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Full Length Research Paper

Weight-lowering effects of *Caesalpinia pulcherrima*, *Cassia fistula* and *Senna alata* leaf extracts

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Methanol extract of *Caesalpinia pulcherrima*, *Cassia fistula*, and *Senna alata* were evaluated for their hypolipidemic activity in diet-induced lipidemia in mice. Preliminary phytochemical screening was performed following standard procedures. The bioassay was conducted in three-week old female mice. Results demonstrated that *C. fistula* and *S. alata* extracts can significantly lower body weight of mice in the treatment groups. In addition, parametrial fat weight of mice was also decreased in a dose-dependent manner, thus confirming the weight lowering potential of these plants.

Key words: Medicinal plants, *Caesalpinia pulcherrima*, *Cassia fistula*, *Senna alata,* obesity, phytochemicals.

INTRODUCTION

Caesalpinia pulcherrima is an ornamental plant in the Philippines and several medicinal properties are also attributed to it. Its root extract is used as an anti-pyretic while leaves are used as purgative and mouthwash (Quisumbing, 1978). Different extracts of *C. pulcherrima* were found to exhibit anti-microbial (Sudhakar et al., 2006) and anti-inflammatory activities (Rao et al., 2005) and various contained flavonoids and diterpenoids were isolated from this plant (Roach et al., 2003; Ragasa et al., 2002). *Cassia fistula* is used as a medicinal plant in the Philippines (Quisumbing, 1978). Its extract showed antibacterial, antifungal (Duraipandiyan and Ignacimuthu, 2007), anti-tumor (Gupta et al., 2000) and hepatoprotective activities (Bhakta et al., 2001). On the other side, *Senna alata* is traditionally used as a remedy for poisonous bites and venereal infections (Quisumbing, 1978). It exhibits antimicrobial activity (Idu et al., 2007; Khan et al., 2001; Somchit et al., 2003) and an ointment containing *S. alata* was found to be active against bovine dermatophilosis (Ali-Emmanuel et al., 2003).

As part of our continuous efforts to further investigate plants used as traditional medicines in the Philippines, the fore-mentioned plants were investigated for their body-weight lowering activity. These plants were chosen on the basis of their phytochemical constituents. To the best of our knowledge, there have been no previous reports on the weight-lowering effect of these plants in mice.

MATERIALS AND METHODS

Plant materials

Approximately 400 g-leaves of *C. pulcherrima*, *C. fistula* and *S. alata* were collected from the University of the Philippines, Diliman campus. The leaves were authenticated and specimens were kept on record in the Jose Vera Santos Herbarium of the Institute of Biology, University of the Philippines, Diliman. The leaves were washed with water and air-dried. The dried leaves were then cut into smaller pieces, homogenized and soaked in distilled methanol. The extract was [then] filtered and concentrated under reduced pressure using a rotary evaporator.

Preliminary phytochemical screening

Phytochemical tests were performed according to previously described standard methods (Edeoga and Okwu, 2005; Harborne,

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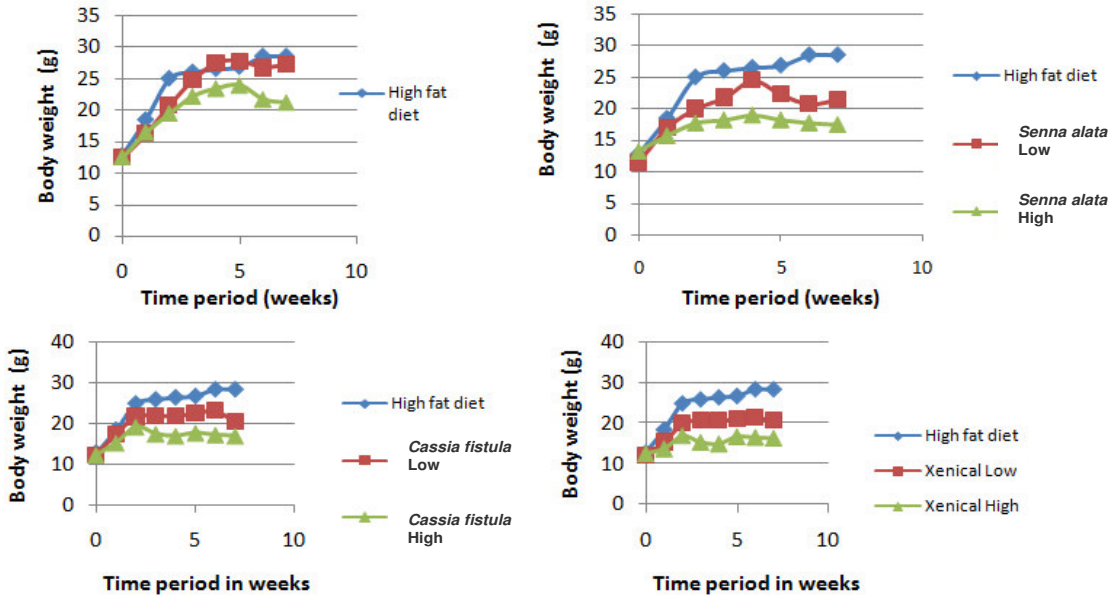

Figure 1. *C. pulcherrima*, *C. fistula, S. alata* and Xenical groups compared with high-fat diet treated group.

1984) and the presence of tannins and saponins was confirmed in the medicinal plants under current study.

Bioassay

Three-week old female ICR strain mice were obtained from the Bureau of Food and Drug Administration, Manila. The mice were handled with care according to the Guide for the Care and Use of Laboratory Animals Manual. They were housed individually under a 12 h light-dark cycle and given free access to food and water. After one week of acclimatization, they were randomly divided into ten groups. **Group 1** was given regular feeds; **Group 2** was given 40% fat and 60% regular feeds.

Groups **3, 4 and 5** were fed with a mixture of 40% fat, 3.0% plant extracts and 57% normal feeds. Groups 6, 7 and 8 were fed with 40% fat, 0.3% plant extract with 59.7% normal feeds. Groups 9 and 10, served as the positive control. Group 9 was fed with 40% fat, 0.5% Xenical and 59.5% normal feeds while Group 10 was fed with 40% fat, 0.05% Xenical and 59.95% normal feeds, respectively.

All mice in the control and treatment groups were fed for seven weeks. The pre-treatment and post-treatment body weights of each animal in different groups were recorded on weekly basis and data was maintained for each mouse. After the treatment period, the mice were sacrificed through cervical dislocation and the parametrial fat removed and weighed using an analytical balance.

Statistical analyses

The data obtained was analyzed by one-way Analysis of Variance (ANOVA) using SPSS 16.0 and Dunnett's post hoc test at α=0.05. Data obtained was used to compare the group means relative to the reference group ensuring the statistically significant differences ($P<0.05$). The percent change in initial body weight was computed for each mouse and the treatment groups with significant results was determined using one way ANOVA. The formula used was:

$$\frac{\text{Body weight of each mouse that week} - \text{Initial body weight}}{\text{Initial body weight}} \times 100\% = \text{Percent change}$$

RESULTS AND DISCUSSION

Around 30 g of methanolic extracts were obtained from the dried leaves of *C. pulcherrima*, *C. fistula* and *S. alata*. Phytochemical tests revealed the presence of saponins in *C. pulcherrima*, condensed tannins in *C. fistula* and hydrolysable tannins in *S. alata*. After seven weeks of feeding the various treatment groups, statistical analysis revealed that the *C. pulcherrima* groups at 3.0% and 0.3% did not significantly lower the body weight of the test animals. The results presented in Figure 1 demonstrated that the body weights of the test animals of *C. pulcherrima* treatment group (with 3.0% of the extract) were found to be lower than those treated with 0.3% extract. It seemed possible that increasing the concentration of the plant extract could further decrease the body weight of the animals in the treatment groups.

Treatments with 3.0% *S. alata* and *C. fistula* respectively significantly lowered the body weights of the animals in the treatment groups. However, at 0.3%, the results were not significant which could indicate dose-dependency. The positive control group was treated with Xenical®, with tetrahydrolipstatin as active ingredient. Tetrahydrolipstatin is a well known lipase inhibitor that blocks fat absorption and has anti-obesity and anti-cholesteromic activities in humans and animals (Yamamoto, 2000). At 0.5% concentration, the results were found to be statistically significant after one week of

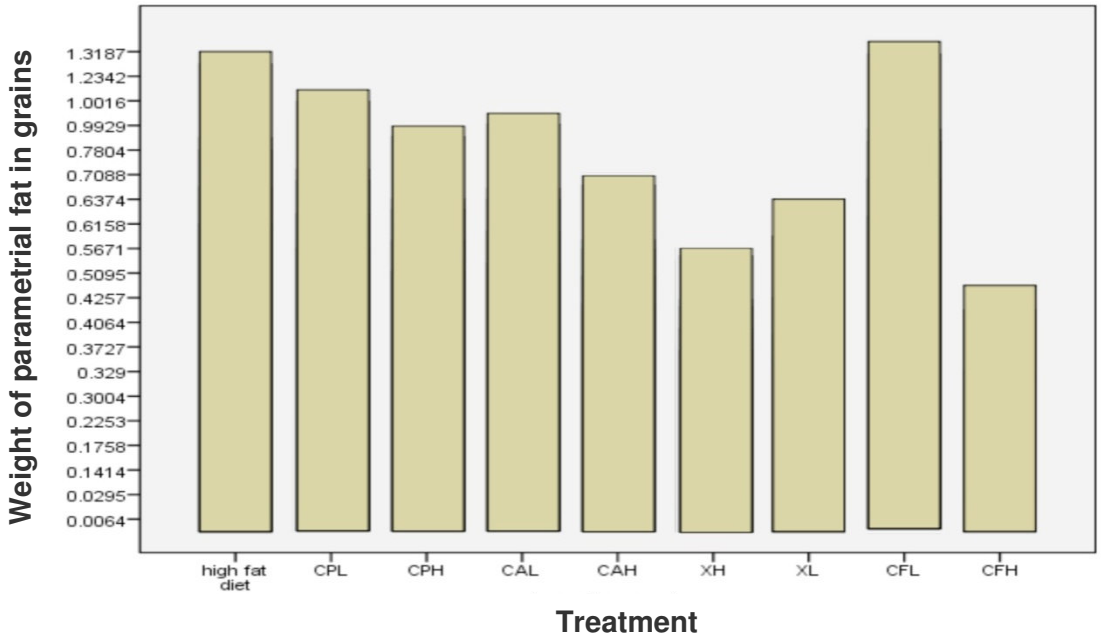

Figure 2. Average parametrial adipose tissue weight from the test animals where CPL is treatment with 0.3% *C. pulcherrima*, CPH with 3.0% *C. pulcherrima*, CAL with 0.3% *S. alata*, CAH with 3.0% *S. alata*, CFL with 0.3% *C. fistula*, CFH with 3.0% *C. fistula*, XL with .05% Xenical and XH with 0.5% Xenical.

treatment. However, the body weight change was only significant after seven weeks when using 0.05%.

C. fistula treatment could lower the body weight more effectively as compared to the *S. alata* treatment group. After three weeks of treatment, the change in body weights of mice in the *C. fistula* treatment group were also lower. However, *S. alata* treatment produced a more immediate effect showing significant results after two weeks of treatment. It is worth mentioning that the results were consistent when data of parmetrial fat was analyzed and compared with the control. Groups treated with 3.0% *S. alata*, 3.0% *C. fistula* and 0.5% xenical showed statistically significant lowering in the weight of parametrial fat. The results obtained during the current study (Figure 2) showed lowering in weight of parametrial fat in *C. fistula* treatment group as compared to *S. alata* treatment.

The current study results has confirmed the weight lowering potential of *C. fistula* and *S. alata* which could at-least be partially attributed to the presence of tannins found in the plants. However, saponins are also known to inhibit growth rate (Scalbert et al., 2002; Xiong et al., 2010). Our results are in full agreement with earlier studies where tannins were reported to be involved in growth regulations (Kadam et al. 1990; Muthusamy et al. 2008). The tannins present in the extracts used during this study, could potentially inhibit the activity of lipases found in mice, thereby lowering their body fat content. Previous studies using tannins from grape seed extract showed their potential hypolipidemic and anti-hypercholesteromic effects (Tebib et al., 1984). Furthermore, the water extract of *Semen Cassiae* was reported to drastically inhibit the weight gain of high-nutrient-fed rats. The effect on weight gain was related with its metabolism regulating actions on glucose and lipids (Junbao et al. 2004).

Conclusion

This study has shown that *C. fistula* and *S. alata* can significantly and effectively reduce the body weight and weight of parametrial fat in mice possibly due to their tannin contents. Further studies are warranted on the activity and toxicity of these plants, and their chemical constituents. Both *C. fistula* and *S. alata* seem to be possible sources of anti-obesity and hypolipidemic compounds which could be developed as phytomedicines or drugs.

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