

Exercise 5B. Resting Heart Rate and Body Positions

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```
library(tidyverse)
library(car)
library(ggpubr)
library(rstatix)
```

1. DATA

```
# imports data into R
bpm <- read.csv("C:/Users/Xyrine/Documents/School Stuff/BS BIO 4th Year/1st Semester/BIO 118/Module 1/M
head(bpm)
```

```
##           Name.of.Student Age Sex Weight      Fitness
## 1           Bio 122 A1    NA      NA
## 2      Perez, Maria Cristina A.  21  F 104.28 Non-athletic
## 3      Tadle, Antonette      20  F 114.64 Non-athletic
## 4 Genson, Julia Raphaela Genson  21  F  83.96 Non-athletic
## 5      Mejias, Mafe Nenia A.    21  F 154.32 Non-athletic
## 6      Cena, Hannah Trisha A.  21  F 116.85 Non-athletic
##           Fitness.Info Coffee Smoking Alcohol Lying.Down
## 1                                     NA      NA
## 2      Walking 30 mins a day      2      0      0      84
## 3      Brisk walking 20 mins a day      0      0      0      96
## 4      walking for 20 minutes a day      2      0      0      87
## 5      walking for 20 minutes a day      3      0      0      64
## 6 walking for 20 minutes every day      3      0      20      64
##      Sitting.Down Standing.Up Standing.Bend Warmup.End First.2min Second.2min
## 1      NA      NA      NA      NA      NA      NA
## 2      78      72      84      96      102      120
## 3      90      84      96      108      126      126
## 4      81      93      80      102      96      120
## 5      64      72      68      84      90      102
## 6      64      76      84      108      132      144
##      Third.2min Fourth.2min Fifth.2min CD.End CD.2min CD.4min CD.6min
## 1      NA      NA      NA      NA      NA      NA
## 2      126      132      132      102      90      84      72
## 3      144      144      150      120      102      96      84
## 4      132      138      141      138      102      78      78
## 5      120      120      126      98      84      54      54
```

```
## 6      150      138      138      120      96      84      76
## Time.RestRate Time.RestRate.NoCD
## 1      NA      NA
## 2      6      8
## 3      6      8
## 4      4      8
## 5      2      6
## 6      6      8
```

Exploring Data

```
# cleans data
## for summary of data
p <- bpm %>%
  select(Fitness, Lying.Down, Sitting.Down, Standing.Up, Standing.Bend) %>%
  drop_na() %>%
  mutate(Fitness = gsub("Non-athletic", "Non-Athletic", Fitness),
         Fitness = gsub("Non- athletic", "Non-Athletic", Fitness),
         Fitness = gsub("\\ ", "", Fitness))

head(p)
```

```
##      Fitness Lying.Down Sitting.Down Standing.Up Standing.Bend
## 1 Non-Athletic      84      78      72      84
## 2 Non-Athletic      96      90      84      96
## 3 Non-Athletic      87      81      93      80
## 4 Non-Athletic      64      64      72      68
## 5 Non-Athletic      64      64      76      84
## 6 Non-Athletic      60      64      74      96
```

```
summary(p)
```

```
##      Fitness      Lying.Down      Sitting.Down      Standing.Up
## Length:56      Min.   : 45.00      Min.   : 54.00      Min.   : 66.00
## Class :character 1st Qu.: 64.00      1st Qu.: 72.00      1st Qu.: 76.75
## Mode  :character Median : 72.00      Median : 78.00      Median : 84.00
##      Mean   : 75.29      Mean   : 78.32      Mean   : 86.20
##      3rd Qu.: 84.00      3rd Qu.: 84.00      3rd Qu.: 96.00
##      Max.   :126.00      Max.   :126.00      Max.   :138.00
## Standing.Bend
## Min.   : 54.00
## 1st Qu.: 66.00
## Median : 74.50
## Mean   : 76.96
## 3rd Qu.: 84.00
## Max.   :126.00
```

```
### position bpm for non-athletic
p.non <- p %>%
  select(Fitness, Lying.Down, Sitting.Down, Standing.Up, Standing.Bend) %>%
  filter(Fitness == "Non-athletic" | Fitness == "Non-Athletic")
```

```
summary(p.non)
```

```
##      Fitness      Lying.Down      Sitting.Down      Standing.Up
## Length:41      Min.       : 48.00      Min.       : 60.00      Min.       : 66.00
## Class :character 1st Qu.: 66.00      1st Qu.: 72.00      1st Qu.: 78.00
## Mode  :character Median : 77.00      Median : 78.00      Median : 84.00
##              Mean  : 76.41      Mean  : 80.27      Mean  : 87.32
##              3rd Qu.: 84.00      3rd Qu.: 84.00      3rd Qu.: 96.00
##              Max.   :126.00      Max.   :126.00      Max.   :138.00
## Standing.Bend
## Min.       : 54.00
## 1st Qu.: 67.00
## Median : 74.00
## Mean  : 76.78
## 3rd Qu.: 84.00
## Max.   :126.00
```

```
### position bpm for athletic
```

```
p.ath <- p %>%
  select(Fitness, Lying.Down, Sitting.Down, Standing.Up, Standing.Bend) %>%
  filter(Fitness == "Athletic")
```

```
summary(p.ath)
```

```
##      Fitness      Lying.Down      Sitting.Down      Standing.Up
## Length:15      Min.       : 45.0      Min.       :54      Min.       : 67.00
## Class :character 1st Qu.: 60.0      1st Qu.:63      1st Qu.: 73.00
## Mode  :character Median : 72.0      Median :72      Median : 84.00
##              Mean  : 72.2      Mean  :73      Mean  : 83.13
##              3rd Qu.: 82.0      3rd Qu.:83      3rd Qu.: 85.00
##              Max.   :126.0      Max.   :96      Max.   :108.00
## Standing.Bend
## Min.       : 54.00
## 1st Qu.: 64.00
## Median : 75.00
## Mean  : 77.47
## 3rd Qu.: 88.50
## Max.   :108.00
```

```
## gathers positions into one column
```

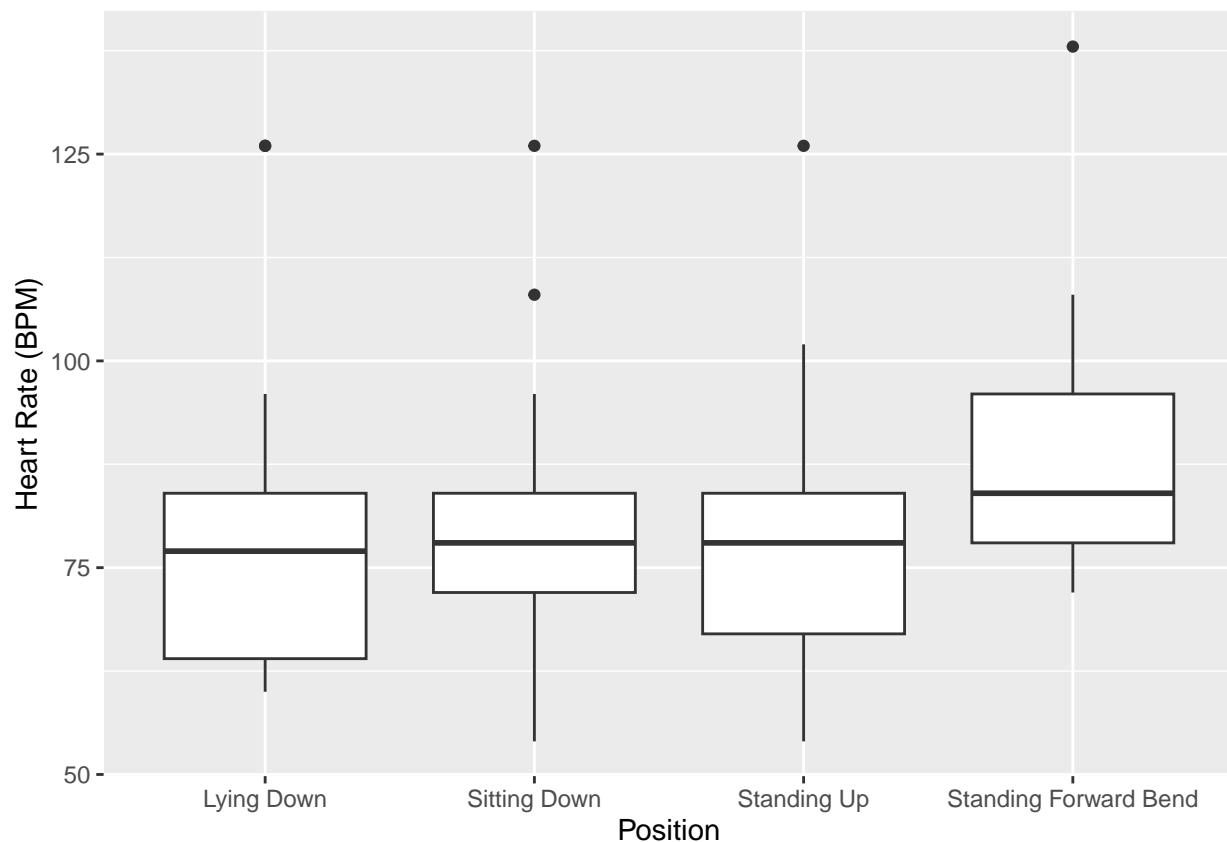
```
f <- bpm %>%
  drop_na() %>%
  select(Fitness, Lying.Down, Sitting.Down, Standing.Up, Standing.Bend) %>%
  gather(Position, BPM, Lying.Down, Sitting.Down, Standing.Up, Standing.Bend) %>%
  mutate(Fitness = gsub("Non-athletic", "Non-Athletic", Fitness),
         Fitness = gsub("\\ ", "", Fitness))
```

```
head(f)
```

```
##      Fitness      Position      BPM
## 1 Non-Athletic Lying.Down      84
```

```
## 2 Non-Athletic Lying.Down 96
## 3 Non-Athletic Lying.Down 87
## 4 Non-Athletic Lying.Down 64
## 5 Non-Athletic Lying.Down 64
## 6 Non-Athletic Lying.Down 60
```

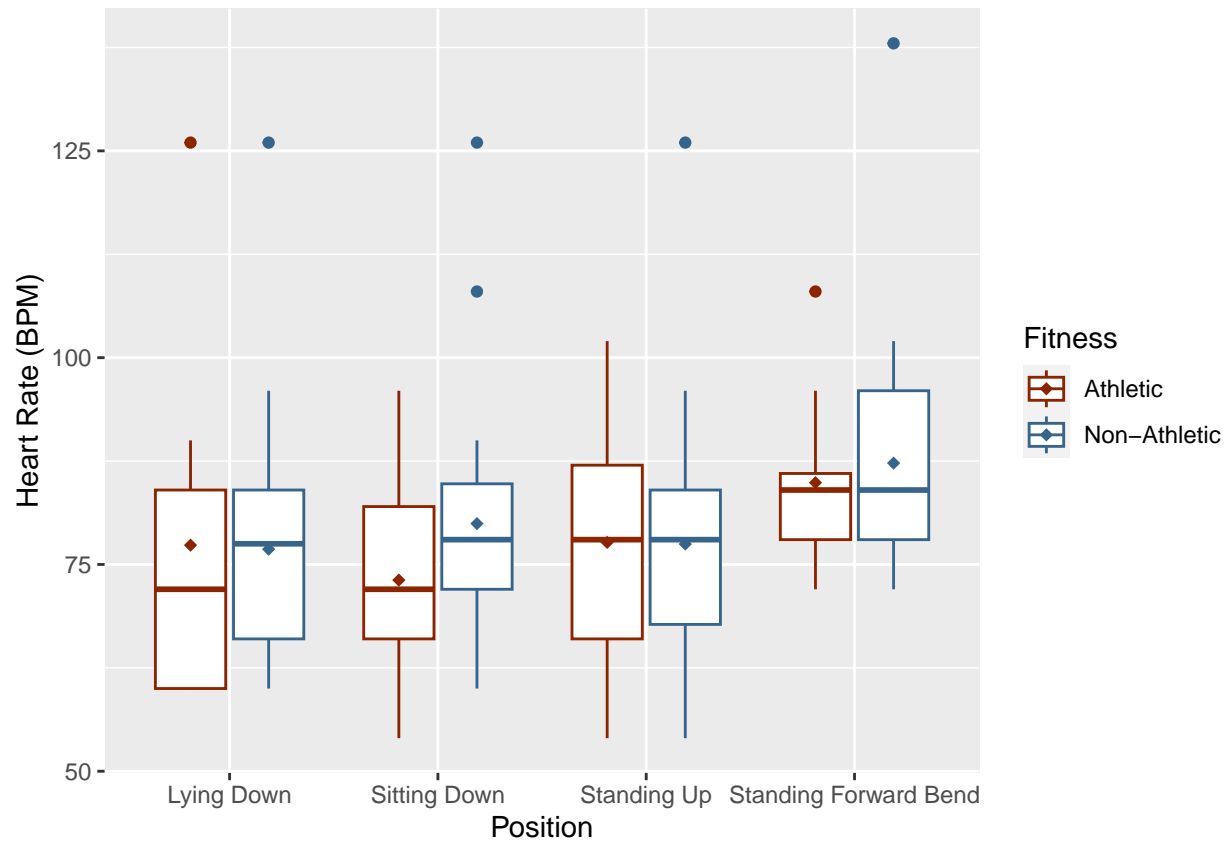
```
# plots
f.plot <- ggplot(f, aes(Position, BPM)) + geom_boxplot() +
  ylab("Heart Rate (BPM)") +
  scale_x_discrete(labels = c("Lying Down", "Sitting Down", "Standing Up",
    "Standing Forward Bend"))
f.plot
```



```
## between fitness
p.plot <- ggplot(f, aes(Position, BPM, color = Fitness)) + geom_boxplot() +
  ylab("Heart Rate (BPM)") +
  scale_x_discrete(labels = c("Lying Down", "Sitting Down", "Standing Up",
    "Standing Forward Bend")) +
  stat_summary(fun = mean, geom = 'point', shape = 18, size = 2,
    position = position_dodge2(width = 0.75, preserve = "single")) +
  scale_color_manual(values = c("orangered4", "steelblue4"))

ggsave("C:/Users/Xyrine/Documents/School Stuff/BS BIO 4th Year/1st Semester/BIO 118/Module 1/Module 1 -
  width = 8, height = 6)

p.plot
```



2. T-TEST

2a. Test for normality of distribution

```
## Shapiro-Wilk normality Test
# Lying Down
shapiro.test(p$Lying.Down[p$Fitness == "Non-Athletic"]) # p = 0.02; not normal
```

```
##
## Shapiro-Wilk normality test
##
## data:  p$Lying.Down[p$Fitness == "Non-Athletic"]
## W = 0.93362, p-value = 0.01907
```

```
shapiro.test(p$Lying.Down[p$Fitness == "Athletic"]) # p = 0.08; normal
```

```
##
## Shapiro-Wilk normality test
##
## data:  p$Lying.Down[p$Fitness == "Athletic"]
## W = 0.89678, p-value = 0.08498
```

```
# Sitting Down
shapiro.test(p$Sitting.Down[p$Fitness == "Non-Athletic"]) # p = 0.002; not normal
```

```
##
## Shapiro-Wilk normality test
##
## data:  p$Sitting.Down[p$Fitness == "Non-Athletic"]
## W = 0.905, p-value = 0.002337
```

```
shapiro.test(p$Sitting.Down[p$Fitness == "Athletic"]) # p = 0.7; normal
```

```
##
## Shapiro-Wilk normality test
##
## data:  p$Sitting.Down[p$Fitness == "Athletic"]
## W = 0.96166, p-value = 0.7212
```

```
# Standing Up
shapiro.test(p$Standing.Up[p$Fitness == "Non-Athletic"]) # p = 0.004; not normal
```

```
##
## Shapiro-Wilk normality test
##
## data:  p$Standing.Up[p$Fitness == "Non-Athletic"]
## W = 0.91272, p-value = 0.004024
```

```
shapiro.test(p$Standing.Up[p$Fitness == "Athletic"]) # p = 0.04; not normal
```

```
##
## Shapiro-Wilk normality test
##
## data:  p$Standing.Up[p$Fitness == "Athletic"]
## W = 0.87839, p-value = 0.04489
```

```
# Standing Forward Bend
shapiro.test(p$Standing.Bend[p$Fitness == "Non-Athletic"]) # p = 0.0006; not normal
```

```
##
## Shapiro-Wilk normality test
##
## data:  p$Standing.Bend[p$Fitness == "Non-Athletic"]
## W = 0.88554, p-value = 0.0006376
```

```
shapiro.test(p$Standing.Bend[p$Fitness == "Athletic"]) # p = 0.6; normal
```

```
##
## Shapiro-Wilk normality test
##
## data:  p$Standing.Bend[p$Fitness == "Athletic"]
## W = 0.95506, p-value = 0.6074
```

2b. Test for homogeneity in variances

```
## homoscedasticity
# Lying Down
leveneTest(p$Lying.Down ~ Fitness, p) # p > 0.05; assume equality of variance
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##      Df F value Pr(>F)
## group 1  0.6137 0.4368
##      54
```

```
# Sitting Down
leveneTest(p$Sitting.Down ~ Fitness, p) # p > 0.05; assume equality of variance
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##      Df F value Pr(>F)
## group 1  0.1274 0.7225
##      54
```

```
# Standing Up
leveneTest(p$Standing.Up ~ Fitness, p) # p > 0.05; assume equality of variance
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##      Df F value Pr(>F)
## group 1  0.163  0.688
##      54
```

```
# Standing Forward Bend
leveneTest(p$Standing.Bend ~ Fitness, p) # p > 0.05; assume equality of variance
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##      Df F value Pr(>F)
## group 1  1.3336 0.2533
##      54
```

2c. Non-parametric and parametric T-test

```
## Unpaired Two-samples Wilcoxon Test
# Lying Down
ld.ttest <- t.test(p$Lying.Down ~ Fitness, data = p,
                  alternative = "two.sided", paired = FALSE, var.equal = TRUE)
ld.ttest # p > 0.05; accept Ho
```

```
##
## Two Sample t-test
##
## data:  p$Lying.Down by Fitness
## t = -0.86385, df = 54, p-value = 0.3915
```

```
## alternative hypothesis: true difference in means between group Athletic and group Non-Athletic is not equal to 0
## 95 percent confidence interval:
## -13.996215 5.566946
## sample estimates:
## mean in group Athletic mean in group Non-Athletic
## 72.20000 76.41463
```

```
ld.wx <- wilcox.test(p$Lying.Down ~ Fitness, data = p,
                    exact = FALSE)
ld.wx # p > 0.05; accept Ho
```

```
##
## Wilcoxon rank sum test with continuity correction
##
## data: p$Lying.Down by Fitness
## W = 248.5, p-value = 0.2767
## alternative hypothesis: true location shift is not equal to 0
```

```
# Sitting Down
sd.ttest <- t.test(p$Sitting.Down ~ Fitness, data = p,
                 alternative = "two.sided", paired = FALSE, var.equal = TRUE)
sd.ttest # p > 0.05; accept Ho
```

```
##
## Two Sample t-test
##
## data: p$Sitting.Down by Fitness
## t = -1.9053, df = 54, p-value = 0.06207
## alternative hypothesis: true difference in means between group Athletic and group Non-Athletic is not equal to 0
## 95 percent confidence interval:
## -14.9164080 0.3798227
## sample estimates:
## mean in group Athletic mean in group Non-Athletic
## 73.00000 80.26829
```

```
sd.wx <- wilcox.test(p$Sitting.Down ~ Fitness, data = p,
                    exact = FALSE)
sd.wx # p > 0.05; accept Ho
```

```
##
## Wilcoxon rank sum test with continuity correction
##
## data: p$Sitting.Down by Fitness
## W = 215, p-value = 0.08685
## alternative hypothesis: true location shift is not equal to 0
```

```
# Standing Up
su.ttest <- t.test(p$Standing.Up ~ Fitness, data = p,
                 alternative = "two.sided", paired = FALSE, var.equal = TRUE)
su.ttest # p > 0.05; accept Ho
```



```
##
## Two Sample t-test
##
## data: p$Standing.Up by Fitness
## t = -1.041, df = 54, p-value = 0.3025
## alternative hypothesis: true difference in means between group Athletic and group Non-Athletic is not equal to 0
## 95 percent confidence interval:
## -12.241217 3.873737
## sample estimates:
## mean in group Athletic mean in group Non-Athletic
## 83.13333 87.31707
```

```
su.wx <- wilcox.test(p$Standing.Up ~ Fitness, data = p,
                     exact = FALSE)
su.wx # p > 0.05; accept Ho
```

```
##
## Wilcoxon rank sum test with continuity correction
##
## data: p$Standing.Up by Fitness
## W = 247.5, p-value = 0.2679
## alternative hypothesis: true location shift is not equal to 0
```

```
# Standing Forward Bend
sfb.ttest <- t.test(p$Standing.Bend ~ Fitness, data = p,
                   alternative = "two.sided", paired = FALSE, var.equal = TRUE)
sfb.ttest # p > 0.05; accept Ho
```

```
##
## Two Sample t-test
##
## data: p$Standing.Bend by Fitness
## t = 0.15332, df = 54, p-value = 0.8787
## alternative hypothesis: true difference in means between group Athletic and group Non-Athletic is not equal to 0
## 95 percent confidence interval:
## -8.286731 9.659089
## sample estimates:
## mean in group Athletic mean in group Non-Athletic
## 77.46667 76.78049
```

```
sfb.wx <- wilcox.test(p$Standing.Bend ~ Fitness, data = p,
                     exact = FALSE)
sfb.wx # p > 0.05; accept Ho
```

```
##
## Wilcoxon rank sum test with continuity correction
##
## data: p$Standing.Bend by Fitness
## W = 313.5, p-value = 0.9185
## alternative hypothesis: true location shift is not equal to 0
```