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Safety evaluation of a novel herbal sugar (DiaBliss): Acute and Subchronic Toxicity Studies

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ABSTRACT

DiaBliss is a novel diabetic friendly cane sugar that has been fortified by mixing with aqueous extracts of herbs with anti-diabetic and antioxidant principles. These herbs are well recognized and widely used in the Indian System of Medicine (ISM) for treating diabetes and other related metabolic disorders. DiaBliss sugar shows low Glycemic Index (GI). These findings motivated us to determine the safety of DiaBliss. Acute oral toxicity and repeated dose (28days) toxicity studies were performed in rats. The acute oral LD_{50} of DiaBliss sugar was greater than 5000 mg/kg in female Wistar rats and no changes in body weight or adverse effects were observed. A repeated dose 28-day sub-acute toxicity study demonstrated no significant changes in selected organ weights. Evaluations on hematology, clinical chemistry, and histopathology did not show any significant adverse changes. The NOAEL of DiaBliss sugar was found to be greater than 1800 mg/kg body weight. These results demonstrate the nontoxic nature and safety of DiaBliss sugar in preclinical toxicity testing.

Keywords: DiaBliss, Herbal sugar, Low Glycemic Index, Diabetic Friendly, Acute Toxicity, Subchronic Toxicity.

1. INTRODUCTION

Diabetes is increasing in prevalence worldwide and is also closely linked to the emergence of obesity in both developed and developing countries. The prevalence of type 2 diabetes is estimated to reach over 300 million cases by year 2030 [1]. Because of the alarming consequences of diabetes on both individuals and national economies, diabetes was declared as an international public health issue after HIV/AIDS by the UN general assembly [2].

In managing diabetes, the key objectives are to reduce hyperglycemia, prevent hypoglycemia in insulin-treated diabetes, and reduce the risk of complications. Prevention and management of diabetes should begin before or during the impaired fasting glucose and/or impaired glucose tolerance stage [3]. While pharmacological therapies are evidently effective, a holistic combination of lifestyle changes, functional foods/nutraceuticals along with drugs can be more effective in not only delaying onset of diabetes but also in achieving better glycaemic control in pre-diabetic and diabetic populations.

A number of components in foods of both plants and/or animal origin that could potentially reduce risk of a variety of chronic diseases have been identified [4]. Many functional ingredients that have been identified or those that are being researched for their potential in disease prevention have been widely used as traditional medicine components for thousands of years. Everyday stress, coupled with an aging, health-conscious population, and changes in food regulations resulted in the formation of new category termed 'functional foods'. Functional foods, with their specific health beneficial effects, represent a new mode of thinking about the relationships between food and health in everyday life.

Many diabetes specific ingredients maybe combined with food or other nutrition formulations to achieve tighter glycaemic control. Some of these food groups include cereals, legumes, fruits, herbs and spices that have active

ingredients with the ability to reduce glycaemic and insulin response and alleviate oxidative stress [5]. The key to a successful diabetic functional food product is to combine all or some of these ingredients into foods and beverages that appeal to consumers.

To date, more than 400 traditional plant treatments for diabetes have been reported, with the World Health Organization Expert Committee on diabetes recommending that traditional medicinal herbs be further investigated for their potential use [6]. A multitude of herbs and spices have been identified for their use in the treatment of diabetes throughout the world [6-11]. Based on chemical and pharmacological research, numerous bioactive compounds have been identified in herbs and spices for diabetes. Functional ingredients, such as stevioside, cinnamon, bitter melon, garlic and onion, ginseng, Gymnema sylvestre, turmeric and fenugreek, have been researched for their use in prevention and management of diabetes and its related disorders [12-20].

Although there is evidence that certain functional foods or food ingredients can play a role in disease prevention and health promotion, safety considerations should be of paramount importance. The objective of the present study was to investigate the adverse effects, if any, of a functional food product that is a low glycaemic index and diabetic friendly food following acute and 28 day repeated dose administration to rats. The test product used in the present study is cane sugar blended with a colorless, odorless and tasteless solution prepared from aqueous extracts of seven herbs.

2. MATERIALS AND METHODS

2.1. Test Product

The test product used in the present study is Diabliss Herbal Sugar, cane sugar blended with herbal solution prepared from aqueous extracts of seven herbs viz., Turmeric (rhizome), Ginger (rhizome), Fenugreek (seeds), Black Pepper (fruit), Pomegranate (fruit seeds), Cinnamon (bark), Gooseberry (fruit). Each of the herbs is individually extracted using a proprietary process. Individual aqueous extracts are then filtered and blended to yield a colorless and odorless solution. Diabliss Herbal Sugar is manufactured by using a proprietary process wherein regular white sugar is blended (half an hour) with the herbal solution (40 ml per kg of sugar). After the blending, the wet sugar is unloaded into a container and left undisturbed overnight. Subsequently the sugar is dried at 60°C for followed by further drying in the open before packing. The product is crystalline and white in color. The test product was provided by DiaBliss Consumer Products Private Limited (Thoraipakkam, Chennai, India) for the present study. Accelerated shelf life testing of Diabliss Herbal Sugar was performed to determine the date until when the product remains safe and at the defined quality. Diabliss Herbal Sugar was conditioned and stored under specific temperature (45°C) and humidity (80% - 90%) conditions. The test sample was analyzed for microbiological (total plate count, yeast/mould, coliform, e.coli), organoleptic/sensory (color, odor and taste) and chemical (moisture and pH-acidity) parameters on day 0, day 8, day 16, day 24, day 32. Results of the accelerated shelf life study with Diabliss Herbal Sugar estimated that the product can be used not more than 2 years from date of manufacture.

Process of manufacture of the herbal solution, Diabliss herbal sugar and the related food products is described herewith. The herbal solution is prepared using techniques from the Indian Traditional Systems of Medicine and is an aqueous extract of seven herbs viz., Turmeric (rhizome), Ginger (rhizome), Fenugreek (seeds), Black Pepper (fruit), Pomegranate (fruit seeds), Cinnamon (bark), Gooseberry (fruit).

2.2 Acute Oral Toxicity Study

2.2.1. Study Design

The study was performed according to a well designed protocol based on the Organization for Economic Co-operation and Development (OECD) Guidelines (OECD 423) for Testing Chemicals, Health Effects Test Guidelines, for Acute Oral Toxicity–Acute Toxic Class Method [21]. The study was conducted in compliance with the OECD principles on Good Laboratory Practices [22]. Wistar rats from Sri Venkateswara Enterprises, Bangalore were used in the study. A total of six female rats were selected for the study. Selected females were nulliparous and non-pregnant. Rats were allowed to acclimatize to the experimental room conditions for a period of five days prior to randomization for group I and group-II prior to commencement of dosing. During the acclimatization period, the rats were observed daily twice for clinical signs of disease. Prior to randomization, a detailed physical examination was performed on all animals. The animals were maintained in hygienic conditions. The animals were housed in standard polypropylene cages with stainless steel top grill under controlled conditions in a room. Autoclaved clean paddy husk was used as a bedding material. The room temperature was maintained between 23-24°C with relative humidity between 54–61 % and a 12 h light/dark cycle. The animals were provided ad

libitum laboratory rodent pellet feed supplied by Provimi Animal Nutrition India Pvt. Ltd., Bangalore and charcoal filtered, UV sterilized water (Aqua guard water filter system). Fresh feed was supplied at least once a week and water bottles were refilled daily or whenever required. Wistar rats (3/group) were randomly divided into two groups. At the time of randomization, the rats were approximately 10-12 weeks old and their body weight was 171-176 g. Test product dosing solution was prepared using sterile distilled water as vehicle. Required quantity of the test product was mixed in distilled water and the final volume was made up to 10 mL/kg. Gavage solutions were prepared freshly prior to dosing on all the occasions. Rats were treated orally (gavage) with Diabliss herbal sugar at a single dose of 2000 mg/kg body weight/day (dosing volume 10 mL/kg) for 14 days. Rats were observed for signs of toxicity and mortality at specific time points for 30 minutes, 1, 2, 3, and 4 hours post dosing on the day of dosing. Subsequently, rats were observed twice a day for morbidity and mortality for a period of 14 days following oral dosing. Clinical signs were recorded twice a day. Individual body weights were recorded prior to dosing on days 0, 7 and 14.

2.3. 28 day Repeated dose toxicity study

2.3.1. Study Design

The study was performed according to a well designed protocol based on Organization for Economic Co-operation and Development (OECD) Guidelines for Testing Chemicals, Health Effects Test Guidelines, No 407, entitled "Repeated Dose 28-day Oral Toxicity Study in Rodents", adopted on July 27, 1995 [23]. The study was conducted in compliance with the OECD principles on Good Laboratory Practices (1998).

2.3.2. Animals

Wistar rats from were used in the study. A total of 48 healthy and young rats (24 male and 24 female; age- 9 weeks) were selected for the study. Selected females were nulliparous and non-pregnant. Rats were allowed to acclimatize to the experimental room conditions for a period of five days prior to randomization. Prior to randomization, a detailed physical examination was performed on all animals and rats were observed daily twice for clinical signs of disease. The animals were housed in group of two of same sex per cage in solid floor polypropylene cages. Each cage was fitted with a stainless steel top grill and a polypropylene water bottle with stainless steel drinking nozzle. Sterilized paddy husk was used as bedding material. The cages were kept on two and three tier racks and their positions were rotated weekly. Cages and bedding material were changed twice a week. Cages and water bottles were cleaned and sterilized in an autoclave. The animals were fed with laboratory rodent pellet feed supplied by Provimi Animal Nutrition India Pvt. Ltd., Bangalore and charcoal filtered, UV sterilized water (Aqua guard water filter system) ad libitum. Fresh feed was supplied at least once a week and water bottles were refilled daily or whenever required. Feed, water and paddy husk was analyzed routinely for contaminates were analyzed. The room temperature was maintained between 22-25°C with relative humidity between 43 - 55 % and a 12 h light/dark cycle.

2.3.3. Treatment

The animals were equally distributed to four groups viz., control (G1), therapeutic dose (G2), average dose (G3) and high dose (G4) using the principle of randomization. Each group was comprised of six male and six female rats. At the time of treatment commencement, the body weight variation among the animals was within ± 10% of the mean body weight for each sex. Individual body weights of the animals ranged between 180.2 to 192.1 g for males and 175.9 to 190.6 g for females at the time of treatment commencement. Test product dosing solution was prepared using sterile distilled water as vehicle. Rats were treated orally (gavage) with Diabliss herbal sugar at dose levels of 0 (G1- control), 180 (G2- therapeutic dose), 540 (G3- average dose), and 1800 (G4- high dose) mg/kg body weight/day for a period of 28 days.

2.3.4. Parameters investigated

2.3.4.1 Clinical parameters, body weight and feed consumption

Animals were observed for mortality and morbidity twice a day. All visible signs and symptoms such as changes in skin, fur, eyes, mucous membranes, respiratory and general behavioral pattern were recorded twice a day. Individual body weight was recorded for all animals on the day of commencement of treatment, weekly intervals and on the day of sacrifice. The weekly food consumption of the animals was calculated throughout the study period.

2.3.4.2 Clinical Pathology

Urine and blood samples for clinical evaluations (urinalysis, hematology, and serum chemistry) were collected from all surviving animals at the end of the treatment period. Animals were deprived of food overnight and blood samples were collected by puncturing the orbital sinus plexus with the help of a fine heparinised capillary tube. Approximately 0.8 ml of blood was collected in vials containing EDTA for

haematological analysis. About 2 ml blood was collected from each animal in clean centrifuge tubes. The blood was allowed to clot at room temperature and the serum was separated by centrifugation at low speed. The serum thus separated was used for all clinical chemistry analyses. Haematology parameters (reference for methods and details of instrumentation) included: Leucocyte count (WBC), Erythrocyte count (RBC), Haemoglobin (Hb), Haematocrit (HCT), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) and Platelet (PLT). Serum Chemistry parameters (reference for methods and details of instrumentation) included: Alkaline Phosphatase (ALP), Albumin, Cholesterol, Creatinine, Glucose, Alanine amino transferase (ALT), Aspartate amino transferase (AST), Total protein, Urea, Sodium, Potassium, Chloride, Calcium and Triglycerides. Urine samples were collected and tests for volume (mL), specific gravity, pH and urobilinogen (mg/dL) were performed.

2.3.4.2 Macroscopic and microscopic examinations

All the animals were euthanized by CO2 asphyxiation and subjected to a complete necropsy under the direct supervision of the veterinary pathologist at the end of the treatment period. The animals were examined carefully for external abnormalities before necropsy. The thoracic, abdominal and cranial cavities were then cut open and thorough examinations of the organs were carried out to detect changes or abnormalities, if any. organs like adrenals, brain, uterus, ovaries, testes, epididymides, heart, kidneys, liver, spleen and thymus were collected organs were washed with phosphate buffered saline and were fixed in 10% buffer formalin for histopathological processing. Samples were processed using an automatic tissue processor (Thermo-scientific) through increasing concentrations of ethanol and infiltrated in paraffin. The processed tissues were embedded in wax and 4µm sections were prepared using microtome. Slides were stained with Hematoxylin-eosin for morphological examination. Absolute wet organ weights were recorded for all the animals after trimming of adherent fat tissue. Paired organs were weighed together. Relative weights of these organs were calculated later.

2.3.5. Statistical analysis

Data analyzed using SPSS statistical software (version number). Values were presented as mean and standard deviations (SD) for comparison between the control and treated groups. All the parameters characterized as continuous data such as, body weight, feed consumption, organ weight, relative organ weight, hematological and clinical chemistry data were subjected to Bartlett's test to meet the homogeneity of variance before conducting analysis of variance (ANOVA) and Dunnett's t-test. Where the data did not meet the homogeneity of variance, Kruskal-Wallis test was performed to calculate the significance (significance value).

3. RESULTS AND DISCUSSION

3.1. Acute toxicity studies

In the acute toxicity studies, oral LD_{50} of Diabliss herbal sugar in Wistar rats was found to be greater than 5000 mg/kg body weight. The 14-day observation period during the acute oral toxicity study and body weight measurements did not reveal any toxic effects (data not shown). No behavioral changes were observed as clinical sign in the rats from both groups treated with the test product. Necropsy at the end of the study did not reveal any gross pathological abnormalities in the rats. All rats survived and appeared normal post dosing and at termination of the experiment.

3.2. 28 day Repeated dose toxicity study

3.2.1. Mortality, Body weights and Clinical observations

No mortality was observed in rats administered with Diabliss herbal sugar at all the dose levels (180.0, 540.0 and 1800.0 mg/kg b.wt) orally for a period of 28 days. No treatment related clinical signs were recorded in rats administered with different doses of the test product when compared with the control group animals in either sex. No significant differences were observed in the weekly mean body weight between the control group and the treated groups of animals of either sex during the 28-day treatment period (Figure 1 and 2). These results suggest that administration of Diabliss herbal sugar at all the dose levels for 28 days has no adverse effects on clinical observations and body weights.

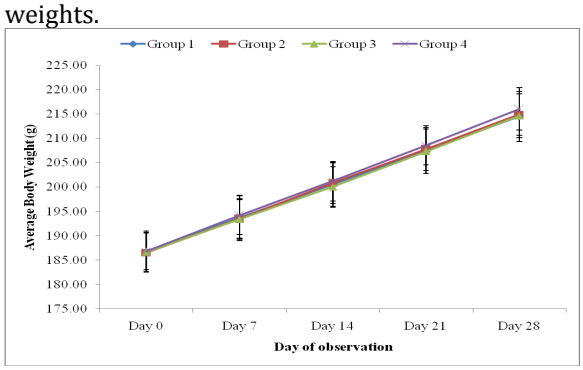

Figure - 1: Effect of Diabliss Herbal Sugar on body weights of Rats (Male).

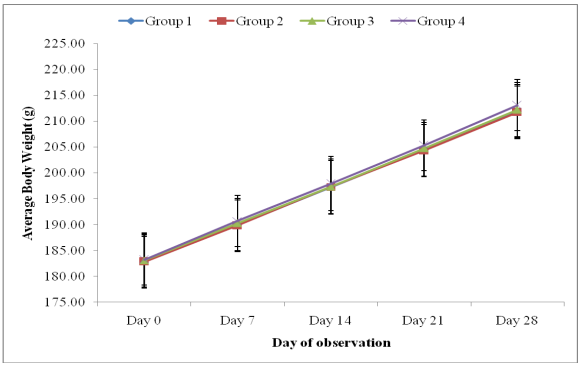

Figure - 1: Effect of Diabliss Herbal Sugar on body weights of Rats (Female).

3.2.2. Feed consumption

No significant difference was observed in the weekly mean food consumption in treated group animals of either sex, when compared to the control group animals during the 28-day treatment period. There were no significant treatment related adverse effects of the test product on feed consumption. These results show that administration of the test product at levels up to 1800 mg/kg body weight/day to rats does not affect feed consumption.

3.2.3. Clinical pathology

3.2.3.1. Urinalysis

No significant difference was observed in all the urine analysis parameters of the animals treated with Diabliss herbal sugar at different doses when compared with the control group animals in either sex. The urine analysis parameters such as volume, specific gravity and urobilinogen did not show any significant difference from the respective control groups. These results suggest that administration of the test product at levels up to 1800 mg/kg body weight/day to rats does not affect urine parameters.

3.2.3.2. Hematology

No significant difference was observed in all the haematological parameters of the animals administered with different doses of Diabliss herbal sugar as compared to the control group animals in either sex. All the hematological parameters were found to be within the normal range (Tables 1 and 2). Mean values of Leucocyte count (WBC), Erythrocyte count (RBC), Haemoglobin (Hb), Haematocrit (HCT), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) and Platelet (PLT) concentrations were within the normal laboratory range and the values of all treatment groups were comparable to control group animals. These results suggest that administration of the test product at levels up to 1800 mg/kg body weight/day to rats had no adverse hematological effects.

Table - 1: Effect of DiaBliss Herbal Sugar on hematological parameters in male rats

Parameter	Group Number											
	G1			G2			G3			G4		
	Mean	S.D	N	Mean	S.D	N	Mean	S.D	N	Mean	S.D	N
RBC ($1x10^6$/µl)	8.1	0.5	6	7.9	0.8	6	7.9	0.8	6	7.8	0.8	6
WBC ($1x10^3$/µl)	7.1	1.8	6	9.5	3.1	6	9.0	2.9	6	7.4	1.9	6
Hemoglobin (g/dl)	14.4	1.1	6	15.5	0.9	6	16.0	1.5	6	15.3	1.0	6
Haematocrit(%)	49.8	5.3	6	50.3	4.8	6	48.3	4.9	6	49.4	3.7	6
MCV (fl)	60.8	3.0	6	60.1	2.3	6	59.8	2.8	6	60.3	3.4	6
MCH (pg)	18.8	2.0	6	18.3	2.0	6	17.9	1.9	6	19.3	1.5	6
MCHC (g/dl)	31.7	1.8	6	30.9	1.6	6	30.6	2.3	6	31.5	2.4	6
Platelets ($1x10^3$/ µl)	864.7	51.1	6	882.5	40.6	6	861.2	64.1	6	833.7	63.6	6

Table - 2: Effect of DiaBliss Herbal Sugar on hematological parameters in female rats

Parameter	Group Number											
	G1			G2			G3			G4		
	Mean	S.D	N	Mean	S.D	N	Mean	S.D	N	Mean	S.D	N
RBC ($1x10^6$/µl)	7.0	1.1	6	7.5	1.0	6	6.9	0.9	6	7.9	0.9	6
WBC ($1x10^3$/µl)	6.6	1.9	6	7.2	1.3	6	8.0	2.0	6	7.6	1.6	6
Hemoglobin (g/dl)	14.2	2.1	6	13.7	1.6	6	14.0	2.1	6	14.1	1.8	6
Haematocrit(%)	50.1	4.5	6	46.9	5.5	6	47.1	3.7	6	47.4	4.1	6
MCV (fl)	61.4	3.1	6	61.2	3.8	6	60.8	1.3	6	60.4	3.7	6
MCH (pg)	18.9	1.6	6	18.2	0.9	6	18.6	1.5	6	19.3	1.6	6
MCHC (g/dl)	30.2	1.3	6	30.7	1.9	6	30.1	1.6	6	30.6	2.0	6
Platelets ($1x10^3$/ µl)	893.2	29.8	6	826.2	40.4	6	879.3	37.8	6	889.2	60.2	6

Table - 3: Effect of DiaBliss Herbal Sugar on serum chemistry parameters in male rats

Parameter	G1			G2			G3			G4		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Glucose (mg/dl)	105.8	9.1	6	105.1	8.1	6	101.1	5.4	6	103.8	7.6	6
ALT (IU/l)	39.6	7.5	6	36.7	4.1	6	41.6	5.5	6	33.8	5.4	6
AST (IU/l)	144.3	14.3	6	144.7	22.8	6	152.0	15.4	6	153.7	20.9	6
ALP (IU/l)	157.6	22.0	6	156.0	29.5	6	152.4	27.1	6	142.0	15.6	6
Total protein (g/dl)	6.3	0.5	6	6.0	0.3	6	6.1	0.4	6	6.4	0.5	6
Albumin (g/dl)	4.4	0.2	6	4.4	0.3	6	4.4	0.3	6	4.2	0.2	6
Creatinine (mg/dl)	0.6	0.1	6	0.6	0.1	6	0.7	0.1	6	0.6	0.1	6
Urea (mg/dl)	17.0	4.0	6	16.7	2.8	6	17.8	3.1	6	18.3	3.4	6
Cholesterol (mg/dl)	69.2	17.2	6	57.6	14.0	6	69.0	12.6	6	62.3	19.0	6
Triglycerides (mg/dl)	67.6	14.7	6	65.1	19.2	6	65.0	16.3	6	62.8	11.2	6
Na (mmol/L)	145.7	6.2	6	145.6	4.1	6	147.9	6.0	6	145.9	4.3	6
K (mmol/L)	4.8	0.4	6	5.0	0.3	6	5.1	0.4	6	4.9	0.4	6
Cl (mmol/L)	105.8	3.2	6	110.0	4.8	6	105.5	3.9	6	108.4	3.7	6
Ca (mg/dl)	9.3	0.6	6	9.7	0.2	6	9.5	0.7	6	9.6	0.3	6

Table - 4: Effect of DiaBliss Herbal Sugar on serum chemistry parameters in female rats

Parameter	G1			G2			G3			G4		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Glucose (mg/dl)	100.5	5.9	6	105.0	5.1	6	100.5	5.6	6	107.4	4.5	6
ALT (IU/l)	39.2	5.6	6	38.8	5.3	6	37.8	9.9	6	38.4	6.8	6
AST (IU/l)	159.8	10.0	6	172.8	13.5	6	155.2	10.0	6	164.2	8.0	6
ALP (IU/l)	87.7	7.2	6	93.7	5.9	6	93.8	11.3	6	88.4	9.6	6
Total protein (g/dl)	6.2	0.5	6	6.3	0.5	6	6.0	0.6	6	5.9	0.3	6
Albumin (g/dl)	4.7	0.6	6	4.5	0.3	6	4.8	0.3	6	4.5	0.3	6
Creatinine (mg/dl)	0.6	0.1	6	0.7	0.1	6	0.6	0.1	6	0.6	0.1	6
Urea (mg/dl)	17.8	2.8	6	17.3	2.8	6	16.3	3.4	6	16.2	2.8	6
Cholesterol (mg/dl)	72.4	13.7	6	71.8	13.4	6	84.5	11.4	6	84.6	8.4	6
Triglycerides (mg/dl)	24.6	6.8	6	23.9	4.2	6	30.0	4.4	6	28.9	5.3	6
Na (mmol/L)	145.8	6.2	6	145.2	4.1	6	148.0	4.5	6	146.4	4.9	6
K (mmol/L)	4.9	0.4	6	4.8	0.3	6	4.8	0.4	6	5.0	0.2	6
Cl (mmol/L)	108.2	4.2	6	105.9	3.5	6	107.2	5.7	6	107.6	3.4	6
Ca (mg/dl)	9.2	0.5	6	9.3	0.5	6	9.5	0.6	6	9.3	0.4	6

3.2.3.3. Serum chemistry

No significant difference was observed in all the serum chemistry parameters of the animals treated with different doses of Diabliss herbal sugar as compared to the control group animals in either sex. All the clinical chemistry parameters were found to be within the normal range (Table 3 and 4). The results of serum chemistry analysis from treatment groups show that administration of the test product at levels up to 1800 mg/kg body weight/day to rats for 28 days did not cause toxicologically significant adverse effects.

3.2.3.4. Organ weights

No treatment-related changes of biological significance in absolute and relative organ weights were noted in male and female rats following administration of the test product suggesting that feeding of the test product had no significant adverse effects on organ weights.

3.2.3.5. Macroscopic and microscopic examinations

There were no treatment-related macroscopic findings at the scheduled necropsy following administration of Diabliss herbal sugar to rats. No significant lesions or abnormalities like changes in size, color, congestion, hemorrhage, inflammation and necrosis were detected in all the organs that were collected and examined. Gross examination at necropsy did not reveal any test product treatment related abnormalities. The animals treated with Diabliss herbal sugar at dose level of 1800.0 mg/kg b.wt did not reveal any histopathological changes in the organs examined

in either sex as compared to control group animals. These results suggest that administration of the test product at levels up to 1800 mg/kg body weight/day to rats for 28 days has no adverse macroscopic or microscopic effects.

Diabliss herbal sugar is a novel, standardized solution that contains aqueous extracts of seven herbs viz., Turmeric (rhizome), Ginger (rhizome), Fenugreek (seeds), Black Pepper (fruit), Pomegranate (fruit seeds), Cinnamon (bark), Gooseberry (fruit). Use of these herbs in management of diabetes and related metabolic disorders is well documented and alternative therapies with anti-hyperglycemic effects are increasingly sought by patients with diabetes. Experimental screening method is imperative in order to establish the safety and efficacy of traditional and herbal products. Investigation of acute toxicity and repeated dose toxicity is the first step in the toxicological analysis of herbal products. The seven herbs used in the test product have been used for various indications in both modern and traditional systems of medicine. The present study was undertaken to determine the safety profile of this novel product. Results from this study have revealed a good safety profile for Diabliss herbal sugar. Oral administration of the test product at a dose of 1800 mg/kg/day for 28 days did not cause any adverse effects.

4. CONCLUSION

In summary, Wistar rats treated with Diabliss herbal sugar orally for 28 consecutive days at 180.0, 540.0 and 1800.0 mg/kg b.wt did not reveal any treatment related adverse/toxic effects under the experimental conditions. Long term toxicity studies involving detection of effects on vital organ functions may be essential to ensure that the test product is safe for human consumption. The present study also will be useful in designing studies to evaluate antidiabetic property and other related pharmacological activities of Diabliss herbal sugar.

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