

# Anti-Obesity Effect Of Bark Of Ficus Racemosa In High Fat Diet Induced Obese Rats

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## Abstract

**Method:** In high fat diet induced obese rats, obesity-related characteristics, including body weight, serum biochemical parameters were assessed. At the end of the experimental histological analysis were carried out. Obesity was induced in Wistar rats using a HFD for first 25 days. Then from 25<sup>th</sup> day to 50<sup>th</sup> day of study F. racemosa is given in dose of 90 mg/kg and 270mg/kg along with HFD. On 0, 25<sup>th</sup>, 50<sup>th</sup> day, body weight, histological changes and other parameters were recorded. Result: Bark powder of F. racemosa significantly reduced the absolute body weight. Ingestion of HFD containing F. racemosa to rat exhibited reduction in lipid parameters. High dose (270 mg/kg b.w) of F. racemosa significantly reduced the levels of triglyceride and VLDL whereas there were few differences observed in LDL and cholesterol. Treatment groups do not exhibited any substantial decrease in BSL. Minimal changes (+1) are found in liver tissues of F. racemose and B. prionitis treated groups. Furthermore, there is a mild fatty deposition is found.

**Conclusion:** The results imply that F. racemose (at higher dose 270 mg/kg body) has anti-obesity effects in obesity-induced rats.

**Keywords-** Udumber, Kurantaka, Barleria prionitis, Ficus racemosa, High fat diet induced obesity.

## INTRODUCTION

Obesity is a health problem of community that has raised alarm worldwide. World health organization (WHO) data suggests, there are 2,300 million overweight individuals (1). Obesity is due to excessive intake as compared with the output of calories, which causes unnecessary accumulation of adipose tissue in the subcutaneous and deep tissues (2). Obesity is mentioned as Sthalya in Ayurveda. Reason for Sthalya can be a high-calorie diet, junk food, overeating, uneven eating timings, lack of exercise, oversleeping, sleeping in the daytime, dysfunction of some endocrine glands as thyroid, pituitary gland, testis, etc. Currently, very few medicines are available in modern medicine for Obesity. Anti-obesity medicines like Orlistat, Sibutramine, Rimonabant, Lorcaserin, Qsymia & Liraglutide which have a lot of adverse effects. In Ayurveda, various Anti-obesity (Medohara) and Hyperlipidemia (Lekhaniya) drugs are mentioned. Ficus racemosa Linn. (Udumber) is one of such a drug which has got attention due to its various properties mentioned in Ayurvedic classical texts (3). It is generally known as ‘Gular’, and it has been used in the management of inflammatory conditions, Diabetes, Biliary disorders & Jaundice (4, 5, 6). Though studies are reported on Ficus racemosa, anti-obesity activity is not reported till date. Considering this, we attempt to assess the anti-obesity effects of bark of Ficus racemosa in rats. Characteristics, which are Obesity-related, such as body weight, BSL, LDL, HDL, VLDL, Total cholesterol & triglyceride, were assessed. Additionally, Histopathological changes in Liver and Adipose tissue were observed. Barleria prionitis Linn. (Kurantaka) which has previously proved actions against Obesity, Diabetes as well as Hypertension was used as control (7).

## MATERIAL AND METHODS

**Collection and authentication of plant:** Bark of Ficus racemosa Linn. (Udumber) & leaves of Barleria prionitis Linn (Kurantaka) are self-collected from Sinhgad road, Pune, Maharashtra, India & identified on the basis of its morphological characters with the help of Taxonomist & flora. The authentication of Udumber and Kurantaka has been done at Ayurveda Institute for Fundamental Research (RAIFR), Pune, India.(Ref.no. 2/67/RARI/Pune/Udyan/Pramanan/414 &415).

**Processing of plant material:** Udumber bark and kurantaka leaves were collected, cleaned and dried in shade. Air dried Udumber bark and Kurantaka leaves put in pulverizer to obtain coarse powder, and stored in airtight container. Mesh size used is 80. These powders were utilized for various experimental studies. Physicochemical, phytochemical & microbial load analyses were done as per API standards.

**Pharmacological screening for anti-obesity activity:** Male wistar albino rats (200 to 250 gm weighing) acquired from Animal house facility of Bharati Vidyapeeth medical college Katraj, Pune. Animals were housed on straw bedding 6 per cage & environment is maintained as per for 14 days before trial. IAEC permitted the protocol (CPCSEA Number: BVDUMC/568/2021 /001/006).

**Grouping and posology:** Rats were distributed in four groups containing six in every group. The dosage were calculated with the help of Paget and Barnes (1969) & dose mentioned in the “Sharnagadhar samhita” Madhyamkhand 6/1(8,9). The form of dose is powder.

**Model of High fat diet induced obesity rat:** Rats were divided in four groups containing six in each. High fat diet (HFD) given to all groups except control group for induction of obesity till the 25<sup>th</sup> days. All groups excluding control group were received test drugs from 25<sup>th</sup> to 50<sup>th</sup> day (Along with HFD).

**Treatment protocol:**

Group	Treatment	
Group 1- Normal Control (NC)	Control	
Group 2-Test drug low dose group (UC1)	Received HFD throughout study for 50 days	Low dose of <i>F. racemosa</i> (Udumber) i.e., 90 mg per kg of body weight
Group 3- Test drug High dose group- (UC2)		High dose of <i>F. racemosa</i> (Udumber) i.e.,270 mg per kg of body weight
Group 4-Standard Drug Control Group (KC)		high dose of <i>B. prionitis</i> (Kurantaka ) i.e., 270 mg per kg of body weight

3 gm of Gum Acacia (Vehicle for dosing) is titrated in 100 ml distilled water and dose is calculated per kg body weight of animal. Calculated amount of Powder (Churn) in milligram is suspended in 3% of gum acacia suspension was administered to animals. All doses were administered once daily by oral route. *B. prionitis* (Kurantaka ) is used as control group.

**Body weight, Blood sugar & Lipid profile assays in Rats:** Weight of animals recorded every 4<sup>th</sup>days throughout the experimental period. I.e. on 0, 4<sup>th</sup>, 8<sup>th</sup>, 12<sup>th</sup>, 16<sup>th</sup>, 20<sup>th</sup>, 24<sup>th</sup>, 28<sup>th</sup>, 32<sup>th</sup>,36<sup>th</sup> & 50<sup>th</sup> day. Blood samples collected from retro-orbital region on day 25<sup>th</sup> and day 50<sup>th</sup> for measurement of Blood sugar, Cholesterol total, Triglycerides, HDL, LDL, LDL/HDL & Cholesterol ratio.

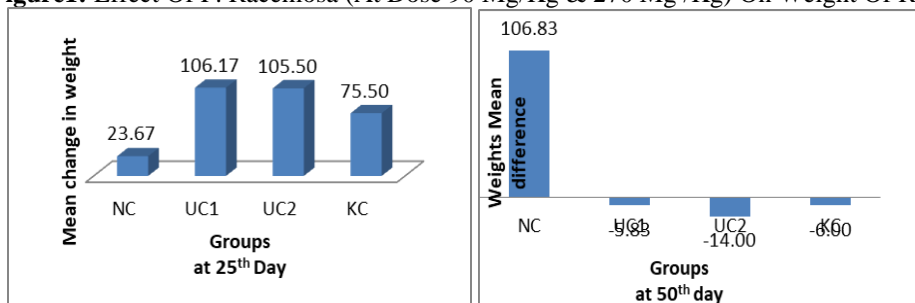
**Histological analysis:** Animals sacrificed on 50<sup>th</sup> day. Liver and Adipose tissue collected from animals. Changes in liver and adipose tissues were studied.

**Statistical analysis:** Analysis of variance applied for comparison between the groups used & results were stated as mean ± SEM. For comparison between each of the pair, Post Hoc Analysis is performed. At p < 0.05, data were considered statistically significant.

**RESULTS:**

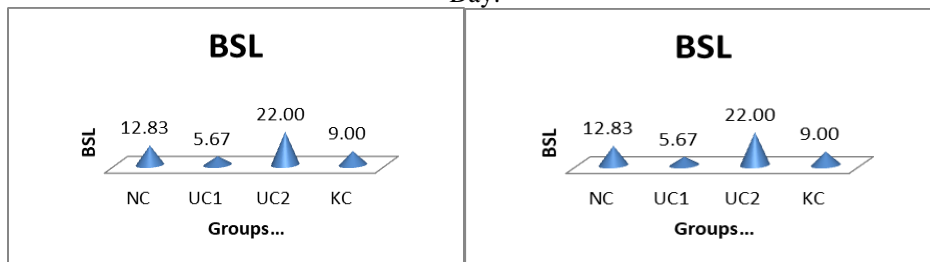
**Effects of *Ficus racemosa* on body weight:** Initially there were no significant difference in weight, but at the end of 25<sup>th</sup> day, all HFD groups showed meaningfully rise in weight compared with Control group (Fig.1a). At the end of study, there were significant decrease in weight in the Test drug High dose group - (UC2) and Standard Drug Control Group (KC). But in test drug low dose group (UC1) no significant weight decrease was found (Fig.1 A, B).

**Figure1:** Effect Of *F. Racemosa* (At Dose 90 Mg/Kg & 270 Mg /Kg) On Weight Of Rats



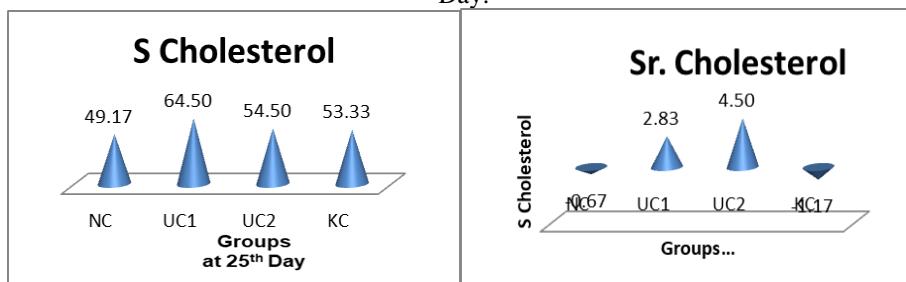
**Effects of the *Ficus racemosa* on blood sugar level and serum lipid profiles:** Effect of *F. racemosa* bark on blood sugar, cholesterol total, triglycerides, HDL, LDL, LDL / HDL ratio & cholesterol ratio were verified. The bark properties were evaluated using leaves of *Barleria prionitis* as positive control. In this study, on 25<sup>th</sup> day there were rise in values of VLDL cholesterol, LDL cholesterol, Serum Cholesterol, & ratio of LDL/ HDL. These values specify the induction of obesity in rats. From 25<sup>th</sup> to 50<sup>th</sup> day of experiment groups 2, 3 and 4 received the treatment along with HFD. It was observed that administration of *Ficus racemosa* in HFD-induced obese rats does not show any significant difference levels of and blood glucose (Fig.2). But it altered the levels of serum lipid profiles. (Fig. 3-9).

**Figure 2:** Effect Of *F. Racemosa* (At Dose 90 Mg/Kg & 270 Mg /Kg) On Blood Glucose Of HFD Fed At 25<sup>th</sup> & 50<sup>th</sup> Day.

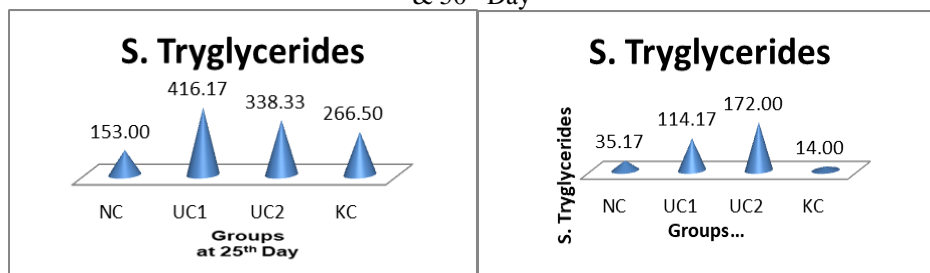


The effect of *F. racemosa* on the serum lipid profile is displayed in Figures 3-9. Treatment of *F. racemosa* (270 mg/kg) on HFD fed rats showed significant reduction in levels of serum Triglycerides and VLDL. There was no difference observed in LDL & serum cholesterol.

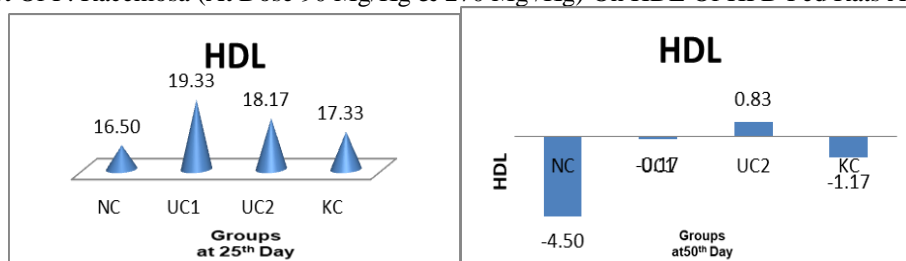
**Figure 3:** Effect Of *F. Racemosa* (At Dose 90 Mg/Kg & 270 Mg /Kg) On Cholesterol Of HFD Fed Rats At 25<sup>th</sup> & 50<sup>th</sup> Day.



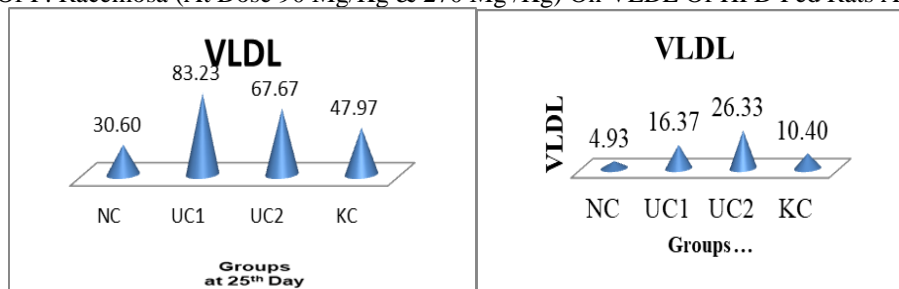
**Figure 4:** Effect Of *F. Racemosa* (At Dose 90 Mg/Kg & 270 Mg /Kg) On Serum Triglycerides Of HFD Fed Rats At 25<sup>th</sup> & 50<sup>th</sup> Day



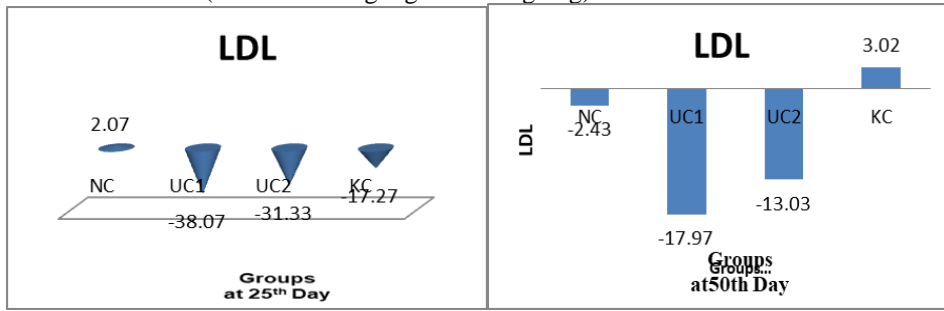
**Figure 5:** Effect Of *F. Racemosa* (At Dose 90 Mg/Kg & 270 Mg /Kg) On HDL Of HFD Fed Rats At 25<sup>th</sup> & 50<sup>th</sup> Day.



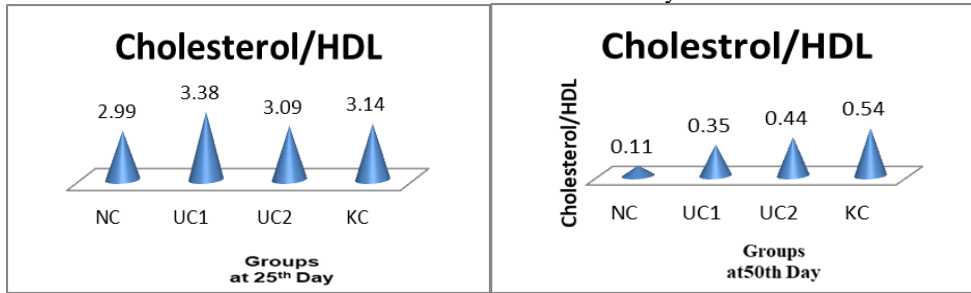
**Figure 6:** Effect Of *F. Racemosa* (At Dose 90 Mg/Kg & 270 Mg /Kg) On VLDL Of HFD Fed Rats At 25<sup>th</sup> & 50<sup>th</sup> Day.



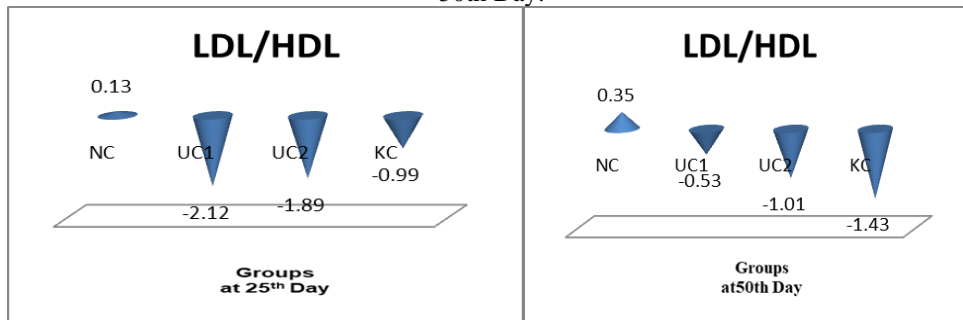
**Figure 7** Effect Of *F. Racemosa* (At Dose 90 Mg/Kg & 270 Mg /Kg) On LDL Of HFD Fed Rats At 25th & 50th Day.



**Figure 8** Effect Of *F. Racemosa* (At Dose 90 Mg/Kg & 270 Mg /Kg) On Cholesterol/ HDL Ratio Of HFD Fed Rats At 25th & 50th Day.

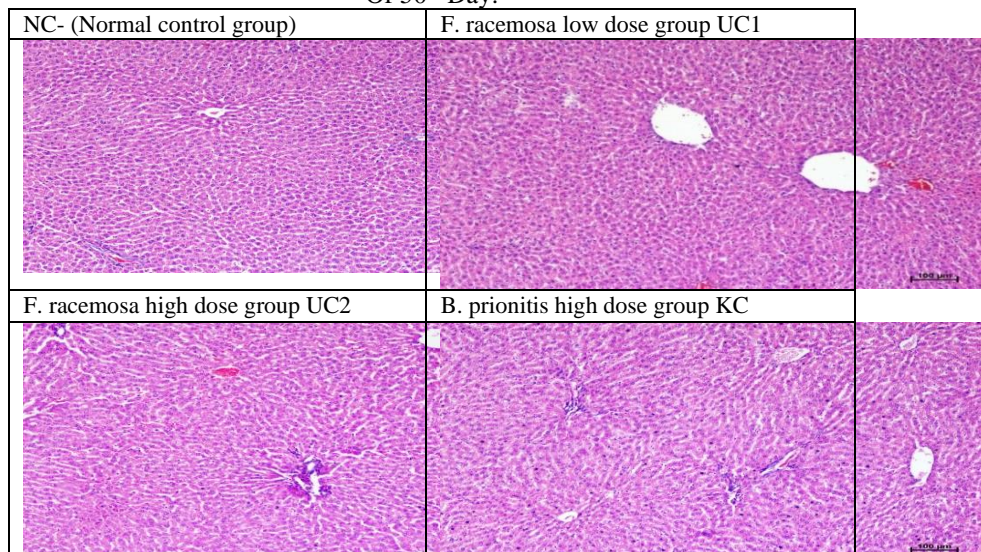


**Figure 9.**Effect Of *F. Racemosa* (At Dose 90 Mg/Kg & 270 Mg /Kg) On LDL/ HDL Ratio Of HFD Fed Rats At 25th & 50th Day.

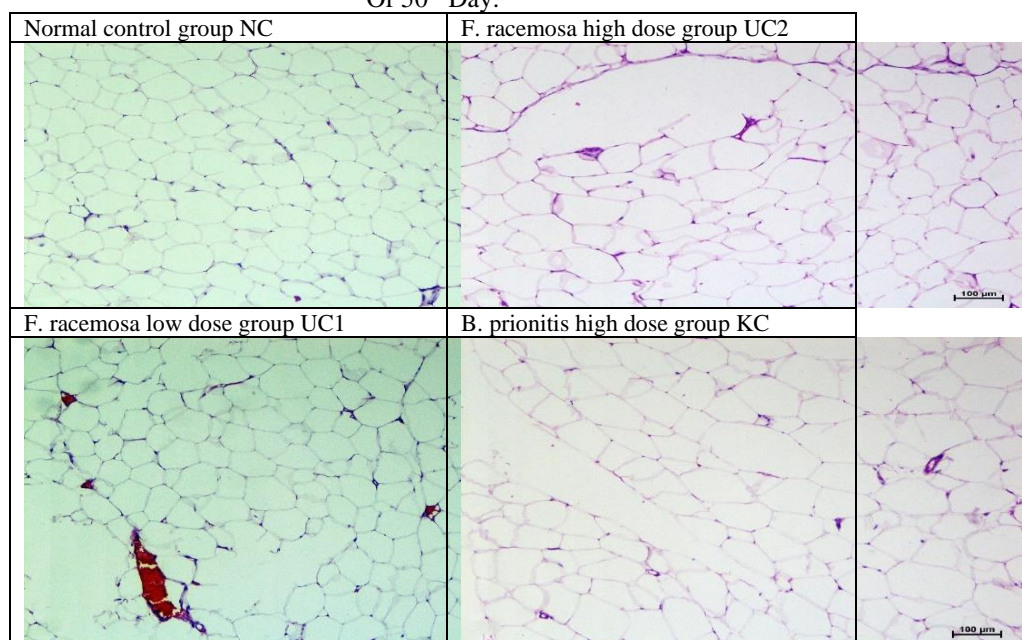


**Effects of *F. racemosa* in liver and adipose tissues:** The changes in the hepatic tissues of rats are summarized in Fig. 10 and 11. In all groups, minimal changes (+1) are found it means mild fatty deposition is found in UC1, UC2, and KC group.

**Figure 10.**Effect Of *F. Racemosa* (At Dose 90 Mg/Kg & 270 Mg /Kg) On Liver Tissues Of HFD Fed Rats At The End Of 50<sup>th</sup> Day.



**Figure 11.**Effect Of *F. Racemosa* (At Dose 90 Mg/Kg & 270 Mg /Kg) On Adipose Tissues HFD Fed Rats At The End Of 50<sup>th</sup> Day.



## DISCUSSION

Obesity-related diseases are the primary cause of death worldwide (10, 11) such as dyslipidemia, stroke, Diabetes type 2, metabolic syndrome and cardiovascular diseases which are complication due to obesity. Western medicine for obesity has restrictions, as they cause various side effects. Therefore, herbal drugs with comparatively little side effects that offers the advantage of being useful for above mentioned indications. There are a number of reports showing that is pre-clinically anti-hypertensive, hypoglycemic and anti-atherosclerotic (12, 13 and 14). Therefore in this study we assessed the anti-obesity effects of bark of *Ficus racemosa*. In an in vivo study of 50days, Obesity was induced by HFD. Consumption of HFD by rat increased the body weight when compared to NPD fed rats. From 25<sup>th</sup> day, wistar albino rats were treated with *Ficus racemosa* doses of 90 & 270 mg kg/day with HFD. Treatment with *F. racemosa* & *B. prionitis* successfully reduces weight in high fat diet induced rats. The reduction may be due to constituents present in the plants which causes the drop in intake of water and food. At the end of the treatment, we assessed plasma glucose level in HFD induced obesity rat model. There were no significant decrease in level of plasma glucose of rats treated with *F. racemosa* and *B. prionitis*. The administration of *F. racemosa* altered the levels of serum lipid profiles. There were significant reduction in the serum triglyceride and Very-low-density lipoprotein (VLDL) in rats treated with ***F. racemosa*** (270 mg/kg) whereas there were few differences observed in low density lipoprotein and cholesterol. These above dyslipidemic markers indicate hypolipidemic activity of ***F. racemosa***. Increase in fat depots in conventional adipose tissue site and fats deposits in and around other tissues and organs are mainly due to obesity in humans and animals. Steatosis and rise in triglyceride are associated with the accumulation of fat in liver. fat deposition in liver is result of feeding high-fat diet for 50 days. Whereas, in Histological analysis there is was minimal changes (+1) are found in liver tissues of ***F. racemosa*** and *B. prionitis* treated groups. Furthermore, there is a mild fatty deposition is found.

## CONCLUSION:

Based on all discussion, we can infer that *Ficus racemosa* powder (Udumber churn) may prevent fat accumulation in HFD induced obese rats. Among these two doses, high dose 270 mg/kg body weight is more effective with comparison to standard drug with all parameters of investigations. There is necessity of further research to understand complete pharmacological activity of *Ficus racemosa*.

## Conflict of Interests:

There are no competing interests.

## Ethical considerations:

Ethical consideration has been fully observed.

## Funding:

No funding is received by this study

## REFERENCES

1. World Health Organization Fact sheet: obesity and overweight. Available online: <https://www.who.int/en/news-room/fact-sheets/detail/obesity-and-overweight>.
2. Caterson, Ian & Gill, Tim. (2003). Obesity: Epidemiology and possible prevention. Best practice & research. Clinical endocrinology & metabolism. 16. 595-610.
3. Bhavmishra, Bhavprakash Nighantu, Commentary by Chunekar K.C, Pandey G, Chaukhamba Bharati Academy, Varanasi, reprint 2013 Vataadi Varg, 16, 17, 18, page 508.
4. Kirtikar KR, Basu BD (1975): Indian Medicinal Plants, second edition. Dehra Dun, Bishen Singh & Mahendra Pal Singh, pp. 2327–2328.
5. Nadkarni KM, Nadkarni AK, Chopra RN (1976): Indian Materia Medica. Bombay,
6. Popular Prakashan, pp. 548–550.
7. Chopra RN, Chopra IC, Handa KL, Kapur LD (1958): Indigenous Drugs of India, second edition. Calcutta, Academic Publishers, pp. 508–674.
8. Pathak S, Gokhale V. Evaluation of the effect of kurantaka churna (*barleria prionitis* linn.) in experimental model of high fat diet induced obesity. International Ayurvedic Medical Journal, (ISSN: 2320 5091) (April, 2017) 5(4)page 1153-1158.
9. Dr Brahmanand Tripathi Sharangdhar Samhita-Dipika Hindi vyakhya Samhita, prat- ham and madhyam khanda, 2nd sanskaran chaukhamba Bharati Prakashan, Varanasi, 1994.
10. Paget GE, Barnes JM., In: Evaluation of drug activities. Pharmacometrics. Lawrence DR, Bacharach AL, editors. Vol.1. New York: Academic press; 1969; 161.
11. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med. 2002; 346:393–403.
12. Aune D, Sen A, Norat T, Janszky I, Romundstad P, Tonstad S, et al. Body mass index, abdominal fatness, and heart failure incidence and mortality: a systematic review and dose-response meta-analysis of prospective studies. Circulation. 2016; 133:639–49.
13. Gitesh Kishor Chaware, Vikas Kumar, Satish Kumar, Pankaj Kumar. (2020) Bioactive Compounds, Pharmacological Activity and Food Application of *Ficus racemosa*: A Critical Review. International Journal of Fruit Science 20:sup2, pages S969-S986.
14. Guangmiao Fu, Wenjuan Li, Xiangzhong Huang, Runzhi Zhang, Kai Tian, Shuqun Hou, Yukui Li. (2018) Antioxidant and alpha-glucosidase inhibitory activities of isoflavonoids from the rhizomes of *Ficus tikoua* Bur. Natural Product Research 32:4, pages 399-405.
15. Hiral Joshi, Devendra Vaishnav, Gaurav Sanghvi, Samir Rabadia, Vishal Airao, Tejas Sharma, Sachin Parmar, Navin Sheth. (2016) *Ficus racemosa* bark extract attenuates diabetic complications and oxidative stress in STZ-induced diabetic rats. Pharmaceutical Biology 54:9, pages 1586-1595.