

Experimental Design and Data Analysis: Calcium, inorganic phosphorus and alkaline phosphatase levels in elderly patients

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June 4, 2015

1 Introduction

In this paper the process of analysing a certain dataset is laid out. The dataset used is calcium.dat, which can be found at http://www.amstat.org/publications/jse/jse_data_archive.htm. This dataset is used for this project is because it has a good number of entries and enough features to be able to do data analysis on. In the rest of this paper the experiment is explained, the data is analysed, the found results are shown and all of this will be discussed at the end. In the appendix the used R code is shown.

2 The Experiment

The experiment that was set up had as goal to see if age and sex has an influence on certain concentrations in the body. The concentrations that were measured are:

- Alkaline Phosphatase International Units/Liter
- Calcium mmol/L
- Inorganic Phosphorus mmol/L

There are 6 different labs from which the data is extracted. Next to these features, the sex, age, agegroup and patient observation number are recorded. In the calcium.dat the original data is stored with errors, in calciumgood.dat the data is already cleaned up. In this project only the calcium.dat data is used to explain how the cleaning up of the data is done. The research question we want to answer is: What influence does age have on the given concentrations in the body?

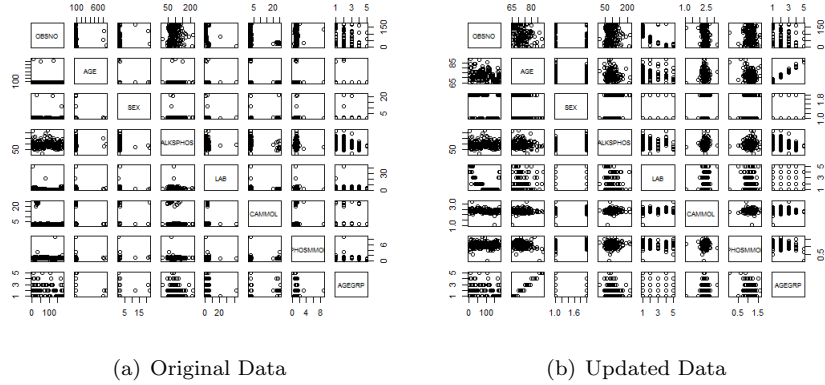


Figure 1: Pairsplot of the data

3 Data Analysis

3.1 Preparation

The data needed to be prepared to be able to read it in R. This preparation exists of replacing the empty fields by an underscore, with this the data can be read in R. First off a pairs plot was made of the data to be able to see how the data relates to each other. In Fig1(a) the foremost problem is clear, the outliers in the data are big and unlogical. Furthermore has Lab more than 6 categories, these problems can be explained by human error. And lastly the lab 3 has strange measurements with the cammol, this might be because of confusion of the measurement unit. The following values were changed:

- Removed Ages over 110
- Removed Sex which is not in the category 1 or 2
- Removed Lab categories which are over 6
- Removed Phosmmol over 2
- Divided Cammol of Lab 3 by 10 (this is visually tested by using a pairs plot)

After removal the same plot is made, see: Fig1(b). Here you can see the correlations between the features better than in Fig1(a).

3.2 Analysis

The feature that needs to be analyzed is age, this can be done by either using the feature age or the feature age group. The age group exists of 5 levels and is thus

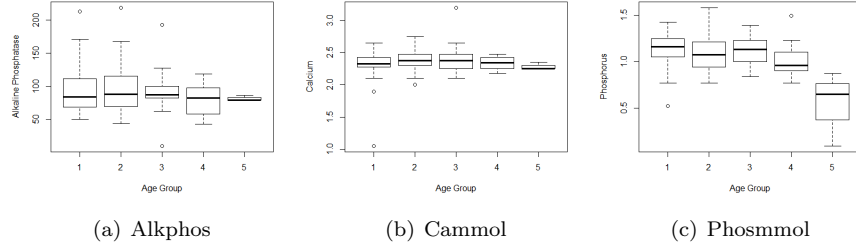


Figure 2: Boxplots of the concentrations with the age groups

Table 1: The number of patients per age group

Groups	1	2	3	4	5
Patients	56	70	38	10	3

categorical. The different age groups are: 1=65-69, 2=70-74, 3=75-79, 4=80-84, 5=85-89 Years. In Fig2 the relation between the different concentrations and the age groups are visually represented.

There is some difference between the different age groups with all of the concentrations. But with Alksphos the difference only seems to be in the variety of the values, the same holds for Cammol. For Phosmmol there does seem to be a difference in the age groups, the median drops with the older ages. The difference in the first two concentrations is because of the number of people in the different age groups, see Table1. This shows that there are only three patients in the last age group and not too much in the group before that. This explains that the variety seems to lower with the higher age groups. For the rest of the analysis the last age group can be discarded, because it has not enough data to be able to analyze.

To see if sex, lab and age have an influence on the concentrations, the interaction plots in Fig3 and Fig4 are made. This shows that all three features have an influence on the measured concentrations.

Next a simple step down linear regression is run on the data.

4 Results

Don't think this section is necessary.

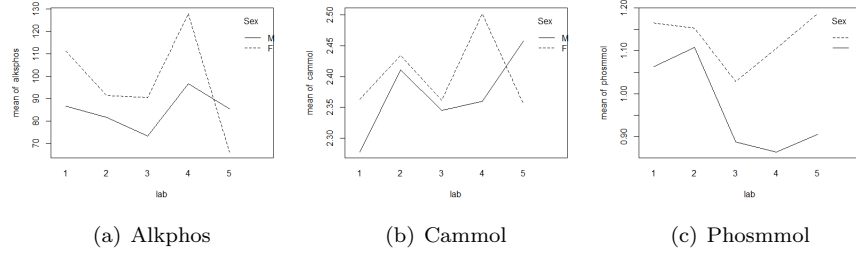


Figure 3: Interaction plots of the sex and labs of the different concentrations

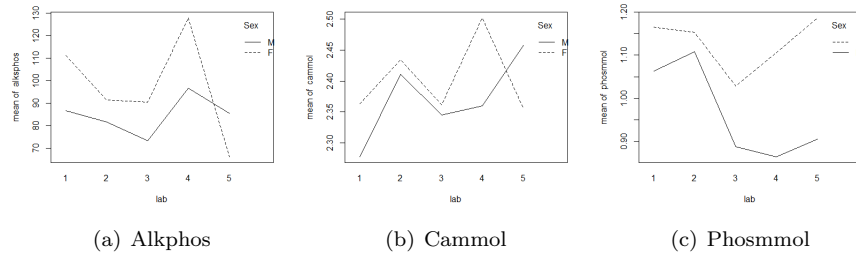


Figure 4: Interaction plots of the sex and age of the different concentrations

5 Discussion

6 R-Code