TO INVESTIGATE THE ACTION OF GINGER-JUICE ZINGIBER OFFICINALE ROSCOE (ZINGIBERACEAE) ON BLOOD COAGULATION PROCESS.

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ABSTRACT:

Investigation of ginger-juice (zingiber officinale roscoe) action on blood coagulation process in rat. Methods: (A) Albino Wister rats (n=6-12) were administered G.J at two doses (2ml & 4 ml/rat, p.o) as single administration and chronic treatment over period of 30 days. Following this assessment was done for possible effects on the blood coagulation. Parameters used during assessment were on the bleeding time, clotting time. prothrombin time, thrombin time, partial thromboplastin with kaolin (PTTk) and platelet count. Results: Chronic administration of G.J (2ml & 4ml/rat, p.o) caused an increase in the bleeding time. There is no effect of ginger-juice treatment (2ml & 4ml/rat, p.o) for 30 days on the clotting time, prothrombin time, thrombin time, partial thromboplastin time with kaolin (PTTk), and Platelet counts. Conclusion: Ginger administration increased bleeding time on chronic administration G.J in two different doses.

Key words: Ginger-juice (G.J), blood coagulation, BT, CT, prothrombin time, thrombin time, PTTk, platelet count.

INTRODUCTION

A Ginger is one of the most important and oldest spices, consisting of the prepared and sun-dried rhizomes of Zingiber officinale (Zingiberaceae). Some grades of ginger are bleached by various means to improve their appearance, e.g. - by lime [1] (Guenther, 1952). It is cultivated in many tropical countries. It is produced all over India from ancient times. It has a good commercial value and is claimed to have many medicinal uses. Because of differences in cultivation pattern, harvesting technique and climatic conditions its commercial value differs and so also the medicinal actions and uses. It is referred by different names in the languages of different regions and countries.

It is widely consumed almost all over the world however in tropical countries or warm regions like Asia, it is more popular [2] (Katiyar et al., 1996). Because of its typical taste and a pleasant odor it's widely used as flavoring agent in numerous food recipes, beverages, pickles, many popular soft drinks etc [1] (Guenther, 1952).

From the ancient times it is included in many traditional medicinal systems for treatment of number of diseases. It is widely claimed as a Stomachic, aromatic, carminative, aphrodisiacs, diaphoretic, antiemetic, allergic rhinitis and gastric stimulant and for treating migraine headache. It is also used an antispastic against intestinal colic. Ginger oil is used in mouthwashes and liquors [3] (Evans et al., 1989).

Many varieties of ginger are found such as processed, coated or unscraped, unbleached (natural) and bleached ginger. There are different types of active principles present in the ginger. Ginger oil is isolated by distillation of dried ginger. Many scientists have investigated the ginger oil and found about 50 constituents, mainly aroma, Starch, Volatile oil, Zingiberene, Gingerol, Oleoresin (Gingerin), Zingiberol, Zingerone, Shagaol etc. The acetone extract of ginger contains Zingerberone and ether extract contain Zingerone (Pungent principles).

In view of the available literature, we have tried to screen some actions of ginger-juice; as crude form of ginger. We presume that crude form contains majority of active principles, may be in very low concentrations. Keeping in mined some of its potential therapeutic applications we have carried out animal experiments to investigate the effects of ginger-juice on blood coagulation.

PLATELET FUNCTION:

Lumb, (1994) [4] have reported that ginger has effect on thromboxane synthetase activity and platelet aggregation. He concluded that the effect of ginger on thromboxane synthetase activity is dose dependent and only occurs with fresh ginger and that up to 2 gm of dried ginger is unlikely to cause platelet dysfunction.

Zingiber officinale significantly reduced platelet aggregation induced by ADP or Epinephrine [5] (Bordia et al., 1997).

Hwa et al., (1995) [6] have investigated the anti-platelet effect of Gingerol. Gingerol (0.5-20 5M), concentration-dependently inhibited the aggregation and release reaction of arachidonic acid and collagen-induced rabbit platelets but not those induced by platelet-activating factor (PAF), U46619 and thrombin. Gingerol (0.5-10 5M) also concentration-dependently inhibited thromboxane B2 and prostaglandin D2 formation caused by arachidonic acid, and completely abolished phosphoinositide breakdown induced by arachidonic acid, but had no effect on that of collagen, PAF or thrombin even at concentrations as high as 300 5M. In human platelet-rich plasma, gingerol and indomethacin prevented the secondary aggregation and blocked ATP release from platelets-induced by ADP (5-5M) and adrenaline (5-5M) but had no influence on primary aggregation. The highest anti-platelet effect was obtained when platelets were incubated with gingerol for 30 minutes and this inhibition was reversible. It is concluded that the anti-platelet action of Gingerol is mainly due to the inhibition of thromboxane formation.

Hangjun et al., (1999) [7] investigated the effects of "Sinitang" a traditional Chinese herbal medicine in rats. Zingiber officinale is the main component of this preparation. Microcirculatory disturbance was induced by endotoxin in rat mesentry. The changes of arteriolar diameter, the velocity of red blood cells in arterioles and venular microcirculation after endotoxin injection (6 mg/kg) were observed by videomicroscopy. It significantly prevented the decrease of mean arterial pressure, controlled the reduced velocity and apparently inhibited the leukocyte extravasation across venules. They show that "Sinitang" has protective effects to improve the microcirculatory disturbances induced by endotoxin in rat mesentry.

Material and Methods:

Preparation of ginger-juice:

The commercially available ginger was obtained from the local market. It was confirmed from the botanist that it was Zingiber officinale. The rhizome of ginger after cleaning and scrapping the superficial skin was cut into small pieces. With the help of mixer-grinder the pieces were made in to paste. The paste was taken on a white clean cloth and the liquid was squeezed out. The juice so obtained was used in the experiments. The stock of juice was kept in a refrigerator for maximum period of 15 days and the required quantity was used for the experiments after removing particulate matter from it.

500 gm ginger rhizomes yielded about 250ml juice.

The liquid portion which was obtained in the course of filtration, looked like yellowish hazy opalescent liquid. It was administered orally in chronic experiments. The doses were either 2 ml to 4 ml per rat.

I. BLOOD COAGULATION: Albino rats of Wistar strain obtained from the commercial supplier were divided into different groups (6-12 rats per group) matched properly according to weight (150-280gm) and sex ratio (1:1). All the animals were kept under optimal conditions of light and ventilation fed on standard food and tap water ad libitum and was kept at the ambient room temperature.

Control groups:

Two control groups were taken .One group received the vehicle (normal saline 2ml/rat for 30 days and the second group received the vehicle (normal saline 4ml/rat) for 30 days orally. They were sacrificed after 24 hours of last dose of normal saline.

Test groups:

Two test groups were taken. One group received 2ml/rat of ginger-juice orally for 30 days and the second group received 4ml/rat of ginger-juice for 30 days. They were sacrificed after 24 hours of last dose of ginger-juice, by anaesthetizing with ether inhalation. The tail was cut with a scalpel 1-2cm proximal from the end, to study the bleeding time and clotting time. Subsequently blood was taken directly from the heart in plain and heparinised bulbs for studying the prothrombin time, thrombin time, partial thromboplastin with kaolin (PTTk) and platelet count. The cold centrifuging machine separated the serum. The sample of blood was centrifuged at 4000 to 5000 r.p.m for 15 minutes.

Methods followed to study the various parameters are as under:

Bleeding Time (Duke's method):

Rat's tail was cut with a scalpel 1-2 cm proximal from the end and bleeding time was calculated from the time of starting of bleeding till bleeding stopped. Spots were made with the bleeding tail on a blotting paper every 15 seconds till bleeding stopped and bleeding time was calculated accordingly. Or the time taken between the appearances of blood to the cessation of bleeding is taken as the bleeding time (Shrivastava B.K et al., [8] 1990; Dacie et al., 1995) [9] expressed in minutes.

Clotting Time:
Blood was drawn into a capillary tube. The time of appearance of the drop of the blood on the cut tail was noted. The capillary glass tube is then kept between the palms of both hands for 30 second to keep it at body temperature. After 30 second the tube was taken out and small portion of the capillary tube was broken at regular intervals of 10 seconds, until a thread of clotted blood appears between the two pieces of capillary glass tube. The time interval between the appearance of the drop of the blood and the thread of the blood clot was the clotting time of the sample of the blood of rat (Shrivastava B. K et al., 1990; Dacie et al., 1995) [8] [9] expressed in minutes.

Prothrombin Time:
The prothrombin time was measured in terms of minutes taken by a sample of blood to form a clot in presence of Thromboplastin and calcium ions (Shrivastava et al., 1990; Dacie et al., 1995) [8] [9]. It is expressed in minutes.

Thrombin Time:
Thrombin time was estimated using the biopool international enzyme kit. The enzyme Thrombin is the penultimate protein in the clotting sequence, acting upon soluble fibrinogen and converting it to insoluble fibrin. Thrombin after adding the plasma and the clotting time measured in term of seconds. (Dacie et al., 1995) [9]. It is expressed in seconds.

Partial thromboplastin time with kaolin (PTTk): PTTk also called activated partial thromboplastin time (APTT) was estimated using Pacific Hemostasis Kit, made by Fisher Diagnostics.

Principles
Adding reagent containing a plasma activator and phospholipid to the test specimen performed APTT test. This mixture was incubated for 3 minutes at 37^{o}C for optimum activation. Calcium chloride was added and clot formation was timed, which measured the clotting time of plasma after the activation of contact factors but without added tissue thromboplastin, and so indicated the overall efficiency of the intrinsic pathway. To standardize the activation of contact factors, the plasma was first pre-incubated with kaolin. To standardize phospholipid was provided to allow the test to be performed on platelet - poor plasma. The test depends not only on the contact factors and on factors VIII and IX, but also on the reactions with factors X, V, prothrombin and fibrinogen. It was also sensitive to the presence of circulating anticoagulants (inhibitors) and heparin (Dacie et al., 1995) [9].

Platelet count:
Platelet count was done by direct methods, which is as describes hereunder, A known volume of blood was diluted 200 times with a fluid which was isotonic with blood which prevented, its coagulation. Platelets in known volume of diluted blood were counted in a special counting chamber and the numbers of platelets per mm of the undiluted blood were calculated. (Shrivastava et al., 1990; Dacie et al.,1995) [8] [9]. It was expressed in counts (Lac). The count was expressed as per cubic mm.

Result: The effects of ginger-juice observed in various experiments are described here:

I. BLOOD COAGULATION:
This section describes the results of various experiments related to blood coagulatory processes.

A. Effect of ginger-juice 2ml/rat, p.o. administered over 30 days.

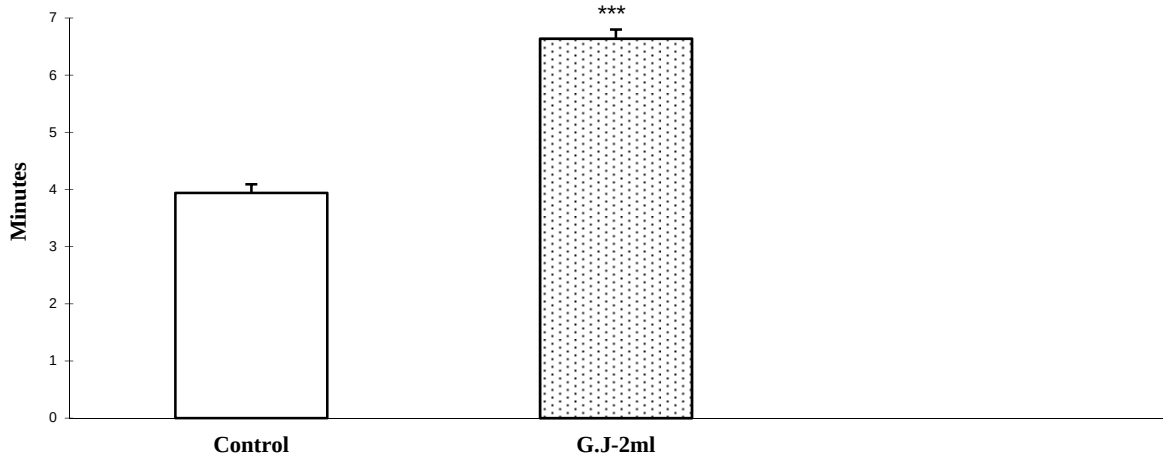
1. Bleeding Time (BT):
In the vehicle treated control group the mean bleeding
time was 3.95 ± 0.14 minutes, while in ginger-juice treated test group it was 6.64 ± 0.16 minutes. Thus it is evident that ginger-juice treatment significantly increased the bleeding time. The results have been shown in table-1 and figure-1.

Table-1: THE EFFECTS OF GINGER-JUICE TREATMENT (30 days) ON BLEEDING TIME IN RATS

Group	BT (minutes)
Control (n=6)	3.94 ± 0.15
Ginger-juice (2ml/rat) (n=6)	6.64 ± 0.16***

Table-1: It shows the effect of ginger-juice (2ml/rat, p.o. for 30 days) on BT in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

Figure-1: Effect of ginger-juice 2 ml/rat for 30 days on Bleeding time.



2. Clotting Time (CT): The mean clotting time in this vehicle treated control group was 1.18 ± 0.02 minutes and in the ginger-juice treated test group the clotting time was 1.24 ± 0.04 minutes expressed in table-2. This shows that there is no significant difference between the two groups indicating that there is no effect of ginger-juice treatment for 30 days on the clotting time.

Table-2: THE EFFECTS OF GINGER-JUICE TREATMENT (30 days) ON CLOTTING TIME IN RATS

Group	CT (minutes)
Control (n=6)	1.18 ± 0.02
Ginger-juice (2ml/rat) (n=6)	1.24 ± 0.04

Table-2: It shows the effect of ginger-juice (2ml/rat, p.o. for 30 days) on CT in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

3. Prothrombin Time (PT):
In the vehicle treated control group the mean prothrombin time was 2.97 ± 1.01 second and in ginger-juice treated test group it was 3.13 ± 1.01 second. This reflects that there is no significant difference between two groups indicating that there is no effect of ginger-juice treatment for 30 days on the prothrombin time. The results have been shown in table-3.

Table-3: EFFECTS OF GINGER-JUICE TREATMENT (30 days) ON PROTHROMBIN TIME IN RAT

Group	PT (seconds)
Control (n=6)	2.97 ± 1.01
Ginger-juice (2ml/rat) (n=6)	3.13 ± 1.01

Table-3: It shows the effect of ginger-juice (2ml/rat, p.o. for 30 days) on PT in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

4. Thrombin Time (TT) :
In the vehicle treated control group the mean thrombin time was 21.16 ± 3.60 second, while in ginger-juice treated test group it was 22.83 ± 3.60 second. Thus it indicates that there is no significant effect of ginger-juice treatment on the thrombin time. The results have been depicted in table-4.

Table-4: EFFECTS OF GINGER-JUICE TREATMENT (30 days) ON THROMBIN TIME IN RATS

Group	TT (second)
Control (n=6)	21.16 ± 3.60
Ginger-juice (2ml/rat) (n=6)	22.83 ± 3.60

Table-4: It shows the effect of ginger-juice (2ml/rat, p.o. for 30 days) on TT in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

5. Partial Thromboplastin Time with kaolin (PTTK) :

In the vehicle treated control group the mean partial thromboplastin time with kaolin (PTTk) was 2.91 + 2.71 second, while in ginger-juice treated test group was 2.41 + 0.71 second. So it proves that there is no effect of ginger-juice treatment on the partial thromboplastin time with kaolin (PTTk). The results have been shown in table-5.

Table-5: EFFECTS OF GINGER-JUICE TREATMENT (30 days) ON PARTIAL THROMBOPLASTIN TIME WITH KAOLIN IN RATS

Group	PTTk (sec)
Control (n=6)	2.91 ± 0.71
Ginger-juice (2ml/rat) (n=6)	2.41 ± 0.71

Table-5: It shows the effect of ginger-juice (2ml/rat, p.o. for 30 days) on PTTk in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

6. Platelet count:

The mean platelet count in vehicle treated control group was 7.23 ± 0.60 Lac, while in ginger-juice treated test group it was 7.06 ± 0.60 Lac. It proves that there is no significant effect of ginger-juice treatment on the Platelet counts. The results have been shown in table-6.

Table-6: EFFECTS OF GINGER-JUICE TREATMENT (30 days) ON PLATELET COUNT IN RATS

Group	Platelet counts
Control (n=6)	7.23 ± 0.60 Lac
Ginger-juice (2ml/rat) (n=6)	7.06 ± 0.60 Lac

Table-6: It shows the effect of ginger-juice (2ml/rat, p.o. for 30 days) on platelet counts in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

Table-7: EFFECTS OF GINGER-JUICE TREATMENT (30 days) ON DIFFERENT PARAMETERS IN RATS

Parameters	Control (n=6)	Ginger-juice (2ml/rat) (n=6)
BT (minute)	3.94 ± 0.15	6.64 ± 0.16***
CT (minute)	1.18 ± 0.02	1.24 ± 0.04
PT (second)	2.97 ± 1.01	3.13 ± 1.01
TT (second)	21.16 ± 3.60	22.83 ± 3.60
PTTk (second)	2.91 ± 0.71	2.41 ± 0.71
Plateletcounts (Lac)	7.23 ± 0.60	7.06 ± 0.60

Table-7: It shows the effect of ginger-juice (2ml/rat, p.o. for 30 days on different parameters in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

The result summarized in table-7, reflects that ginger-juice (2ml/rat, p.o. for 30 days) treatment significantly alter bleeding time only. Other parameters are not altered.

B. Effect of ginger-juice 4ml/rat, p.o. administered over 30 days.

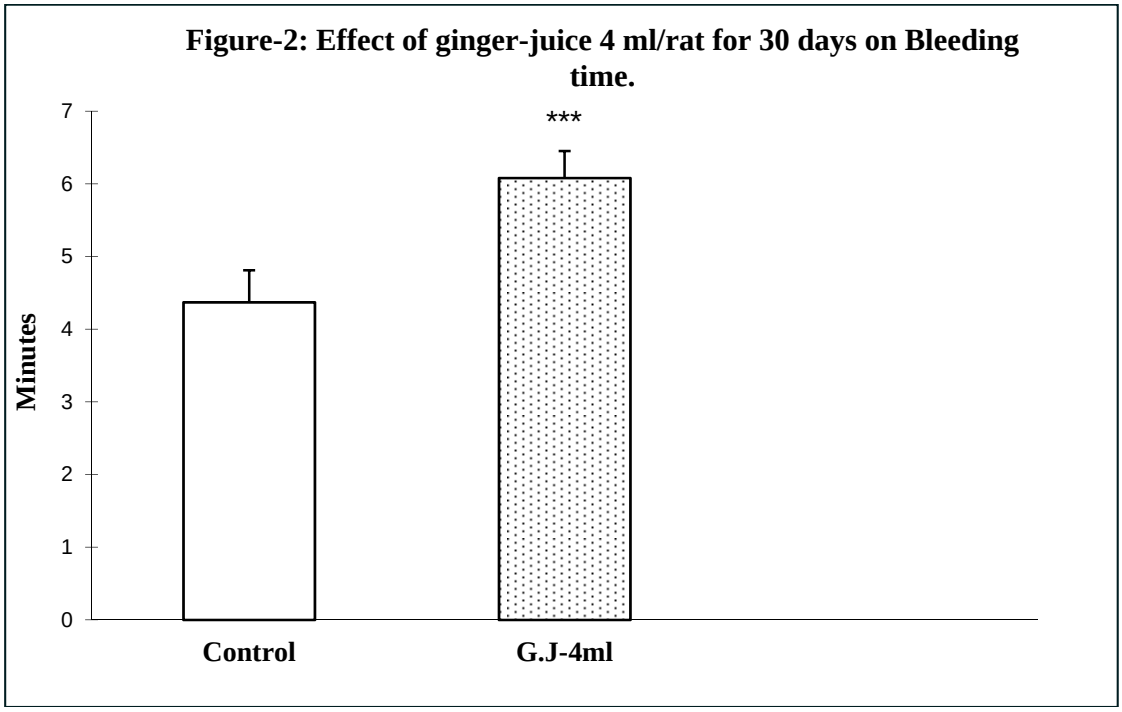
1. Bleeding Time (BT):

In the vehicle treated control group the mean bleeding time was 4.37 ± 0.44 minutes and in ginger-juice treated test group it was 6.08 ± 0.37 minutes. Thus it is evident that ginger-juice treatment significantly prolongs the bleeding time. The results are depicted in table-8 and figure-2.

Table-8: THE EFFECTS OF GINGER-JUICE TREATMENT (30days) ON BLEEDING TIME IN RATS

Group	BT (minutes)
Control (n=10)	4.37 ± 0.44
Ginger-juice (4ml/rat) (n=10)	6.08 ± 0.37***

Table-8: It shows the effect of ginger-juice (4ml/rat, p.o. for 30 days) on BT in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001



2. Clotting Time (CT) :

The mean clotting time in vehicle treated control group was 1.29 ± 0.09 minutes and in the ginger-juice treated test group it was 1.21 ± 0.01 minutes. Results indicate that there is no significant change in clotting time by ginger-juice treatment.

Results are illustrated in table-9.

Table-9: THE EFFECTS OF GINGER-JUICE TREATMENT (30days) ON CLOTTING TIME IN RATS.

Group	CT (minutes)
Control (n=10)	1.29 ± 0.09
Ginger-juice (4ml/rat) (n=10)	1.21 ± 0.01

Table-9: It shows the effect of ginger-juice (4ml/rat, p.o. for 30 days) on CT in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

3. Prothrombin Time (PT):
The mean prothrombin Time in vehicle treated control group 4.36 ± 0.57 second, while in ginger-juice treated test group the mean prothrombin time was 4.40 ± 0.58 second. Thus it is evident that 4ml/rat, p.o. 30 days treatments of ginger-juice not significantly alter the PT. The results were shown in table-10.

Table-10: THE EFFECTS OF GINGER-JUICE TREATMENT (30days) ON PROTHROMBIN TIME IN RATS.

Group	PT (seconds)
Control (n=10)	4.36 ± 0.57
Ginger-juice (4ml/rat) (n=10)	4.40 ± 0.58

Table-10: It shows the effect of ginger-juice (4ml/rat, p.o. for 30 days) on PT in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

4. Thrombin Time (TT):
The mean thrombin time in vehicle treated control group was 23.00 ± 2.23 second and in ginger-juice treated test group the mean thrombin time was 24.00 ± 2.31 second. This change was not significant between two group indicating that there is no effect of ginger-juice in 4ml/rat, p.o. for 30 days. The results are depicted in Table-11.

Table-11: THE EFFECTS OF GINGER-JUICE TREATMENT (30days) ON THROMBIN TIME IN RATS.

Group	TT (second)
Control (4ml/rat) (n=6)	23.00 ± 2.23
Ginger-juice (4ml/rat) (n=10)	24.00 ± 2.31

Table-11: It shows the effect of ginger-juice (4ml/rat, p.o. for30 days) on TT in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

5. Partial Thromboplastin Time with kaolin (PTTk) :
In the vehicle treated control group the mean partial thromboplastin time with kaolin (PTTk) was 2.17 ± 0.41 second, while ginger-juice treated test group it was 1.69 + 0.49 second. This shows that there is no significant alteration in partial thromboplastin time with kaolin (PTTk) between two groups indicating there is no effect of ginger-juice (4ml/rat, p.o. for 30 days). The results are illustrated in Table-12.

Table-12: THE EFFECTS OF GINGER-JUICE TREATMENT (30days) ON PARTIAL THROMBOPLASTIN TIME WITH KAOLIN IN RATS.

Group	PTTk (second)
Control (n=10)	2.17 ± 0.41
Ginger-juice (4ml/rat) (n=10)	1.69 ± 0.49

Table-12: It shows the effect of ginger-juice (4ml/rat, p.o. for 30 days) on PTTk in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

6. Platelet count:
The mean platelet count in vehicle treated control group was 6.71 ± 0.35 Lac and in ginger-juice treated test group it was 6.29 ± 0.25 Lac. This is evident that ginger-juice treatment not significantly alters the platelet count. So it indicates that there is no effect of ginger-juice treatment on the Platelet counts. The results are shown in table-13.

Table-13: THE EFFECTS OF GINGER-JUICE TREATMENT (30days) ON PLATELET COUNT IN RATS.

Group	Platelet Counts
Control (n=10)	6.71 ± 0.35 (Lac)
Ginger-juice (4ml/rat) (n=10)	6.29 ± 0.25 (Lac)

Table-13: It shows the effect of ginger-juice (4ml/rat, p.o. for 30 days) on platelet count in rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

Table-14: EFFECTS OF GINGER-JUICE TREATMENT (30days) ON DIFFERENT PARAMETERS IN RATS.

Parameters	Control (n=10)	Ginger-juice (4ml/rat) (n=10)
BT (minute)	4.37 ± 0.44	6.08 ± 0.37***
CT (minute)	1.29 ± 0.09	1.21 ± 0.01
PT (second)	4.36 ± 0.57	4.40 ± 0.58
TT (second)	23.00 ± 2.73	24.00 ± 2.31
PTTk (second)	2.17 ± 0.41	1.69 ± 0.49
Platelet Counts (Lac)	6.71 ± 0.35	6.29 ± 0.25

Table-14: It shows the effect of ginger-juice (4ml/rat, p.o. for 30 days) on different parameters in the rats. The statistical significance vis a vis the vehicle treated control is presented as *P<0.05 **P<0.01 ***P<0.001

The above results on BT, CT, PT, TT, PTTk and Platelet count are summarized in table-14: reflects that ginger-juice (4ml/rat, p.o. for 30 days) treatment significantly prolonged the bleeding time only but other parameters are not altered. It appears that there is no difference in 2ml/rat, p.o. for 30 days treatment and 4ml/rat, p.o. for 30 days treatment. It is evident that enhanced bleeding time in low dose of ginger-juice was not altered by increase the dose of ginger-juice.

Discussion: As mentioned in "aims and objective" certain properties of ginger were screened in experimental animals. Literature describes active principles of ginger and their actions. In the present study, however, crude preparation of ginger is used. Over all screening was the aim and crude preparation is expected to contain maximal possible principles together. There is drawback in doing so from point of view that concentrations of certain principles may be very low in crude preparation as compared to other extracts. Despite this short coming study was pursued from point of hope of screening the various possible actions. Areas covered during screening, as specified in methodology, included blood coagulation,

The haemostatic mechanisms are meant to arrest bleeding at the site of injury and blood loss by formation of a haemostatic plug, subsequently there is the eventual removal of the plug when healing is complete. Normal physiology keeps a delicate balance between these processes and the deficiency or exaggeration of any one mechanism leads to hemorrhage or thrombosis. There are various components viz blood vessels, platelets, plasma coagulation factors, their inhibitors and the fibrinolytic system, which maintain the physiology (Dacie et al., 1995) [9].

Ginger-juice in the doses of 2ml/rat and 4ml/rat over period of 30 days prolonged the bleeding time significantly. Other parameters viz prothrombin time, thrombin time, partial thromboplastin time with kaolin and platelet count remained unaltered by ginger-juice treatment. The effect was same on both groups treated with 2ml and 4ml of ginger-juice, suggesting that there is no enhancement of bleeding time by increasing the dose of ginger-juice.

The present finding raises the possibility of action of ginger-juice on platelet function or on vasculature. Inhibition of platelet aggregation may lead to enhance bleeding time and vasodilatation may also enhance bleeding time. Several mechanisms, which can interfere with platelet function could be proposed Lumb, 1994 [4] have reported effect of ginger on thromboxane synthtase activity, similarly Bordia et al., 1997 [5] have shown ginger induced inhibition of platelet aggregation induced by ADP.

Further study is needed to work out the mechanism of increased bleeding time by ginger -juice.

Conclusion: Ginger administration enhanced bleeding time on chronic administration of ginger-juice in two different doses.

Limitation of study: Further study is needed to work out the mechanism of increased bleeding time by ginger -juice.

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