Course Title: Statistical Methods in Physiological Research

Course Description

This course provides students with the essential statistical methods required for designing and analyzing data in physiological research. It focuses on moving beyond descriptive statistics to inferential techniques used for comparison. Students will learn to choose, perform, and interpret appropriate statistical tests for common experimental designs in physiology, with a practical introduction to statistical software (SPSS).

General Course Objectives

Upon successful completion of this course, students will be able to:

1. Understand the rationale for selecting specific statistical tests based on research design and data type.
2. Perform, interpret, and report the results of One-Way and Two-Way Analysis of Variance (ANOVA).
3. Apply correlation and linear regression analysis to assess relationships between physiological variables.
4. Utilize common non-parametric tests when data do not meet parametric assumptions.
5. Conduct standard tests for categorical data (e.g., Chi-square, Fisher's Exact Test).
6. Understand the principles of standardization and sample size calculation.
7. Implement basic statistical analyses using software (SPSS) and interpret the output.
8. Critically evaluate the statistical methods used in published physiological literature.

Detailed Course Schedule and Content Outline (34 Hours)

Review & Foundations
Review of Descriptive Statistics
Comparing Quantitative variables in Two Independent Groups (t-tests recap)
Introduction to Statistical Software (SPSS) Environment
Refresh core concepts. Perform independent and paired samples t-tests using software. Navigate SPSS interface.

One-Way Analysis of Variance (ANOVA)
Independent samples and completely randomized design
Multiple Comparisons (Post-hoc tests)
Understand the logic of ANOVA. Test for differences among ≥3 group means.
Interpret post-hoc test results.

Two-Way Analysis of Variance (ANOVA)
Grouping by two factors without replication (Randomized Complete Block Design)
Grouping by two factors with replication (Factorial Experiments)
Analyze effects of two independent variables and their interaction.
Distinguish between block and factorial designs.

Correlation and Linear Regression
Concept of dependence between two variables
Linear Correlation (Pearson's r)
Simple Linear Regression
Calculate and interpret correlation coefficients.
Fit a regression line, interpret slope and intercept.
Predict outcomes.

Common Applications of Tests
Goodness-of-fit test
Test of homogeneity in contingency tables
Test of independence in contingency tables (Chi-square)
Fisher's Exact Test
McNemar's Test
Analyze categorical (frequency) data.
Choose the correct test for different contingency table scenarios.

Non-Parametric Statistics & Final Topics
Simple Non-Parametric Tests (e.g., Mann-Whitney U, Kruskal-Wallis)
Standardization of Indices and Their Tests
Principles of Sample Size Calculation
Apply alternatives to t-tests and ANOVA when assumptions are violated. Understand the purpose of standardization. Grasp the factors influencing required sample size.

Comprehensive Review & Case Studies
Integrate knowledge to select tests for complex physiological research scenarios.