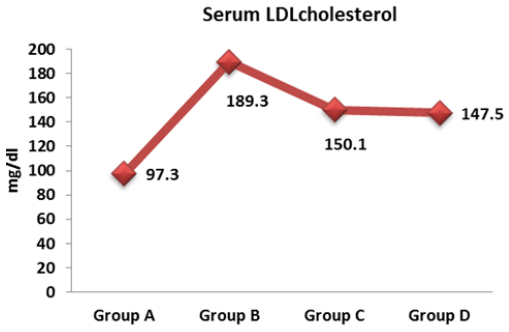


**Figure No.4: Serum Low Density Lipoproteins (LDLc) in study rat groups**

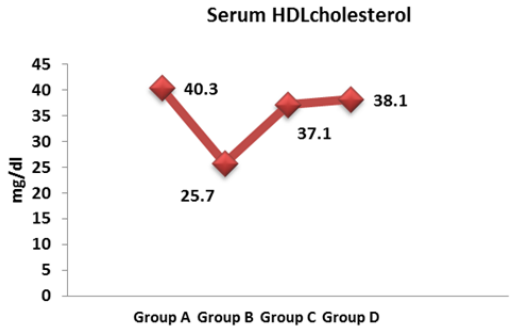


**Figure No.5: Serum High Density Lipoproteins levels (HDLc) in study rat groups**

# DISCUSSION

Present is the first experimental study conducted to study and analyze the lipid lowering and anti – obesity potential of pumpkin seed oil (PSO) in high fat diet induced hyperlipidemia rat model. PSO shows significantly lipid lowering effects with concomitant reduction in body weight. TAGs, LDLc, and TC were decreased with increase in HDLc (P=0.0001). The findings are in agreement with previous studies.[11,12] In present study, hyperlipidemia was ameliorated and increasing body weight was decreased by PSO. This is supported by previous studies.[13,14] The present study observed decrease in body weight that is new finding not observed in a previous study.[15] However, the lipid lowering finding of PSO is consistent with above studies. PSO lipid lowering potential may b may be exploited clinically for treating body weight and hyperlipidemia in community as both disorders are inclining due to over eating habits particularly in urban populace. It is reported the overeating has increased due to economic prosperity particularly in the children of urban areas and are at risk of hyperlipidemia and obesity and related co – morbidities in the future.[15-17] The present WHO based data reveals 58.1% are overweight and 43.9% are obese, both leading to hyperlipidemia hence the future will be worse and a preplanned herbs research is demanding for preparedness of handling the co – morbidities. Data of Asian countries shows 72.3% Pakistani`s are overweight and 58.1% are obese.[18,19] Previous studies[18,19] from Pakistan indicate 17.3% population shows hypercholesterolemia and 17.3% dyslipidemia and 41.0% are suffering from systemic hypertension. This indicates higher future risk of hyperlipidemias and metabolic disorders in near future in the country. The PSO proves significantly effective in improving hyperlipidemia and body weight in present study; this may be further researched in clinical trials for the future. We found an increase in serum HDL cholesterol that is very important clinical finding for prevention of atherosclerotic arterial disease. PSO are enriched in PUFA, α-tocopherol (vitamin E), B vitamins, micro minerals that may be used for overcoming the

hyperlipidemia and obesity.[15,17] The findings of present study are supported by other previous studies.[20,21] A previous study[21] has reported similar lipid lowering effects of PSO in experimental rats. Other previous studies[16,17,22] concluded the hypolipidemic effect of PSO are due to the PUFA, vitamins, carotenoids and tocopherol, etc. PUFA lowers blood lipids and protects against the coronary atherosclerotic disease.[22,23] The findings of present study proves the lipid lowering potential of PSO that may be used as add – on herbal therapy with least adverse effects. Pumpkin seed oil (PSO) is herbal oil hence safe for clinical use. PSO is easily available, inexpensive and cost effective hence it may be used for treating hyperlipidemia but this needs further research studies.

# CONCLUSION

The present study shows the pumpkin seed oil (PSO) exerts lipid lowering and anti – obesity potential. Cholesterol, TAGs and LDLc were decreased with a concomitant rise in HDLc. It is concluded PSO may be used treating hyperlipidemia and may be used as add – on therapy in urban community. However, Clinical trials are recommended to validate the lipid lowering potential making it convenient for clinical use.

**Author's Contribution:**

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|---|---|
| Concept & Design of Study: | Asim Mehmood |
| Drafting: | Samreen Ali, Rasheed Ahmed Soomro |
| Data Analysis: | Majid Ali Hingoro, Umair Ali Soomro, Muhammad Atif Ata |
| Revisiting Critically: | Asim Mehmood, Samreen Ali |
| Final Approval of version: | Asim Mehmood |

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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