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Pre-Clinical Evaluation of Vidangadi Churna an Ayurvedic Formulation for Its Anti-Obesity Potential in Laboratory Animal

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Abstract

This research focuses on pre-clinical screening of anti-obesity effect of Vidangadi churna- ayurvedic formulation in experimental obesity induced animals. The drug Vidangadi churna was procured from the authentic and certified supplier- Amazon Pvt Ltd India. The Animal House, Hygia Institute of Pharmaceutical Education & Research (HIPER) Lucknow, provided albino mice (either sex) weighing 60–90g. All the mice are distributed into 5 groups (n=6) as followings; Group 1: Mice administered normal saline each day for 29 days, Group 2: Mice administered progesterone (10mg/kg) + normal saline for 29 days, Group 3: Mice administered progesterone (10mg/kg) + Orlistat (50mg/kg) for 29 days; served as standard group, Group 4: Mice administered progesterone (10mg/kg) + Vidangadi churna (200mg/kg) for 29 days & Group 5: Mice administered progesterone (10mg/kg) + Vidangadi churna (400mg/kg) up to 29 days. Parameters i.e., body weight, organs weight, total cholesterol & triglyceride level, food consumption level and blood sugar level. In results, it significantly exhibited anti-obesity potential by showing the decreased body weight, body organs, total cholesterol, triglyceride levels, food consumption pattern and blood sugar level. This study suggests that Vidangadi churna might be prescribed as a well-known medicine for managing obesity and reducing the bad cholesterol and thus refining the better health for longer lives, after more successful research.

Keywords: Anti-obesity, Vidangadi churna, orlistat, blood sugar level, lipid profile; Progesterone

Introduction

Obesity refers a medical condition that is occasionally referred to a medical condition in which excessive body fat is stored that is anxious to human health. According to WHO, obesity is the excessive fat deposition in body that may affect its physiology. Since 1975, obesity has nearly tripled its prevalence globally. More than 1.9 billion adults were found obese in 2016. In 2020, Over 39 million children (≤5 years) were examined for over-weight. Obesity is preventable [1]. It is imperative to identify and diagnose obesity as soon as is practical. Because it can deliver quick, immediate, and precise answers, AI is a promising alternative for early forecasts of obesity and overweight risk [2].

Unwanted weight gain that leads to overweight and obesity is taken as non-communicable disease and has become a global cause of obesity in non-communicable diseases [3]. Obesity happening rates have risen globally in the last three decades, from 1980 to 2008, achieving a global prevalence of 10–14 percent among adults in 2008 [4]. Obesity prevalence is greater in upper-middle & high-income countries, but they are expected to rise quickly in poorer countries [5].

Numerous factors, such as economic development, urbanization, and the resulting changes in lifestyle, are to blame for the global obesity epidemic [6]. According to recent data from IDF, Kuwait is now among the top 7% of nations with the highest occurrence rate of adult obesity and it is in the top 3% of nations with the highest occurrence rate of diabetes [7]. During perimenopause and post menopause, many women's bodies weight, total body fat & its distribution fluctuate (Lay et al. 1992).

A noteworthy Ayurvedic remedy for treating krimiroga is vidangadi churna, which is listed in the chapter krimicikitsa of the ayurvedic book Cakradatta [8] (Figure 1).

Botanical Name : Embelia ribes Burm

Family : Myrsinaceae

Synonyms

Sanskrit Name : Vidanga

Hindi Name : Vaividanga

English Name : False black pepper, White Flower Embelia

Part Used : Fruit

Embelin makes up 2.5 to 3.1 percent of its dry weight, Quercitol makes up 1.0 percent, and fatty components make up 5.2 percent. It also contains the alkaloid Christembine, a resinoid, tannins, and trace amounts of a volatile oil.

This research focuses on pre-clinical screening of anti-obesity effect of Vidangadi churna- ayurvedic formulation in experimental obesity induced animals.

Materials and Methods

Experimental requirements

Vidangadi churna, progesterone, water-bath, distilled water, Swiss albino mice (either sex), rotatory evaporator, weighing machine and ethanol.

Collection and preparation of drug

The drug Vidangadi churna was procured from the authentic and certified supplier- Amazon Pvt Ltd India. It was filtered for removal of coarse particles or impurities. After that the powder was used in the research study.

Preparation of animals

Hygia Institute of Pharmaceutical Education & Research Lucknow, animal house provided albino mice (either sex) weighing 60-90g. The animals were kept in good conditions, with a 12-hour light-dark cycle and ambient temperatures of 25±1 °C. They receive a conventional rat pellet meal and unlimited amounts of water while the relative humidity is kept between 44 and 56 percent. Mice are taken off their food an hour before the experiment [9].

Group design

All the mice are distributed into 5 groups (n=6) as followings-

Group 1: Mice administered normal saline each day for 29 days.

Group 2: Mice administered progesterone + normal saline for 29 days.

Group 3: Mice administered progesterone + Orlistat (50mg/kg) for 29 days; served

as standard group.

Group 4: Mice administered progesterone + Vidangadi churna (200mg/kg) for 29 days.

Group 5: Mice administered progesterone + Vidangadi churna (200mg/kg) up to 29 days.

Parameters

Body weight

All the animals in each are subjected to weigh-out their weight before the administration of drug starts and after the dosing is complete. Body weight, before drug administration and after drug administration is compared.

Weight of organs

All the mice of different groups are incised after sacrificing them. Organs such as Kidney, Lever, Brain were weighed separately to confirm the impact on different organs as well.

Total cholesterol & triglyceride level

Lipid profile test was conducted appropriately according to specified protocols. All the tests were performed by using their specific medical kits available in the market. Triglycerides level in blood plasma was also measured by its medical kit procured from the certified manufacturer and supplier [10].

Food consumption module

It is studied on days 5, 10 & 15. The mice are kept on fasting of food or HFD, 1 hour before to the experiment. After 30 minutes of progesterone ingestion, 5g of mice pellets are given to mice in their cage (s) and food ingestion was recorded at every 0.5, 1, and 1.5 h intervals [11].

Blood sugar level

Blood glucose is estimated seven times at 0, 5, 10 and 15 days after the beginning of the dosing of drugs. Blood sample is collected from the puncturing tail vein, and blood glucose is estimated using a blood glucometer made by Dr Morepen. This procedure is easy and authentic [12].

Statistical analysis

Two-tailed T test were used after ANOVA to assess the statistical data. Values are presented as S.E.M. Sigma Stat pro3.3 will be used to do the statistical analysis. At $P \leq 0.05$, the findings were deemed statistically significant.

Results and Discussion

Body weight determination

In order to confirm the anti-obesity potential (through all the parameters) of Vidangadi churna that mice were taken and divided into different 5 groups. The Group 1 was administered with normal saline, group 2 with progesterone (10mg/kg) + normal saline, group 3 treated with progesterone (10mg/kg) + Orlistat (50mg/kg) and group 4 fed with progesterone (10mg/kg) + Vidangadi churna (200mg/kg) whereas group 5 administered progesterone (10mg/kg) + Vidangadi churna (400mg/kg) for once per day up to 29 days (Table 1).

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Figure 1: Depiction of Vidangadi churna.

Table 1: Body weight determination of Vidangadi churna treatment.

Treatment	Body weight (g)	
	Before	After
Normal Saline	65.21±0.57*	67.32±0.62*
Progesterone (10mg/kg) + Normal saline	68.35±0.61**	74.46±0.49**
Progesterone (10mg/kg) + Orlistat (50mg/kg)	70.62±0.59*	67.28±0.53***
Progesterone (10mg/kg) + Vidangadi churna (200mg/kg)	64.17±0.69**	61.41±0.51**
Progesterone (10mg/kg) + Vidangadi churna (400mg/kg)	67.13±0.74***	63.17±0.67***

Significance level was represented by *; P<0.05

n=6; readings were given in Mean± SEM

In body weight determination, body weight of different mice was determined before treatment and after treatment for 15 days. In this context, normal saline fed group showed a significant increase in body weight after treatment which was 65.21±0.57*g as before and 67.32±0.62*g as after. Progesterone showed a remarkable increase in body weight as 74.46±0.49**g which was 68.35±0.61**g before the treatment.

Orlistat exhibited marked decrease in body weight even with progesterone exposure. Vidangadi churna demonstrated body weight as 61.41±0.51**g and 63.17±0.67***g after the treatment, at dose of 200mg/kg and 400mg/kg Vidangadi churna respectively that was significant decrease in body weight. Thus, this maintained body weights of mice while given with high fat diet.

Weight of organs

In order to confirm the anti-obesity potential (through all the parameters) of Vidangadi churna that mice were taken and divided into different 5 groups. The Group 1 was administered with normal saline, group 2 with progesterone (10mg/kg) + normal saline, group 3 treated with progesterone (10mg/kg) + Orlistat (50mg/kg) and group 4 fed with progesterone (10mg/kg) + Vidangadi churna (200mg/kg) whereas group 5 administered progesterone (10mg/kg) + Vidangadi churna (400mg/kg) for once per day up to 29 days (Figure 2).

Mice were anesthetized with diethyl ether. Then they were sacrificed with cervical dislocation method, prior dissecting different organs to weight. Following pictures demonstrates the dissection of mice- (Figure 3) (Table 2)

Significance level was represented by *; P<0.05

n=6; readings were given in Mean± SEM

In determination of weight of organs, control group showed normal weights of spleen, kidney and liver when estimated. Whereas progesterone fed mice exhibited an increase in body weights as 0.47±0.20**g, 1.96±0.37*g and 10.34±0.29**g of spleen, kidney, and liver respectively.

Orlistat fed group significantly decreased weights of concerning organs. Progesterone + Vidangadi churna (200mg/kg) showed body weights as 0.43±0.17*g (spleen), 1.85±0.30**g (kidney) and 8.16±0.51**g (liver) whereas, progesterone + Vidangadi churna (400mg/kg) significantly decreased weight of organs of spleen, kidney, and liver as 0.38±0.14**g, 1.24±0.17*g and 7.26±0.63**g respectively.

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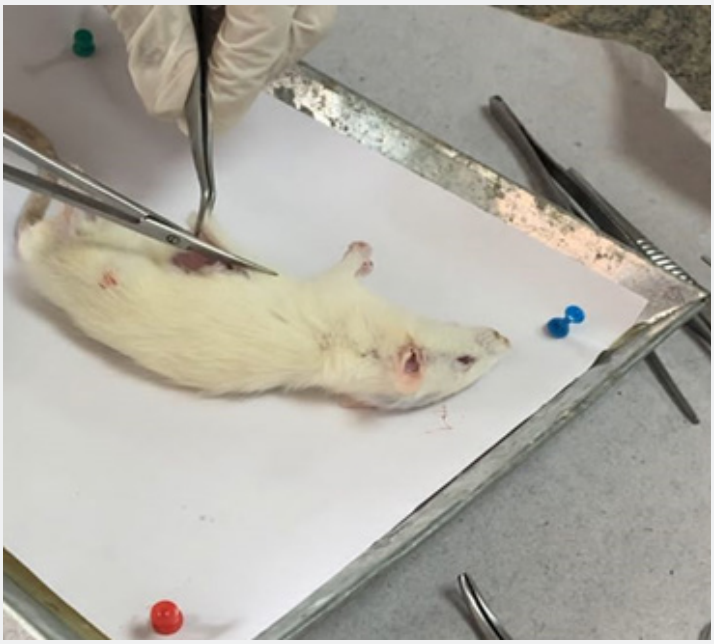

Figure 2: Dissection of mice.

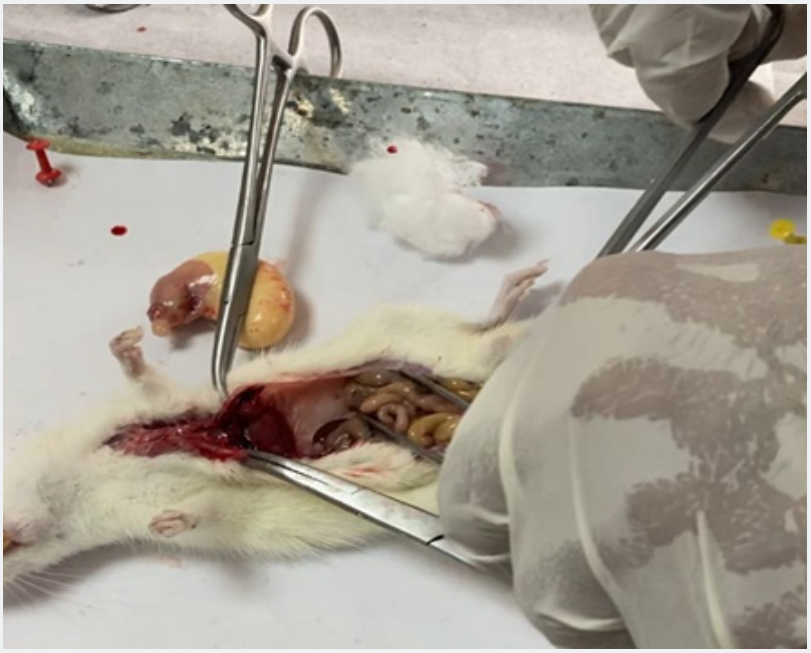

Figure 3: Dissecting organs.

Total cholesterol level

In order to confirm the anti-obesity potential (through all the parameters) of Vidangadi churna that mice were taken and divided into different 5 groups. The Group 1 was administered with normal saline, group 2 with progesterone (10mg/kg) + normal saline, group 3 treated with progesterone (10mg/kg) + Orlistat (50mg/kg) and group 4 fed with progesterone (10mg/kg) + Vidangadi churna (200mg/kg) whereas group 5 administered progesterone (10mg/kg) + Vidangadi churna (400mg/kg) for once per day up to 29 days (Table 3).

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Table 2: Determination of weight of organs.

Treatment	Spleen (g)	Kidney (g)	Liver (g)
Normal Saline	0.25±0.25*	1.12±0.41**	7.14±0.37**
Progesterone (10mg/kg) + Normal saline	0.47±0.20**	1.96±0.37*	10.34±0.29**
Progesterone (10mg/kg) + Orlistat (50mg/kg)	0.26±0.13**	1.14±0.29**	7.36±0.42*
Progesterone (10mg/kg) + Vidangadi churna (200mg/kg)	0.43±0.17*	1.85±0.30**	8.16±0.51**
Progesterone (10mg/kg) + Vidangadi churna (400mg/kg)	0.38±0.14**	1.24±0.17*	7.26±0.63**

Table 3: Estimation of Total Cholesterol (TC).

Treatment	TC (mg/dl)				
	Day 1	Day 3	Day 5	Day 10	Day 15
Normal Saline	62.23±1.20*	63.74±1.24**	64.29.19±1.31**	63.38±1.53*	61.36±1.42**
Progesterone (10mg/kg) + Normal saline	129.35±1.16**	137.32±1.53*	146.46±1.64**	145.23±1.30**	147.17±1.43***
Progesterone (10mg/kg) + Orlistat (50mg/kg)	163.37±1.30**	159.21±1.64**	141.43±1.73*	135.51±1.35**	121.14±3.12**
Progesterone (10mg/kg) + Vidangadi churna (200mg/kg)	169.31±1.64*	164.40±1.63***	157.10±1.52**	154.27±1.71*	151.17±1.52**
Progesterone (10mg/kg) + Vidangadi churna (400mg/kg)	174.27±1.37**	167.13±1.29**	157.54±1.37*	149.16±1.53**	143.39±1.27*

Significance level was represented by *; P<0.05

n=6; readings were given in Mean± SEM

Total cholesterol level was estimated in day 1, 3, 5, 10 and 15 in all the treatment group of animals. Total cholesterol was estimated in progesterone + Vidangadi churna (400mg/kg) administered mice as 174.27±1.37**mg/dl, 167.13±1.29**mg/dl, 157.54±1.37*mg/dl, 149.16±1.53**mg/dl and143.39±1.27* at the day 1, 3, 5, 10 and 15, respectively which was comparable to progesterone + Orlistat (50mg/kg) treated group as 163.37±1.30**mg/dl (day 1), 159.21±1.64**mg/dl (day 3), 141.43±1.73*mg/dl (day 5), 135.51±1.35**mg/dl (day 10) and 121.14±3.12**mg/dl (day 15).

Whereas progesterone + Vidangadi churna (200mg/kg) administered mice exhibited total cholesterol level as 169.31±1.64*mg/dl, 164.40±1.63***mg/dl, 157.10±1.52**mg/dl, 154.27±1.71*mg/dl and 151.17±1.52**at the day 1, 3, 5, 10 and 15 respectively that was different when compared with the control and progesterone fed rodents. Therefore, at both the doses Vidangadi churna showed anti-obesity potential in mice.

Triglyceride level

In order to confirm the anti-obesity potential (through all the parameters) of Vidangadi churna that mice were taken and divided into different 5 groups. The Group 1 was administered with normal saline, group 2 with progesterone (10mg/kg) + normal saline, group 3 treated with progesterone (10mg/kg) + Orlistat (50mg/kg) and group 4 fed with progesterone (10mg/kg) + Vidangadi churna (200mg/kg) whereas group 5 administered progesterone (10mg/kg) + Vidangadi churna (400mg/kg) for once per day up to 15 days.

Triglyceride level was estimated in the day 1, 3, 5, 10 and 15 in all the treatment group of animals. Triglyceride level was estimated in progesterone + Vidangadi churna (400mg/kg) administered mice as 216.31±1.42**mg/dl, 211.31±1.23**mg/dl,205.33±1.45**mg/dl, 181.31±1.20**mg/dl and 169.11±1.26**mg/dl at the day 1, 3, 5, 10 and 15, respectively which was comparable to progesterone + Orlistat (50mg/kg) treated group as 119.37±1.26**mg/dl (day 1), 123.34±1.28**mg/dl (day 3), 127.37±1.25**mg/dl (day 5), 132.36±1.25**mg/dl (day 10) and 137.39±1.28**mg/dl (day 15).

Whereas progesterone + Vidangadi churna (200mg/kg) administered mice exhibited Triglyceride level as 217.27±1.73**mg/dl, 210.23±1.35*mg/dl, 204.26±1.64**mg/dl, 195.22±1.15**mg/dl and 183.34±1.60***mg/dl at the day 1, 3, 5, 10 and 15 respectively that was different when compared with the control and progesterone fed rodents. Therefore, at both the doses Vidangadi churna showed anti-obesity potential in terms of lowering the triglyceride level in mice (Table 4).

Significance level was represented by *; P<0.05

n=6; readings were given in Mean± SEM

Food consumption pattern

In order to confirm the anti-obesity potential (through all the parameters) of Vidangadi churna that mice were taken and divided

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into different 5 groups. The Group 1 was administered with normal saline, group 2 with progesterone (10mg/kg) + normal saline, group 3 treated with progesterone (10mg/kg) + Orlistat (50mg/kg) and group 4 fed with progesterone (10mg/kg) + Vidangadi churna (200mg/kg) whereas group 5 administered progesterone (10mg/kg) + Vidangadi churna (400mg/kg) for once per day up to 15 days. Food consumption pattern was also estimated in the day 1, 3, 5, 10 and 15 in all the treatment group of animals. Food consumption pattern was estimated in progesterone + Vidangadi churna (400mg/kg) administered mice as 109.35±0.26**mg/dl, 103.15±0.29**mg/dl, 97.43±0.37**mg/dl, 101.22±0.17**mg/dl and 94.27±0.19*mg/dl at the day 1, 3, 5, 10 and 15, respectively which was comparable to progesterone + Orlistat (50mg/kg) treated group as 98.42±0.18*mg/dl (day 1), 97.19±0.22*mg/dl (day 3), 89.28±0.38**mg/dl (day 5), 87.18±0.65***mg/dl (day 10) and 84.60±0.25*mg/dl (day 15) (Table 5).

Table 4: Estimation of Triglyceride level.

Treatment	Triglyceride level (mg/dl)				
	Day 1	Day 3	Day 5	Day 10	Day 15
Normal Saline	86.23±1.20**	87.83±1.33**	83.20±1.41**	84.21±1.30**	86.37±1.19***
Progesterone (10mg/kg) + Normal saline	124.35±1.13**	128.30±1.24**	132.75±1.28**	137.35±1.39*	141.34±1.23**
Progesterone (10mg/kg) + Orlistat (50mg/kg)	119.37±1.26**	123.34±1.28**	127.37±1.25**	132.36±1.25**	137.39±1.28**
Progesterone (10mg/kg) + Vidangadi churna (200mg/kg)	217.27±1.73**	210.23±1.35*	204.26±1.64**	195.22±1.15**	183.34±1.60***
Progesterone (10mg/kg) + Vidangadi churna (400mg/kg)	216.31±1.42**	211.31±1.23**	205.33±1.45**	181.31±1.20**	169.11±1.26**

Table 5: Food consumption pattern after treatment.

Treatment	Blood sugar level (mg/dl)				
	Day 1	Day 3	Day 5	Day 10	Day 15
Normal Saline	84.12±0.46*	88.25±0.41**	91.52±0.24*	84.46±0.25**	92.61±0.61**
Progesterone (10mg/kg) + Normal saline	97.17±0.36**	112.13±0.14*	123.61±0.27**	126.27±0.20**	128.43±1.61*
Progesterone (10mg/kg) + Orlistat (50mg/kg)	98.42±0.18*	97.19±0.22*	89.28±0.38**	87.18±0.65***	84.60±0.25*
Progesterone (10mg/kg) + Vidangadi churna (200mg/kg)	105.58±0.32**	98.27±0.47**	96.51±0.34**	93.23±0.17**	87.23±0.32**
Progesterone (10mg/kg) + Vidangadi churna (400mg/kg)	109.35±0.26**	103.15±0.29**	97.43±0.37**	101.22±0.17**	94.27±0.19*

Significance level was represented by *; P<0.05

n=6; readings were given in Mean± SEM

Whereas progesterone + Vidangadi churna (200mg/kg) administered mice exhibited food consumption pattern as 105.58±0.32**mg/dl, 98.27±0.47**mg/dl, 96.51±0.34**mg/dl, 93.23±0.17**mg/dl and 87.23±0.32**mg/dl at the day 1, 3, 5, 10 and 15 respectively that was different when compared with the control and progesterone fed rodents. Therefore, at both the doses Vidangadi churna showed decreased food consumption pattern in terms of in mice.

Estimation of blood glucose level

Blood Glucose Level was estimated in day 1, day 3, day 5, day 10 and day 15 in all the treatment group of animals. Blood Glucose Level was estimated in progesterone + Vidangadi churna (400mg/kg) administered mice as 95.30±0.30***mg/dl, 92.12±0.24**mg/dl, 88.50±0.61***mg/dl, 84.25±0.14***mg/dl and 83.26±0.16**mg/dl at the day 1, 3, 5, 10 and 15, respectively which was comparable to progesterone + Orlistat (50mg/kg) treated group as 87.42±0.16*mg/dl (day 1), 81.14±0.18*mg/dl (day 3), 82.29±0.32**mg/dl (day 5), 84.18±0.35**mg/dl (day 10) and 81.27±0.15*mg/dl (day 15).

Whereas progesterone+ Vidangadi churna (200mg/kg) administered mice exhibited Blood Glucose Level as 94.58±0.38***mg/dl, 89.21±0.34**mg/dl, 86.53±0.35***mg/dl, 84.21±0.11**mg/dl and 85.27±0.72**mg/dl at the day 1, 3, 5, 10 and 15 respectively that was different when compared with the control and progesterone fed rodents.

Therefore, at both the doses Vidangadi churna showed anti-obesity potential in terms of lowering the blood sugar level in mice.

Reduction in the levels of proteins, glucose- blood plasma indicate for the anti-obesity activity of the Vidangadi churna. It confirms that regulation of insulin becomes normal or increases the sensitivity of Tyrosine Kinase receptor subtypes for better binding and opening the glucose transporters. Thus, it facilitates

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the release of glucose molecules for better delivery at the targeted organs and produce the energy in terms of ATP for proper metabolism cycles of tissues. Its action might be based on the sensitization of receptors in Type 2 DM or insulin release in Type 1 DM (Table 6).

Significance level was represented by *; P<0.05

n=6; readings were given in Mean± SEM

In all the parameters, Vidangadi churna showed a significant modulation in order to confirm its anti-obesity potential. It lowered body weights of rodents when compared with the control at both the doses of 200mg/kg and 400mg/kg. Body organ weights also got decreased when measured at the spleen, liver, and kidneys.

It is also linked with managing the total cholesterol and triglycerides and weights of organs. When food consumption is abandoned then it's obvious to control the body weight as in gross as well the weight of different organs.

In results, it significantly exhibited anti-obesity potential by showing the decreased body weight, body organs, total cholesterol, triglyceride levels, food consumption pattern and blood sugar level.

Table 6: Estimation of blood sugar level.

Treatment	Blood sugar level (mg/dl)				
	Day 1	Day 3	Day5	Day 10	Day 15
Normal Saline	86.24±0.36*	85.23±0.42*	85.54±0.27*	85.37±0.13*	84.11±0.18*
Progesterone (10mg/kg) + Normal saline	94.17±0.26**	98.17±0.19*	103.62±0.16**	107.21±0.23**	104.73±1.21*
Progesterone (10mg/kg) + Orlistat (50mg/kg)	87.42±0.16*	81.14±0.18*	82.29±0.32**	84.18±0.35**	81.27±0.15*
Progesterone (10mg/kg) + Vidangadi churna (200mg/kg)	94.58±0.38***	89.21±0.34**	86.53±0.35***	84.21±0.11**	85.27±0.72**
Progesterone (10mg/kg) + Vidangadi churna (400mg/kg)	95.30±0.30***	92.12±0.24**	88.50±0.61***	84.25±0.14***	83.26±0.16**

Conclusion

As the research concerns with screening of anti-obesity potential of Vidangadi churna in different experimental protocols among rodents. Decrease in body weight is an important parameter of anti-obesity potential, in this study, Vidangadi churna was successfully found active in lowering the body weights (gross) of mice. When observed body organs, they also decreased weights of liver, spleen, and kidneys. This action might be due to lowering the energy levels thus controlling the weights.

This study suggests that Vidangadi churna might be prescribed as a well-known medicine for managing obesity and reducing the bad cholesterol and thus refining the better health for longer lives, after more successful research.

Conflict of interest

Authors have declared for none conflict of interest.

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