Journal of Health Sciences Institute, 8(2): 175-178, 2023
DOI: 10.51754/cusbed.1272736

Journal of Health Sciences Institute

| cusbed.cumhuriyet.edu.tr Founded: 2016 Available online, ISSN: 2587-0874 Publisher: Sivas Cumhuriyet Üniversitesi

The Evaluation of Haematological Parameters After Administrated Allium Schoenoprasum L. and Acrylamide in the Rats

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Research Article

History

Received: 28/03/2023
Accepted: 18/05/2023

ABSTRACT

In this study, it was aimed to investigate the protective effect of Allium schoenoprasum L. plant against acrylamide toxicity. As animal material, 32 Wistar-Albino female rats were divided into 4 groups. The first group formed the control group. In the second group, 25 mg/kg Acrylamide was administered by gastric gavage every day for 15 days. In the third group, 200 mg/kg Allium schoenoprasum L. ethanol extract was given by gastric gavage for 15 days. In the fourth group, 25 mg/kg Acrylamide + 200 mg/kg Allium schoenoprasum L. ethanol extract was administered by gastric gavage for 15 days. As a result of the analysis, although the levels of red blood cell (RBC), hemoglobin (Hb), hematocrit (HCT), mean cell volüme (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), Leukocyte (WBC), platelet (PLT), Lymphocyte, Monocyte and Eosinophil Lymphocyte (%) decreased in rats in the acrylamide group, the amount of neutrophils and red blood cell distribution width (RDW) increased (P<0.05). It was determined that Allium schoenoprasum L. plant may have an effect in correcting the negative effects of acrylamide exposure.

Keywords: Acrylamide, Allium schoenoprasum L., Hematological parameters, Rat

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How to Cite: Mis L, Yasar S, Yurderi Gizey O (2023) The Evaluation of Haematological Parameters After Administrated Allium Schoenoprasum L. and Acrylamide in the Rats, Journal of Health Sciences Institute, 8(2): 175-178

Introduction

Acrylamide is a widely used substance that dissolves in polar solvents such as water, acetone, chloroform, ethanol and methanol and has very high chemical activity. The most important factor in the formation of acrylamide in foods with high fat content is the amount of ammonium and acrolein in the environment (Claus et al.,2008). Acrylamide is not used as an additive to foodstuffs, on the contrary, it is formed by the reaction of carbohydrates and proteins, which are natural components, in high temperature environments. For this reason, acrylamide is formed more frequently in high-carbohydrate and low-protein foods, in frying and baking processes at high temperatures (Stadler et al., 2002; Richmond and Barrow, 2003).

In various studies, when animals are exposed to Acrylamide, degeneration in peripheral nerves, degeneration in hippocampus, thalamus, cerebral cortex neurons and negative conditions in their morphology have been observed. In addition, it has been found to cause ataxia and skeletal muscle fatigue in studies conducted with experimental animals and humans (Ko et al., 2002; Pruser and Flynn, 2011).

Allium schoenoprasum L. (Sirmo) is a member of the lily family (Liliaceae). In the analyzes carried out on the stem, head and leaves of the plant, the plant Antioxidative properties were checked, catalase, superoxide dismutase, glutathioneperoxidase, malondialdehyde, hydroxyl radicals were found in extracts from all organs of the plant superoxide, reduced glutathione and flavonoid content, vitamin C, carotenes, chlorophyll and soluble proteins were detected. All parts of the plant have antioxidant activity, but when the results are examined, it has been reported that the highest antioxidant activity is in the leaves (Stajner et al., 2004; Stajner et al., 2011).

Up to now, the literature on acrylamide toxicity testing includes reports of studies with various phytotherapy methods. However, the protection of Allium schoenoprasum L against the action of acrylamide is largely unknown. In this article, we aimed to examine the toxic effect of acrylamide on hematological parameters. We also investigated for the first time the consequences of Allium schoenoprasum L on the mechanism of toxicity to acrylamide.

Material and Methods

This study was authorized by Van Yüzüncü Yıl University Animal Local Ethics Committee with the decision numbered 2018/08 on 06-09-2019. The animal material of the study consisted of 32 Wistar-albino female rats with a live weight of

200-220 g. Rats Yüzüncü Yıl University Experimental Application and Research. In the center; they were fed with standard pellet feed in rooms at 22 ± °C.

This study was continued for a total of 15 days. In the study, there are 4 groups consisting of 8 animals in total.

1- Control group: The rats in this group were not administered any treatment (n=8).

2- Acrylamide group: Daily 25 mg/kg Acrylamide (Sigma for electrophoresis, ≥99%, CAS No 76-06-1) was given by gastric gavage (n=8) (Altinoz and Turkoz, 2014).

3- Allium schoenoprasum L. (Sirmo) Group: The rats in this group were given 200 mg/kg Allium schoenoprasum L. (Sirmo) ethanol extract by gastric gavage (n=8) (Aamir et al., 2016).

4- Acrylamide and Allium schoenoprasum L. (Sirmo) Group: Rats in this group were given 25 mg/kg Acrylamide and 200 mg/kg Allium schoenoprasum L. (Sirmo) ethanol extract by gastric gavage (n=8).

At the end of the 15-day study, blood samples were collected from the heart into tubes with EDTA. Hematological parameters were measured on the Sysmex XN-1000 hemogram device.

Preparation of Plant Extract

Allium schoenoprasum L. was collected from the Keşgöl, location (2100 m), located behind the Erek Mountain in Van. After 300 g of shade-dried Allium schoenopraum L. plant was ground and powdered in an electric mill, it was kept in 4 liters of 80% ethanol for 3 days and mixed. Then Watman filter It was evaporated with ethanol at 50°C in a rotary evaporator. After the extract obtained was prepared daily and mixed with a vortex device, the determined doses were given by gavage (Yasar, 2022).

Statistical Analysis

Statistical analysis of data SPSS 20 statistics made in the program. Data in One Way ANOVA It was evaluated with the Tukey test and the values were, given as mean±SD. P<0.05 is significant accepted.

Results and Discussion

Hematological parameters levels red blood cell (RBC), hemoglobin (Hb), hematocrit (HCT), mean cell volüme (MCV), mean corpuscular hemoglobin (MCH), , mean corpuscular hemoglobin concentration (MCHC),red blood cell distribution width (RDW),leukocyte(WBC) ,Lymphocytes, Monocytes, Eosinophils neutrophil, Plt) obtained as a result of the study are given in Table 1.

Table 1. Effects on some hematological parameters in rats of all groups. (X±SD).

Parameters	Control (group I)	Acr (group II)	Acr+Allium schoenoprasum L (group III)	Allium schoenoprasum L (group IV)
Hb (g/dL)	13.8±0.3	12.7±0.1[a]	13.3±0.3	13.8±0.4
RBCs(10^6 /mm3)	5.4±0.2	4.6±0.2[a]	4.8±0.4	4.7±0.5
HCT (%)	45.5±2.3	41.43±2.1[a]	43.5±2.4	45.1±2.3
MCV (fL)	57.36±0.37	65.37±6.91[a]	59.15±6.76	56.55±1.77
MCH (pg)	18.42±0.14	16.03±0.29[a]	17.29±0.21	18.85±0.46
MCHC (g/dL)	32.23±0.61	27.72±3.47[a]	32.15±0.39[b]	32.72±0.88[b]
RDW (%)	13.57±0.52	21.98±0.26a	16.75±.0.63a	13.41±.0.52
WBCs (10^3 /mm)	8.8±0.8	7.4±0.5a	7.8±1.4	8.4±1.1
Lymphocytes (%)	65±3.6	49±5.7a	59±6.5	61±4.1
Monocytes (%)	4±0.06	3±0.05a	3.8±0.2	4±0.06
Eosinophils (%)	2±0.04	1±0.03a	2±0.02	2±0.02
neutrophil(%)	28±2.3	56±7.2a	54±5.1 a	47±4.8 b
PLT (10^9 /l)	777.83± 36.72a	578.66± 81.02b	609.16 ± 61.03b	831.66± 32.48a

Values marked with a,b in the same column are statistically significant (p<0.05). ACR, acrylamide; Hb hemoglobin; RBCs, red blood cell; HCT, hematocrit ; MCV, mean cell volume; MCH, mean corpuscular hemoglobin; MCHC, mean corpuscular hemoglobin concentration; RDW, red blood cell distribution width,; WBC, Leukocyte ; PLT, platelet

RBC, HCT, HGB, MCV, MCH, MCHC levels, which are erythrocyte parameters, decreased in the acrylamide group compared to the control group. It was observed that RDW level increased in the acrylamide group (P<0.05). Blood RBC, HCT, HGB, MCV, MCH, MCHC levels were higher in the acrylamide + Allium schoenoprasum L. group compared to the acrylamide group and approached the control group values (P<0.005).

WBC, Lymphocyte, Monocyte, Eosinophiland PLT levels were decreased in the acrylmid group, while neutrophil counts were increased. WBC, Lymphocyte, Monocyte, and Eosinophil were found to be significantly higher in the acrylamide + L group compared to the acrylamide group, while the neutrophil level was found to be lower (p <0.05).

The hematopoietic system is one of the most sensitive systems to detect the harmful effects of drugs and toxins, so the determination of hematological parameters makes it necessary to use it widely (Mis et al.,2018; Mis et al., 2021). Acrylamide causes haematological toxic effects associated with oxidative stress and disturbances in the biological functions of the formed elements of the blood (Irısci and Yasar, 2022).

After exposure to acrylamide, it is absorbed in the organism and neurons, Hb and various essential enzymes also interact with DNA (Rayburn et al.,2010). In this study, we present experimental evidence showing changes in hematological parameters in acrylamide, toxicity and evaluate some hematological parameter levels and functional effects of acrylamide, and Allium schoenoprasum L.

Acrylamide has been used as an industrial material in the production of a substance called polyacrylamide. Therefore, it seems to be one of the main causes of occupational poisoning (Hashimoto and Aldridge, 1970). People can be exposed to this substance in their workplace or in their environment (Boettcher et al, 2005). In addition, acrylamide can be formed in the foodstuffs consumed. Acrylamide formation It is associated with high-temperature cooking processes when the amino acid asparagine reacts with sugars and for nutrient-rich nutrients. (Stadler et al., 2002; Claus and Shieber, 2008). Acrylamide levels as high levels (2.3 ppm) have been reported in potato chips and fries (Pedreschi et al., 2004). In various studies, oxidative stress, which may be caused by acrylamide in rat kidney and liver tissue, was investigated with in vivo and in vitro experimental models; From these studies, different findings were obtained depending on the route of administration and dosage in in vivo models (Awad et al., 1998; Yousef and El Demerdash, 2006). Various results from acrylamide is of great interest in the world.

Factors such as age, gender, pregnancy, exercise, region, environmental temperature, nutrition and diseases are effective on hematological parameters (Comba et al. 2016). In our study, hematological changes in rats occur as a physiological response to agents such as acrylamide. When we examined the hematological profile in rats exposed to acrylamide experimentally, it was found that it showed significant decreases.The decrease in Hb and RBCs levels in the acrylamide given groups indicated an anemic response. It can be explained as a decrease in hematopoiesis and subsequent anemia in rats exposed to ACR. The reason for the decrease in these parameters can be explained as the decrease in erythrocyte resistance resulting from Hb degradation and increased lipid peroxidation (Barber et.al.,2001). Many studies have shown that acrylamide increases oxidative stress (Dybing and Sanner, 2003; Yousef and El-Demerdash, 2006). Studies have shown that Allium schoenoprasum L. (Sirmo) has antioxidant,It has been reported that it is a plant with antiseptic and appetizing effects (Firat and Aziret, 2016;Ceylan et al., 2019).

It has been reported that acrylamide decreases the level of hemoglobin by interacting with the sulfhydryl groups in the hemoglobin structure, causing the destruction of heme and disorders in the iron level. Thus, anemia can be associated with acrylamide exposure (Gargas, 2009; Kaninigs, 2003) Since Allium schoenoprasum L. increases the plasma iron level (Yasar, 2022), the iron-related defect in erythrocyte production due to acrylamide may be eliminated.

As a result of studies on Allium schoenoprasum L. it has been reported that the plant has anti-inflammatory, antibacterial, antifungal, anthelmintic, antihypertensive and anticancer effects as well as a strong antioxidant effect (Haro et al., 2017). This herb contains vitamins A and C and small amounts of iron and sulfur. It has been determined that it has a cytotoxic effect on colon cancer cells. Although phytochemical studies reveal the presence of sulfur and phenolic compounds, flavonoids, saponins and steroidal glycosides, methodical studies are needed to identify bioactive compounds (Timite et al.,2013). It was determined that Allium schoenoprasum L. which is claimed to have such effects, increased the erythrocyte level in acrylamide exposure (Ma et al., 2014). Due to the antioxidant properties of this plant, it may have protected erythrocytes against lipid peroxidation products to which they are exposed.

The increase in RDW level in the acrylamide group was due to the deformity of erythrocytes due to iron deficiency. The cause of iron deficiency should be investigated. In rats exposed to acrylamide, iron inhibition may occur as a response, as well as a problem with iron absorption.

In addition, the decrease in MCV indicates iron deficiency. It can give us a clue to distinguish it from other anemia (Comba et.al 2016; Comba et al. 2020). The concomitant decrease in MCHC and MCV can be evaluated as a finding indicating iron deficiency.However, looking at the iron parameters is necessary to determine the defects in iron metabolism (Mis and Oğuz, 2021). In a study in which acrylamide was given to rats at different doses, it was stated that the levels of RBC, HCT, HGB decreased in the groups where the dose was increased (Ma,2014).

A decrease was observed in the levels of WBC, Lymphocytes, Monocytes, Eosinophils, RBC, PLT in the groups given acrylamide. The fact that these decreases are seen in all blood cells may be an indication of inhibition related to the bone marrow. It should be considered that the decrease in total leukocytes may be due to the fact that they are transferred to the tissues. It should also be considered that the increased neutrophil count will be the neutrophils that pass from the marginal pool to the circulation. Some physiological responses are expected to occur against acrylamide toxication.

Conclusion

Acrylamide, which we discussed in our study, is one of the important health problems. Increasing consumption of processed food provides exposure to acrylamide. It was determined that Allium schoenoprasum L plant had a healing effect on the levels of some blood parameters against the damage caused by acrylamide. Collectively, our findings provide valuable insight into the importance of using Allium schoenoprasum L. as a viable tool in protective toxicity mechanisms against the adverse effects that acrylamide can cause.

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