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Evaluation of biochemical markers in non-alcoholic fatty liver disease (NAFLD) before and after the use of Ursodeoxycholic Acid and their correlation with physiological parameters.

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Abstract:

Non-Alcoholic Fatty Liver Disease (NAFLD) represents one of the most common chronic liver disorders worldwide and is strongly associated with metabolic risk factors, including obesity, insulin resistance, dyslipidemia, and sedentary lifestyle. Early detection of NAFLD progression depends heavily on the assessment of ***biochemical markers*** *such as* ***ALT, AST, ALP, GGT, fasting glucose, lipid profile****, and non-invasive indices like* ***BMI, waist circumference,*** *and* ***blood pressure****.* ***Ursodeoxycholic Acid (UDCA)*** *has been explored as a hepatoprotective agent due to its ability to improve bile flow, reduce oxidative stress, stabilize hepatocyte membranes, and modulate inflammatory pathways. The present study evaluates the biochemical parameters of NAFLD patients before and after administration of UDCA and examines their correlation with physiological variables to determine therapeutic effectiveness. Patients clinically diagnosed with NAFLD based on ultrasonography and laboratory markers were enrolled and administered UDCA for a defined treatment period. Baseline biochemical profiles and physiological measurements were recorded, followed by reassessment after therapy. This prospective evaluation aims to quantify the degree of improvement across liver function markers and metabolic parameters, providing insight into how UDCA influences hepatic recovery. In addition, the study correlates biochemical changes with physiological indicators to determine whether improvements at the cellular level translate to measurable*

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systemic outcomes. Understanding this relationship is essential to improve the early detection, management, and monitoring of NAFLD progression. The study's findings are expected to provide supportive evidence for the therapeutic benefits of UDCA while identifying the biochemical markers most sensitive to treatment-related changes. Overall, this research contributes to improved clinical management and monitoring protocols for NAFLD in tertiary care settings.

Keywords:

NAFLD, Ursodeoxycholic Acid, biochemical markers, liver enzymes, physiological parameters, ALT, AST, hepatoprotection.

Introduction：

Non-Alcoholic Fatty Liver Disease (NAFLD) has emerged as one of the most prevalent liver disorders globally and is now recognized as a major public health concern due to its close association with metabolic syndrome. NAFLD encompasses a wide spectrum of hepatic abnormalities ranging from simple steatosis to non-alcoholic steatohepatitis (NASH), fibrosis, cirrhosis, and hepatocellular carcinoma. The rising prevalence is attributed to lifestyle transitions, increasing obesity rates, physical inactivity, and the global epidemic of type 2 diabetes mellitus. This chronic liver condition is characterized by excess accumulation of triglycerides within hepatocytes, leading to hepatocellular injury, inflammation, and in advanced stages, fibrosis. The assessment of NAFLD relies heavily on biochemical markers that reflect hepatic injury and metabolic dysfunction, including **alanine transaminase (ALT)**, **aspartate transaminase (AST)**, **alkaline phosphatase (ALP)**, **gamma-glutamyl transferase (GGT)**, fasting glucose, and lipid profile. In addition, physiological parameters such as **body mass index (BMI)**, **waist-to-hip ratio**, and **blood pressure** provide essential information on the metabolic status of affected patients. A comprehensive correlation between biochemical and physiological variables is therefore crucial for determining disease severity and evaluating therapeutic outcomes. **Ursodeoxycholic Acid (UDCA)**, a hydrophilic bile acid, has gained clinical relevance due to its cytoprotective, anti-inflammatory, antioxidant, and immunomodulatory effects. UDCA has been used in various cholestatic liver diseases and has shown potential benefits in improving biochemical markers and reducing hepatic fat accumulation in NAFLD. Its mechanism of action involves enhancement of bile acid secretion,

reduction of endoplasmic reticulum stress, stabilization of mitochondrial membranes, and suppression of apoptotic pathways. Despite these beneficial properties, evidence regarding its efficacy in NAFLD remains variable, necessitating further clinical evaluation. The present study aims to investigate the impact of UDCA therapy on biochemical markers of liver injury in NAFLD patients and determine their association with physiological indicators. A systematic comparison of pre- and post-treatment profiles will help identify the most sensitive biomarkers for monitoring therapeutic response. Understanding these relationships will contribute to improving diagnostic accuracy and optimizing treatment strategies for NAFLD patients in a tertiary care environment.

Materials and Methods :

This prospective observational study was conducted in the Departments of Pharmacology and Physiology at Rama Medical College, Hospital & Research Centre, Hapur, India, from **12 February 2024 to 25 March 2025**. Ethical approval was obtained prior to commencement, and informed consent was taken from all participants. Patients clinically diagnosed with NAFLD based on ultrasonographic evidence of hepatic steatosis and elevated biochemical markers were included. Exclusion criteria involved chronic alcohol intake, viral hepatitis, autoimmune liver disease, pregnancy, prior hepatotoxic drug use, or other metabolic liver conditions. A structured proforma was used to collect demographic details, medical history, lifestyle factors, and baseline physiological parameters including body weight, BMI, waist circumference, hip circumference, systolic and diastolic blood pressure, and pulse rate. Baseline biochemical tests included **ALT, AST, ALP, GGT, fasting glucose, total cholesterol, HDL, LDL, triglycerides**, and **serum bilirubin**. Selected non-invasive hepatic fibrosis indices such as **FIB-4** and **NAFLD fibrosis score** were also computed where applicable. After baseline assessment, all participants were administered **Ursodeoxycholic Acid (UDCA)** in standard therapeutic doses (10–15 mg/kg/day), divided into two doses daily. Compliance was monitored through follow-ups and patient medication diaries. Dietary and lifestyle advice, including increased physical activity and reduction of saturated fats, was provided uniformly to all patients to minimize external variance. Participants were evaluated at pre-defined intervals throughout the study period. Repeat biochemical and physiological assessments were conducted after UDCA therapy to determine therapeutic changes. The primary outcome measured was the reduction in liver enzyme levels, particularly ALT and AST, as indicators of hepatocellular injury. Secondary outcomes included improvements in

metabolic markers such as fasting glucose and lipid profile, and changes in physiological variables like BMI and waist circumference. Data were statistically analyzed using paired t-test and correlation coefficients to evaluate the strength of association between biochemical improvements and physiological changes. A p-value <0.05 was considered statistically significant. The observation methodology ensured standardized measurement procedures for laboratory and clinical assessments, maintaining reliability and minimizing bias across study stages. All data were maintained confidentially and were cross-verified for accuracy.

Results :

Following UDCA therapy, significant improvements were observed in key biochemical markers of liver function. ALT and AST levels showed a marked reduction, indicating decreased hepatocellular injury. ALP and GGT also demonstrated improvement, reflecting better bile flow and reduced cholestatic stress. Fasting glucose and triglyceride levels showed noticeable decline, while HDL levels improved modestly. Physiological parameters such as BMI and waist circumference decreased in a majority of participants, suggesting enhanced metabolic regulation. Blood pressure values showed mild improvement, particularly in patients who adhered to dietary recommendations. Correlation analysis revealed that reductions in ALT and AST strongly matched improvements in BMI and waist circumference, indicating that hepatic recovery and metabolic changes progressed simultaneously. Patients with higher baseline severity showed the most pronounced changes. Overall, UDCA demonstrated measurable therapeutic benefits.

Discussion:

This study highlights the positive impact of UDCA on hepatic biochemical markers in NAFLD patients and establishes a clear correlation between biochemical and physiological improvements. UDCA's antioxidant and cytoprotective effects likely contributed to the reduction in liver enzyme levels. Physiological improvements indicated enhanced systemic metabolic function. While UDCA showed beneficial outcomes, lifestyle modifications also played a contributory role. Long-term studies may be required to assess sustained efficacy and fibrosis reversal.

Summary:

The study demonstrates significant improvement in liver biochemical markers and physiological parameters in NAFLD patients following UDCA therapy. ALT, AST, ALP, GGT, fasting glucose, and lipid levels showed favorable changes, while BMI and waist circumference decreased, indicating improved metabolic regulation. Strong correlations between biochemical and physiological indicators confirm UDCA's therapeutic potential. These findings support the use of UDCA as a beneficial adjunct in NAFLD management.

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