

Antiobesity and Hypolipidemic Activity of *Macrotyloma Uniflorum* in Albino Rats

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Abstract: Background: Obesity is one of the major health problem and has become a pandemic. It affects all population and age groups worldwide resulting in significant morbidity and mortality. Treatment of obesity is difficult and challenging because of multiple and obscure aetiology. *Macrotyloma uniflorum* commonly called as horse gram has been used time immemorial by natives as a food supplement and for obesity. This study was done to evaluate the anti-obesity and hypolipidemic activity of *Macrotyloma uniflorum* in comparison with Orlistat. Study design: Obesity was induced by feeding high fat diet (HFD) to male albino rats and were assigned into four groups. A control group on HFD alone, standard group on HFD and orlistat 10mg/kg, test group 1 & 2 on HFD with 100mg, 200mg /kg horse gram extract respectively. Body weight was measured weekly. Lipid profile was measured before treatment and 4 weeks later. Locomotor activity and food intake were also observed. Results: Body weight & lipid profile were reduced significantly when compared with HFD control group. Conclusion: The result of the present study shows that *Macrotyloma uniflorum* extract had significant anti-obesity and hypolipidemic activity, and may be used safely in weight management. Further studies are needed to elucidate the mechanism of its anti-obesity activity.

Keywords: Obesity, HFD- High fat diet, orlistat, *Macrotyloma uniflorum* extract, Lipid profile

1. Introduction

Obesity and overweight are major public health problems and has recently become a pandemic. In 2014 more than 1.9 billion adults were over weight of whom more than 600 million were obese world wide.[1,2]. WHO has declared obesity as a global epidemic in 1997. There is overwhelming evidence that obese individuals have a higher risk of developing many diseases like type II DM, hyperlipidemia, cardiovascular disease, HT [3]. It is a chronic disorder with complex interaction between genetic and environmental factors and occurs due to high fat intake and decreased energy expenditure. Obesity affects individuals physically and emotionally. Endogenous involvement of leptin, insulin, ghrelin, CCK, NPY neuropeptide, glycogen like peptide-1, and (PTP-1B) protein tyrosine phosphatase-1B signalling have potential effect on food intake and energy expenditure [4]. These peptides are new drug targets for anti-obesity drugs. The existing drugs approved for obesity carry an array of adverse effects and also people with obesity have associated co-morbid conditions and are prone for drug interaction. Many drugs developed for obesity mimic amphetamine, but these central appetite suppressants have significant toxicity. Sibutramine and Rimonabant were withdrawn because of cardiotoxicity. Orlistat and Locaserine are the single agents non-amphetamine group approved in USA for the treatment of obesity [5]. Increase in incidence and lack of safe and effective drugs has pushed considerable scientific and financial interest in developing therapy for obesity. In traditional system of medicine many medicinal plants and their extracts are used for treatment of obesity and hyperlipidemia. Potential of natural products for treatment of obesity is still largely unexplored and might be an excellent alternative strategy for development of safe and effective anti obesity drug.

2. Materials and Methods

Plant Material: Horse gram or Kulthi (Botanical name- *Macrotyloma uniflorum*) is widely consumed in South India. Horse gram is known by different names all over the world, it is called, Kollu in South India. Horse gram is scientifically known as *Macrotyloma uniflorum*. It also goes by the name *Dolichos biflorus*. Horse gram is a legume and seeds are round and flattened in shape. It is famous for its medicinal use because different parts of the plants are used for the treatment of heart conditions, asthma, bronchitis, leucoderma, and for treatment of kidney stones. [6]

Horse gram is used traditionally to treat renal stones, piles, flatulence, fever and oedema. Additionally it has anti ulcer, hepatoprotective and antioxidant property. It is rich in iron, calcium and molybdenum [7].



Figure 1: Horse Gram Seeds

Aqueous extract preparation was done in Pharmacognacy department, Madurai Medical College, Madurai. Seeds of *Macrotyloma uniflorum* were shade dried and powdered. 200 grams of powdered horsegram was kept in 200 ml conical flask and 100 ml of water was added as a solvent. Extract was filtered by using muslin cloth followed by

Whatman no 1 filter paper and finally filtered by using vacuum and pressure pump. The solvent from the extract was removed by using rotary vacuum. The extract was then freeze-dried. The extraction yielded a brown powder and it was stored at 20°C until use. Doses of 100, and 200 mg/kg extract were dissolved in distilled water at the time of oral administration. Orlistat reduce the fat absorption by inhibiting gastrointestinal lipase activity. It is safe and well tolerated. Hence Orlistat (Meyer private limited) was used as standard drug in the present study. 60mg capsules were dissolved in distilled water just before oral administration at a dose of 10mg /kg body weight.

High-Fat Diet [8,9] : The composition of HFD used to induce obesity consisted of

- A : 40 gm of condensed milk+40gm of bread,
- B : 15 gm of chocolate+30 gm of biscuit and
- C : 30gm of dried coconut+40 gm of cheese +50gm of boiled potatoes.

Three different combinations were added to the standard pellet diet given on three consecutive days. This pattern of diet was followed for 28 days.

Experimental Animals: 30 adult male albino rats weighing 150-200 grams were selected and housed in polypropylene cages at a constant temperature and 12 h light/dark cycle. They were given food and water ad libitum. All experiments were approved by the Institutional ethical committee R.No.5953/E1/5/2015.

3. Methodology

Animals were divided into 4 groups of 6 animals each and were fed on a high-fat diet along with normal food. The total experimental period was 30 days. Rats in Group I, II, III and IV were fed with high fat diet mixed with normal feed for 30 days. In addition group II received orlistat 10mg/kg, group III & IV received horse gram extract 100mg/kg and 200mg/kg respectively. All animals were fasted overnight. On the first day of experiment blood samples were collected by cardiac puncture and serum was separated to analyse the lipid profile. The same procedure was repeated on the last day of experiment. Food intake was measured every day, and body weight was measured once every week. Locomotor activity was also observed.



Figure 2: Blood Collection

Statistical Analysis: The results obtained were subjected to statistical analysis and expressed as mean ± SD. The data were statically analyzed by one way analysis of various (ANOVA) and to compare the means of the studied groups with post hoc LSD. Values are expressed as Mean ± S.E.M (n=6) *p<0.05, **p<0.01, Compared with control

4. Results

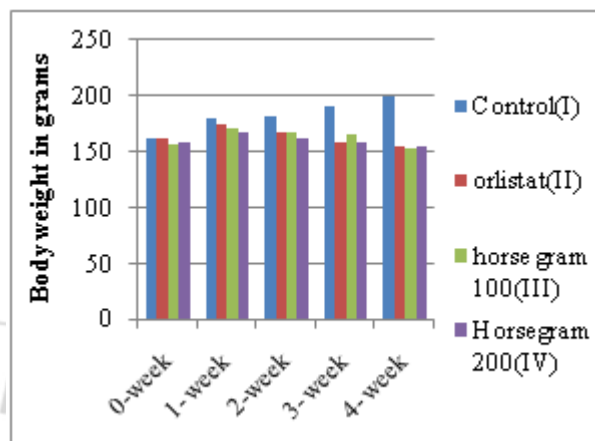


Figure 3: Comparison of Body Weight Between Groups

HFD control group showed an increase in body weight from baseline to 4th week. Orlistat produces a significant decrease in body weight in rats fed on HFD. Treatment with 100mg/Kg and 200mg/kg of horse gram extract also significantly reduced body weight. All the rats in the orlistat and test groups showed an initial increase in body weight in the first week followed by a consistent decrease in body weight in the subsequent weeks.

Effect on Lipid profile

Orlistat produces a significant decrease in cholesterol level in rats fed on HFD. Treatment with 100mg/Kg (*pvalue<0.05) and 200mg/kg (**pvalue<0.001) of horse gram extract has significantly reduced the cholesterol level when compared to the high fat diet control group as in figure 4.

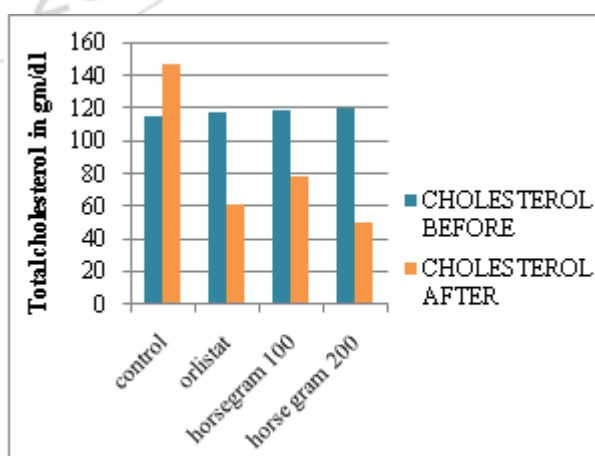


Figure 4: Comparison of Total Cholesterol Baseline and Post Test

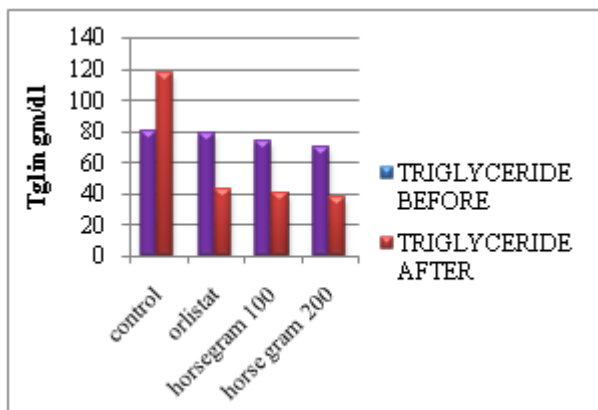


Figure 5: Comparison of Triglyceride Baseline And Post Test

Orlistat produces a significant decrease in Triglyceride level in rats fed on HFD. Treatment with 100mg/Kg (*p value<0.05) and 200mg/kg (**p value<0.001) of horse gram extract has significantly reduced the Triglyceride level when compared to the high fat diet control group.

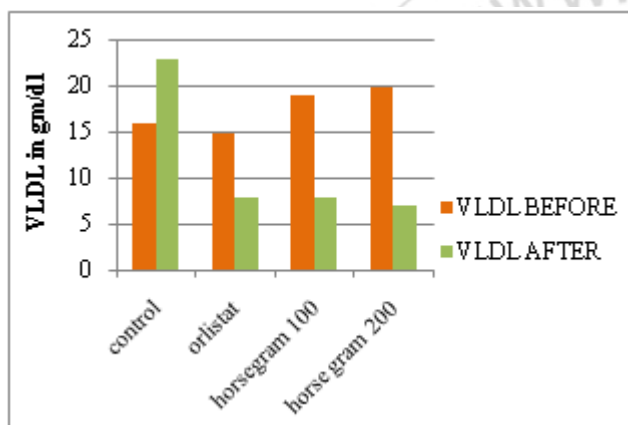


Figure 6: Comparison of VLDL Baseline and Post Test

Orlistat produces a significant decrease in VLDL level in rats fed on HFD. Treatment with 100mg/Kg (*pvalue<0.05) and 200mg/kg (**pvalue<0.001) of horse gram extract has significantly reduced the VLDL level when compared to the high fat diet control group.

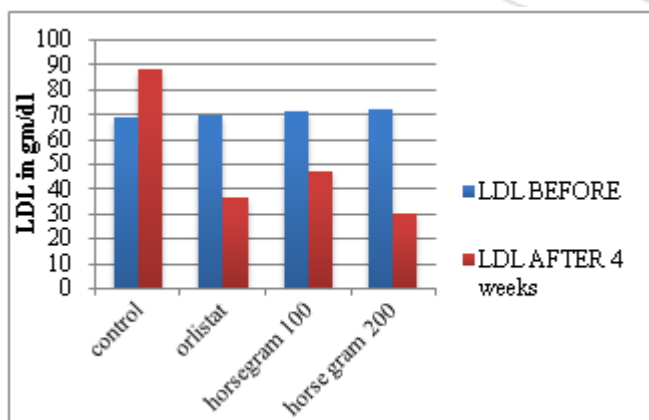


Figure 7: Comparison of LDL Baseline And Post Test

Orlistat produces a significant decrease in LDL level in rats fed on HFD. Treatment with 100mg/Kg (*pvalue<0.05) and 200mg/kg (**pvalue<0.001) of horse gram extract has

significantly reduced the LDL level when compared to the high fat diet control group.

5. Discussion and Conclusion

In the present era medicinal plants and herbs have gained much attention as they are widely accepted without toxic effects. In the current study obesity was experimentally induced by feeding rats on high fat diet for 4 weeks, This model closely resembles obesity in human. The results of the present study showed that the extract of seeds of *macrotyloma uniflorum* when given orally to rats fed on high fat diet for 4 weeks led to decrease in final body weight of the rats along with a significant reduction in the total cholesterol and triglyceride level. This effect is similar to that previously reported by Bhuvaneshwari et al. The mechanism underlying the anti obesity and hypolipidemic effect could be explained by the high level of phenolic acid present in horse gram. Changes in body weight, lipid profile and may be attributed to the overall hypolipidemic activity of phenol and flavanoids in horse gram

Horse gram (*Macrotyloma uniflorum*) is a minor legume used as a pulse crop in India [10] and has been found to be of good nutritional quality [11]. Horse gram seeds have recently been shown to prevent atherosclerosis in rats and may be a potential functional food for the prevention of hyperlipidaemic atherosclerosis [12]. An α -amylase inhibitor from horse gram seeds has recently been shown to have anti hyperglycemic potential [13]. The seed has the ability to reduce postprandial hyperglycemia by slowing down carbohydrate digestion and reducing insulin resistance by inhibiting protein-tyrosine phosphatase 1 beta enzyme.

The first line of approach in treatment of obesity is low calorie diet, increased physical activity. Obesity is associated with co morbid conditions like HT, DM, arthritis, depression etc. Phenol compound in horse gram helps in reducing body weight and lipid levels, this being a natural food supplement it may be ideal when used routinely in patients with obesity and hyperlipidemia. Further experiments are required to prove the mechanism and this will prove advantageous to obese individual as it is a food supplement and practically has no toxic effect and also cheaper.

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