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Original Article

Fasting Blood Glucose Levels and Hematological Values in Normal and Streptozotocin-Induced Diabetic Rats of *Mimosa pudica* L. Extracts

Ampa Konsue[1], Chayan Picheansoonthon[2,3], Chusri Talubmook[4]

ABSTRACT

Context *M. pudica* is a common plant found in moist waste ground, lawns, open plantations and weedy thickets. **Aims** The fasting blood glucose levels (FBG) and hematological values of *M. pudica* aqueous(MPA) and hydro-ethanolic (MPHE) extract were evaluated in normal and streptozotocin (STZ)-induced diabetic rats. **Materials and Methods** MPA and MPHE 125, 250 and 500 mg/kg body weight (b.w.) were administered orally and daily to the rats for 8 weeks. The FBG were determined weekly. Red blood cells (RBC), hemoglobin (Hb), hematocrit (Hct), platelet, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), white blood cells (WBC), lymphocytes, monocytes, neutrophils and eosinophil were evaluated. **Results**: MPA and MPHE had no effect on blood glucose levels in normal rats. All doses of all extracts showed significantly ($p<0.05$) decreasing FBG in diabetic rats. Especially MPA at the dose of 250 mg/kg b.w. showed more potent significantly ($p<0.05$) decreasing blood glucose levels than anti-diabetic drug glibenclamide at the end of experiment. All extracts had no effect on RBC, Hb, Hct, platelet, MCH, MCHC, lymphocytes, monocytes neutrophils and eosinophils. Surprisingly, the extracts were decreased WBC and MCV in diabetic rats. In addition, all of the extracts did not produce the alteration of blood cells structure in all rats. **Conclusion**: This study indicated that the extracts were hypoglycemic effect and improve hematological values in diabetes which confirms the traditional use of the plant.
Key words: *Mimosa pudica*, Blood glucose level, Hematological values, Red blood cell, White blood cell.

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INTRODUCTION

M. pudica is belonging to family Fabaceae that recommended for preventing and treating various diseases arising from corrupted blood and bile, bilious fever, piles, jaundice, leprosy, ulcer and small pox, amoebic dysentery, bleeding piles, bronchitis, sexual impotency, migraine, insomnia and diabetes.[1-4] Its pharmacological activities such as wound healing,[5,6] antimicrobial,[7,8] analgesic, anti-inflammatory,[9] anticonvulsant,[10] anti-diarrhea,[11,12] anti- fertilization,[13] anti-malaria,[14] anti-oxidant,[4,8,15] hepatoprotective,[15,16] anti-helmintic,[17] hypolipidemic,[3,18] diuretic property,[19] anti-hyperglycemic,[4,20] α-Glucosidase inhibitory activity[21] and hyperglycema.[22] have been reported. Although this plant was widely used for treatment of diabetes.[4] However, any side effect on diabetic treatment has not yet been demonstrated. Therefore, the purposes of this study were designed to determine the blood glucose levels and hematological values both in normal and STZ-induced diabetic rats administering orally with whole plant from *M. pudica* extract.

MATERIALS AND METHODS

Plant Material

The plants were collected from Kalasin Province, Northeastern of Thailand. The specimen was identified by the Plant Varieties Protection Division, Department of Agriculture, Ministry of Agriculture and Cooperatives, Thailand. The voucher specimen is deposited at the Faculty of Medicine, Mahasarakham University, Thailand (code: MSU.Med-MP0001/AK). The fresh whole plants were dried at 50°C for 48 hr in an hot air oven then powdered.

Preparation of MPA and MPHE

The MPA was prepared by boiling the plant powder in distilled water for 15 min (1:10 w/v). The boiling process was repeated twice. The MPHE were prepared by macerating the plant powder in 50% ethanol for 7 days (1:5 w/v). The residue powder was excluded by using the filter papers. The filtrate was evaporated using rotary evaporator (Heidolph Laborota 4000, Germany) and freeze-dried to obtain dark brown extract. The extracts were kept in the fridge at -20°C until be used. Percent yield of MPA was 9.75% and MPHE was 7.29% dry powder.

Animals

Male albino Wistar rats weighing 150-200 g purchasing from the National Laboratory Animal Centre, Mahidol University, Thailand were used in this study. They were acclimatized in an air conditioned room at 25±2°C, 12-h light/12-h dark cycle and relative humidity 50-55%, and given

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a standard chow and watered *ad libitum* for 7 days prior to the commencing experiment. The rats were maintained in accordance with the guidelines of the Committee Care and Use of Laboratory Animal Resource, National Research Council Thailand, and performed in accordance with the advice of the Institutional Animal Care and Use Committee, Mahasarakham University of Thailand (License, No. 0003/2014).

Induction of diabetic rats

The animals were injected intraperitoneally with a single dose of 65 mg/kg b.w. STZ (Sigma Chemicals, St. Louis, MO) dissolved freshly in cold 20 mM citrate buffer adjust to pH 4.5.[23] After injection, they were provided with 2% sucrose solution for 48 hr to alleviate the discomfort after initiating the hypoglycemic phase. Three days after injection, the rats were examined for FBG to confirm their diabetic stage. The rats with FBG higher than 126 mg/dL were used in the experiments.[24]

Experimental designs

The animals were divided into the following sixteen experimental groups with eight animals in each: group I normal control rats treated orally with 0.5% Tween 80; groups II normal rats treated orally with glibenclamide 0.5 mg/kg b.w.; group III-V normal rats administrated orally with MPA at the doses of 125, 250 and 500 mg/kg b.w.; group VI normal rats administrated orally with MPHE at the doses of 125, 250 and 500 mg/kg b.w.; group IX diabetic control rats treated orally with 0.5% Tween 80; group X diabetic rats treated orally with glibenclamide 0.5 mg/kg b.w.; group XI-XIII diabetic rats administrated orally with MPA at the doses of 125, 250 and 500 mg/kg b.w.; group XIV-XVI diabetic rats administrated orally with MPHE at the doses of 125, 250 and 500 mg/kg b.w. MPA, MPHE and glibenclamide were suspended in 0.5% Tween 80 and administered orally once a day for 8 weeks using an orogastric tube. The volume of administration was 1mL for each animal. After eight weeks of treatments, the rats were fasted overnight then sacrificed by cervical dislocation technique. The blood samples were drawn from the rat heart for determination of hematological values and blood cell structure.

Effect of MPA and MPHE on FBG

The normal and STZ-induced diabetic rats were fasted overnight before collecting of blood samples. They were taken from the tail vein of the rats. FBG was measured weekly for 8 weeks with Glucometer (Accu-chek Performa, Roche, Germany).

Effect of MPA and MPHE on hematological values

After 8 weeks of administration, the rats were fasted overnight and then sacrificed by cervical dislocation technique. The blood samples were collected and put into tubes containing 10% of ethylene diamine tetracetic acid (EDTA) and were used immediately for determination of hematological values including white blood cell count (WBC), red blood cell count (RBC), hemoglobin concentration (Hb), hematocrit (Hct), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), platelet (Plt) and differential white blood cell count including lymphocytes, momocytes, neutrophils and eosinophils by using an automatic blood analyzer (Swelab Alfa, Biozen, Sweden).

Effect of MPA and MPHE on blood cell structure

The blood was smeared then fixed in 95% ethanol for 5 min and stained with Wright-Geimsa. Structure of blood cells were examined and photographed under a Light Microscope.[21]

Statistical analysis

All data were expressed as mean±standard error of mean (SEM). Statistical analysis was carried out using *F*-test (One-Way ANOVA) followed by Scheffe's test. The criterion for statistical significance was at a *p*-value less than 0.05.

RESULTS

Effect of MPA and MPHE on blood glucose levels

Table 1 showed effect of MPA and MPHE on the FBG in normal and STZ-induced diabetic rats. The FBG in normal control, normal rats with glibenclamide, MPA and MPHE were not effect. FBG with glibenclamide, MPA and MPHE were significantly ($p<0.05$) decreasing in diabetic rats. MPA at the dose of 250 mg/kg b.w. showed significantly ($p<0.05$) decreasing FBG more potent than MPA 500 mg/kg b.w and MPHE 125 mg/kg b.w. All the extracts were decreased FBG slightly better than glibenclamide at the week 5.

Effect of MPA and MPHE on hematological values

Table 2 showed the effect of MPA and MPHE on hematological values in normal and STZ-induced diabetic rats. RBC, Hb, Hct, platelet, MCH and MCHC in normal and diabetic rats were not different. Surprisingly, the treated diabetic rats showed decreasing of WBC and MCV. Interestingly, MPA at the doses of 250 mg/kg b.w. was significantly ($p<0.05$) increasing WBC count in diabetic rats more than glibenclamide.

Effect of MPA and MPHE on differential WBC

Table 3 showed the effect of MPA and MPHE on differential WBC in normal and STZ-induced diabetic rats. All the doses of MPA and MPHE were not different on lymphocytes, monocytes, neutrophils and eosinophil values both in normal and diabetic rats.

Effect of MPA and MPHE on blood cell structure

Light micrographs showed the RBC structure, differential WBC structure including lymphocytes, monocytes, neutrophils and eosinophils. The RBC has unique structure. Their flexible disc shape helps increase the surface area to volume ratio of these extremely small cells. Mature RBC does not contain a nucleus, and a biconcave disc. It is round ball that is squeezed from two opposite ends to appear, widest at the sides and narrowest in the middle. RBC structure of all experimental groups were not different. White blood cells are different in shape and size. They contain nuclei and can be divided into granulocytes (lymphocytes, monocytes, neutrophils and eosinophils). The granules in these WBC are apparent when stained. Lymphocytes these cells are spherical in shape with large nuclei and very little cytoplasm. Monocytes These cells are the largest of the WBC. Neutrophils these cells have a single nucleus that appears to have multiple lobes. They are the most abundant granulocyte. Eosinophils the nucleus in these cells is double lobed and often appears U-shaped. Basophils they are the least numerous of the white blood cells. They have a multi-lobed nucleus, agranulocytes there are two types of agranulocytes also known as nongranular leukocytes: lymphocytes and monocytes. These WBC appear to have no obvious granules. Agranulocytes typically have a large nucleus due to the lack of noticeable cytoplasmic granules. They have a large, single nucleus that can have various shapes. The nucleus often appears to be kidney-shaped. All types of WBC structure of all experimental groups were not different (Figure 1).

DISCUSSION

The present study was designed to investigate the FBG and hematological values of different *M. pudica* extracts to prove its traditional use. In addition, it was also tested for its effect on the hematological values and blood cell structure in the normal and STZ-induced diabetic Rats. The present

Table 1: Effect of MPA and MPHE on fasting blood glucose levels in normal (NM) and diabetic rats (DM)

Groups (mg/kg)	Fasting blood glucose levels (mg/dL) (weeks)								
	0	1	2	3	4	5	6	7	8
NM Control	94.63±1.39^{a}	89.50±3.82^{a}	96.13±1.16^{a}	87.13±2.23^{a}	93.38±3.09^{a}	96.13±1.82^{a}	87.88±1.08^{a}	94.50±2.68^{a}	89.25±1.62^{a}
NM+GB 0.5	90.50±1.84^{a}	89.88±3.90^{a}	95.38±0.96^{a}	95.25±4.31^{a}	91.63±2.09^{a}	95.38±1.57^{a}	90.00±0.33^{a}	90.75±1.21^{a}	90.25±1.94^{a}
NM+MPA 125	92.50±1.46^{a}	97.75±2.74^{a}	96.88±1.67^{a}	98.88±0.88^{a}	88.50±0.80^{a}	89.25±1.61^{a}	98.50±1.10^{a}	97.25±1.40^{a}	90.50±1.43^{a}
NM+MPA 250	89.88±2.41^{a}	99.50±4.01^{a}	97.38±3.56^{a}	99.50±2.58^{a}	89.38±1.58^{a}	95.38±1.58^{a}	95.38±0.60^{a}	94.25±4.13^{a}	94.00±1.63^{a}
NM+MPA 500	85.88±3.64^{a}	98.50±2.85^{a}	99.13±2.02^{a}	94.88±1.75^{a}	88.75±1.26^{a}	91.75±1.87^{a}	92.50±1.69^{a}	91.00±2.10^{a}	90.25±3.55^{a}
NM+MPHE 125	86.38±1.86^{a}	90.50±11.52^{a}	99.63±2.93^{a}	98.38±2.66^{a}	96.25±0.96^{a}	97.63±1.67^{a}	96.25±2.62^{a}	86.25±2.00^{a}	89.38±2.30^{a}
NM+MPHE 250	90.25±2.44^{a}	109.00±3.87^{a}	97.75±1.78^{a}	98.75±1.75^{a}	98.25±3.64^{a}	98.63±3.05^{a}	97.63±2.00^{a}	92.00±3.38^{a}	90.13±1.92^{a}
NM+MPHE 500	87.75±3.62^{a}	107.63±2.44^{a}	105.25±2.79^{a}	105.25±2.80^{a}	94.50±1.15^{a}	97.00±1.09^{a}	101.50±1.75^{a}	92.25±0.94^{a}	94.50±1.76^{a}
DM Control	364.38±13.83^{b}	518.50±31.67^{c}	452.13±11.89^{b,c}	519.63±12.04^{b}	528.75±17.86^{c,d}	554.50±25.89^{d}	420.75±11.51^{b,c}	530.38±19.71^{b}	509.38±11.45^{c}
DM+GB 0.5	376.25±23.08^{b}	419.50±14.77^{b,c}	483.38±19.23^{b,c,d}	495.00±15.14^{b}	441.75±29.98^{b}	533.75±7.57^{d}	484.38±25.90^{b,c}	465.25±26.87^{b}	439.13±12.16^{b}
DM+MPA 125	371.00±16.64^{b}	509.50±32.53^{c}	465.63±11.75^{b,c}	528.75±10.49^{b}	530.63±12.45^{c,d}	507.25±24.09^{c,d}	488.13±29.35^{b,c}	507.25±18.15^{b}	478.38±9.88^{b,c}
DM+MPA 250	346.50±7.89^{b}	531.88±17.30^{c}	442.00±4.19^{b}	454.63±3.79^{b}	438.88±12.41^{b}	450.88±10.16^{b,c}	406.25±16.47^{b}	475.75±9.19^{b}	472.75±6.03^{b,c}
DM+MPA 500	335.25±11.12^{b}	309.88±82.77^{b}	590.25±6.17^{e}	475.75±15.79^{b}	503.63±4.43^{b,c}	527.25±11.75^{c,d}	505.50±13.07^{b,c}	520.38±10.63^{b}	475.13±2.45^{b,c}
DM+MPHE 125	348.00±16.98^{b}	471.13±27.01^{b,c}	528.75±21.65^{c,d,e}	500.88±8.68^{b}	442.13±17.04^{b}	415.88±14.93^{b}	498.75±22.43^{b,c}	530.25±13.64^{b}	439.88±15.65^{b}
DM+MPHE 250	342.13±2.86^{b}	517.00±12.26^{c}	562.88±15.85^{d,e}	503.75±21.23^{b}	451.00±10.78^{b,c}	476.88±12.25^{b,c,d}	517.63±26.79^{c}	447.50±27.57^{b}	453.88±6.38^{b,c}
DM+MPHE 500	333.75±9.21^{b}	484.00±13.95^{b,c}	527.63±23.15^{c,d,e}	527.00±20.06^{b}	552.38±17.01^{d}	448.63±11.39^{b,c}	497.00±12.30^{b,c}	538.13±22.50^{b}	476.13±17.25^{b,c}

The values represent the mean ±SEM within the same column followed by the different superscript letters are significantly different at $p<0.05$.

Table 2: Effect of MPA and MPHE on hematological values included red blood cells (RBC), hemoglobin (Hb), hematocrit (Hct), white blood cells (WBC), platelet, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) in normal (NM) and diabetic rats (DM)

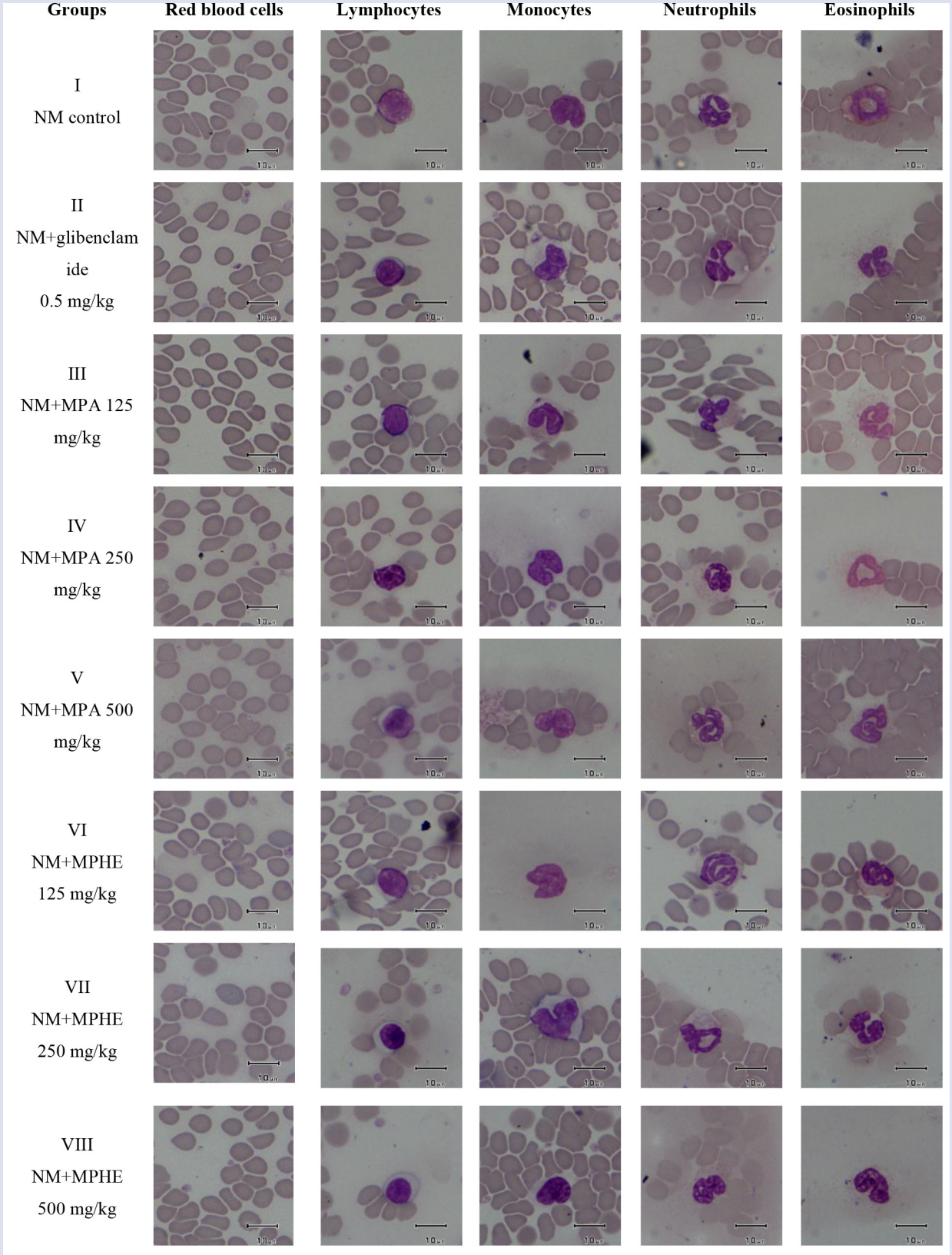
Groups (mg/kg)	Hematological values							
	RBC ($x10^6$ cells/mm^3)	Hb (g/dL)	Hct (%)	WBC ($x10^3$ cells/µL)	Platelet ($x\ 10^5/mm^3$)	MCV (fL)	MCH (pg)	MCHC (g/dL)
NM Control	9.28±0.08^{a,b}	16.96±0.20^{a}	52.84±0.66^{a,b}	6.20±0.21^{f,g}	756.75±6.66^{a,b}	56.46±0.37^{d,e}	18.13±0.11^{b}	32.04±0.02^{a,b,c}
NM+GB 0.5	10.04±0.45^{a,b}	16.75±0.39^{a}	52.95±1.69^{a,b}	7.10±0.26^{g}	733.00±29.67^{a,b}	54.20±0.38^{a,b,c,d}	17.20±0.15^{a,b}	31.73±0.29^{a,b,c}
NM+MPA 125	9.52±0.07^{a,b}	16.43±0.14^{a}	51.57±0.16^{a,b}	5.00±0.19^{b,c,d,e,f}	861.50±22.14^{b,c}	53.43±0.15^{a}	17.03±0.16^{a,b}	31.83±0.20^{a,b,c}
NM+MPA 250	9.27±0.27^{a,b}	15.99±0.56^{a}	51.03±1.85^{a,b}	6.34±0.36^{f,g}	989.50±20.61^{c}	54.95±0.28^{a,b,c,d,e}	17.23±0.05^{a,b}	31.61±0.07^{a,b,c}
NM+MPA 500	9.35±0.07^{a,b}	16.18±0.17^{a}	50.44±0.46^{a,b}	5.85±0.20^{d,e,f,g}	822.13±17.83^{a,b,c}	53.90±0.16^{a}	17.26±0.11^{a,b}	32.04±0.11^{a,b,c}
NM+MPHE 125	9.17±0.10^{a,b}	16.18±0.33^{a}	50.18±0.57^{a}	5.93±0.32^{e,f,g}	763.75±25.04^{a,b,c}	54.70±0.34^{a,b,c,d}	17.60±0.26^{a,b}	32.18±0.34^{b,c}
NM+MPHE 250	9.51±0.15^{a,b}	16.63±0.25^{a}	52.10±0.70^{a,b}	6.13±0.32^{f,g}	812.75±26.13^{a,b,c}	54.83±0.43^{a,b,c,d}	17.50±0.23^{a,b}	31.95±0.27^{a,b,c}
NM+MPHE 500	9.89±0.34^{a,b}	16.88±0.36^{a}	52.08±1.17^{a,b}	5.83±0.20^{c,d,e,f,g}	805.00±28.31^{a,b,c}	54.08±0.21^{a,,b}	17.53±0.07^{a,b}	32.43±0.26^{c}
DM Control	9.91±0.04^{a,b}	17.13±0.27^{a}	54.40±0.33^{a,b}	5.88±0.25^{e,f,g}	682.00±27.22^{a,b}	56.40±0.35^{c,d,e}	17.20±0.42^{a,b}	31.88±0.61^{a,b,c}
DM+GB 0.5	9.09±0.15^{a,b}	15.44±0.15^{a}	50.19±0.50^{a}	2.77±0.26^{a}	621.25±62.69^{a}	54.74±0.40^{a,b,c,d}	16.89±0.10^{a}	30.58±0.30^{a,b,c}
DM+MPA 125	8.85±0.23^{a}	16.69±0.10^{a}	54.30±0.47^{a,b}	3.92±0.17^{a,b}	700.88±21.54^{a,b}	55.50±0.07^{a,b,c,d,e}	17.06±0.01^{a,b}	30.74±0.09^{a,b,c}
DM+MPA 250	10.57±0.18^{b}	17.40±0.24^{a}	57.05±0.75^{b}	5.29±0.10^{b,c,d,e,f}	763.25±14.48^{a,b,c}	55.26±0.15^{a,b,c,d,e}	16.85±0.05^{a}	30.54±0.02^{a,b}
DM+MPA 500	9.22±0.10^{a,b}	16.19±0.22^{a}	52.54±0.93^{a,b}	4.20±0.15^{a,b,c,d}	793.13±46.00^{a,b,c}	54.51±0.19^{a,b,c,d}	16.81±0.15^{a}	30.81±0.17^{a,b,c}
DM+MPHE 125	10.31±0.13^{a,b}	17.24±0.09^{a}	55.66±0.09^{a,b}	4.43±0.19^{a,b,c,d,e}	720.75±0.49^{a,b}	55.19±0.50 ^{a,b,c,d,e}	16.92±0.07^{a,b}	30.65±0.12^{a,b,c}
DM+MPHE 250	9.80±0.18^{a,b}	16.95±0.26^{a}	55.95±0.78^{a,b}	4.18±0.22^{a,b,c}	709.00±54.46^{a,b}	57.18±0.20^{e}	17.33±0.03^{a,b}	30.30±0.05^{a}
DM+MPHE 500	9.10±0.28^{a,b}	17.01±0.21^{a}	56.15±1.34^{a,b}	3.73±0.10^{a,b}	681.13±32.40^{a,b}	56.16±0.35^{b,c,d,e}	17.04±0.08^{a,b}	30.34±0.35^{a,b}

The values represent the mean±SEM within the same column followed by the different superscript letters are significantly different at $p<0.05$.

Table 3: Effect of MPA and MPHE on differential white blood cells, lymphocytes, monocytes, neutrophils and eosinophil in normal (NM) and diabetic rats (DM)

Groups (mg/kg)	Differential white blood cells (%)			
	Lymphocytes	Monocytes	Neutrophils	Eosinophil
NM Control	70.76±2.55^{a}	1.04±0.21^{a}	27.11±2.45^{a}	1.09±0.12^{a}
NM+ glibenclamide 0.5	86.69±1.34^{a}	0.83±0.18^{a}	11.71±1.18^{a}	0.78±0.30^{a}
NM+MPA 125	85.00±0.53^{a}	0.27±0.03^{a}	13.63±0.68^{a}	1.10±0.15^{a}
NM+MPA 250	84.24±1.00^{a}	0.75±0.05^{a}	14.29±0.83^{a}	0.73±0.18^{a}
NM+MPA 500	85.18±1.18^{a}	1.27±0.32^{a}	13.18±0.90^{a}	0.38±0.03^{a}
NM+MPHE 125	87.78±0.13^{a}	0.20±0.04^{a}	10.95±0.29^{a}	1.08±0.19^{a}
NM+MPHE 250	88.95±0.45^{a}	0.18±0.04^{a}	9.30±0.36^{a}	1.58±0.18^{a}
NM+MPHE 500	88.90±0.46^{a}	0.35±0.06^{a}	9.13±0.28^{a}	1.63±0.24^{a}
DM Control	82.23±0.40^{a}	1.88±0.28^{a}	15.13±0.28^{a}	0.78±0.11^{a}
DM+ glibenclamide 0.5	89.61±0.28^{a}	1.39±0.13^{a}	8.26±0.63^{a}	0.74±0.22^{a}
DM+MPA 125	78.13±0.30^{a}	0.75±0.19^{a}	19.50±0.46^{a}	0.36±0.08^{a}
DM+MPA 250	74.34±1.01^{a}	1.11±0.27^{a}	23.88±1.22^{a}	0.68±0.06^{a}
DM+MPA 500	80.63±0.98^{a}	2.50±0.10^{a}	16.13±0.92^{a}	0.73±0.08^{a}
DM+MPHE 125	80.31±2.06^{a}	0.60±0.07^{a}	18.69±1.92^{a}	0.40±0.07^{a}
DM+MPHE 250	83.53±0.79^{a}	4.10±1.05^{a}	11.90±1.57^{a}	0.48±0.12^{a}
DM+MPHE 500	74.63±2.53^{a}	1.07±0.25^{a}	23.50±2.66^{a}	0.80±0.21^{a}

The values represent the mean ±SEM within the same column followed by the different superscript letters are significantly different at $p<0.05$.


Groups
Red blood cells
Lymphocytes
Monocytes
Neutrophils
Eosinophils
I
NM control
II
NM+glibenclamide
0.5 mg/kg
III
NM+MPA 125
mg/kg
IV
NM+MPA 250
mg/kg
V
NM+MPA 500
mg/kg
VI
NM+MPHE
125 mg/kg
VII
NM+MPHE
250 mg/kg
VIII
NM+MPHE
500 mg/kg

continued...

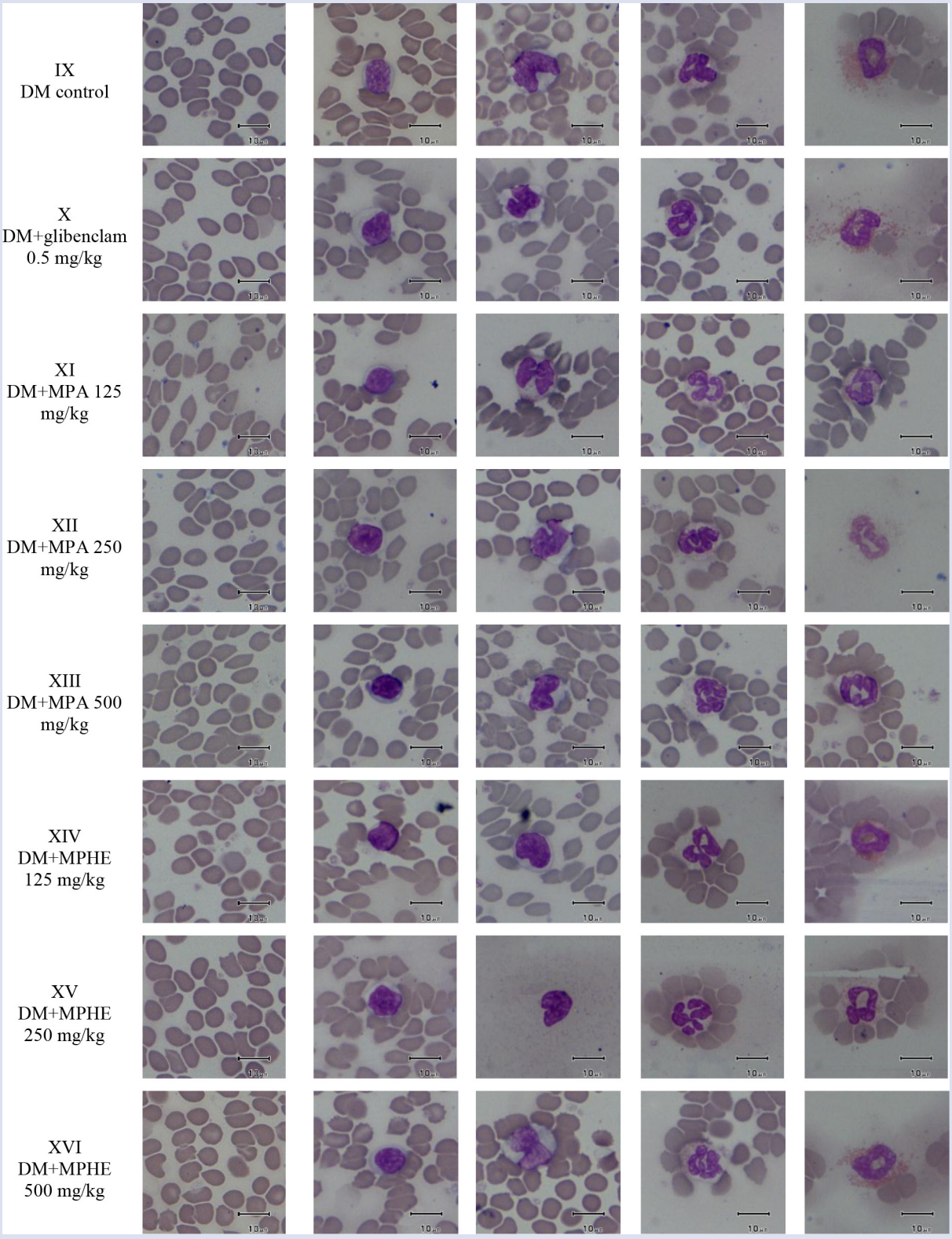


Figure 1: Wright-Giemsa staining shows the structure of RBC and WBC from normal control rats (I), normal rats treated with glibenclamide 0.5 mg/kg b.w. (II), normal rats treated with MPA and MPHE at the doses125, 250 and 500 mg/kg b.w. (III, IV, V, VI, VII, VIII) diabetic control rats (IX), diabetic rats treated with Glibenclamide 0.5 mg/kg b.w. (X), diabetic rats treated with MPA and MPHE at the doses of 125, 250 and 500 mg/kg b.w. (XI, XII, XII, XIV, XV, XVI).

study, STZ 65 mg/kg b.w. was selected in order to partially destroy the β-cell of pancreas and consequently the rats became permanently diabetes.[25,26] The results showed that MPA had a hypoglycemic effect by decreasing FBG but not in a dose dependent manner.[27,28] The hypoglycemic effect of MPA and MPHE were not different in normal rats. MPA at the dose of 250 mg/kg b.w. showed more potent effect than glibenclamide (0.5 mg/kg b.w.) which is probably the optimum dose.[4,20] WBC count was reduced in diabetic treated rats. However, granulocytes of the diabetic rats were close to those of normal control rats. The observed leukopenia may be due to the suppressing effect of the immune system by STZ thereby reducing the number of WBC. A reduction in the number of WBC could also be as a result of diabetes induced stress which breaks down the rat defensive mechanism.[29] Diabetic rats treated with all doses of the extracts showed improvement in WBC count. Mechanism of experiment could probably be due to the fact that the extract contains some constituents that stimulate and/or promote the production of WBC and hence offer some form of protection to the rat immune system.[30]

Effects of the extracts from *M. pudica* in this study on hematological values and blood cell structure in diabetic rats was not difference from normal rats because MPA and MPHE have varied therapeutic potential which all have their own therapeutic impact[4,20,21] observing in this study may also be due to the ameliorative effects of the extracts on the oxidative damage associated with diabetes.[29-30]

Most of the plants with antidiabetic properties have been found to contain metabolites such as glycosides, alkaloids, and flavonoids.[4,22] The plant composition such as steroids, tannins, flavonoids and phenolic compounds have been reported.[11,15] The plant constituent such as kaempferol and stigmasterol are known to improve insulin stimulating glucose uptake.[31-33] Although the major components that possess antidiabetic activity in the *M. pudica* extract were not precisely identified in this study. However the phytochemical analysis of the whole plant extract revealed the presence of alkaloids, flavonoids, tannins, saponins and glycosides that could be stimulated insulin secretion as well.[32] The extracts in the present study possess hypoglycemic activity may be due to these chemical substances responsible for this activity. Further study, the underlying mechanism of hypoglycemic effect of the extract from *M. pudica* has to be clarified.

CONCLUSION

The results from this study in particularly *M. pudica* aqueous extract support the traditional use of the plant for diabetic treatment and health promoting agent for prevention of diabetes. The aqueous extract also prevents diabetes and improves the hematological values.

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CONFLICT OF INTEREST

None

ABBREVIATIONS USED

FBG: Fasting blood glucose levels; **STZ:** Streptozotocin; **MPA:** Aqueous extract; **MPHE:** Hydro-ethanolic extract; **RBC:** Red blood cells; **Hb:** Hemoglobin; **Hct:** Hematocrit; **MCV:** Mean corpuscular volume; **MCH:** Mean corpuscular hemoglobin; **MCHC:** Mean corpuscular hemoglobin concentration; **WBC:** White blood cells; **NM:** Normal rats; **DM:** Diabetic rats.

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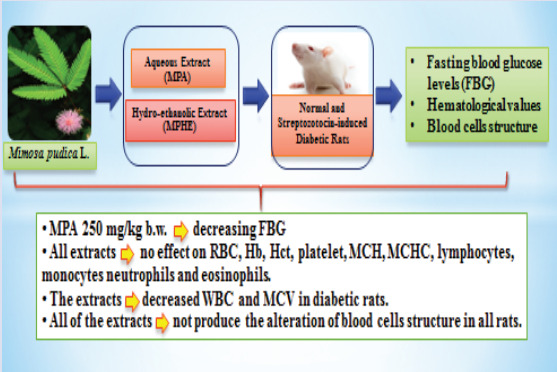
GRAPHICAL ABSTRACT



SUMMARY

- The MPA 250 mg/kg b.w. showed significantly ($p<0.05$) decreasing fasting blood glucose levels more potent than glibenclamide.
- All extracts had no effect on RBC, Hb, Hct, platelet, MCH, MCHC, lymphocytes, monocytes neutrophils and eosinophils.
- The extracts were decreased WBC and MCV in diabetic rats.
- All of the extracts did not produce the alteration of blood cells structure in all rats.
- The aqueous extract from *Mimosa pudica* has a beneficial effect in hypoglycemic rats and may prevent the complication of diabetes.

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