NATURAL DRUGS

EFFECT OF A NOVEL ANTIINFLAMMATORY POLYHERBAL PREPARATION (SUDARSHANAM OIL) ON HEMATOLOGICAL PARAMETERS IN WISTAR RATS

CHINTAN D. PATEL, VANDANA D. MODI, BHASWAT S. CHAKRABORTY, NEETA MATHURIA*, PARESH DADHANIYA, PRASAD A. BORADE and PRAVIN MORANKAR

Abstract: The present investigation was an attempt to evaluate the anti-inflammatory effect of a polyherbal preparation (Sudarshanam Oil) on hematological parameters in Wistar rats. This polyherbal formula contains main ingredients of *Tinaspora Cordifolia, Curcuma longa, Terminalia chebula, Emblica officinalis, Andrographis paniculata* and *Terminalia belerica*. The active phytochemicals such as tannins, glycosides, flavonoids and triterpenoids are extracted from these herbal plants. And extract was prepared in corn oil. Young adult Wistar rats of either sex were divided into 4 groups and each group having 6 males and 6 females were dosed for 28 days. First group was the control group which was dosed with corn oil as vehicle (15 mL/kg body weight). Groups II, III and IV were treated with different doses of Sudarshanam oil, viz. as 5 mL/kg, 10 mL/kg and 15 mL/kg body weight respectively. On 29th day, after overnight fasting, the blood samples were collected through cardiac puncture under CO_2 anaesthesia. The blood samples were collected and transferred into prelabelled vaccutainer coated with EDTA for hematological parameters investigation by using Advia-120 hematology analyser. The results revealed that no treatment related adverse effects in any of the hematological parameters. Thus, Sudarshanam oil proves to be highly potent, novel anti-inflammatory preparation which can be a challenge against allopathic anti-inflammatory drug.

Keywords: polyherbal, *Curcuma longa*, antiinflammation, tannins, hematology

Inflammation is one of the cooperative reactions of many functions of body towards an injury by physical, chemical or biological agents. What appears to be characteristic of such "pattern reactions" is that they do not depend as much as on the nature of aggressive (or noxious) agent, but mainly on the manner by which organism can metabolize its defensive resources (1). More recently, inflammation was described as "the succession of changes, which occurs in all living tissues when it is injured, provided that the injury is not of such a degree as to at once destroy its structure and vitality. Furthermore, inflammation is considered cornerstone of pathology in that the changes observed are indicative of injury and disease" (2). Anti-inflammatory agents are used in the treatment of inflammation of various types. Nonsteroidal anti-inflammatory drugs (NSAIDs) are used to treat different arthritis, other inflammatory diseases and in management of different postoperative conditions. The anti-inflammatory effect of these drugs (NSAIDs) or asprin-like drugs is due to their ability to inhibit activities of cycylooxygenases (COX), enzymes which mediate the production of prostaglandins. There are two isoforms of COX viz; COX-1 and COX-2. It is thought that anti-inflammatory actions of NSAIDs are caused by the inhibition of COX-2, whereas the unwanted side effects, such as gastrointestinal and renal toxicity, are caused by the inhibition of COX-1 (3).

In present fast moving world, allopathy had covered a great field in medicine. But their constant use for long duration may cause many side effects, which are not noticeable in earlier stages. Use of herbal and other naturally based medicines has a long history with minimum or no side effects, which are used in traditional system of medicine like Ayurveda, Unani and Siddha as home remedy for various diseases. However, utilization of whole plant, plant crude preparation and isolated active constituents with biological activity, which are used as folk remedies for various diseases shows way for new alternative treatment. In recent years, investigation of bioactive natural products has assumed a greater sense of urgency in response to the expanding human population for good health. On the other

---

* Corresponding author: e-mail: mathuria_25@yahoo.co.in

hand, we have to depend on allopathic medicines for quick results, which in long term lead to severe side effects.

Sudarshanam oil is a polyherbal formula of which *Tinospora cordifolia, Curcuma longa, Terminalia chebula, Emblica officinalis, Andrographis paniculata* and *Terminalia belerica* are the main ingredients. The active phytochemicals are tannins, glycosides, flavonoids and triterpenoids. Sudarshanam oil is processed traditionally and encapsulated in soft gel form. It is a novel anti-inflammatory polyherbal preparation and also possesses analgesic, antipyretic, antioxidant and immunomodulatory activites. Till now, the research work has been done only on the individual plant extracts or the combination of two to three extracts, but this is the first time that we worked on many plant extracts together to get the anti-inflammatory effect.

It is reported that andrographolide, an active component of *Andrographis paniculata,* inhibits inflammatory responses by rat neutrophils. To further elucidate the possible mechanism underlying andrographolide's effect, N-formyl-methionyl-leucyl-phenyl-alanine (FMLP)-induced adhesion and transmigration of isolated peripheral human neutrophils were studied. Pretreatment with andrographolide concentration dependently prevented FMLP-induced neutrophil adhesion and transmigration in rats (4). The minimum lethal dose of these compounds by oral administration was greater than 20 g/kg (5). The anti-inflammatory effect of all compounds disappeared in adrenalectomized animals. Administration of major diterpenoids did not significantly affect inflammatory hyperplasia and migration of leucocytes into inflammatory focus (5). The inhibition of carrageenin- and dextran-induced edema by water fraction of methanol extract of *Emblica officinalis* has been proved. One of the concepts is that this plant has anti-inflammatory activity. The main anti-inflammatory mechanism of this extract is through its antimigration activity and it does not influence production of lipid mediators either through COX or lipoxygenase pathway (6). The aqueous extract of the stem of *Tinospora cordifolia* antagonizes effects of agonists such as 5-HT, histamine, bradykinin and PG-E$_1$ and E$_2$ on rabbit smooth muscles. The anti-inflammatory activity of this plant resembles that of NSAID agents (7).

When whole spice of turmeric or *Curcuma longa* (curcumin) were fed to rats at doses normally consumed by humans, it did not cause any adverse effect on growth, feeding efficiency ratio, erythrocytes, leucocytes or on the level of blood constituents (8). Curcumin and sodium curcuminate exhibited strong anti-inflammatory activity in carageenin-induced paw edema after intraperitoneal administration in rats (9). The hepatoprotective effect of *Terminalia chebula* fruit extract was attributed to its prominent antioxidative and membrane stabilizing activities. The biochemical and histopathological examinations were found to be normal (10). The healing activity of the ethanol extract of *Terminalia belerica* along with *Emblica officinalis* and *Terminalia chebula* against indomethacin-induced stomach ulceration was studied and compared with that of misoprostol, proved to be potent antioxidant agents (11). The combination of three herbal extracts of *Emblica officinalis, Terminalia bellerica* and *Terminalia chebula* combined called as "Triphala" has been proved to be active component as anti-inflammatory agent (12).

We report the study of subacute toxicity of this polyherbal preparation named as "Sudarshanam oil" specifically, on hematological parameters of Wistar rats, which were examined in detail to evaluate the repeated exposure toxicity in these animals. The study may support the drug to prove itself as a boon drug for any kind of inflammation in human beings.

EXPERIMENTAL

Materials and methods

Sudarshanam oil, the polyherbal formulation was prepared from *Tinospora cordifolia, Curcuma longa, Terminalia chebula, Emblica officinalis, Andrographis paniculata* and *Terminalia belerica* by a crude extraction method. All the required parts of the respective plants were collected, shade dried and crushed mechanically to get in their powder forms. The extractions of all these herbals were found to be stable together in corn oil. Thus, corn oil was used as a vehicle.

Young healthy adult, male and female Wistar rats of 8-10 weeks showing normal physical and behavioral veterinary examination were chosen for the experiment. The animals were obtained from Cadila Pharmaceuticals Ltd., Ahmedabad, India. They were provided feed and water *ad libitum* and were maintained under laboratory conditions. Forty-eight such animals were divided into 4 groups of 6 males and 6 females each. Group I served as control and received only corn oil (15 mL/kg) as vehicle. Groups II, III and IV served as low, mid and high dose treated groups, respectively. Group II received 5 mL/kg body weight Sudarshanam oil, while groups III and IV received 10 mL/kg b. w. and 15 mL/kg b. w. Sudarshanam oil, respectively. All the

Table 1. Effect of 28 days oral administration of Sudarshanam oil on hematology of male Wistar rats.

Hematological parameters	Sex	Group I Vehicle 15 mL/kg		Group II 5 mL/kg		Group III 10 mL/kg		Group IV 15 mL/kg		Compared Group No. p value		
		Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	1&2	1&3	1&4
RBC ($\times 10^6/\mu$L)	M	7.64	0.12	7.93	0.13	7.69	0.13	7.78	0.17	0.13	0.76	0.52
WBC ($\times 10^3/\mu$L)	M	25.23	2.40	23.54	2.28	29.06	1.97	33.03	4.02	0.60	0.26	0.13
Neutrophils	M	8.67	1.28	15.00	3.63	10.28	1.87	8.48	2.36	0.13	0.49	0.95
Lymphocytes	M	85.58	1.74	80.12	4.41	84.93	1.98	85.53	2.52	0.28	0.80	0.99
Monocytes	M	1.42	0.016	1.42	0.26	0.57	0.12	1.30	0.20	1.00	0.47	0.65
Eosinophils	M	1.23	0.52	1.13	0.35	0.67	0.18	0.80	0.34	0.88	0.32	0.50
HCT	M	38.12	0.81	40.35	0.53	37.88	0.53	38.22	1.05	0.04	0.81	0.94
MCV	M	49.92	0.74	50.87	0.44	49.25	0.43	49.15	0.43	0.29	0.45	0.39
MCH	M	18.73	0.27	18.88	0.09	18.13	0.23	18.38	0.13	0.61	0.12	0.27
MCHC	M	37.53	0.46	37.05	0.23	36.77	0.34	37.47	0.30	0.37	0.21	0.91
PLT	M	1146.83	63.66	1255.6	34.69	1157.83	36.63	1239.83	71.55	0.16	0.88	0.35
Hg	M	14.32	0.18	14.93	0.19	13.95	0.16	14.32	0.35	0.06	0.16	1.00

animals were given doses orally using a feeding tube attached to a hypodermic syringe, for 28 days.

On the completion of the treatment the rats were kept for overnight fasting. On 29th day the rats were weighed and underwent CO_2 anesthesia. The blood was collected by cardiac puncture in the vaccutainer containing EDTA coating so that blood did not clot. These blood samples were used to estimate hematological parameters such as RBC [red blood corpuscles ($\times 10^6/\mu$L)], WBC [white blood corpuscles ($\times 10^3/\mu$L)], neutrophils (%), lymphocytes (%), monocytes (%), eosinophils (%), HCT [hematocrit (%)], MCV [mean corpuscular volume (fL)], MCH [mean corpuscular hemoglobin (pg)], MCHC [mean corpuscular hemoglobin concentration (g/dL)]. PLT [platelets ($X10^3/\mu$L)] and hemoglobin (g/dL). All these hematological parameters were estimated with the help of hematology analyzer (Advia-120).

For all the parameters a minimum of 10 replicates were studied. The statistical test used for analysis of the obtained data was the unpaired two tail Student's 't' test, where the $p < 0.05$ has been considered as statistically significant and $p < 0.01$ is considered as highly significant.

RESULTS AND DISCUSSION

Table 1 shows the hematological data for males of all the four groups, while Table 2 shows the hematological data of the females for all the four groups. The results revealed that there was no significant difference found in all the parameters of both males and females. The data of all the parameters were comparatively normal and were near to the data of the control group. There was no alteration found in any of the parameters in the data of high dose groups of both the sexes.

Oral administration of Sudarshanam oil for a period of 28 days revealed a continuous increase in body weight of male and female animals belonging to all treatment groups. This indicates that oral administration of Sudarshanam oil did not produce any adverse effect on growth rate of animals. Thus, these results correlate with the results of study conducted on albino rats reporting the effects of Immu-21 (containing extracts of *Tinospora cordifolia, Withania somnifera, Emblica offic-*

Table 2. Effect of 28 days oral administration of Sudarshanam oil on hematology of female Wistar rats.

Hematological parameters	Sex	Group I Vehicle 15 mL/kg		Group II 5 mL/kg		Group III 10 mL/kg		Group IV 15 mL/kg		Compared Group No. p value		
		Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	1&2	1&3	1&4
RBC ($\times 10^6$/μL)	M	7.74	0.18	7.67	0.18	7.39	0.16	7.64	0.16	0.77	0.19	0.67
WBC ($\times 10^3$/μL)	M	19.75	2.82	18.90	2.83	28.63	3.42	23.05	3.73	0.84	0.07	0.5
Neutrophils	M	9.05	2.31	18.65	4.83	5.42	0.53	9.85	2.60	0.10	0.16	0.82
Lymphocytes	M	86.00	2.90	74.85	5.34	88.95	1.33	1.33	2.89	0.70	0.38	0.79
Monocytes	M	1.87	0.29	2.48	0.42	1.45	0.22	1.80	0.45	0.26	0.28	0.90
Eosinophils	M	1.28	0.57	2.05	0.22	1.28	0.33	1.80	0.37	0.24	1.00	0.77
HCT	M	39.25	0.59	38.22	0.55	37.73	0.60	37.73	0.71	0.23	0.10	0.74
MCV	M	50.77	0.58	49.93	0.60	51.07	0.47	50.65	0.52	0.34	0.69	0.88
MCH	M	18.92	0.28	18.90	0.29	19.32	0.19	18.80	0.15	0.97	0.26	0.72
MCHC	M	37.25	0.33	37.83	0.19	37.83	0.30	37.13	0.27	0.15	0.72	0.79
PLT	M	1351.50	90.17	1391.8	183.62	1064.83	50.72	1249.17	57.23	0.85	0.02	0.36
Hg	M	14.62	0.25	14.47	0.22	14.27	0.25	14.45	0.33	0.66	0.34	0.70

inalis and *Ocimum sanctum*), which showed body weight gain in rats in treated groups as compared to control groups. Also there was no adverse effect on food consumption, growth retardation, hemopoietic system and no toxic effect was observed on vital organs such as liver, kidney, spleen, heart and lungs after postmortem examination of control and experimental groups (13).

Treatments of Sudarshanam oil at all the doses shows normal hematology (RBC, WBC, HCT, MCV, MCH, MCHC, hemoglobin etc.) as compared to control group. Immune activation of immunomodulatory activities of Triphala (*Terminalia chebula, Terminalia belerica and Emblica officinalis*) were assessed by testing various neutrophil functions like adherence, phagocytosis (phagocytic index (P.I.) and avidity index (A.I.) and nitro blue tetrazolium (NBT) reduction in albino rats. Hence, the study had divulged that oral administration of Triphala appears to stimulate the neutrophil functions in immunized rats and stress induced suppression in the neutrophil functions were significantly prevented by Triphala (14). Another study revealed that addition of aflatoxin (0.5-2.0 microgram/mL) to RBC suspension caused a significant dose-dependent increase in the rate of hemolysis. However, concurrent addition of aflatoxin (2.0 mg/mL) and extracts of turmeric and curcumin caused a dose-dependent retardation in aflatoxin-induced hemolysis (15). One of the studies indicated that *Andrographis paniculata* and Vitamin E may act as putative protective agent against nicotine induced tissue injury and may pave a new path to develop suitable drug therapy (16). It was proved by one of the findings that out of several ill-defined compounds present in *Andrographis paniculata*, ANDRO and AGPs are potential bioactive compounds responsible for protection against ethanol-induced toxicity (17).

CONCLUSION

Based on the results obtained it can be concluded that Sudarshanam oil, the polyherbal preparation, is highly potent anti-inflammatory drug which acts efficiently on the hematological parameters and did not show any toxicity in the subacute study. It also clears that the "no observed adverse effect level (NOAEL)" dose is 15 mL/kg b. w. Thus,

the drug proves to be very potent against any kind of inflammation and can be considered as a challenge against allopathic inflammatory drugs and stands as boon drug for humankind.

REFERENCES

1. Vane J.R., Ferreira S.H.: Inflammation, Handbook of Experimental Pharmacology, vol. 50, pp. 6-11, Springer-Verlag, Berlin, Heidelberg, New York 1978.
2. Punchard N.A., Whelan C.J., Adcock I.: J. Inflamm. (Lond) 1, 1 (2004).
3. Vane J.R., Bottling R.M.: Semin. Arthritis Rheum. 26, 2 (1997).
4. Nandan K.J.: Phytopharm 5, No. 8, 3 (2004).
5. Saxena S., Jain D.C., Bhakun R.S., Sharma R.P.: Indian drugs 35, 446 (1998).
6. Asmawi M.Z.: Kankaanranta H., Moilanen E., Vapaatalo H.: J. Pharmacol. 45, 581 (1993).
7. Selected Medicinal Plants of India. A monograph of safety, identity and purity. pp. 319-322, Chemexcil publications. Bombay 1998.
8. Ammon H.P.T., Wahl M.A.: Planta Med. 57, 1 (1991).
9. WHO selected monographs on selected medicinal plants: Thizoma *Curcuma longa*. 1, 119, Geneva 1999.
10. Tasduq S.A., Singh. K., Satti N.K., Gupta D.K., Suri K.A., Johri R.K.: Hum. Exp. Toxicol. 25, 111 (2006).
11. Bhattacharya S., Chaudhari S.R., Chattpadhyay S, Bandyopadhyay S.K.: J. Clin. Biochem. Nutr. 41, 106 (2007).
12. Rassol M., Sabina E.P.: Phytotherapy Res. 21, 889 (2007).
13. Das S.N., Singh J., Agarwal SK.: Phytomedica 1, 89 (2000).
14. Srikumar R., Jeya Parthasarathy N., Sheela Devi R.: Biol. Pharm. Bull. 28, 1398 (2005).
15. Mathuria N., Verma RJ.: Acta Pol. Pharm. Drug Res. 64, 165 (2007).
16. Neogy S., Das S., Mahapatra SK., Mandal N., Roy S.: Environ. Toxicol. Pharmacol. 25, 321 (2007).
16. Singha P.K., Roy S., Dey S.: J. Ethnopharmacol. 111, 13, (2007).