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Attachments: 1 figure, code

Summary

This memo is split into two parts. In Part I, the objective is to review the methods, results, and discussion of a published study on a topic of interest. In Part II, the goal is introductory exposure to the R programming language and RStudio. Only the results and answers to questions are shown for the provided R tutorial.

Part I. Article Review

The study I chose is titled “Effects of 8-hour time restricted feeding on body weight and metabolic disease risk factors in obese adults: A pilot study,” and was carried out by researchers at the University of Illinois at Chicago, Indiana University, and the Salk Institute for Biological Studies. It discusses the effects of a 16:8 diet, in which subjects eat for 8 hours of the day and only drink water for the other 16, on health and weight loss. I chose the study because I’m interested in the medical field and planning on attending medical school.

Link to study:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6004924/pdf/nha-4-nha170036.pdf>

Summary of Methods

A reasonably large sample (23) of subjects were chosen, which qualified based on several criteria including BMI, age, daily activity, and medical history to remove bias. The control group was derived from historical data from an earlier trial of similar duration and inclusion criteria. Before the study started, subjects participated in a stabilization period of two weeks of usual diet and physical activity.

For the experiment, subjects were able to eat at will from 10:00 a.m. to 6:00 p.m. each day, without restriction. During other times, they were encouraged to eat no food and drink lots of water, and their adherence to this encouragement was tracked. Food intake timing and daily activity was thoroughly tracked.

The main variables tracked were body weight, height, and composition, recorded weekly. Blood pressure, heart rate, and blood characteristics such as insulin, cholesterol, and glucose levels were measured at the beginning and end of the experiment.

Summary of Results

During the 12-week period, body weight decreased by $2.6 \pm 0.5\%$ ($P < 0.001$) and BMI also decreased. Systolic blood pressure also significantly decreased by 7 ± 2 mmHg ($P = 0.02$). Other blood characteristics did not significantly change.

Summary of Discussion

Much of the discussion goes into detail about the significance of the results, but the unique content is the discussion of the experiment's limitations. Limitations that the researchers brought up include little randomization – the experimental group was intentionally matched to the control group, because the sample size was not very large. The trial was carried out 3-7 years after the control group data was obtained, and participants' knowledge of weight control and access to certain foods may have changed. The researchers acknowledge that future trials should be more randomized and have concurrent control groups, longer trial terms, and better participant tracking (eating was self-reported, and may have been biased towards healthier food options).

Review

The conclusion of this experiment is well supported by the data. Some of the hypotheses were not significantly supported, which the researchers acknowledged, and they only promoted the ones that were significantly supported (decreases in body weight and systolic blood pressure).

The biggest bias seems to be in the participants' activities and reporting. They were more likely to report healthy eating, but more importantly, they were likely influenced by knowing they were involved in a health study (placebo!) and wanting to lose weight, despite being encouraged to keep the same diet (not eating times though). As discussed in the *Summary of Discussion* section, the other weakness in the study is the control group. A concurrent control group would eliminate most of the discrepancies.

Assuming these limitations were a result of difficulty in obtaining participants, or of limited resources (time/money), the study was well designed. The researcher's effort to match participants to the previous control group was particularly impressive. Although that effort made for a better control group, it also decreased randomization and thus limited generalizability to larger groups. The researchers did a good job of acknowledging all the weaknesses and encouraging more thorough future studies.

Excluding specific chemical names, some terms used that weren't very familiar include:

- Coronary – Relating to the arteries surrounding and supplying the heart.
- Glucoregulatory – With the intent of maintaining steady levels of glucose in the body
- Myocardial infarction – Medical term for a heart attack or permanent death of heart tissue
- Stratified – Separated into groups/levels for sampling
- Ad libitum – As much or as often as necessary or desired.
- Stadiometer – A long ruler with a slider used to measure human height.
- Visceral – Internal organs in the main cavities of the body, especially abdominal.
- Systolic – Pressure on blood vessels from heartbeat (top # on blood pressure reading)

- Diastolic – Pressure in arteries between heartbeats (bottom # on blood pressure reading)

Part II. R Tutorial

The methods used to complete the tutorial are shown in the attached code.

Answers to Questions

1. The years in the present data set range from 1940 to 2002. There are 63 rows and 3 columns, with column names “year”, “boys”, and “girls”.
2. The present counts are much larger than Arbuthnot’s counts. They are around one thousand times larger.
3. Yes, Arbuthnot’s observation about boys being born in greater proportion than girls holds up in the US. A t-test on the difference of means yields a p-value of 0.02243, or 97.7% confidence that more boys are born than girls. The difference in means is 91,684 births per year, which is fairly large compared to the means of around 1.7 million.
4. Figure 1 shows a plot of the boy-to-girl ratio for the present data. The ratio remains between a minimum of 1.045686 and 1.058698. This means that between 51.12% and 51.43% of the births each year were boys.
5. The largest number of births was 4268326, recorded in 1961.

Conclusion

The thoroughness of researchers’ experimental assumptions and methods is important for meaningful and accurate results. R is a useful tool for statistical analysis. This will be an interesting class!

Attachments

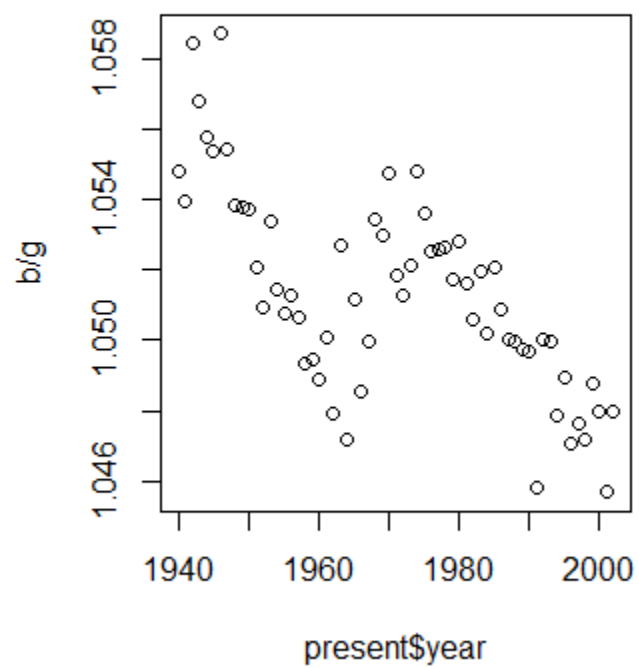


Figure 1. Ratio of boys to girls birthed between 1940 and 2002