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 Raphaella 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 wallking 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      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
## 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
```

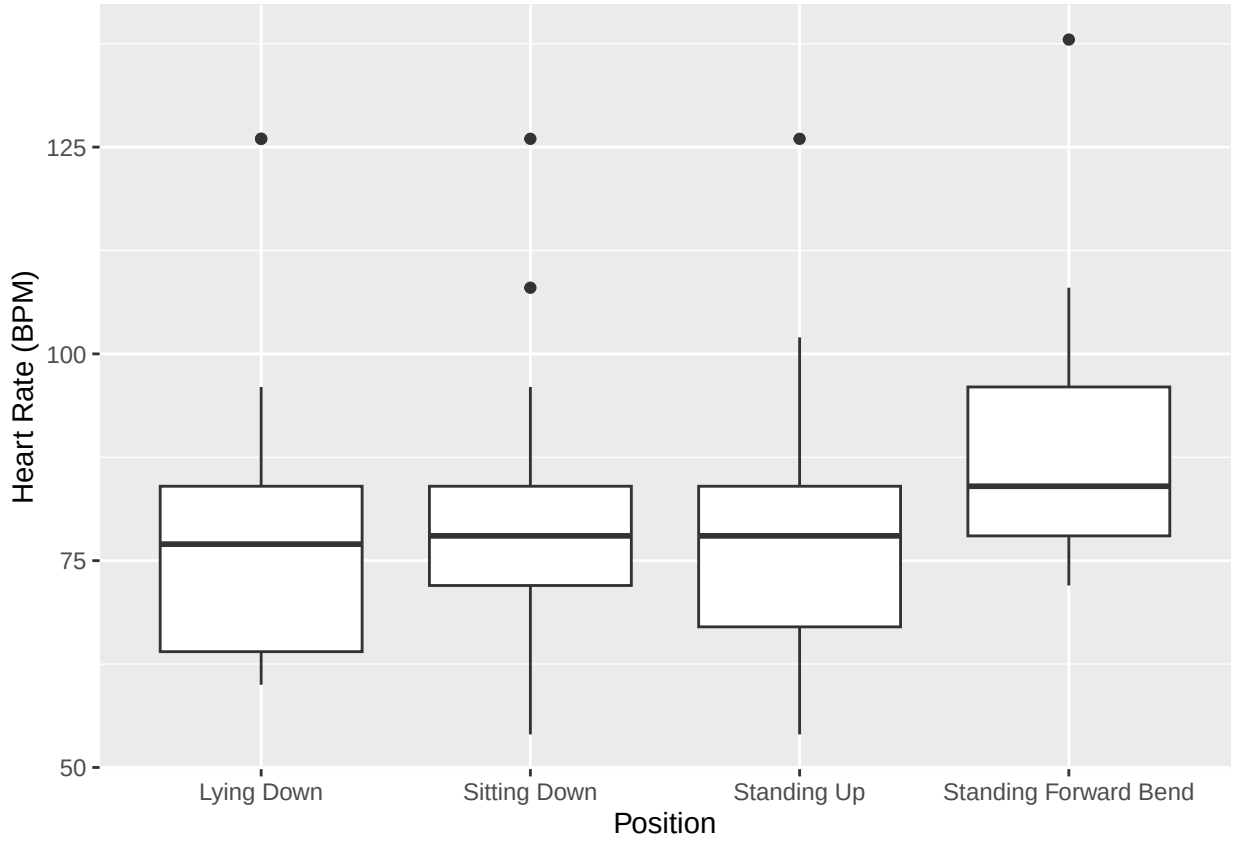
```
## gathers positions into one column
f <- bpm %>%
  drop_na() %>%
  select(Fitness, Lying.Down, Sitting.Down, Standing.Up, Standing.Bend) %>%
  gather(Position, BPM, Lying.Down, Sitting.Down, Standing.Up, Standing.Bend) %>%
  mutate(Fitness = gsub("Non-athletic", "Non-Athletic", Fitness),
      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

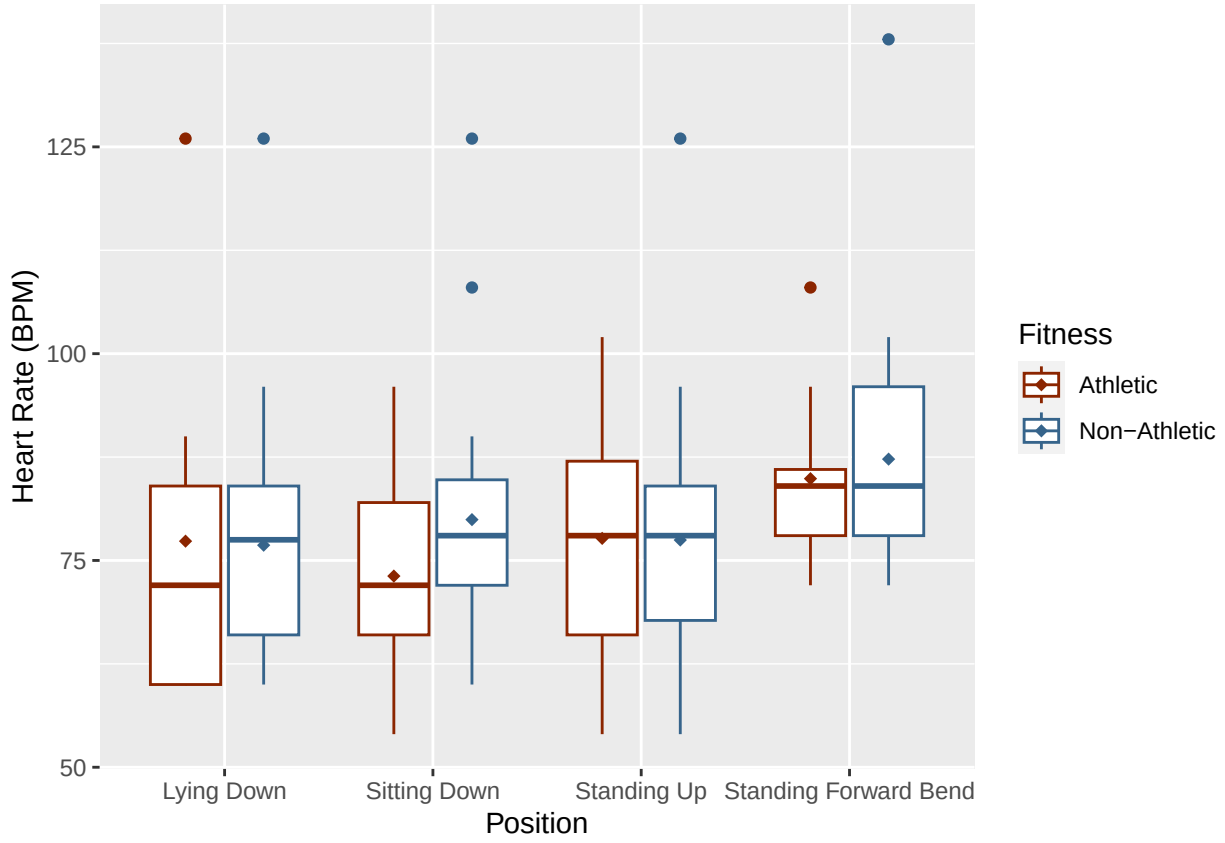
```r
# plots
f.plot <- ggplot(f, aes(Position, BPM)) + geom_boxplot() +
  ylab("Heart Rate (BPM)") +
  scale_x_discrete(labels = c("Lying Down", "Sitting Down", "Standing Up",
                              "Standing Forward Bend"))
f.plot
```




```r
## 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
```

```r
#  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
```

```r
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
```

```r
#  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
```

```r
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
```

```r
#  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
```

```r
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 no
## 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 no
## 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 no
## 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 no
## 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
```