Nutritional Physiology and Biochemistry

Statistical Analysis

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# Abstract:

**Objective:**

To evaluate whether or not factors such as age, BMI, Sex, Body fat, Body Mass, etc. influence blood glucose levels in the body and to determine the effectiveness of using continuous glucose monitoring in this participant. Furthermore, the purpose of this study was to examine the impacts of age and mass index (BMI), Sex, Fat, Mass on blood glucose.

**Methods:**

An analytical observation utilising an experimental approach to gather data in a certain format, but keep in mind that the volunteers for this research strictly follow the directions that were provided to them, such as no food or drink in the morning for the blood glucose test (N=32) as the study design. The study enlisted the participation of 26 women and three males aged 20 to 40.

**Result:**

Based on the statistical test, age, BMI, sex, fat, and mass all had a direct influence on blood glycose levels.

**Conclusion:**

Being older has a direct influence on rising blood glucose levels. Maintaining a normal BMI as women age is useful in reducing blood glucose increases. Furthermore, fat and mass had an effect on blood glucose levels in the body, laying the framework for future investigations employing continual glucose monitoring in these volunteers.

# Introduction:

It is critical to keep your blood sugar levels as close to normal as possible to help avoid or delay long-term, major health concerns such as heart disease, eyesight loss, and kidney disease. Staying inside your target range will also assist enhance your energy and attitude while you search for the true meaning of something 3. Age, increasing body mass index, and high blood pressure have all been recognized as risk factors for postprandial hyperglycemia 1. We collect data on blood glucose reactions in a cohort of food and nutrition students, as well as other information, and the major goal of this project is to examine this blood data to discover if blood glucose responses are impacted by parameters such as gender, BMI, body fat, and so on. We may discover in our study that the blood glucose response to a sugary drink differs from that of a placebo, but how can we determine whether there is a relevant difference? A suitable statistical test can be used to explore this moreover data analysis gives us a more inside knowledge of the glucose response based on body mass, body composition, biological sex, age. To select T-Test, One-Way ANOVA, and Normality of Data to determine whether there are any statistically significant differences in the mean of three or more independent variables by observing the p-value; additionally, to investigate whether variations, or different levels of that factor, have a measurable effect on a dependent variable 2.

# Experimental methods:

An experimental method is scientific research in which a hypothesis is tested 4. An experiment involves manipulating an independent variable in our case Age, BMI, Sex, Mass, Fat, Baseline, IAUC was take part and measuring the dependent variable in our case Blood glucose; any extraneous factors are controlled.

## Study design:

We used quantitative data analysis in this worked by gathering data from participants following certain fundamental guidelines and regulations with their ethical consent. Data analysis in quantitative research will require detecting common patterns among numerical data and critically assessing them in order to attain study aims and objectives. Quantitative research methods are frequently used in public health research and assessment to evaluate the requirements of a community or population, investigate correlations between numerous factors, and compare outcomes across demographic subpopulations 2.

## Participants:

In order to participate in the study, volunteers from each practical class were required. A 50 g glucose solution must be acceptable to the participants. For us to determine how the drink affected the level of glucose in a person's blood, participants must also be willing to give a series of extremely small finger prick blood samples. The day before the practical session, anybody participating in it must fast the previous night and refrain from eating anything. On the morning of the practical sessions, participants may drink water but not any other liquids. We deliberately avoided the participant who had a fear of blood and had diabetes Moreover, The pre-screening health questionnaire and informed consent papers must been completed by participants.

## Measurements:

The individual may take all measures themself or had another student did so. You must wear gloves and could been required to put on an FFP2 masked if you as were measured another student. We take measurements of their weight, body composition, waist and hip circumferences, height, and degree of physical activity. Biological sex and age of each participant was also required to been recorded (if the participant was happy to provided this information). With the helped of the stadiometer and Tanita body composition analyzer, we were able to take these measures. Additionally, we cleaned it before and after used with the offered alcohol wipes. Gathered the sample in a biosen glass capillary tube, placed the capillary tube into a mixing tube made of plastic, and then seal the tube. the closed mixing tube should been inverted ten times before being inserted into the biosen c line automated analyser in the designated rotor area. To got an accurate measurement, the tube must been well mixed. The next stepped entails that participant drink some glucose. The drink must been finished in no more than 10 minutes. Following that, we must collected further fingerstick blood samples at 15, 30, 45, 60, 90, and 120 minutes after the individual began ate their glucose drink. We capture all of the aforementioned data in a customized manner(Appendix 1), and during the practical, we ensure that our participants complete the International Physical Activity Questionnaire (IPAC)(appendix 2).

## Statistical analysis:

We may discover in our study that the blood glucose response to a sugary drink differs from that of a placebo, We need to know how probable the results may have been seen if the null hypothesis was correct. The P-Value is used to test hypotheses. It indicates the statistical significance of a value. The p-value indicates whether or not a null hypothesis is correct. It may be quantified using a significance scale ranging from 0 to 1. The lower the p-value, the more likely the null hypothesis is wrong. (This suggests that the alternative hypothesis has a better likelihood of being correct.) The lower the p-value, the less likely the null hypothesis is to be incorrect. A p-importance value's may be judged on three levels 2.

* Statistically significant: equal to or less than 5% (0.05)
* Significant: Between 0.05 (5%) and 0.10 (10%)
* Significant: more than 0.10 (10%)

In our case the P value is less than 0.05 in T-Test and One-Way ANOVA which means null hypothesis is incorrect.

# Result:

In this section, we will go through each variable in detail using statistical nomenclature such as Mean, Median, Mode, SD, CI, and so on. Before delving further, we must remove any data or variables that do not affect blood glucose levels, such as ID. This column is not required for data analysis because it is a unique and discrete (identifier) variable. Furthermore, it has no effect on blood glucose levels.

Dataset Summary:

After cleaning, the data set comprises 32 items, indicating that 32 people participated in our experimental data collecting.

**Variables:**

Age:

* Type: Discrete Numeric Variable
* Description:

The participant's age in years. The youngest person in this dataset is 21 years old, while the oldest is 37 years old. The 25-year-old age group has the most involvement (21.9%), followed by the 23-, 24-, and 26-year-old age groups, and we only have one member who is 37 years old.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Descriptive Statistics** | | | | | | | | | | | | | |
|  | N | Range | Minimum | Maximum | Mean | | Std. Deviation | Variance | Skewness | | Kurtosis | |
| Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic | Statistic | Statistic | Std. Error | Statistic | Std. Error |
| Age | 32 | 16.00 | 21.00 | 37.00 | 26.5000 | .80322 | 4.54369 | 20.645 | 1.050 | .414 | .106 | .809 |
| Valid N (listwise) | 32 |  |  |  |  |  |  |  |  |  |  |  |

Chart, histogram

Description automatically generated

Sex:

* Type: Categorical Variable
* Description:

The participant's gender If volunteers do not hesitate, we gather this information; moreover, we translate it to numerical form, which is male = 2 and female = 1, to make the computational calculation easier. We had 26 girls (71.9% of the total) and just 6 males engage in this activity. F and f stands for female nomination, or as we like to call it, a human error while filling out the data table.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Descriptive Statistics** | | | | | | | | | | | | | |
|  | N | Range | Minimum | Maximum | Mean | | Std. Deviation | Variance | Skewness | | Kurtosis | |
| Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic | Statistic | Statistic | Std. Error | Statistic | Std. Error |
| SexCategory | 32 | 1.00 | 1.00 | 2.00 | 1.1875 | .07010 | .39656 | .157 | 1.681 | .414 | .877 | .809 |
| Valid N (listwise) | 32 |  |  |  |  |  |  |  |  |  |  |  |

Chart, pie chart

Description automatically generated

Mass:

* Type: continuous variables
* Description:

The body mass of the participants is measured in kilogrammes; we have two volunteers who weigh 62.4kg; moreover, the smallest weight is 47.9kg and the greatest weight is 98.6kg.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Descriptive Statistics** | | | | | | | | | | | | | |
|  | N | Range | Minimum | Maximum | Mean | | Std. Deviation | Variance | Skewness | | Kurtosis | |
| Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic | Statistic | Statistic | Std. Error | Statistic | Std. Error |
| Mass | 32 | 50.70 | 47.90 | 98.60 | 62.4562 | 1.94410 | 10.99751 | 120.945 | 1.309 | .414 | 2.436 | .809 |
| Valid N (listwise) | 32 |  |  |  |  |  |  |  |  |  |  |  |

Chart, histogram

Description automatically generated

BMI:

* Type: continuous distributed variable
* Description:

To make computational calculations easier, we classified Body Mass Index as 25> = 2 and 25 = 1.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Descriptive Statistics** | | | | | | | | | | | | | |
|  | N | Range | Minimum | Maximum | Mean | | Std. Deviation | Variance | Skewness | | Kurtosis | |
| Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic | Statistic | Statistic | Std. Error | Statistic | Std. Error |
| BMI | 32 | 11.80 | 18.50 | 30.30 | 23.7455 | .57014 | 3.22518 | 10.402 | .356 | .414 | -.830 | .809 |
| Valid N (listwise) | 32 |  |  |  |  |  |  |  |  |  |  |  |

Chart, histogram

Description automatically generated

Body Fat:

* Type: Continuous Variable
* Description:

We calculated the fat %. We record a minimum body fat of 9.9% and a maximum of 39%, and we have 32 different entries.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Descriptive Statistics** | | | | | | | | | | | | | |
|  | N | Range | Minimum | Maximum | Mean | | Std. Deviation | Variance | Skewness | | Kurtosis | |
| Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic | Statistic | Statistic | Std. Error | Statistic | Std. Error |
| Fat | 32 | 29.10 | 9.90 | 39.00 | 29.0562 | 1.23699 | 6.99746 | 48.964 | -.937 | .414 | .451 | .809 |
| Valid N (listwise) | 32 |  |  |  |  |  |  |  |  |  |  |  |

Chart, histogram

Description automatically generated

Base Line:

* Type: Continuous Variable
* Description:

We measured blood glucose levels in millimol/L for this measurement, which was taken prior to ingesting the 50g glucose drink. We recorded a maximum baseline of 5.79 and a lowest of 2.56. Furthermore, we have 31 unique values, yet the interquartile range is 0.625.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Descriptive Statistics** | | | | | | | | | | | | | |
|  | N | Range | Minimum | Maximum | Mean | | Std. Deviation | Variance | Skewness | | Kurtosis | |
| Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic | Statistic | Statistic | Std. Error | Statistic | Std. Error |
| BL | 32 | 3.14 | 2.65 | 5.79 | 4.5053 | .11547 | .65322 | .427 | -.847 | .414 | 1.657 | .809 |
| Valid N (listwise) | 32 |  |  |  |  |  |  |  |  |  |  |  |

Chart, histogram

Description automatically generated

IAUC:

* Description:

Incremental area under the curve is been already get calculated.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Descriptive Statistics** | | | | | | | | | | | | | |
|  | N | Range | Minimum | Maximum | Mean | | Std. Deviation | Variance | Skewness | | Kurtosis | |
| Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic | Statistic | Statistic | Std. Error | Statistic | Std. Error |
| iAUC | 32 | 396.34 | 46.66 | 443.00 | 194.6878 | 15.60156 | 88.25575 | 7789.078 | .589 | .414 | .635 | .809 |
| Valid N (listwise) | 32 |  |  |  |  |  |  |  |  |  |  |  |

Chart, line chart

Description automatically generated

After gaining in-depth knowledge of the aforementioned variables, also known as exploratory data analysis, we can determine how much data is present and its mean, skewness, standard deviation, variance, and so on. Furthermore, to determine the significance of these variables, we use statistical tests such as the Normality of Data, Independent (Two Samples) T-Test, and One-Way ANOVA.

## Normality of Data:

I discovered the following P-Values based on data normality (Sig. Shapiro-Wilk). Variables such as Age, BMI, Sex, Mass, and Fat failed the false hypothesis test or should be rejected (Statistically Significant), while Baseline and IAUC did not reject the null hypothesis.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Tests of Normality** | | | | | | |
|  | Kolmogorov-Smirnova | | | Shapiro-Wilk | | |
| Statistic | df | Sig. | Statistic | df | Sig. |
| Age | .263 | 32 | <.001 | .862 | 32 | <.001 |
| SexCategory | .494 | 32 | <.001 | .478 | 32 | <.001 |
| Mass | .129 | 32 | .189 | .909 | 32 | .010 |
| BMIcategory | .434 | 32 | <.001 | .585 | 32 | <.001 |
| Fat | .142 | 32 | .102 | .930 | 32 | .038 |
| BL | .122 | 32 | .200\* | .947 | 32 | .120 |
| iAUC | .095 | 32 | .200\* | .969 | 32 | .461 |
| \*. This is a lower bound of the true significance. | | | | | | |
| a. Lilliefors Significance Correction | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  | | | | | | | | | | | | |
|  | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | | | |
| F | Sig. | t | df | Significance | | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| One-Sided p | Two-Sided p | Lower | Upper |
| iAUC | Equal variances assumed | .743 | .396 | 2.429 | 30 | .011 | .021 | 90.22705 | 37.14370 | 14.36950 | 166.08460 |
| Equal variances not assumed |  |  | 2.927 | 9.699 | .008 | .016 | 90.22705 | 30.82376 | 21.25711 | 159.19699 |

## Independent (Two Samples) T-Test:

The P value for this test with just two samples (IAUC, Sex) is less than 0.05, indicating that the null hypothesis should be rejected.

## One-Way ANOVA:

The P-Value for the One-Way ANOVA test (IAUC and IPAC) is less than 0.05, and this test likewise rejects the null hypothesis.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ANOVA** | | | | | |
| iAUC | | | | | |
|  | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 62906.722 | 2 | 31453.361 | 5.109 | .013 |
| Within Groups | 178554.698 | 29 | 6157.059 |  |  |
| Total | 241461.419 | 31 |  |  |  |

# Discussion:

In this work, we are attempting to examine quantitative data collected from experimental bases. Quantitative data and analysis may be used to produce compelling evidence, but comprehending and interpreting data requires a fundamental awareness of the use and misuse of methodologies 3. After recording that data in a specific manner, we must determine whether or not that factor has an effect on blood glucose levels. Furthermore, in order to analyse this, we must perform some statistical tests to determine the significance of the variable 2. Before entering into the hypothetical test, we must first understand the data, so I try to understand the mean, mode, or standard deviation, as well as many other factors. After rigorously examining the test on the two variables, I discovered that there is a solid, consequential association between IAUC and Sex in the T-test, and the same for IAUC and IPAC in the One-Way ANOVA. If I get the opportunity to research this again, I would like to gather more data and try to perform some regression analysis to discover the probability answer for the glucose level reduction. Finally, I would like to collect some more data without creating human error. This study's design was adequate for understanding the fundamentals of body variables that impact blood glucose levels.

# Conclusion:

In this Data Analysis, we do three tests: Normality of Data, T-test, and One-Way ANOVA. All of these statistical tests were performed to determine whether or not two or more variables are connected with each other by monitoring the p-values. I chose seven variables for the normality test, and I see that Age, Sex, Mass, BMI, and Body Fat are statistically significant, but the baseline and IAUC are not. Furthermore, T-Test and One-Way ANOVA conclude statistical significance with the two factors, indicating that the data favours the alternative hypothesis. Age, sex, mass, BMI, and body fat should all raise blood glucose levels in the body, with women being more vulnerable. Furthermore, greater age had a direct influence on blood glucose levels.

# Acknowledgements:

"God, thank you for providing me with the strength and encouragement I needed to complete this Data Analysis."

First and foremost, I would like to thank my instructors, for their patience, inspiration, and support during my lab and related research. I'd also want to thank the rest of the staff and team at The University of Sheffield Hallam's School of Computing, Science, and Engineering for their insightful remarks and support during this data analysis and experimental effort. I would like to thank everyone who helped with the validation and who took part in the survey for this study. The initiative would not have been a success without their kind cooperation and input. Thank you very much.

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# Appendix:

Appendix 1:



Appendix 2:



Appendix 3:

All SPSS software working Doc directly imported from the spss

