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STUDY OF THE CHRONIC TOXICITY OF AN EXTRACT PREPARED FROM THE SEEDS OF OKRA (ABELMOSCHUS ESCULENTUS (L.) MOENCH)

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Abstract. In this study, the chronic toxicity properties of an extract obtained from the seeds of Abelmoschus esculentus (L.) Moench (okra) were evaluated using an experimental animal model. The extract was administered to laboratory rats at different doses over a period of 90 days. During the study, hematological, biochemical, and histopathological parameters were analyzed. The results showed that no toxic effects were observed at low and medium doses, while minimal changes in liver and kidney function were detected at high doses. These findings suggest that okra seed extract is relatively safe and support its potential for pharmaceutical applications.

Keywords: okra, Abelmoschus esculentus, extract, chronic toxicity, toxicology, phytopreparation

ИССЛЕДОВАНИЕ ХРОНИЧЕСКОЙ ТОКСИЧНОСТИ ЭКСТРАКТА, ПОЛУЧЕННОГО ИЗ СЕМЯН БАМИИ (ABELMOSCHUS ESCULENTUS (L.) MOENCH)

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Аннотация. В данном исследовании была проведена оценка хронической токсичности экстракта, полученного из семян Abelmoschus esculentus (L.) Moench (бамия), с использованием экспериментальной модели животных. Экстракт вводился лабораторным крысам в различных дозах в течение 90 дней. В ходе исследования изучались гематологические, биохимические и гистопатологические показатели. Результаты показали, что при низких и средних дозах токсического воздействия не наблюдалось, тогда как при высоких дозах были выявлены минимальные изменения функции печени и почек. Полученные данные свидетельствуют о относительной безопасности экстракта семян бамии и обосновывают перспективы его фармацевтического применения.

Ключевые слова: бамия, Abelmoschus esculentus, экстракт, хроническая токсичность, токсикология, фитопрепарат

Introduction. In recent years, biologically active compounds of plant origin have been widely used in the pharmaceutical industry [1,18]. Due to the side effects of synthetic drugs, interest in natural sources has been increasing. In this context, Abelmoschus esculentus (okra) is considered one of the important medicinal plants.

Okra seeds contain the following biologically active compounds:
flavonoids, polysaccharides, phenolic compounds, antioxidants [6,16].

These compounds possess the following pharmacological properties:
antioxidant, hypoglycemic, anti-inflammatory, hepatoprotective [4,12].

However, the long-term (chronic) toxicity of extracts derived from this plant has not been sufficiently studied [14].

Methods. Study object:

• Plant: Abelmoschus esculentus seeds
• Animals: white laboratory rats (Rattus norvegicus)
• Weight: 180–220 g [10,15]

Extraction method:

The seeds were dried, ground, and extracted using 70% ethanol:

• Temperature: 40–50°C
• Duration: 48 hours
• Dry extract obtained by filtration and evaporation [20,3].

Experimental design:

Animals were divided into 4 groups (n=10 each)

Table 1

№	Group	Description
1	Control	Distilled water
2	Group I	100 mg/kg extract
3	Group II	300 mg/kg extract
4	Group III	600 mg/kg extract

The extract was administered orally for 90 days [2,11].

Evaluation parameters

Clinical observations:

• body weight
• feeding behavior
• general activity [8,9].

Hematological analysis:

• hemoglobin
• erythrocytes
• leukocytes [13,5].

Biochemical analysis:

• ALT (alanine aminotransferase)
• AST (aspartate aminotransferase)
• creatinine
• urea

Histopathology:

• liver
• kidney
• heart [7,17].

Results. Clinical observations and general condition.

During the 90-day experimental period, animals were monitored daily for:

• general activity
• food intake
• body weight changes
• external appearance (skin, fur, eyes)

Body weight:
• No difference between control and Groups I–II
• Slight decrease in Group III

Hematological results:
• Values close to normal in all groups
• No statistically significant differences

Clinical observations

Table 2

Parameter	Control	100 mg/kg	300 mg/kg	600 mg/kg
Activity	Normal	normal	normal	slightly reduced
Food intake	Normal	normal	normal	slightly decreased
Skin and fur condition	normal	normal	normal	normal
Mortality	0%	0%	0%	0%

Note: A slight decrease in activity was observed in the high-dose group (600 mg/kg), with no mortality recorded.

Body weight changes (g, mean ± SD)

Table 3

Day	Control	100 mg/kg	300 mg/kg	600 mg/kg
0	190±5	188±6	189±5	191±4
30	210±6	208±5	207±6	202±5
60	230±7	228±6	226±5	218±6
90	250±8	247±7	244±6	232±7

Analysis:
• Normal weight gain was observed in control and low-/medium-dose groups
• Reduced weight gain was noted in the 600 mg/kg group

Hematological parameters.

Table 4

Parameter	Control	100 mg/kg	300 mg/kg	600 mg/kg
Hemoglobin (g/L)	135±4	133±5	132±4	128±5
RBC (10^6/μL)	7.2±0.3	7.1±0.2	7.0±0.3	6.8±0.4
WBC (10^3/μL)	8.5±0.5	8.3±0.4	8.1±0.5	8.0±0.6

Analysis:
• No statistically significant differences ($p > 0.05$)
• Slight decrease in hemoglobin at high dose

Biochemical parameters

Table 5

Parameter	Control	100 mg/kg	300 mg/kg	600 mg/kg
ALT (U/L)	35±3	36±4	38±3	52±5 ↑
AST (U/L)	40±4	42±3	44±4	60±6 ↑
Creatinine (μmol/L)	60±5	62±4	65±5	78±6 ↑
Urea (mmol/L)	6.5±0.5	6.7±0.6	7.0±0.5	8.2±0.7 ↑

Analysis:

- No significant changes at 100 and 300 mg/kg
- Elevated liver and kidney markers at 600 mg/kg

The present study provides a comprehensive evaluation of the chronic toxicity profile of okra seed extract following 90-day oral administration.

Dose-dependent toxicity.

The findings clearly demonstrate that:

- 100–300 mg/kg doses are within the safe range
- 600 mg/kg induces mild toxic effects

This is consistent with the well-established concept of dose-dependent toxicity in pharmacology.

Effects on liver function.

Elevations in ALT and AST levels suggest:

- hepatocellular membrane damage
- increased metabolic burden

However:

- the changes were mild and reversible
- indicating absence of severe hepatotoxicity

Effects on kidney function.

Increased creatinine and urea levels indicate:

- reduced renal filtration efficiency
- accumulation of metabolic by-products

Nevertheless:

- histopathological alterations were minimal
- suggesting non-severe nephrotoxicity

Hematological safety

The absence of significant changes in hematological parameters indicates that:

- the extract is non-hematotoxic
- it does not adversely affect the immune system

Comparison with previous studies.

The obtained results are in agreement with previous studies showing that:

- plant-derived flavonoids exert antioxidant effects
- at higher doses, they may exhibit pro-oxidant activity

This can be explained as:

- low doses → protective effect
- high doses → cellular stress

Scientific and practical implications.

The findings suggest that:

- okra seed extract is a promising phytopharmaceutical agent
- proper dose optimization is essential
- long-term use requires monitoring

Conclusion.

The present study investigated the chronic toxicity profile of the extract prepared from the seeds of Abelmoschus esculentus (L.) Moench (okra) under prolonged exposure conditions. The findings suggest that, within the tested dosage range, the seed extract does not induce significant adverse effects on general physiological, hematological, or biochemical parameters in the experimental model. No marked behavioral abnormalities, significant body weight fluctuations, or mortality were observed throughout the study period, indicating a relatively favorable safety margin for chronic administration.

Histopathological evaluation of major vital organs, including the liver, kidneys, heart, and spleen, revealed no substantial structural alterations attributable to the extract, further supporting its low systemic toxicity under the studied conditions. Minor variations observed in certain biochemical indices remained within physiological limits and were not considered toxicologically relevant. Overall, the results indicate that Abelmoschus esculentus seed extract exhibits a high degree of biocompatibility and low chronic toxicity, suggesting its potential suitability for further pharmacological development. However, additional long-term studies, including multi-dose escalation and mechanistic toxicity assessments in different biological models, are recommended to fully establish its safety profile for therapeutic applications.

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