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# Randomized trial on weight and lipid profile of obese by formulation from *Garcinia cambogia*

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## ABSTRACT

*Background:* Obesity is one of the most common contributors to ill health, mortality and the reduced quality of life. Prevalence is increasing across the world especially in developed countries but now a days it is also increasingly noticed in developing countries including India due to change in life styles of the people. *Garcinia cambogia* (GC) is an herbal remedy, used for treatment of various health conditions including obesity. The aim of the study was to find out the effects of homeopathic formulation of *G. cambogia* in reducing the weight of obese patients and their lipid profile. *Materials methods:* A prospective, open randomized controlled trial was conducted. Thirty numbers of obese individuals having BMI ≥ 30 were divided into three comparable groups of 10 in each group receiving either GC3x (Decimal scale), GC 6c (Centesimal scale) or placebo in the form of 4 globule thrice a day for three months. The medicine and dilutions were prepared according to the homoeopathic principles. Their weight, total cholesterols, triglycerides, low-density lipoproteins, very low-density lipoproteins and high-density lipoproteins were measured, before and after treatment time point. *Result:* It was observed that GC 3x and GC 6c has significant reduction effects on weight ($P < 0.001$) as well as in lipid profiles ($P < 0.001$) in comparison to control group. *G. cambogia* prepared homeopathically in 3x and 6C potencies may be prescribed for significant reduction in weight and lipid profiles in obese patients. The initial diarrhea and constipation in certain study individuals required no medicinal intervention. *Conclusion:* Homoeopathic formulations from *Garcinia cambogia* especially at 6 c potency are highly beneficial for the management of body weight and lipid profile in obese subjects. Another randomized study with large sample size is suggested.


**Keywords:** Obesity, *Garcinia cambogia*, lipid profile, randomized controlled trial, homeopathic formulation

## 1. INTRODUCTION

Obesity is perhaps the most prevalence form of malnutrition. It is a chronic disease prevalent in both developed and developing countries and affects children as well as adult. Obesity is now so common that it is replacing the more traditional public health concerns including under nutrition. It is the one of the most significant contributor to ill health worldwide (WHO, 2019a). In India, 1.3% males and 2.5% females aged more than 20 years were obese in the year 2008 (WHO, 2019b). The first adverse effects of obesity to emerge in population in transition is hypertension, hyperlipidemia and glucose intolerance, while coronary heart disease and the long term complications of diabetes such as renal failure begin to emerge several decades later (Lauby-Secretan et al., 2016). Obesity is generally accepted as a worldwide epidemic with troublesome consequences. A trend of increasing prevalence of obesity and obesity-related co-morbidity and mortality was observed over the last few decades. Obesity is considered when there is an excess accumulation of fat in the subcutaneous tissue and the other parts of the body (Ghai et al., 2004). In such conditions, natural products and plant-based dietary supplements have been used by people for centuries. Several ethno botanical studies have been reported that positive application of herbs in the treatments for obesity (Heber, 2003). Lipid metabolism or their oxidation accumulation is also found to be related with obesity and associated cellular stress (Subudhi et al., 2008). In such conditions, aging, environmental factors and nutritional imbalance also provides a base to internal stress which may also lead to complicate diseases including cancer (Chainy et al., 2016; Iswariya et al., 2019; Paital, 2016, 2018; Paital et al., 2016, 2017, 2019; Pradhan et al., 2019). Supplying right medicine or nutraceuticals may give relaxation from many cellular stress factors (Paital, 2018; Mishra et al., 2019; Subudhi et al., 2009). Mechanistic approaches in relation to different inhibitory molecules that provide the reduced lipid metabolism is highly needed (Paital et al., 2013).

*Garcinia* has been used for centuries in Asian countries for culinary purposes as a condiment and flavoring agent in place of tamarind or lemon and to make meals more filling (Lim, 2012; Sergio, 1988). In Indian ayurvedic medicine having sour flavors are said to help in active digestion. *Garcinia cambogia* is popularly known as Gummi-gutta, Malabar tamarind and brindle berry belong to the family Clusiaceae. *G. cambogia* are grown for its fruit in Southeast Asia, India and Africa. It is an exotoxic yellowish pumpkin-like fruit and is about the size of an orange where it has long been flavored as a souring agent for pork and fish dishes. The fruit of *G. cambogia* has been traditionally used in food preparation and cooking, having a distinctive taste. *Garcinia* has also been used routinely for many centuries with no known toxicity. The fruit extract seems to have inhibitory lipogenic properties, which means an ability to prevent the production of fat. This extract reduces appetite and to increase the energy level. *Garcinia* has garnered a lot of attention as a popular natural weight loss could be the reason for its substance called hydroxy citric acid/HCA. So, there was a need to study the efficacy of homoeopathic preparations of *G. cambogia* on obesity (NIH & NCCIH, 2019). Another preparation in homoeopathy of the sub species named as *Gambogia* is prepared from resinous gum of *G. Morella*, native to China. But the present

study was carried out by using fruits of *G. Cambogia*. The aim of the present study was to find out the efficacy of *G. cambogia* 3X and 6C potencies in obese patients by comparing their lipid profiles.

## 2. MATERIALS AND METHOD

Institutional ethical clearance was obtained from the National Institute of Homoeopathy to carry out the study. The study was registered under CTRI for clinical trial (CTRI/2020/01/023061). *G. cambogia* fruit was collected from the Central Council for Research Homoeopathy Unit, under Ministry of AYUSH at Otty. Its mother tincture was extracted from fresh fruit by maceration with 95 % (v/v) of ethyl alcohol. The 3X potency of the said medicine was prepared by using the dispensing alcohol as a vehicle as per Decimal scale preparation and 6C potency was prepared by using the dispensing alcohol as per centesimal scale preparation as per direction of Homoeopathic Pharmacopoeia of India.

Patients were included from IPD/OPD, Peripheral health centers of Vinayaka missions Homoeopathic Medical college & Hospital and Medical camps conducted by the college. Written permission from the patients was obtained to publish the output of the study.

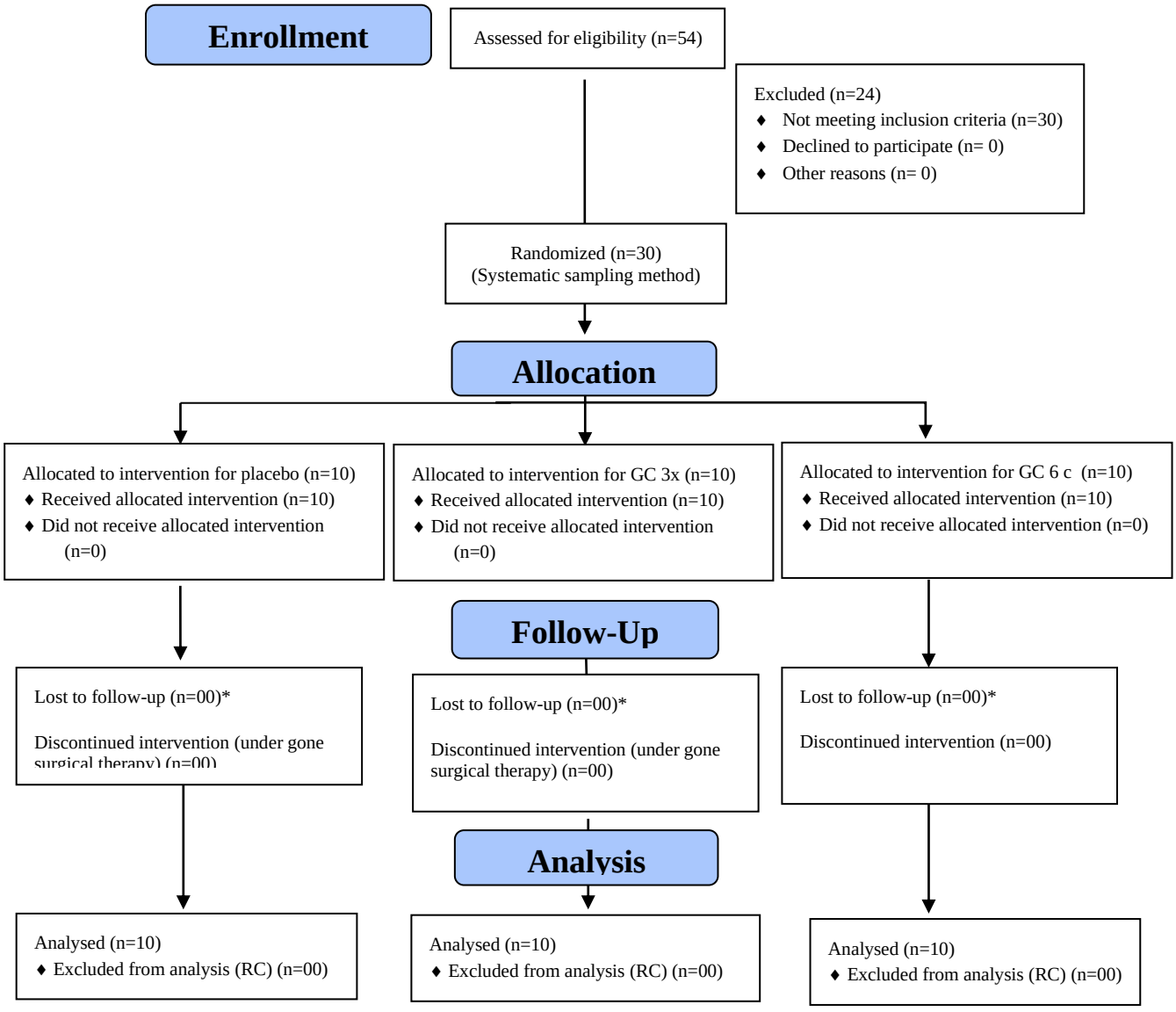



**Figure 1** Flow diagram for the sample and allocation of homoeopathic medicine *Garcenia cambogia* (GC).

### Inclusion and exclusion criteria

The obese individuals were selected on the basis of their body mass index and case was taken according to the predetermined pro-forma. Detailed physical examination was done for such individuals. The patients having endocrine diseases were excluded from the study. Men

and women with a BMI ≥30 and between the age group of 15 to 55 were included in the study. The baseline data like weight, height and lipid profile of such individuals who were included in the study were collected.

**Sampling technique**

Out of 54 registered patients, total 30 obese individual were included in the study after screening and they were followed for a period of three months (January to March 2017). The Patients both male and female from the age group 15 to 55 years were divided into three groups of 10 each by the process of randomization (Fig. 1, Table 1). *G. cambogia* 3x was given to one group and the same medicine in 6C potency was given to the second group. The third group also consisting of 10 obese individual were given a placebo and these individuals were regarded as the control group. All the 30 obese individuals were on their regular & normal diet. The three groups were compared with respect to the variables like weight and lipid profile at the beginning and the end of the study.

**Table 1** Age and gender wise distribution of patients in various treatment groups

| Age Group | Sample groups | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | GC 3x | | GC 6c | | Control | | |
| | Male | Female | Male | Female | Male | Female | |
| 15-25 | 2 | 1 | 3 | 2 | 2 | 2 | 12 |
| 26-35 | 2 | 1 | 1 | 1 | - | 1 | 6 |
| 36-45 | 1 | 2 | - | - | 1 | 1 | 5 |
| 46-55 | - | 1 | 1 | 2 | 1 | 2 | 7 |
| Total | 5 | 5 | 5 | 5 | 4 | 6 | 30 |

**Prescription of medicine**

*G. cambogia* 3x and 6c potency and the placebo were given four globules orally three times a day to obese individuals. The effect was evaluated by estimating the variables such as weight and lipid profiles.

**Measurement of body weight and lipid profile**

Body weight of the subjects was measured using aDigital (Blue) automatic personal digital weight machine with large liquid crystal display (LCD) and 4 Sensor Technology (Model HN 289, Omron, Gurgaon, Haryana). Data are expressed as the kg body weight. Lipid profile was measured following colorimetric method (Govt. of India, 2011) and the results were expressed as $mgdL^{-1}$.

**Statistics**

Data are presented for samples in each group as mean ± SD values. Students "t" test (paired) was performed to evaluate the change in body weight of the individuals after and before treatment schedule. One-way ANOVA followed by Duncan test was followed to know the significance difference among the groups at $p < 0.05$ level.

**Table 2** Critical analyses of the effects of *Garcina cambogia* formulation on change in body weight of the patients in the studied three groups (GC 3x, GC 6c and Control)

| Sample treated | Mean | | Variance | | Calculated t value | Critical t value | P value |
|---|---|---|---|---|---|---|---|
| | Before | After | Before | After | | | |
| Control | 92.15 | 92.05 | $80.98^a$ | 83.63 | 0.16 | 2.26 | >0.05 |
| GC 3x | $81.60^a$ | $76.80^b$ | $72.90^a$ | $78.40^b$ | 19.24 | 2.26 | <0.001 |
| GC 6c | $95.10^a$ | $88.30^b$ | $206.10^a$ | $207.10^b$ | 10.25 | 2.26 | <0.001 |

Paired't' test was performed and data (n=10) with different superscripts in their respective mean values are considered as statistically significant at $p < 0.05$

## 3. RESULTS

It was observed that subjects prescribed with *G. cambogia* 3x have shown symptoms such as loss of appetite, diarrhea for few days, after that they become normal. The *G. cambogia* 6c group has shown symptoms such as loss of appetite, constipation for few days, after that they become normal without any medication. The control group did not show any specific symptom like loss of appetite, diarrhea and constipation. A significant loss ($p<0.001$) in the body of all patients was observed after the treatment of the medicine

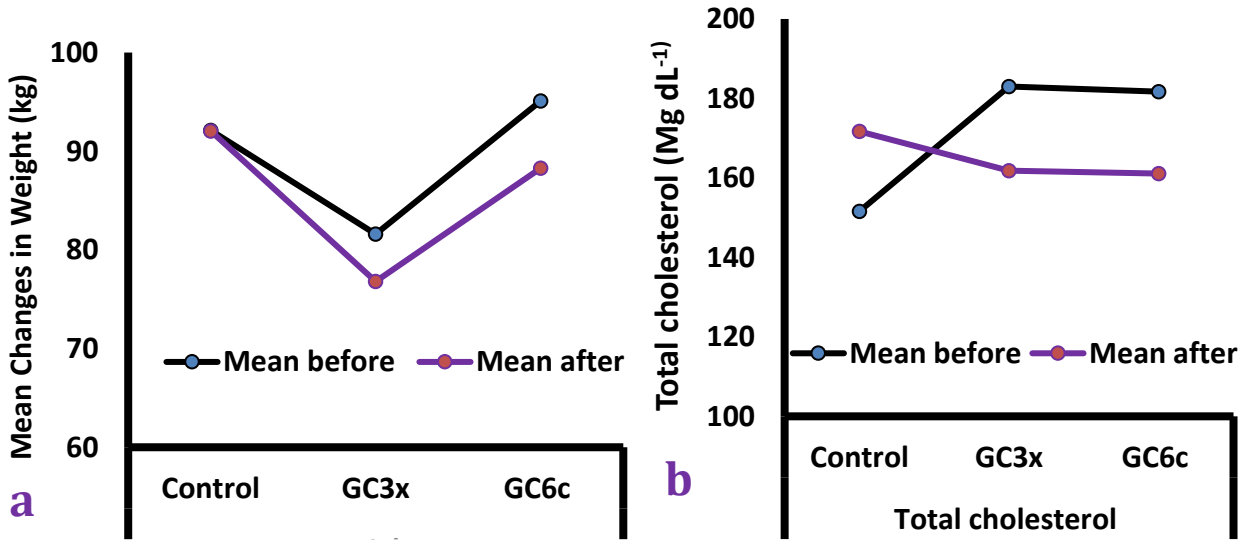
(Table 2). The reduced total serum cholesterol and serum triglycerides level was also recorded in both 3x and 6c groups and also a remarkable change in the level of VLDL, LDL and HDL was evident after the medication (Table 3).

**Table 3** Effects of *Garcina cambogia* (GC) formulation on body weight and lipid profile of subjects.

| Sl. No. | Variables | Group | Mean Before | Mean after | F Critical # | F calculated | *P* Value |
|---|---|---|---|---|---|---|---|
| 1 | Weight | Control | 92.1 | 92.05 | 3.354131 | 60.18776 | p<0.001 |
| | | GC3x | 81.6 | 76.8 | | | |
| | | GC6c | 95.1 | 88.3 | | | |
| 2 | Total cholesterol | Control | 151.6 | 171.7 | 3.354131 | 29.69777 | p<0.001 |
| | | GC3x | 183 | 161.8 | | | |
| | | GC6c | 181.7 | 161.1 | | | |
| 3 | Triglycerides | Control | 120.9 | 141.7 | 3.354131 | 41.69927 | p<0.001 |
| | | GC3x | 164.2 | 137.8 | | | |
| | | GC6c | 148.3 | 129.2 | | | |
| 4 | HDL | Control | 39.9 | 37.3 | 3.354131 | 13.18229 | p<0.001 |
| | | GC3x | 37.8 | 40.6 | | | |
| | | GC6c | 39.5 | 42.0 | | | |
| 5 | LDL | Control | 92.9 | 101.5 | 3.354131 | 6.751254 | p<0.001 |
| | | GC3x | 102.9 | 91.1 | | | |
| | | GC6c | 109.1 | 97.1 | | | |
| 6 | VLDL | Control | 25.1 | 27.8 | 3.354131 | 8.034587 | p<0.001 |
| | | GC3x | 33.1 | 30.2 | | | |
| | | GC6c | 29.9 | 27.0 | | | |

#ANOVA $V_1$= 27, $V_2$=2 ANOVA was performed for comparing the difference in data (n=10) between before and after treatment among the three groups (GC 3x, GC 6c and Control) for each variables. Differences among mean values were considered as significant at p <0.05.

The age and sex distribution of the obese individuals included in the study is given in Table 1. The study was carried out for three months among 30 obese people and the variable revealed that the reduction of weight in both GC 3x and GC 6c potency groups than the placebo group. In *G. cambogia* 3x group, the reduction of weight was averagely of 4.8 kg (Table 2). In *G. cambogia* 6c potency group, the average reduction in body weight was higher than its low potency group and it was 6.8 kg on an average (Table 2). The findings for the other variables for lipid profile are given in Table 3 and Figure 2. Except HDL that was increased in individuals from each experimental groups, LDL, VLDL and triglycerides titre was found to be lower down (p<0.001) after the medication (Table 3).



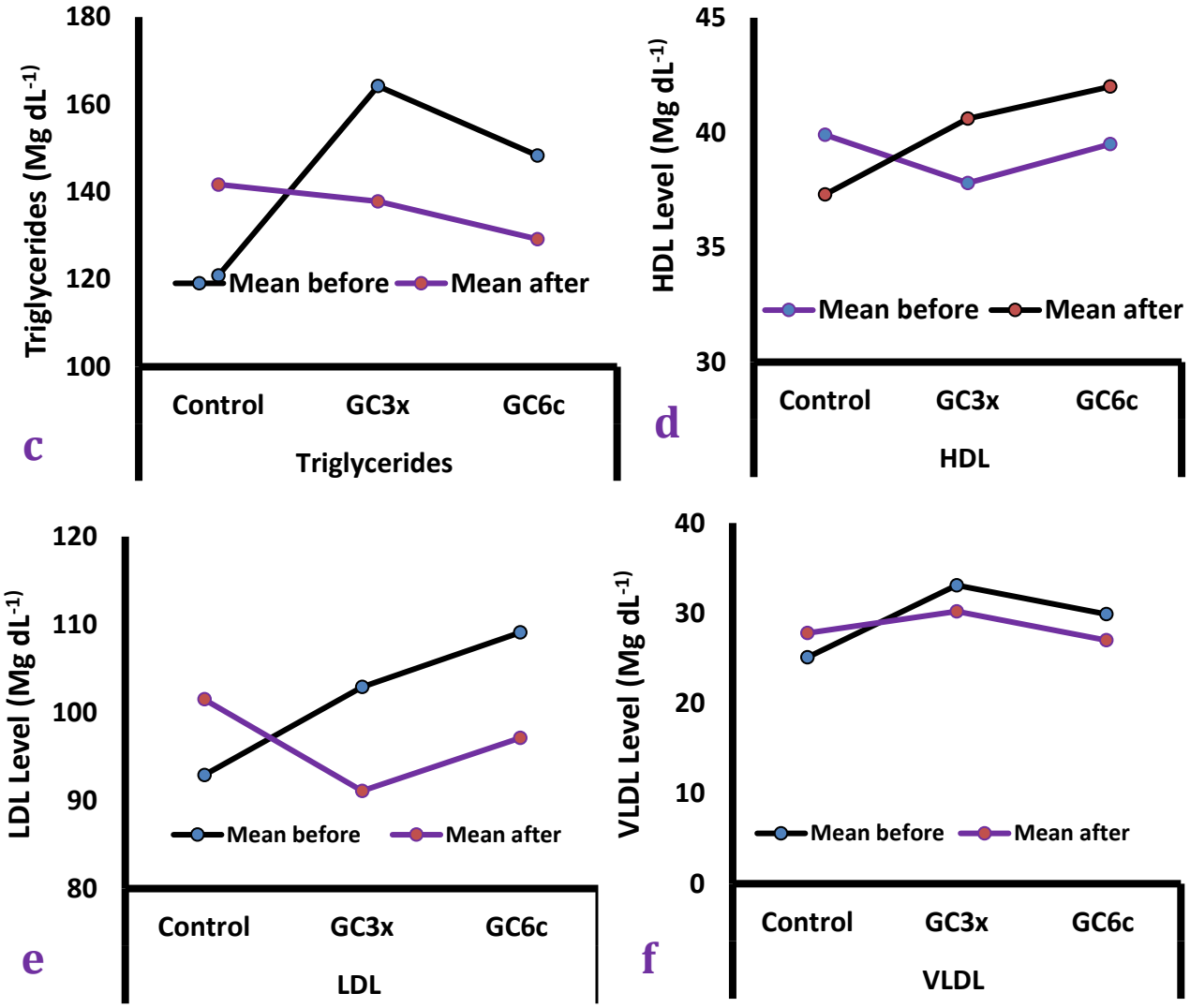



**Figure 2** Effects of *Garcinia cambogia* homoeopathic formulation on body weight and lipid profile in human subjects. a-weight, b-total cholesterol, c-triglycerides, d-HDL, e-LDL, f-VLDL. In the experimental groups, the mean values were significantly different as shown in figure at $p < 0.05$ (t-test to compare mean before and after group, ANOVA to compare mean among control, GC3x and GC6c groups, n=10).

## 4. DISCUSSION

The diverged age and sex wise distribution of obese patients as participated in the present study and from the results obtained for weight loss and alternation in lipid profile after the prescription of formulation from *G. cambogia*, it was observed that the prevalence of obesity in was more in the age group of 15-25 years irrespective of sex. It means obesity affects predominantly the productive age group as compared to other age groups. However, in contrast to the study findings a non-communicable risk factor survey phase 2 carried out in 2007-08 in eight states including Tamilnadu of India shows high prevalence of overweight in all age groups except in 15 to 24 years groups (Govt. of India, 2011). Table 2 shows that there was significant reduction in the mean body weight of subjects before and after treatment with GC 3x ($P<0.001$) and also with GC6c ($P<0.001$) medicines in comparison to control group, where the change in body weight was not significant ($P>0.05$). It indicates that the medicine has potent effects on reduction in body of patients affected with obesity.

Few previous studies indicate that administration of *G. cambogia*reduces weight (Sun et al., 2016; Semwal et al., 2015) although contradictory studies also exist with this medicine (Heymsfield et al., 1998). Certain studies also concluded about the uncertainty of its long term effects. It is because the drug was not administered for long period i.e. more than 12 months (Márquez et al., 2012). The present study is in confirmation of the fact that *G. cambogia* reduces the mean weight as well as the lipid profile (e.g. Total Cholesterol, Triglycerides, LDL and VLDL) level except HDL, where, the titre was after treatment with GC 3x and GC 6c in comparison to control groups. So, the drug can efficiently be administered to the patients for effective management of body weight and lipid profile in

obese patients. A study carried out by Maia-Landim et al. showed that treatment with *G. cambogia* and *Glucomannan* of people with overweight or obesity in different sex, age and affected by difference metabolic diseases decrease weight, fat mass, visceral fat, glucose, triglycerides and cholesterol levels together with an increasing basal metabolic rate without having any adverse effect (Maia-Landim et al., 2018). But they had taken glucose, cholesterol and triglycerides only, however, in this study apart from weight, cholesterol, triglycerides HDL, LDL and VLDL were also analyzed to find its broad spectrum effects associated with obesity. The results showed promising effects on the studies parameters.

**Table 4** Some of our previous studies showing the efficacy of homoeopathic preparations on different diseases.

| Name of the disease/homoeopathy in general | Medicines/Regimen | References |
|---|---|---|
| Benign prostatic hyperplasia (BPH) | Thujaoccidentalis, Conium maculatum,Sulphur , Lycopodium clavatum, Staphysagrialodium, Pulsatilla, Mercuriussolubilis, Barytacarbonica, Natriummuriaticum, Lyssin, Tuberculinumbovinum, Calcareacarbonica, Gelsemiumsempervirens, Nux vomica, Sepia officinalis, Causticum, Medorrhinum, Argnentumnitricum, Phosphorus, Nitricumacidum, Selenium, Carcinosin, Sabalserruata, Hydrangea arborescens, Chimaphillaumbellate, Solidagovigra, Senecioaureus, Triticumrepens, Ferrumpicricum, Picric acid | (Hati et al., 2012) |
| BPH | Same as above | (Paital et al., 2017) |
| Musculoskeletal Disorders in Sports Injuries | Arn, Con, Hep, Hyper, Puls, Rhus-T, Sul-Ac,-Cic, Led, Nat-S, Nit-ac,Ruta, Sulph, Symph,-Bell-P, Bry, Lyc, Bellis, Calen, Led, Hyper, Rhus-t,-Acet-ac, Cic, Nat-S, Ruta, Stont-C, Sul-c.Bruises,contusion-Arn, Ham, Con, Hyper, Rhus-t, Ruta, Symphyt.-Acet-Ac, Bellis, Led, Sul-ac,Bruise of bone-Ruta, Symphyt.-Arn, Cac-P, Chronic effect of injuries-Arn, Con, Nat.s, Stont.c-Carbo v, Cic, Glon, Ham, Hyper, Led, Sprain, Strain - Acon, Arn, bellis, Carbo an, Hyper, Rhus t, Ruta, Symphyt.-Acet.ac, Calend, Rhod, Stront | (Nayak et al, 2019) |
| Homoeopathy treatment | Diet control and homeo medicines | (Shankar et al., 2019) |
| BPH | Hydrangea arborescens Q, Thujaoccidentalis LM potency, Sulphur 200 | (Paital et al., 2013) |
| Homoeopathy treatment | Homoeopathic medicines | (Sahoo et al., 2008b) |
| Vitiligo | Calcareacarbonica | (Hati et al., 2018) |
| Pediatric nephrolithiasis | Carcinosin | (Mishra et al., 2018) |
| Ureteric calculus | Hydrangea arborescens 30 | (Nayak et al., 2018) |
| Urinary tract infections | Sulphur,Nuxvom, Lycopodium, Benz.acid, Staphysagria, Terebinth, Sarsaparilla, Berb. vulg., Phosphorus, Platina, Uvaursi, Colibacillinum, Causticum, Cantharis and Eupatorium perf. | (Sahoo et al., 2018a) |
| Verruca Palmaris | Natrummuraticum | (Sahoo et al., 2018b) |
| Ureteric calculi | Lycopodium clavatum | (Hati et al., 2018) |
| BPH | Carcinosin 200, Sabal serrata Q | (Mishar et al., 2018) |

In general there are enormous critics noticed against use of homeopathic drugs for the treatment of even the most complicated diseases such as prostatic hyperplasia (CCRH, 2019; Hati et al., 2012). However, our long term clinical practices indicate that homoeopathic formulations (Paital et al., 2019; Sahoo et al., 2017) are quite effective for broad range of diseases,

for example, Begin Prostatic Hypertrophy (Nayak et al., 2017a; 2017b; Paital et al., 2013, 2017), (Musculoskeletal Disorders in Sports Injuries (Nayak et al., 2019), vitiligo (Hati et al., 2018), pediatric nephrolithiasis (Misra et al., 2018), ureteric calculus (Hati et al., 2018; Nayak et al., 2018), urinary tract infections (Sahoo et al., 2018), Verruca Palmaris (Sahoo et al., 2018b) (Table 4). Therefore, this treatment system must be encouraged for cost effective and side affect less management of several diseases.

Similarly, many negative effects of the studied drug GC in the current case are also discussed. Although positive results are obtained with this drug i*n vitro* and in animal models in relation to weight loss aid, but the drug is failed in human trials. Common side effects of the drug were stated to be nausea, upset stomach, diarrhea, headache, dizziness and dry mouth. Some of the serious side effects of the drug are believed to be mania that includes euphoria, delusions, over excitement, very fast speech, decreased need for sleep, and irritability (Cunha, 2020). The Food and Drug Administration was considers it as unsafe in 2017 and eventually banned any weight-loss product that contained *Garcinia cambogia* as constituent. Some of the main complains were reported to be serious hepatic and ocular issues (Cho et al., 2019; Liver Tox, 2029; Mas and Bordón, 2019; Yousaf et al., 2019). In addition, the drug was criticized to interact badly with Diabetes medicines, including pills and insulin, pain medicines, prescriptions for psychiatric conditions, so, it was suggested against the sue of this medicine during pregnancy or nursing, or with liver problems. It is possible that manic symptoms may emerge as a side effect (Ratini, 2020). However, in above cases, the drug was used as ayurvedic preparation, could be the major limitation of above studies. Hence, based on the current result, homeopathic preparation of GC is suggested to be safe.

## 5. CONCLUSION

The present study shows that there is a significant reduction in weight in obese patient following administration of *Garcinia cambogia* 3x and 6c along with placebo. A significant reduction in total cholesterol, triglycerides, LDL and VLDL levels in after treatment group than before treatment group with appropriate Placebo. It was observed that the effect of *G. cambogia* 6c was more as compared to its 3x potency. The effects of the same medicine needs to be tested in other potencies and may be compared with the other sub species prepared homeopathically such as *Garcinia morella* with higher sample size.

**Abbreviations**

BMI: Body Mass Index
GC: *Garcinia cambogia*
RCT: Randomized Controlled Trial
WHO: World Health Organization
C: Centesimal scale
NIH: National Institutes of Homeopathy
NCCIH: National Center for Complementary and Integrative Health
CTRI: Clinical Trials Registry – India
SD: Standard Deviation
ANOVA: Analysis of variance
VLDL: Very Low-Density Lipoproteins
LDL: Low-Density Lipoproteins
HDL: High-Density Lipoproteins

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**Conflict of Interest**

The authors declare that there is no conflict of interest with any one in relation to any institution or person.

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