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EFFECT OF *ZINGIBER OFFICINALE* AND *VALERIANA OFFICINALIS* ON BIOCHEMICAL PROFILE AND BODY WEIGHTS IN ADULT WISTAR RAT

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ABSTRACT

The influence of two medicinal plants, *Zinger officialise* and *Valeriana officinalis* on food intake, weight gain and blood parameters of adult Wistar rats was studied. Forty adult Wistar rats maintained on normal diet were divided into 5 groups, control group (1) was given placebo, and others (2-5) were fed with dry ginger and valerian root powder via gavage at 3 and 6 mg levels respectively for 30 days. A record of food intake and weight gain was maintained. At the end of the study all animals were sacrificed and organs were weighed (spleen, pancreas, kidney and liver). Biochemical indices measured were liver function tests, lipid profile, complete blood count and serum electrolytes. Results revealed that there were no significant differences between control and study group in any of blood parameters and organ weights. There was significant weight loss in both groups fed ginger in comparison to control, though the food intake of all groups was similar. In both valerian fed groups, there was an increase in food intake with higher weight gain. Valerian increased appetite of animals and induced lethargy in comparison to control group. It can be said that ginger possibly increased the metabolic rate thereby decreasing body weight despite normal food intake.

KEY WORDS: Food intake, feed efficiency, liver function tests, lipid profile.

1. INTRODUCTION

Herbal medicines have been found to be very effective for treatment of many diseases such as diabetes mellitus, obesity and cardiovascular disease [1, 2]. Herbal medicines are still the mainstay of about 75-80% of the world population, mostly in the developing countries for primary health care because of higher cultural satisfactoriness, and compatibility with the human body and lesser side effects. The therapeutic effects of various herbal medicines have been established, though exact pharmacological mechanism of action on the central nervous system remains to be explained for many herbal medications [3]. The Indian system of medicine is attracting attention and popularity in many parts of the world. It relies on a goldmine of well-recorded and well practiced knowledge of traditional herbal medicine. But, unlike China, India has not been able to capitalize on this herbal wealth by promoting its use in the developed world despite their renewed interest in herbal medicines.

Zingiber officinale belonging to *Zingiberaceae family*, commonly known as ginger, is a spice used in the traditional system of medicine since ancient times and has many medicinal properties such as hypoglycaemic and hypolipidaemic effect [4]. It is used to treat a wide range of ailments including stomach aches, diarrhea, nausea, asthma, respiratory disorders [5, 6]. Essential volatile oils and non-volatile pungent compounds are the major chemical components of ginger. Major bioactive constituent of ginger are gingerols and shogaols which are found in both fresh and dry ginger. Some studies suggest that ginger has antiobesity action [7, 8] but in Indian folk medicine ginger is used as an appetizer so we were interested in exploring the effect of ginger on food intake, weight gain and biochemical parameters of rat.

Valeriana officinalis (valerian) belonging to *Valerianaceae* family, is a widely used plant with many medicinal properties. It is well known for its anxiolytic and sedative effect, and for treatment of headaches, palpitation, high blood pressure, irritable or spastic bowel, menstrual cramps, childhood behavior problems and learning disability [9-11]. Valerian root contains two substances of special pharmacological interest—valepotriates and sesquiterpenes [12]. The essential oil in valerian appears to provide its sedative activity while its valepotriates exhibit a regulatory effect on the autonomic nervous system [13]. Even though more than 150 components have been recognized, none show to be solely responsible for their effects, suggesting a synergistic action of its constituents [14, 15].

Hence, with this background the study was planned to investigate the effect of ginger and valerian root powder on appetite, food intake, weight gain and biochemical parameters in adult Wistar rats.

2. Methodology

2.1. Animals

Forty adult Wistar rats (20 males and 20 females) were used for the study. Animals were provided from disease free animal house of Department of Zoology, University of Mysore, India. Approval of the Animal Ethics Committee of the Institution was obtained prior to the study. They were acclimatized to the laboratory condition for 7 days. Animals were fed with the commercial diet which they were taking before the study, housed individually in wire mesh cages under controlled atmosphere of temperature and light. Room temperature was maintained at 22-26°C and light cycle was 12 hours with lights out at 18:00. The animals were accustomed to wire mesh cages and gavage (plain corn starch paste) for one week. They were divided into 5 groups of 8 animals (4 male and 4 female) each by random design with average weight of 200 g at the beginning of the study.

Dry valerian (*Valeriana officinalis*) and dry ginger (*Zingiber officinale*) was procured from local market of Iran and India respectively, washed, dried and stored in airtight containers under refrigeration. Corn starch paste was prepared (1g: 30 ml water) by heating to get suitable consistency and cooled to 37°C. Three and 6 mg of dry ginger or valerian powder was added to corn starch to get 3.0 and 6.0 mg of ginger and valerian per ml of paste. For the control group plain corn starch was used.

2.2. Mode of administration

At the start of acclimatization period, administration was initiated by giving plain corn starch paste via gavage. After adaptation period animals were weighed and grouped by random design method so that there were no marked differences in animal weight among the groups. They were fed with medicinal plant via gavage once a day every morning for 30 days. Control group (GI) was given placebo which contained only corn starch paste, 3 and 6 mg of ginger were given to group II (G2) and III (G3), and 3 and 6 mg of valerian was given to group IV (GIV) and V (GV) respectively.

2.3. Body weight gain and food intake

Food intake was recorded throughout the experiment; body weight was recorded once in 10 days with electronic balance.

2.4. Organ weight and blood parameters

All rats were anaesthetized with ether. Blood was collected from heart and 4 vital organ weights (spleen, liver, pancreas and kidney) were measured immediately after dissection to avoid drying and expressed as relative weight.

Relative weight= Absolute weight/weight of animals X 100

The complete blood count was performed using the instrument MINDRAY, BC 2800 Auto hematology analyzer. Bilirubin (direct/ total) [16], total protein [17], albumin [18], SGPT [17], SGOT [17], alkaline phosphatase[17], total cholesterol [19] was also measured in all five groups. Lipid profile was determined by standard techniques as follows - triglyceride [20], high density lipoprotein [21], very low density lipoprotein [22] and LDL.[23]

2.5. Blood electrolytes

Sodium and potassium was determined according to Oser and Summerson [24] method. Chloride was measured according to Van Slyke [25] technique.

During the 30 days of the experiment, all rats were observed daily. Notations were made regarding their physical activity/lethargy, eye and skin condition, fur condition and stools.

2.6. Histopathology study

Liver, pancreas, kidney and spleen were separated after dissection, weighed and kept in 70% alcohol and fixed in bouin's fluid. Dehydration in grades of alcohol and clearance in chloroform was done and then the organ was embedded in paraffin wax. Sections were taken at 5 µm thickness using microtom and stained with hematoxyline and eosine as per the standard procedure and observed under light microscope.

2.7. Statistics

Data were analyzed using statistical program Epi info version 3.4.3. Animal weight, organ weight, food consumption, clinical blood parameters were analyzed for variance. The result with P value less than 0.05 were considered to be statistically significant.

3. RESULTS AND DISCUSSION

The results of the study are compiled in Tables 1 to 3 and Figures 1 to 3.

3.1. Body weights

The mean body weights of the animals were similar in all 5 experimental groups at the beginning of the study (192.1-193.1 g) since animals were distributed in groups with random design (Figure 1). After 15 days, there were differences in weight of animals. Control group gained weight (213.2 g) whereas ginger group showed weight reduction in both level of ginger (184.2 and 172.37 g respectively). Valerian group gained more weight than control. After 30 days of treatment, the weights of animals were taken and found to be 219.4 g for control group, 176.5 and 157.1 g in group II and III and 239.1 and 246.2g in group IV and V respectively. Statistically, there was significant weight reduction in both levels of ginger group compared to control group whereas in group IV and V there was a significant weight gain after 30 days of treatment with valerian but difference between group IV and V was not significant. The results of other studies support the data of present study. Nammi et al., [26] in their study showed that ethanolic extract of ginger (100, 200 and 400 mg/kg body weight) given to rats along with high fat diet significantly suppressed the body weight gain. Han et al., [8] in an *in vitro* study

reported that, an aqueous extract of *Zingiber officinale* could inhibit the hydrolysis of triolein emulsified with phosphatidylcholine by pancreatic lipase and it reduced the elevation of rat plasma triglyceride one and two hours after oral administration of a lipid emulsion containing corn oil. They also observed that feeding *Zingiber officinale* significantly reduced mice weight and final parametrical adipose tissue weights. They suggested that aqueous extract of *Zingiber officinale* might inhibit the intestinal absorption of dietary fat by inhibiting its hydrolysis by the active compounds of *Zingiber officinale*. David et al., [7] studied the effect of a Chinese herbal extract with 7% *Zingiber officinale* on weight gain of rat and found a significant weight reduction when animals received extract equivalent to 1.5 and 0.75 g of ginger per day. They found a significant reduction in leptin hormone in both treatment groups (27.5% to 46.2) vs. control group. And reduction of parametrical fat was observed at both dose of treatment (14.1% and 55.5%). Group IV and V fed with 3 and 6 mg of dry valerian for 30 days exhibited significant weight gain in both groups. Also animals were found to be sleepier than control group. This may be one more reason for the animals to gain weight.

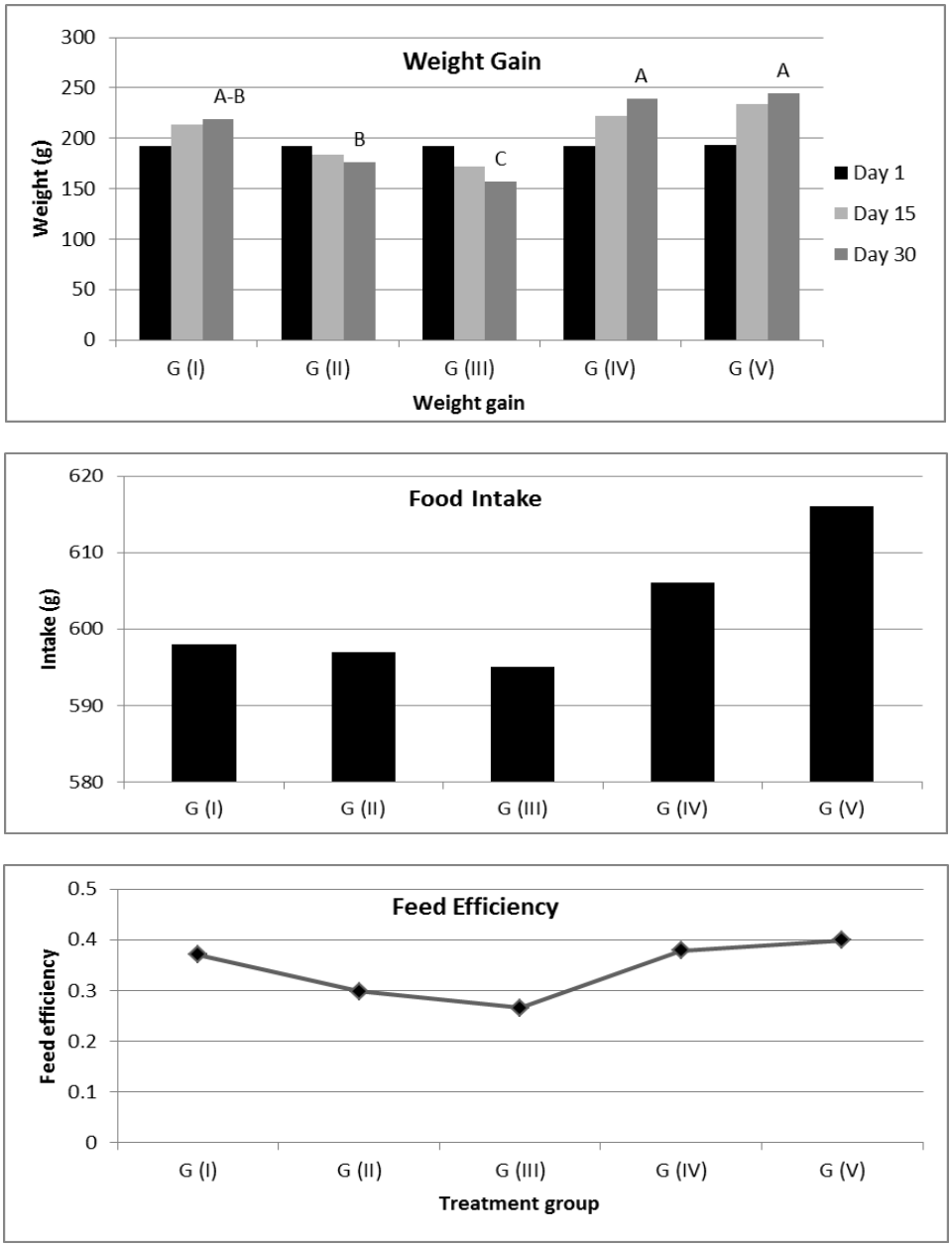

Fig. 1. Effect of ginger & valerian supplementation on body weight gain (g), food intake and feed efficiency of adult Wistar rats

G:Group. Significant weight gain differences between groups on application of post test (Tukey's) is indicated by different alphabets.

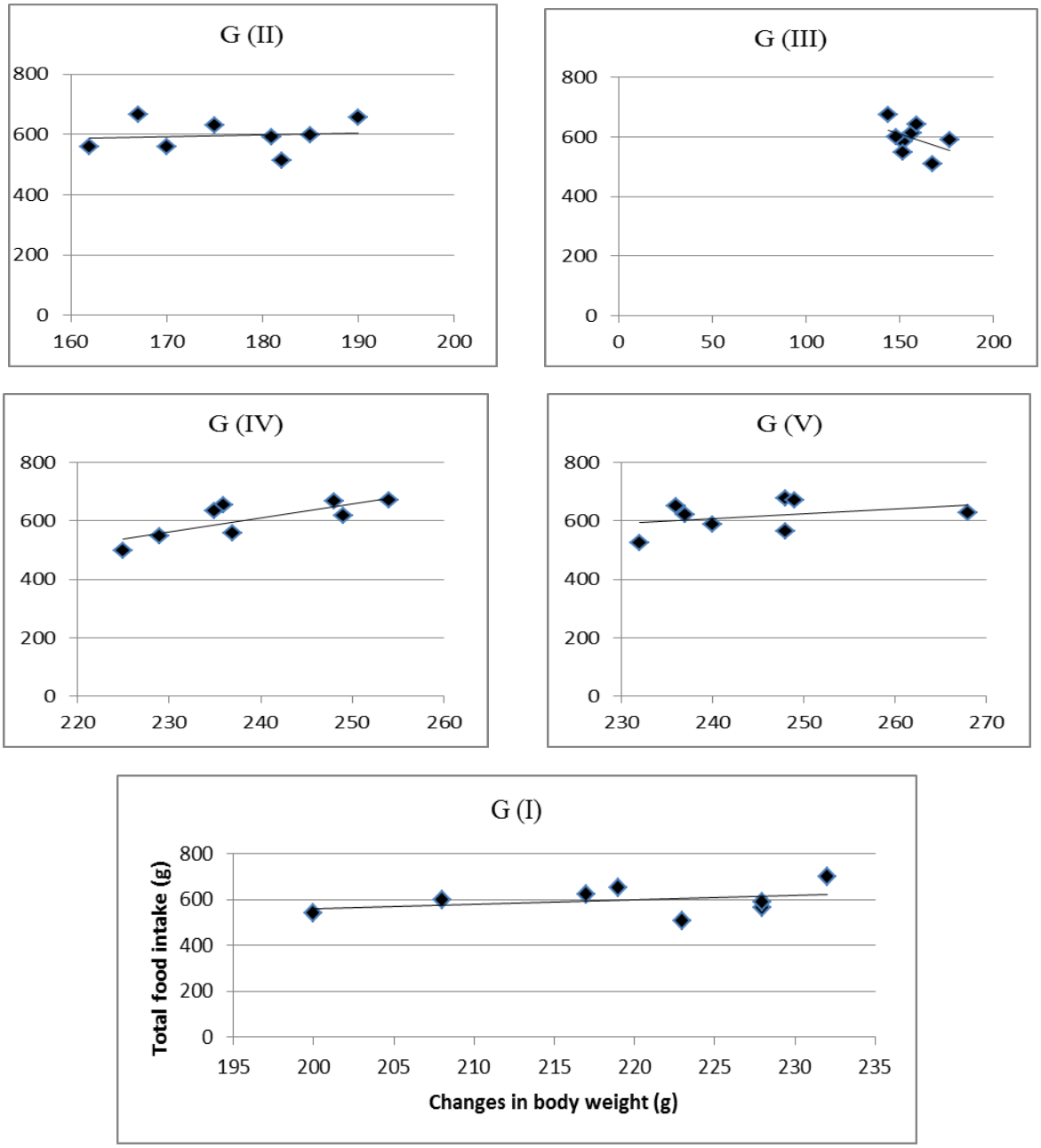

Fig. 2. Correlation between weight gain and food intake of Wistar rats fed with ginger and valerian.

3.2. Food intake

The animals were fed on regular commercial standardized food during the study *ad libitum*. Food intake of animals was measured for 30 days and as shown in Figure 1, control group consumed 598 g and group II and III, 597 and 595 g of food respectively. Statistically there were no significant difference in food intake in control and ginger group. Hence it can be said that ginger did not affect the appetite of animal in present study. On the other hand in group IV and V, food intake significantly increased, hence weight gain may be due to the effect of valerian on rat's appetite. It has been shown that valerian increases release of GABA (gamma aminobutyric acid) and inhibits enzyme induced break down of GABA [27-29]. GABA has direct relationship with serotonin, the secretion of which inhibits appetite and food intake [30]. It has been found that ghrelin hormone (hunger hormone) increases production and release of GABA [31], the adverse effect may accrue and increase ghrelin production and so improve the appetite. On the other hand actinidine (Ia) which is a steam-volatile in the essential oil of valerian root [32], is psychoactive which interferes with the gamma-aminobutyric acid (GABA)-ergic metabolism; it is an agonist on benzodiazepine receptors and thus revealed an allosteric modulation of the GABA-receptor-proteins [33]. The mechanism of action needs more study.

3.3. Feed Efficiency

The feed efficiency is expressed as weight gain (g) divided by weight of food consumed (Figure 1). The feed efficiency of the valerian group (IV & V) was higher

than control and both levels of ginger groups. Statistical analysis did not show significant difference between control and both levels of valerian groups. Feed efficiency of the group IV and V were 5.7% and 7.3% higher than control group and that of group II and III were 18.2% and 28% lower than that of the control group respectively. Correlation analysis revealed that R values for each group were: Control, 0.346; 3 mg valerian, 0.780; 6 mg valerian, 0.348; 3 mg ginger, 0.117 and 6 mg ginger, -0.441. Inverse correlation indicates that feed efficiency did not contribute to weight gain in animals (Figure 2).

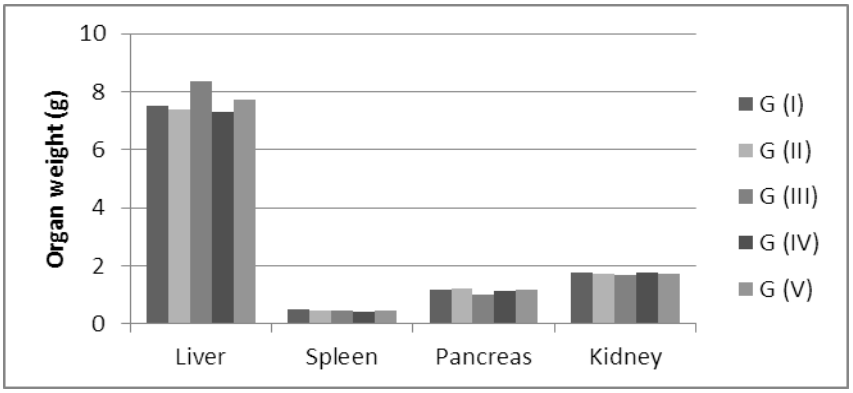

Fig. 3. Effect of ginger and valerian supplementation on organ weights of adult Wistar rats G: Group

3.4. Organ weight

After the study, weights of four vital organs (spleen, pancreas, liver and kidney) were recorded and values are presented in Figure 3. Liver weight was found to be 7.5, 7.3, 8.3, 7.3 and 7.7 g in group I-V respectively. Weight of spleen was found to be in the range of 0.42 to 0.48 g, pancreas, 1.002-1.22 g and kidneys, 1.65- 1.76 g. When statistically analyzed, there was no significant difference between control group and other groups, in any organ weight.

3.5. Blood chemistry

3.5.1. Blood electrolytes

Blood electrolytes were analyzed at the end of the study. As shown in Table 1, sodium level of females in control group was 141.11 mEq/l and in all other groups was in the range of 140.58 to 142.33 mEq/l; control group males had 140.71 mEq/l sodium in blood and in other groups it varied between 140.9- 145.1 mEq/l. Blood potassium of female and male of control group was 6.97 and 5.10 mEq/l, respectively and in other groups, it was in the range of 6.0 – 7.2 and 5.3- 6.1 mEq/l respectively. Blood chloride in female and male in control group was 104.4 and 101.9 mEq/l respectively and in other groups, it was in the range of 104.4-105.1 and 101.7- 103.0 mEq/l respectively. Statistically there were no significant differences between the study group and control group in analyzed blood electrolytes.

3.5.2. Complete Blood Count

Complete blood count was determined at the end of study with automated analyzer set for animal blood count. WBC of female and male in control group was found to be 5.6 and 7.4×10^3/µl respectively and in other groups was in the range of 5.5-9.0 and 6.0-11.9 respectively. RBC value in control group was 6.98 and 8.7 in female and male respectively and in study groups, it was in the range of 7.3-8.0 and 7.5 -8.9×106 µl respectively. Hemoglobin was found to be 13.06 and 13.65 in control group female and male respectively and in other study groups it was in the range of 13.7-14.8 and 15.7-16.4 g/dl respectively. Haematocrit values (%) were 39.8 and 50.8 in control group female and male respectively and in study groups these were in the range of 42.5-46.7 and 50.1-52.1% respectively. All analyzed blood cells were in the normal range.

3.5.3. Liver function test

Liver function test was done at the end of study and results are shown in Table 2. In female rat, total bilirubin was found to be in the range of 0.247- 0.333 mg/dl in experimental group and 0.35 mg/dl in control group. In male animals, it was 0.242-0.340 mg/dl in experimental and 0.331 mg/dl in control group. SGOT was 624 and 306.45 u/l in control group female and male rats respectively. In experimental groups, it ranged between 442-571 and 372-537 u/l respectively. In control group SGPT was 137.7 and 64.8 u/l in female and male respectively, whereas in experimental groups, it ranged between 97.6 to 109.4 and 81.6 to 84.1 u/l respectively.

Zahedi et al [34] administered the percolated extract of *valeriana officinalis* plant with doses of 100 and 200 mg/kg to five groups of rats via orogastric tube for 7 days. At the 8th day, the blood samples were taken for biochemical studies. The results showed significant variation of the levels of AST, ALT and AlkP in comparisons with control group. AlkP increased significantly after oral administration of extract with dose of 100 mg/kg and 200 mg/kg. ALT decreased with dose of 100 and 200 mg/kg of valerian significantly but AST increased significantly only with dose of 100 mg/kg. AST did not change with dose of 100 mg/kg, but decreased significantly with dose of 200 mg/kg ($P < 0.01$). They reported that renal function tests including blood urea nitrogen and creatinine also did not change significantly after oral administration of extract.

Table 1. Effect of ginger and valerian supplementation on complete blood count and blood electrolytes of animals.

CBC	Sex	Control	Ginger		Valerian	
			3.0 mg	6.0 mg	3.0 mg	6.0 mg
WBC ×10³/µl	F	5.6±0.98	6.55±0.42	7.72±3.03	9.075±1.75	5.575±2.46
	M	7.45±1.20	9.9±1.01	10.5±2.20	11.9±0.90	6±2.06
Neutrophils %	F	14.20±0.72	15.32±3.70	14.67±1.55	16.00±3.59	11.55±0.98
	M	16.1±0.42	13.8±0.91	16.6±1.7	12.9±1.06	15.8±3.2
Lymphocytes %	F	81.5±1.3	79.8±3.51	78.8±2.49	80.0±3.24	81.8±3.39
	M	79.25±1.4	82.66±1.2	77.2±2.3	77.55±4.5	76.8±3.7
Monocytes %	F	2.86±1.80	3.72±0.92	4.17±2.64	2.975±0.73	3.97±1.93
	M	2.75±1.06	2.50±0.49	3.60±1.81	4.30±0.56	4.46±2.40
Eosinophils %	F	1.00±0.50	0.57±0.68	1.07±1.20	0.30±0.14	1.32±1.70
	M	1.05±1.00	0.53±0.37	1.00±0.47	0.25±0.07	1.76±1.07
Basophils %	F	0.33±0.20	0.55±0.57	1.20±1.50	0.42±0.12	1.32±1.49
	M	1.30±0.35	0.46±0.30	1.60±0.79	1.45±1.12	1.1±0.95
RBC × 10^6/µl	F	6.98±0.88	8.00±1.20	7.83±0.70	7.47±0.78	7.32±1.00
	M	8.70±0.16	8.62±0.60	8.90±0.11	7.50±1.13	8.19±1.37
Hb g/dl	F	13.06±2.41	14.82±1.60	14.72±1.22	13.77±1.30	13.92±1.49
	M	13.65±2.89	15.86±0.75	16.40±4.12	15.75±0.91	16.26±1.46
Hematocrit %	F	39.83±7.29	46.77±6.28	45.35±4.61	42.67±4.44	42.52±5.50
	M	50.85±0.21	52.13±3.81	51.40±3.71	50.15±3.32	52.00±4.68
MCV fL	F	57.06±3.15	58.62±1.34	57.85±1.73	57.15±1.88	58.12±1.98
	M	58.0±1.27	60.5±2.71	57.8±2.4	68.0±14.63	60.0±3.89
MCH pq	F	18.7±1.40	18.6±0.97	18.8±0.65	18.4±0.72	19.0±0.85
	M	15.5±3.60	18.4±0.43	18.4±1.82	21.3±4.38	18.4±0.62
MCHC %	F	32.8±2.36	31.7±1.03	32.5±0.64	32.3±0.42	32.7±0.75
	M	26.8±5.60	30.4±1.30	31.8±1.99	31.4±0.28	31.3±0.00
RCDW fL	F	14.76±2.23	14.10±1.65	14.07±1.83	14.02±0.84	13.57±0.67
	M	16.00±0.28	17.40±1.58	14.70±2.52	15.50±0.84	16.36±1.52
Platelet × 10³/ µL	F	407±128	576±122	455±166	524±182	513±146
	M	484±95	478±211.3	483±120	480±95	421±165
PDW	F	16.43±0.75	12.45±7.65	17.97±0.61	16.60±0.98	17.65±0.73
	M	16.90±1.13	17.20±0.96	16.60±3.21	17.35±0.77	18±0.80
MPV	F	8.70±2.55	7.12±4.60	7.45±1.23	7.05±0.79	7.40±0.66
	M	6.95±0.35	7.30±0.34	6.70±1.10	8.05±1.06	7.26±1.15
Sodium	F	141.11±2.41	142.33±2.56	142.33±2.80	140.58±3.50	140.76±1.56
	M	140.71±4.10	140.90±1.50	145.10±0.99	143.60±3.30	142.23±1.89
Potassium	F	6.97±2.59	6.80±3.14	6.97±1.33	6.00±1.29	7.20±2.37
	M	5.10±0.28	5.96±0.60	5.30±0.30	5.90±0.26	6.10±0.35
chloride	F	104.40±1.80	105.12±2.70	104.67±0.87	104.80±0.86	104.45±0.66
	M	101.95±3.60	101.76±2.26	102.50±0.92	103.03±0.95	102.50±2.18

RBC: Red blood cell
MCV: Mean corpuscular volume
MCH: Mean corpuscular hemoglobin
MCHC: Mean corpuscular hemoglobin concentration
PDW: Platelet distribution width
MPV: Mean platelet volume
Hb: Hemoglobin
CBC: Cell blood count
WBC: White blood cell

Table 2. Effect of ginger and valerian supplementation on liver function tests of adult Wistar rats.

Constituents	Sex	Control	Ginger		Valerian	
			3.0 mg	6.0 mg	3.0 mg	6.0 mg
Bilirubin T mg/dl	F	0.350±0.073	0.325±0.017	0.333±0.070	0.247±0.096	0.301±0.040
	M	0.331±0.028	0.242±0.121	0.340±0.100	0.303±0.011	0.312±0.099
Bilirubin direct mg/dl	F	0.077±0.033	0.087±0.022	0.085±0.026	0.142±0.139	0.071±0.021
	M	0.075±0.035	0.166±0.167	0.111±0.080	0.086±0.023	0.062±0.025
Bilirubin indirect mg/dl	F	0.272±0.063	0.237±0.020	0.245±0.058	0.225±0.034	0.231±0.043
	M	0.25±0	0.246±0.015	0.29±0.020	0.216±0.011	0.250±0.077
SGOT u/l	F	624.0±270.20	501.7±247.44	539.5±283.48	442.8±219.64	571.3±167.54
	M	306.4±67.6	497.1±197.2	372.0±11.5	537.4±61.7	416.3±212.0
SGPT u/l	F	137.7±44.0	106.3±34.6	109.4±44.5	97.6±35.3	104.5±38.8
	M	64.8±8.34	82.7±14.81	83.5±7.21	84.1±12.4	81.6±24.57
Alkaline phosphatase u/l	F	352.9±146.21	359.6±48.14	296.4±31.46	271.5±75.47	203.1±17.04
	M	349.4±36.41	350.8±46.58	351.5±8.60	303.7±54.05	291.3±67.44
GGT u/l	F	5.77±5.53	4.85±4.46	4.60±4.03	2.15±0.85	3.87±1.83
	M	1.6±0.14	2.6±1.47	3.2±1.01	4.5±1.70	2.3±1.90
Total protein g/dl	F	7.13±0.65	7.11±0.53	7.30±0.40	6.78±0.56	7.35±0.24
	M	6.57±0.20	6.81±0.25	6.41±0.80	6.80±0.57	6.73±0.48
Albumin g/dl	F	2.86±0.392	2.97±0.232	3.17±0.211	2.87±0.087	3.27±0.186
	M	2.97±0.37	3.02±0.20	3.09±0.09	3.34±0.47	3.13±0.26
Serum albumin/ globulin ratio	F	0.67±0.104	0.72±0.074	0.76±0.049	0.74±0.121	0.80±0.044
	M	0.85±0.240	0.80±0.111	0.93±0.040	0.96±0.112	0.87±0.114

Table 3. Effect of ginger and valerian supplementation on lipid profile of adult Wistar rats.

Lipid profile	Sex	Control	Ginger		Valerian	
			3.0 mg	6.0 mg	3.0 mg	6.0 mg
Total cholesterol	F	39.45±8.54	41.92±2.42	45.47±10.44	46.50±12.12	49.60±17.84
	M	44.5±1.83	37.6±2.53	40.3±2.10	47.1±7.59	38.3±10.85
High-density lipoprotein	F	30.35±5.43	30.45±2.22	35.22±1.92	33.12±7.54	37.85±5.76
	M	26.95±0.91	26.43±4.79	29.50±1.80	24.70±3.21	26.87±3.86
Triglyceride	F	87.8±12.20	81.7±27.73	100.9±35.84	52.8±22.46	95.4±24.80
	M	53.9±7.9	68.6±25.8	101.1±15.8	102.9±26.3	70.0±16.5
Very low density lipoprotein	F	17.56±2.44	16.34±5.54	20.19±7.16	10.56±4.49	22.08±8.34
	M	10.78±1.58	13.72±5.16	19.32±2.41	17.59±39.00	14.96±4.53
TG/HDL ratio	F	1.32±0.334	1.39±0.176	1.28±0.260	1.39±0.111	1.28±0.278
	M	1.65±0.120	1.44±0.222	1.37±0.900	1.91±0.321	1.41±0.285

3.5.4. Lipid profile

Lipid profile of all animals was measured at the end of the study and the results are presented in Table 3. Total cholesterol of animals in control group was 46.45 and 44.5 mg% in female and male respectively. All experimental group values were close to control group. And significant difference was not seen. A mild increase was seen in triglyceride level of male animals in group III, IV and V but it was not statistically significant. HDL level was in the range of 30.35 to 37.85 mg % in female animals and in the range of 24.7 to 29.5 mg% in male animals.

Many studies have reported the hypolipidemic effect of ginger [35, 36]. It is said that ginger can increase the pancreatic lipase [37] and when ginger was incorporated in rat's diet, it significantly increased the activity of hepatic cholesterol 7a-hydroxylase [38]. Bhandari [35, 36] used 200 mg/kg ethanolic extract and observed the lipid lowering effect of ginger on rat and rabbit. At the dose level of ginger used in present study, we did not find any effect on cholesterol level of animals.

3.6. Safety and toxicity

During the 30 days of the experiment, all rats were observed daily. Notations were made regarding their physical activity/lethargy, fur condition, skin condition, eye condition and stools. During the study alopecia was not seen in any group. Fur condition, skin condition, eye condition, stools were found to be normal. In group IV and V, rats found to be sleepier than control group. And group I, II and III were found to be normally active. Histology of liver, kidney, pancreas and spleen was carried out after the study. It was observed that there were no changes in tissue of these organs in experimental group in comparison with the control group.

4. CONCLUSION

Traditionally, ginger is used in herbal preparations for weight reduction. Present study demonstrated that ginger supplementation lead to weight reduction without significant reduction in food intake, whereas valerian showed a significant weight gain with significant increase in food intake. Blood biochemical analysis demonstrated that either ginger or valerian did not affect lipid profile, liver function, blood electrolyte and complete blood count.

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