We can see from the description and the data that we have what looks to be an independent t-test but also with paired data.

The easiest thing to do is to create a new column that is the difference between before and after:

CholestoralData$difference <- CholestoralData$After - CholestoralData$Before

Now we can see if the variances in these differences are equal between the two different margarine types (get the car library loaded):

levene.test(CholestoralData$difference, CholestoralData$Margarine)

**group 1 15.478 0.0003431 \*\*\***

We have a violation so will need to use unequal variances independent t.

t.test(difference ~ Margarine, data = CholestoralData, var.equal = FALSE)

**t = -3.9902, df = 19.854, p-value = 0.0007285**

**sample estimates:**

**mean in group A mean in group B**

**-3.7805 -0.3125**

We find that Margarine A seems to reduce cholesterol more than Margarine B

Because we had unequal variances we might want to run non-parametric test just to be sure we aren’t getting biased results.

wilcox.test(CholestoralData$difference~CholestoralData$Margarine)

**W = 86, p-value = 0.001593**

We get the same result so we can have more confidence in our conclusion that A is better than B. Now we just need a summary, but wait, does margarine A lead to a robust reduction?

t.test(CholestoralData$Before[CholestoralData$Margarine == "A"], CholestoralData$After[CholestoralData$Margarine == "A"], paired = TRUE)

**t = 4.3984, df = 19, p-value = 0.0003089**

**95 percent confidence interval:**

**1.981502 5.579498**

**mean of the differences**

**3.7805**

Looks like it does better than chance (CI 95% don’t contain 0 either). A clear effect. Lets get our descriptives.

tapply(CholestoralData$difference, CholestoralData$Margarine, mean)

**A B**

**-3.7805 -0.3125**

tapply(CholestoralData$difference, CholestoralData$Margarine, sd)

**A B**

**3.8438953 0.5764125**

We compared the change in cholesterol levels for individuals eating margarine A or B (20 participant in each group). Performing and independent-test (corrected for unequal variances) we find margarine A (*M* -3.78; *SD* = 3.84) led to a greater reduction than margarine B (*M* = -.31; *SD* = .58), *t*(19.85) = -3.99, *p* < .001. A follow up paired t-test examining whether those in the margarine A group showed a significant reduction from their starting levels reveals they did (Mean difference CI95% [1.98, 5.58]), *t*(19) = 4.39, *p* < .001. In sum margarine A appears to lower cholesterol levels significantly and does so to a greater extent than margarine B.