Examination of the Effects of Chromium Levels on Glucose Metabolism, Lipid Metabolism, Morbidity and Mortality Rates in Patients Followed in Intensive Care Unit

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This study was approved by the Hacettepe University Non – Interventional Clinical Research Ethics Committee on July 25, 2023, with the reference number GO 23/488 (Decision Number: 2023/13 – 54) and was supported by the Hacettepe University Scientific Research Projects Coordination Unit (Project Number: 21026). The study is non – interventional, prospective, and observational. It included 309 patients followed in the Anesthesiology Intensive Care Unit of Hacettepe University Hospital between February 7, 2024, and August 8, 2024.

Study Location

The evaluation of patients for eligibility, recording of parameters, and collection of blood samples were conducted in the Anesthesiology Intensive Care Unit of Hacettepe University Hospital.

Lipid profile and HbA1c measurements were performed in the Department of Biochemistry Laboratory of the same hospital. Blood samples for chromium measurement were also stored in this laboratory before analysis.

Blood chromium levels were measured at the Department of Pharmaceutical Toxicology, School of Pharmacy, Hacettepe University.

Study Population, Sample, and Research Group

Inclusion Criteria

- Age ≥ 18 years,
- Being followed up in the Anesthesiology Intensive Care Unit of Hacettepe University Hospital,
- Availability of required data (medical history, laboratory results, etc.) for analysis,
- Not taking chromium supplements.

Exclusion Criteria

- Age < 18 years,
- Refusal to participate in the study,
- Taking chromium supplements.

Research Method and Data Collection Tools

Data of patients meeting the inclusion criteria in the Anesthesiology Intensive Care Unit were obtained from: blood samples sent to the laboratory during the patient's stay, medical history collected from the patient or relatives, and nurse follow – up forms. The patients were followed up by Dr. Oğuzhan KAHVECİ during their stay, with data recorded both physically and digitally. Blood samples were sent to the laboratory weekly, starting from the patient’s admission.

Data Collection

Data Collection

Parameters shown in Table 1 were monitored throughout the ICU stay.

Table 1. Data Collection Form

Parameters	Timing
Date	Upon Admission and Weekly
Age	Upon Admission
Gender	Upon Admission
Height (cm)	Upon Admission
Weight (kg)	Upon Admission
Body Mass Index (BMI)	Upon Admission
Comorbidities	Upon Admission
Reason for ICU Admission	Upon Admission
SOFA Score	24 Hours Post-Admission
APACHE – II Score	Upon Admission
Nutritional Status	During Stay
Triglycerides (mg/dL)	Upon Admission and Weekly

Parameters	Timing
HDL (mg/dL)	Upon Admission and Weekly
LDL (mg/dL)	Upon Admission and Weekly
VLDL (mg/dL)	Upon Admission and Weekly
Total Cholesterol (mg/dL)	Upon Admission and Weekly
HbA1c (%)	Upon Admission
Blood Glucose (mg/dL)	Daily During Stay
Coefficient of Variation (CV) (%)	During Stay
Blood Chromium Level (µg/L)	Upon Admission and Weekly
ICU Stay Duration	Throughout ICU Stay
Post-Discharge Outcome (Discharge, Transfer, Death)	Upon Discharge
Hospital Stay Duration	ICU and Ward Duration

Power Analysis

Based on a study by Chen et al., which examined plasma chromium levels in relation to metabolic syndrome components in a large patient group, the effect size (Cohen's D) was calculated as 0.202. With a 0.05 error margin and 0.95 power, the minimum sample size required to detect significant differences in repeated measures was calculated as 277. The sample size estimation was performed using G*Power 3.1.9.7.

Blood Sample Analysis

Capillary Blood Glucose

Measurements (mg/dL) taken from fingertip blood by nurses using FreeStyle Optium Neo H glucometer and Abbott Blood Glucose Test Strips.

Lipid Profile

Triglycerides (mg/dL), Total Cholesterol (mg/dL), HDL (mg/dL), LDL (mg/dL), and VLDL (mg/dL) were analyzed in the Beckman Coulter AU 5800 device in the Biochemistry Laboratory.

HbA1c

Analyzed (%) using the Tosoh G11 device in the Biochemistry Laboratory.

Blood Chromium Level

Analyzed (µg/L) using the Thermo Scientific iCAP Q ICP – MS device in the Department of Pharmaceutical Toxicology, School of Pharmacy.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics 25 © Copyright SPSS Inc. 1989, 2017. Normal distribution of continuous variables was examined using Kolmogorov – Smirnov and Shapiro – Wilk tests, depending on sample size. Categorical variables were presented as frequency (n) and percentage (%), and continuous variables were expressed as mean ± standard deviation (SD), median (IQR 25 – 75), and minimum – maximum values. Mann – Whitney U test, a non – parametric test, was used for analyzing independent two – group data as the data did not show normal distribution. Pearson Chi – Square Test, Fisher's Exact Test, Fisher's Freeman – Halton Exact Test, Yates' Correction, and Post – Hoc Bonferroni adjustments were used for independent categorical variable analysis. For correlation analysis between continuous variables, Spearman Rho Correlation Analysis was applied. Friedman Test and Post – Hoc Bonferroni adjustments were used for comparing dependent variables in more than two groups when parametric test assumptions were not met. Statistical significance was set at 0.05.