

EFFECT OF ACUTE EXPOSURE OF GLYPHOSATE HERBICIDE, ON WISTAR RATS WITH REFERENCE TO HAEMATOLOGY AND BIOCHEMICAL ANALYSIS

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ABSTRACT

Herbicides have been used tremendously worldwide to control the unwanted herbs or weeds. Herbicides are synthetic compounds having the ability to inhibit the growth of plant or to kill it. Directly or indirectly these herbicides enters to our body, through accumulated in fruits, grains and water, or accidentally. Rats were exposed to oral dose of LD 50 of Glyphosate for 7 days (4000 mg/kg body weight) to study haematological and biochemical alterations, it shows that Roundup interferes with blood components altering their basic composition, Significant increase in RBC count, significant decrease in the Hb% and TLC also causing alterations in metabolism, significant increase were found in alkaline phosphatase, total proteins, glucose etc.

INTRODUCTION

The quality and quantity of agricultural production depends on various natural factors like soil quality, water availability as well as damage caused by insects, pests and weed occurrence. Weeds are those unwanted plants or herbs, which grow in field/garden along with crop plants. They compete with crop plants for water and nutrients; some time it has been observed that weeds grow faster than desire plants and affects crop production. Indian agriculture always faced the problem of weeds; hand weeding is traditionally used method but now days due to problem of labors weedicide/ herbicides are used tremendously. Here an attempt has been made to study the effect of Glyphosate on haematological and biochemical composition of Wistar rats.

Herbicides are the synthetic chemicals, which kills the target plant by interfering with the growth of the weed and often synthetic "limitation" of plant hormone. Target specific or Selective herbicides are more toxic to some species than to others, while nonspecific or non-selective herbicides destroy or prevent plant life in general regardless of species. Depending upon the weed to be controlled variety of herbicides is used. This practice is routinely used in other countries from last 60 years. Along with agriculture they are often used in lawns, gardens where children may get exposed. Most of the herbicides have short half-life period ranges from few days to 1-3 months, and therefore they are repeatedly used. Most commonly used are (Glyphosate, Roundup, 2, 4 -D, Atrazine, Pursuit, Paraquat etc.).

Glyphosate also known as Roundup, Rodeo and Accord, the major product is Roundup, which consists of their isopropyl amine salt of N- (phosphonomethyl) Glycine and surfactant. The predominant surfactant used is a polyethoxylated tallow amine (POEA), which is a mixture of polyethoxylated long-chain alkyl amines (Williams *et al.*, 2000). Roundup, a target specific herbicide, inhibits the shikimic acid pathway, which is important for plant protein synthesis (Schonbrunn *et al.*, 2001). It is a water-soluble and its half-life period > 35 day's therefore it has been applied in the field 2 or 3 times, depending upon the growth of weeds. Glyphosate herbicides are among the world's most widely used herbicides (Monsanto, 2002) and the Glyphosate is the world's leading agrochemical (Baylis, 2000). Although Glyphosate herbicide has been popular since they were first marketed in 1974 their use in agriculture has expanded recently with the increased use of crops that have been genetically modified to tolerate Glyphosate treatment (Williams *et al.*, 2000). It is often said that there is no indication of any human health hazard (Washington state uni. 2004).

Roundup showed significant decrease in the Hb% and TLC and highly significant increase in alkaline phosphatase (Dhanarajam *et al.*, 2010). According to Adam (2002) effect of Round-up show respiratory effect, blood stained weeping from noses and diarrhea. In case of chronic exposure many reported carcinogenicity.

Farmers in fields repeatedly use Roundup/Glyphosate with the recurrence of weeds. Since herbicides are intended to kill plants, accumulation of herbicides may take place in the soil

as well as it may percolate in nearby water bodies. They get fall on crop (which are not weeds) may not killing or destroying but accumulate inside the leaves, grains or fruits, by consuming such product by birds or mammals indirectly or accidentally herbicides enters in body. As the use of herbicides is increasing day by day therefore attempt is made to identify the effect of acute exposure of Glyphosate on Wister rats (female) with reference to variation in haematological parameters as well as biochemical analysis, as biochemical characteristics of blood are important indices of the status of internal environment of the organism. As farmers are not aware about the bad effects of herbicides therefore unusual and repeated use of herbicides may cause adverse effect on human beings.

MATERIALS AND METHODS

Glyphosate (Roundup) the most widely used non-target herbicide is used to study the acute effect of herbicide.

Healthy female Wister rats were acclimatized to laboratory condition by providing food and water *ad libitum*. The rats were grouped in two groups, six rats in each group; control, and experimental. Experimental rats were given oral dose of LD₅₀ of Glyphosate (4000 mg/kg body weight) dissolved in water for 7 days, whereas control rats were given water by same rout.

The control rats were sacrificed by giving anesthetic ether, (according to norms of ethical committee) on seventh day for results of normal values. Whereas experimental rats were sacrificed on eighth day after giving 7 days oral dose. The blood is drawn from renal artery for haematological and biochemical analysis. Standard deviation, student t test ($p > 0.05$, $p > 0.01$)

RESULTS AND DISCUSSION

The present study deals with the Hematological and Biochemical analysis of female wistar rats exposed to

Table I: Haematological parameters from control and Glyphosate treated rats

	Control	Glyphosate
Haemoglobin %	10.75 ± 5.266	12.2 ± 0.463*
RBC	6.31 ± 0.02	7.03 ± 0.432*
WBC	5966.66 ± 2813.53	7865 ±
Neutrophils	18 ± 4.70	23.5 ± 1.378*
Monocytes	2.5 ± 1.224	1 ± 0.408*
Eosinophils	1 ± 0	1 ± 0
Lymphocytes	78 ± 3.723	74 ± 1.632

Table II: Biochemical parameters from control and Glyphosate treated rats

	Control	Glyphosate
Glucose mg/dL	133 ± 28.44	205.83 ± 41.700**
Total proteins gm/dL	8.05 ± 1.268	7.03 ± 0.773
Alkaline phosphatase U/L	186.33 ± 21.20	554 ± 98.713*
Cholesterol mg/dL	62.83 ± 15.458	43.66 ± 3.204*
Sodium mEq/L	141 ± 2	142.66 ± 1.505**
Potassium mEq/L	6.2 ± 1.185	9.7 ± 1.841**
Calcium mg/dL	5.31 ± 0.231	5.61 ± 0.311

Values are given as means of six separated animals ± Standard Deviation; * $P < 0.05$; ** $p < 0.01$ (student test)

Glyphosate herbicide. The oral dose of LD 50 of Glyphosate (4000 mg/kg body weight) dissolved in water was given for 7 days, on 8th day animals were sacrificed for blood; blood was collection from renal artery.

Hyperactivity was seen just after the administration of dose for 5-10 minutes, rubbing of face/nose after the giving oral dose, sneezing and blood stained weeping from nose, shortness of breath was also observed. Excreta were semisolid with pungent smell. Adam, A. observed the effect of Round-up at concentration of 0.1 g/kg POEA and 0.2g/kg Glyphosate, elicited unmediated respiratory effect which were more sever and which last longer in the groups residing the POEA containing preparation than in the Glyphosate along group. He also observed administration of Glyphosate 2g produced diarrhea and blood stained weeping from noses.

Haematological parameters comparison shows the variations between control and experimental animals. (Table I) Significant increase in RBC count and Haemoglobin percent was observed in Roundup fed rats. Long-term exposure of Roundup showed significant decrease in the Hb% and TLC (Dhanarajam *et al.* (2010). While in case of TLC analysis neutrophils and monocytes have been increased significantly no alterations were found in eosinophils and lymphocytes.

Biochemical estimation of glucose, total proteins, alkaline phosphatase, cholesterol, sodium, potassium and calcium was performed to observe the effect of Glyphosate exposure. (Table II). Highly significant increase in alkaline phosphatase was observed; same results were observed by Dhanarajam *et al.* (2010). Glucose, cholesterol, sodium and potassium were found significantly increased at $p > 0.01$. No variation observed in calcium level after administration of Glyphosate.

CONCLUSION

The present study suggests that the oral exposure to herbicide, Glyphosate (Roundup), is having toxic effects, haematology and biochemical analysis shows alterations in blood parameters as well as it interferes with biochemical mechanisms as compared to control rats. While other researchers have documented the risk of genetic damage, carcinogenicity caused due to long term exposure of roundup (Andre 2007).

On the basis of these findings Glyphosate should not be recommended for the use of weed control. If it needs to be used, people should be aware about the harmful effects; proper care should be taken by users as well as the amount of it to be used.

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Cont. P. 390