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Comparative Analysis of The Effects of Momordica Charantia Extract and Carsil On Liver Parameters in Experimental Hepatitis

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Abstract

This article examines the pharmacological properties of the dry extract of Momordica charantia fruit. **(1) Background**: The liver of young organisms in the prepubertal period is particularly vulnerable to toxic effects, and acute toxic hepatitis (ATH) remains a serious clinical and experimental problem. Natural hepatoprotectors such as Momordica charantia are of growing interest due to their antioxidant and cytoprotective properties. **(2) Methods**: An experimental study was conducted on prepubertal rabbits (0.5–0.55 kg, 2 months old). ATH was induced by a single administration of 50% CCl_4 (1.0 ml/kg). Animals were divided into 6 groups and treated orally for 6 days with Momordica extract (25, 50, or 100 mg/kg) or Carsil (40 mg/kg). Biochemical parameters (ALT, AST, ALP, total protein, albumin, total bilirubin) and endogenous intoxication indicators (sorption capacity of erythrocytes [SCE]; medium molecular peptides [MMP]) were assessed**. (3) Results**: Momordica extract at 100 mg/kg reduced ALT by 58.9%, AST by 42%, ALP by 45.8%, and MMP by 51.6% compared to the untreated control, surpassing Carsil in all key parameters. **(4) Conclusions**: Momordica charantia fruit extract at 100 mg/kg exhibits a pronounced dose-dependent hepatoprotective effect exceeding that of Carsil, and represents a promising natural phytohepatoprotective agent for toxic liver injury in young organisms.

Keywords: Momordica charantia, extract, acute toxic hepatitis, prepubertal period, hepatoprotector, Carsil, endogenous intoxication, SCE, MMP, biochemical parameters.

Introduction

The liver, as the body's major metabolic 'laboratory,' is responsible for neutralizing toxins—chemicals, drugs, and other substances—yet it is frequently damaged by these very agents, resulting in a condition known as toxic hepatitis [5, 7]. Acute toxic hepatitis (ATH) is one of the most common forms of liver injury, characterized by marked cytolysis, cholestasis, and impaired synthetic function of hepatocytes [2, 17]. ATH is also accompanied by pronounced endogenous intoxication, disruption of the liver's barrier function, activation of lipid peroxidation, and accumulation of toxic metabolites. Sorption capacity of erythrocytes (SCE) and the concentration of medium molecular peptides (MMP) are considered informative indicators of endogenous intoxication.

The liver of young organisms in the prepubertal period is particularly vulnerable to toxic effects, owing to functional immaturity of enzyme systems and high metabolic activity [1, 4]. Carbon tetrachloride (CCl_4) is one of the most well-studied hepatotropic toxicants, inducing lipid peroxidation and destruction of hepatocyte and mitochondrial membranes. Hepatoprotective agents are frequently used in pharmacotherapy for liver function disorders [3, 6]. Against this background, the search for effective phytohepatoprotectors with pronounced antioxidant and membrane-stabilizing properties is relevant. In our view, the medicinal plant Momordica charantia is one such candidate [9, 12].

Momordica (Momordica charantia) — also known as bitter melon or bitter gourd — is a genus of plants from the Cucurbitaceae family, cultivated in tropical and subtropical regions of Asia, Africa, and Australia. It contains a broad spectrum of biologically active compounds, including flavonoids, phenolic substances, cucurbitacins, and triterpenoids, with antioxidant, anti-inflammatory, and cytoprotective effects. Its fruits are rich in proteins (α and β momorcharins), triterpenoid glycosides, lectin, pectin, amino acids, and vitamins B and C [8, 9, 15]. Carsil (silymarin) is the standard reference hepatoprotector whose effectiveness is well established, making it the optimal comparator [5, 8].

The aim of this study was to evaluate the effect of various doses of Momordica charantia fruit extract on biochemical parameters and endogenous intoxication markers in prepubertal rabbits with experimental toxic hepatitis, and to compare the results with Carsil.

Methods

Experiments were performed on rabbits of both sexes weighing 0.5–0.55 kg at the prepubertal age of 2 months. The study was conducted in accordance with the European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes (ETS No. 123, Strasbourg, 1986) and regulatory documents of the Republic of Uzbekistan. Animals were kept in standard vivarium conditions with free access to water and food.

The dry fruit extract of Momordica charantia was obtained by maceration and standardized to a dry ethanol-water residue. ATH was induced by a single intragastric administration of 50% CCl_4 solution at 1.0 ml/kg. Twenty-four hours later, animals were divided into 6 groups: Group 1 — intact (healthy); Group 2 — control (untreated, received distilled water); Groups 3–5 — received Momordica extract at 25, 50, and 100 mg/kg, respectively; Group 6 — received Carsil at 40 mg/kg. All preparations were administered orally once daily for 6 days.

Two series of experiments were conducted. In Series 1, blood biochemical parameters (ALT, AST, ALP, total protein, albumin, total bilirubin) were measured using CYPRESS Diagnostics reagent kits (Belgium) and a BA-88A analyzer (Mindray, China). In Series 2, endogenous intoxication was assessed: SCE was determined photometrically; MMP level was assessed as total chromophoric compounds of intermediate metabolism. Statistical analysis was performed with Biostat 2009 using Student's t-test; $p<0.05$ was considered significant (M±m).

Result and Discussion

Administration of CCl_4 caused marked hepatocellular damage in the control group, reflected by a sharp increase in ALT (by 272.5%; $p<0.001$) and AST (by 133.4%; $p<0.001$) compared to intact animals (Table 1). Momordica extract at 25 mg/kg produced non-significant changes ($p>0.05$), while at 50 mg/kg, ALT and AST decreased by 34.9% and 26.1% ($p<0.001$), respectively. The 100 mg/kg dose produced the maximum effect: ALT fell by 58.9% ($p<0.001$) and AST by 42% ($p<0.01$), approaching intact values. Carsil reduced ALT and AST by 42.9% and 32.1%, respectively — weaker than the 100 mg/kg Momordica dose.

Table 1

Effect of Momordica Extract and Carsil on Blood Serum Biochemical Parameters in Prepubertal Rabbits with ATH

Groups	ALT (U/L)	AST (U/L)	ALP (U/L)	Total protein (g/L)	Albumin (g/L)	Total bilirubin (μmol/L)
1. Intact	50.63±2.96	101.51±5.35	228.31±11.08	70.28±2.48	31.88±0.75	1.44±0.11
2. CCl_4+H_2O (control)	188.68±10.63*	236.93±15.25*	533.33±19.76**	45.91±1.94*	21.05±0.65*	3.45±0.27*
3. CCl_4+Momordica 25 mg/kg	170.88±9.82*	218.62±16.48*	487.30±13.11*	50.08±1.42*	24.36±1.15**	3.17±0.34*
4. CCl_4+Momordica 50 mg/kg	122.85±11.91***	175.08±9.54***	426.51±16.32***	57.80±3.81***	26.13±2.36**	2.56±0.31*
5. CCl_4+Momordica 100 mg/kg	77.53±5.46***	137.47±11.53***	289.27±12.77***	66.40±1.76*	28.32±1.21*	1.98±0.19***
6. CCl_4+Carsil 40 mg/kg	107.80±6.92***	160.91±10.23***	362.81±37.82***	58.40±3.64***	27.26±2.16*	2.15±0.21***

Note: * — significant vs. intact group; ** — significant vs. control group ($p<0.05$)

ALP elevation in the control group (by 133.6%; $p<0.001$) reflected cholestatic liver damage. The 100 mg/kg Momordica dose reduced ALP by 45.8% ($p<0.001$) — the maximum effect — compared to a 31.9% reduction with Carsil ($p<0.002$). Total protein and albumin decreased by 34.7% and 33.9% in untreated animals; the 100 mg/kg dose restored these by 44.6% and 31.5%, respectively ($p<0.001$), outperforming Carsil (27.2% and 29.5%). Total bilirubin in the control group increased by 139.6% ($p<0.001$); Momordica at 100 mg/kg reduced it by 42.6% ($p<0.01$) vs. 37.7% with Carsil ($p<0.02$).

ATH caused a sharp rise in SCE by 47.1% ($p<0.001$) relative to intact animals, indicating pronounced endogenous intoxication (Table 2). Momordica at 25 mg/kg showed a non-significant 4.2% reduction. At 50 and 100 mg/kg, SCE decreased by 16.1% and 24.8% ($p<0.02$), respectively, compared to 22.5% with Carsil. MMP increased by 217.2% in the ATH control. Momordica at 25 mg/kg reduced MMP by only 10.0% ($p>0.05$); at 50 mg/kg — by 22.2% ($p<0.05$); at 100 mg/kg — by 51.6% ($p<0.001$), which was nearly twice the effect of Carsil (30.8%, $p<0.02$).

Table 2

Effect of Momordica Extract and Carsil on Endogenous Intoxication Indicators in Prepubertal Rabbits with ATH

Animal groups	SCE (%)	MMP (conv. units)
1. Intact (healthy)	53.88±2.54	22.45±1.4

2. ATH+H_2O (control)	79.25±2.23*	71.21±4.38*
3. ATH+Momordica 25 mg/kg	75.93±2.71*	64.10±4.8*
4. ATH+Momordica 50 mg/kg	66.45±2.92**	55.38±4.74**
5. ATH+Momordica 100 mg/kg	59.31±5.71**	34.43±2.86**
6. ATH+Carsil 40 mg/kg	61.37±2.68**	49.26±3.42**

Note: * — significant vs. intact group; ** — significant vs. control group ($p<0.05$)

These findings demonstrate that the dry Momordica charantia fruit extract exerts a pronounced dose-dependent hepatoprotective effect. The minimum dose (25 mg/kg) is insufficient for statistically significant protection. At 50 mg/kg, moderate improvement is observed. At 100 mg/kg, all studied parameters showed maximal recovery, approaching intact values and consistently surpassing Carsil across anti-cytolytic, anti-cholestatic, and detoxification effects. The superior activity of the 100 mg/kg dose is likely attributable to the combined antioxidant and membrane-stabilizing actions of the flavonoids, triterpenoids, and phenolic compounds present in the extract.

Conclusions

Momordica charantia fruit extract exhibits a pronounced, dose-dependent hepatoprotective effect in prepubertal rabbits with experimental acute toxic hepatitis. The dose of 25 mg/kg is ineffective; 50 mg/kg provides moderate improvement; and 100 mg/kg achieves the maximum therapeutic effect, surpassing the reference hepatoprotector Carsil in anti-cytolytic, anti-cholestatic, and detoxification parameters. Based on these results, Momordica charantia extract at 100 mg/kg can be recommended as a promising, natural, and accessible phytohepatoprotective agent for the correction of toxic liver damage in young organisms.

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