Effect of exercise type and diet on pulse rates

- 18 subjects in study to assess effects of exercise type and diet on pulse rate.
- Each subject randomly assigned to one of three types of exercise:
  - racquetball,
  - aerobic stair climbing,
  - weights.
- Each subject also classified as a meat-eater or a vegetarian (with 3 meat-eaters and 3 vegetarians doing each type of exercise.)
- Response variable: pulse rate.
- So far, two-factor ANOVA with 3 replicates per combo of exercise- type and diet.
- But: **3 responses** for each subject: pulse rate at low, moderate, high intensity in their exercise. Makes it **repeated measures**.
- 3 factors:
  - diet and exercise type "between subjects",
  - intensity-of-exercise "within subjects".
- MANOVA to assess within-subjects factors and their interactions with all else
- ordinary ANOVA to assess between-subjects factors & interactions with each other. (Based on response averaged over the repeated measures.)

# Data:

| | | | | |
|---|---|---|---|---|
| stairs | 112 | 166 | 215 | meat |
| stairs | 111 | 166 | 225 | meat |
| stairs | 89 | 132 | 189 | meat |
| stairs | 95 | 134 | 186 | veg |
| stairs | 86 | 109 | 150 | veg |
| stairs | 89 | 119 | 177 | veg |
| racquetball | 105 | 177 | 241 | meat |
| racquetball | 85 | 117 | 186 | meat |
| racquetball | 97 | 137 | 185 | meat |
| racquetball | 93 | 151 | 197 | veg |
| racquetball | 77 | 122 | 178 | veg |
| racquetball | 78 | 119 | 173 | veg |
| weights | 81 | 134 | 205 | meat |
| weights | 88 | 133 | 180 | meat |
| weights | 88 | 157 | 224 | meat |
| weights | 58 | 99 | 131 | veg |
| weights | 85 | 132 | 186 | veg |
| weights | 78 | 110 | 164 | veg |

SAS code:

```
options ls=70;

data ex;
  infile "exercise.dat";
  input exercise $ pulse1 pulse2 pulse3
    diet $;

proc means;
  class exercise diet;
  var pulse1--pulse3;

proc glm data=ex;
  class exercise diet;
  model pulse1 pulse2 pulse3 =
    exercise diet / nouni;
  repeated intensity;
```

Would normally do “exercise|diet” on model line, but interaction turns out non-significant, so removed from here.

## Proc means output:

| exercise | diet | NObs | Variable | N | Mean | Std Dev |
|---|---|---|---|---|---|---|
| racquetb | meat | 3 | pulse1 | 3 | 95.6666667 | 10.0664459 |
| | | | pulse2 | 3 | 143.6666667 | 30.5505046 |
| | | | pulse3 | 3 | 204.0000000 | 32.0468407 |
| | veg | 3 | pulse1 | 3 | 82.6666667 | 8.9628864 |
| | | | pulse2 | 3 | 130.6666667 | 17.6729549 |
| | | | pulse3 | 3 | 182.6666667 | 12.6622799 |
| stairs | meat | 3 | pulse1 | 3 | 104.0000000 | 13.0000000 |
| | | | pulse2 | 3 | 154.6666667 | 19.6299092 |
| | | | pulse3 | 3 | 209.6666667 | 18.5831465 |
| | veg | 3 | pulse1 | 3 | 90.0000000 | 4.5825757 |
| | | | pulse2 | 3 | 120.6666667 | 12.5830574 |
| | | | pulse3 | 3 | 171.0000000 | 18.7349940 |
| weights | meat | 3 | pulse1 | 3 | 85.6666667 | 4.0414519 |
| | | | pulse2 | 3 | 141.3333333 | 13.5769412 |
| | | | pulse3 | 3 | 203.0000000 | 22.0680765 |
| | veg | 3 | pulse1 | 3 | 73.6666667 | 14.0118997 |
| | | | pulse2 | 3 | 113.6666667 | 16.8027775 |
| | | | pulse3 | 3 | 160.3333333 | 27.6827263 |

- Must be intensity-of-exercise effect
- Might be diet effect
- Probably not a type-of-exercise effect.

# Test for intensity-of-exercise effect:

MANOVA Test Criteria and Exact F Statistics
for the Hypothesis of no intensity Effect
H = Type III SSCP Matrix for intensity
E = Error SSCP Matrix

S=1 M=0 N=5.5

| Statistic | Value | F Value | Num DF | Den DF | Pr > F |
|---|---|---|---|---|---|
| Wilks' Lambda | 0.01778139 | 359.05 | 2 | 13 | <.0001 |
| Pillai's Trace | 0.98221861 | 359.05 | 2 | 13 | <.0001 |
| Hotelling-Lawley Trace | 55.23856418 | 359.05 | 2 | 13 | <.0001 |
| Roy's Greatest Root | 55.23856418 | 359.05 | 2 | 13 | <.0001 |

Strongly significant as expected.

Intensity-of-exercise by exercise type interaction:

```
            MANOVA Test Criteria and F Approximations for
             the Hypothesis of no intensity*exercise Effect
           H = Type III SSCP Matrix for intensity*exercise
                        E = Error SSCP Matrix

                        S=2    M=-0.5    N=5.5
```

| Statistic | Value | F Value | Num DF | Den DF | Pr > F |
|---|---|---|---|---|---|
| Wilks' Lambda | 0.88850421 | 0.40 | 4 | 26 | 0.8098 |
| Pillai's Trace | 0.11235730 | 0.42 | 4 | 28 | 0.7952 |
| Hotelling-Lawley Trace | 0.12451746 | 0.40 | 4 | 14.623 | 0.8079 |
| Roy's Greatest Root | 0.11617098 | 0.81 | 2 | 14 | 0.4633 |

NOTE: F Statistic for Roy's Greatest Root is an upper bound.

NOTE: F Statistic for Wilks' Lambda is exact.

Nothing here. Whatever effect of exercise type is same at all intensity levels.

Intensity-of-exercise by diet interaction:

```
MANOVA Test Criteria and Exact F Statistics for
  the Hypothesis of no intensity*diet Effect
 H = Type III SSCP Matrix for intensity*diet
          E = Error SSCP Matrix

           S=1    M=0    N=5.5
```

| Statistic | Value | F Value | Num DF | Den DF | Pr > F |
|---|---|---|---|---|---|
| Wilks' Lambda | 0.64025576 | 3.65 | 2 | 13 | 0.0551 |
| Pillai's Trace | 0.35974424 | 3.65 | 2 | 13 | 0.0551 |
| Hotelling-Lawley Trace | 0.56187584 | 3.65 | 2 | 13 | 0.0551 |
| Roy's Greatest Root | 0.56187584 | 3.65 | 2 | 13 | 0.0551 |

Marginally significant. The effect of exercise intensity in pulse rates is different for each diet type. Investigate later.

Effect of diet and exercise type on pulse rate (averaged over intensity-of-exercise):

```
                              The GLM Procedure
                   Repeated Measures Analysis of Variance
               Tests of Hypotheses for Between Subjects Effects

Source                     DF     Type III SS     Mean Square   F Value

exercise                    2      1524.77778       762.38889      1.03
diet                        1      7800.01852      7800.01852     10.51
Error                      14     10390.70370       742.19312

                    Source                 Pr > F

                    exercise               0.3835
                    diet                   0.0059
                    Error
```

- Exercise type has no effect, but diet *does* have an effect on pulse rates overall.
- Diet by intensity interaction significant, so effect of diet on pulse rate differs by intensity as well.
- Look back at PROC MEANS output (over):

| exercise | diet | NObs | Variable | N | Mean | Std Dev |
|---|---|---|---|---|---|---|
| racquetb | meat | 3 | pulse1 | 3 | 95.6666667 | 10.0664459 |
| | | | pulse2 | 3 | 143.6666667 | 30.5505046 |
| | | | pulse3 | 3 | 204.0000000 | 32.0468407 |
| | veg | 3 | pulse1 | 3 | 82.6666667 | 8.9628864 |
| | | | pulse2 | 3 | 130.6666667 | 17.6729549 |
| | | | pulse3 | 3 | 182.6666667 | 12.6622799 |
| stairs | meat | 3 | pulse1 | 3 | 104.0000000 | 13.0000000 |
| | | | pulse2 | 3 | 154.6666667 | 19.6299092 |
| | | | pulse3 | 3 | 209.6666667 | 18.5831465 |
| | veg | 3 | pulse1 | 3 | 90.0000000 | 4.5825757 |
| | | | pulse2 | 3 | 120.6666667 | 12.5830574 |
| | | | pulse3 | 3 | 171.0000000 | 18.7349940 |
| weights | meat | 3 | pulse1 | 3 | 85.6666667 | 4.0414519 |
| | | | pulse2 | 3 | 141.3333333 | 13.5769412 |
| | | | pulse3 | 3 | 203.0000000 | 22.0680765 |
| | veg | 3 | pulse1 | 3 | 73.6666667 | 14.0118997 |
| | | | pulse2 | 3 | 113.6666667 | 16.8027775 |
| | | | pulse3 | 3 | 160.3333333 | 27.6827263 |

- Meat pulse rates a little higher than corresponding veg pulse rates eg:

| | | | | | | |
|---|---|---|---|---|---|---|
| weights | meat | 3 | pulse1 | 3 | 85.6666667 | 4.0414519 |
| | | | pulse2 | 3 | 141.3333333 | 13.5769412 |
| | | | pulse3 | 3 | 203.0000000 | 22.0680765 |
| | veg | 3 | pulse1 | 3 | 73.6666667 | 14.0118997 |
| | | | pulse2 | 3 | 113.6666667 | 16.8027775 |
| | | | pulse3 | 3 | 160.3333333 | 27.6827263 |

  - significant diet main effect
- Difference in pulse rates between meat and veg *increases* as intensity increases: for weights, means differ by 12, 28, 43 for three intensities. This pattern consistent across exercise types.
  - significant diet by intensity interaction.

Looking at means is one way to assess how groups differ; discriminant analysis is another.

First make a variable with all combos of exercise and diet:

```
data ex;
  infile "exercise.dat";
  input exercise $ pulse1 pulse2 pulse3 diet $;
  gp=cat(diet,"-",exercise);
  one=pulse1/pulse1;
```

(variable “one” explained later)

Then see what it is about pulse1 pulse2 pulse3 that explains differences among groups:

```
proc discrim can out=fred;
  class gp;
  var pulse1--pulse3;
```

Output (edited):

Generalized Squared Distance to gp

| From gp | meat -racquetb | meat -stairs | meat -weights | veg -racquetb | veg -stairs | veg -weights |
|---|---|---|---|---|---|---|
| meat -racquetb | 0 | 1.16623 | 3.41757 | 3.41347 | 2.93105 | 7.33211 |
| meat -stairs | 1.16623 | 0 | 7.38962 | 6.45912 | 3.17538 | 11.27939 |
| meat -weights | 3.41757 | 7.38962 | 0 | 1.23812 | 9.55256 | 3.86302 |
| veg -racquetb | 3.41347 | 6.45912 | 1.23812 | 0 | 6.12220 | 1.06346 |
| veg -stairs | 2.93105 | 3.17538 | 9.55256 | 6.12220 | 0 | 7.79109 |
| veg -weights | 7.33211 | 11.27939 | 3.86302 | 1.06346 | 7.79109 | 0 |

Where generalized squared distance is large, groups are very different (in pulse rate profile) – eg. meat-stairs and veg-weights. Most similar groups: meat-racquetball & stairs; veg-racquetball & weights; veg-racquetball & meat-weights (!)

Canonical variables are combinations of original variables that explain differences among groups. How many do we need?

Test of H0: The canonical correlations in the current row and all that follow are zero

| | Likelihood Ratio | Approximate F Value | Num DF | Den DF | Pr > F |
|---|---|---|---|---|---|
| 1 | 0.14954639 | 1.85 | 15 | 28.007 | 0.0778 |
| 2 | 0.47530543 | 1.24 | 8 | 22 | 0.3236 |
| 3 | 0.89044735 | 0.49 | 3 | 12 | 0.6943 |

Only 1 near significance.

Raw Canonical Coefficients

| Variable | Can1 | Can2 | Can3 |
|---|---|---|---|
| pulse1 | 0.1965980326 | -.0565263460 | 0.0251750782 |
| pulse2 | -.0834670872 | 0.0092799901 | -.1315596602 |
| pulse3 | 0.0109568453 | 0.0533423277 | 0.0875031123 |

Can1 mostly pulse1 with a little (negative) pulse2 (pulse3 near 0). *But* pulse2 and pulse3 more variable than pulse1, so might be more influential than they look:

Pooled Within-Class Standardized Canonical Coefficients

| Variable | Can1 | Can2 | Can3 |
|---|---|---|---|
| pulse1 | 1.940143588 | -0.557834818 | 0.248442296 |
| pulse2 | -1.618486870 | 0.179945685 | -2.551036460 |
| pulse3 | 0.250534283 | 1.219701610 | 2.000806707 |

Pulse2 more influential than appears.

## How do groups differ on canonical variables?

Class Means on Canonical Variables

| gp | | Can1 | Can2 | Can3 |
|---|---|---|---|---|
| meat | -racquetb | 0.759973767 | 0.519620228 | 0.281658046 |
| meat | -stairs | 1.542241535 | 0.452920427 | -0.459854929 |
| meat | -weights | -1.022206867 | 1.009888050 | 0.249376692 |
| veg | -racquetb | -0.944474555 | -0.004146803 | -0.202075451 |
| veg | -stairs | 1.204085362 | -1.133800397 | 0.277268748 |
| veg | -weights | -1.539619242 | -0.844481506 | -0.146373106 |

Meat values generally more positive than veg ones on Can1 (comparing like exercise). Pattern for exercise probably affected by variability in data.

Next part of discriminant analysis: see how well data were classified into correct groups.

Number of Observations and Percent Classified into gp

| From gp | meat -racquetb | meat -stairs | meat -weights | veg -racquetb | veg -stairs | veg -weights | Total |
|---|---|---|---|---|---|---|---|
| meat - racquetb | 1 | 0 | 1 | 0 | 1 | 0 | 3 |
| | 33.33 | 0.00 | 33.33 | 0.00 | 33.33 | 0.00 | 100.00 |
| meat -stairs | 1 | 2 | 0 | 0 | 0 | 0 | 3 |
| | 33.33 | 66.67 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| meat -weights | 0 | 0 | 2 | 1 | 0 | 0 | 3 |
| | 0.00 | 0.00 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| veg - racquetb | 0 | 0 | 0 | 3 | 0 | 0 | 3 |
| | 0.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 |
| veg -stairs | 0 | 0 | 0 | 0 | 3 | 0 | 3 |
| | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 | 0.00 | 100.00 |
| veg -weights | 0 | 0 | 0 | 2 | 0 | 1 | 3 |
| | 0.00 | 0.00 | 0.00 | 66.67 | 0.00 | 33.33 | 100.00 |
| Total | 2 | 2 | 3 | 6 | 4 | 1 | 18 |
| | 11.11 | 11.11 | 16.67 | 33.33 | 22.22 | 5.56 | 100.00 |

11.11

Error Count Estimates for gp

| | meat -racquetb | meat -stairs | meat -weights | veg -racquetb | veg -stairs | veg -weights |
|---|---|---|---|---|---|---|
| Rate | 0.6667 | 0.3333 | 0.3333 | 0.0000 | 0.0000 | 0.6667 |
| Priors | 0.1667 | 0.1667 | 0.1667 | 0.1667 | 0.1667 | 0.1667 |

| | Total |
|---|---|
| Rate | 0.3333 |
| Priors | |

Overall 33% of 18 observations misclassified – meat-racquetball and veg-weights hardest to get right.

Was classification clear-cut or a close call? Look at output data set (2 parts here):

| Obs | gp | | pulse1 | pulse2 | pulse3 | Can1 | _INTO_ | |
|---|---|---|---|---|---|---|---|---|
| 1 | meat | -stairs | 112 | 166 | 215 | 2.22750 | meat | -stairs |
| 2 | meat | -stairs | 111 | 166 | 225 | 2.14047 | meat | -stairs |
| 3 | meat | -stairs | 89 | 132 | 189 | 0.25875 | meat | -racquetb |
| 4 | veg | -stairs | 95 | 134 | 186 | 1.23853 | veg | -stairs |
| 5 | veg | -stairs | 86 | 109 | 150 | 1.16138 | veg | -stairs |
| 6 | veg | -stairs | 89 | 119 | 177 | 1.21234 | veg | -stairs |
| 7 | meat | -racquetb | 105 | 177 | 241 | 0.21806 | meat | -weights |
| 8 | meat | -racquetb | 85 | 117 | 186 | 0.69149 | meat | -racquetb |
| 9 | meat | -racquetb | 97 | 137 | 185 | 1.37037 | veg | -stairs |
| 10 | veg | -racquetb | 93 | 151 | 197 | -0.45308 | veg | -racquetb |
| 11 | veg | -racquetb | 77 | 122 | 178 | -1.38628 | veg | -racquetb |
| 12 | veg | -racquetb | 78 | 119 | 173 | -0.99407 | veg | -racquetb |
| 13 | meat | -weights | 81 | 134 | 205 | -1.30566 | meat | -weights |
| 14 | meat | -weights | 88 | 133 | 180 | -0.11993 | veg | -racquetb |
| 15 | meat | -weights | 88 | 157 | 224 | -1.64104 | meat | -weights |
| 16 | veg | -weights | 58 | 99 | 131 | -3.71687 | veg | -weights |
| 17 | veg | -weights | 85 | 132 | 186 | -0.56051 | veg | -racquetb |
| 18 | veg | -weights | 78 | 110 | 164 | -0.34147 | veg | -racquetb |

Some groups very consistent on Can1 (eg. veg-stairs), some not.

Now look at “posterior probabilities” of group membership given pulse rates:

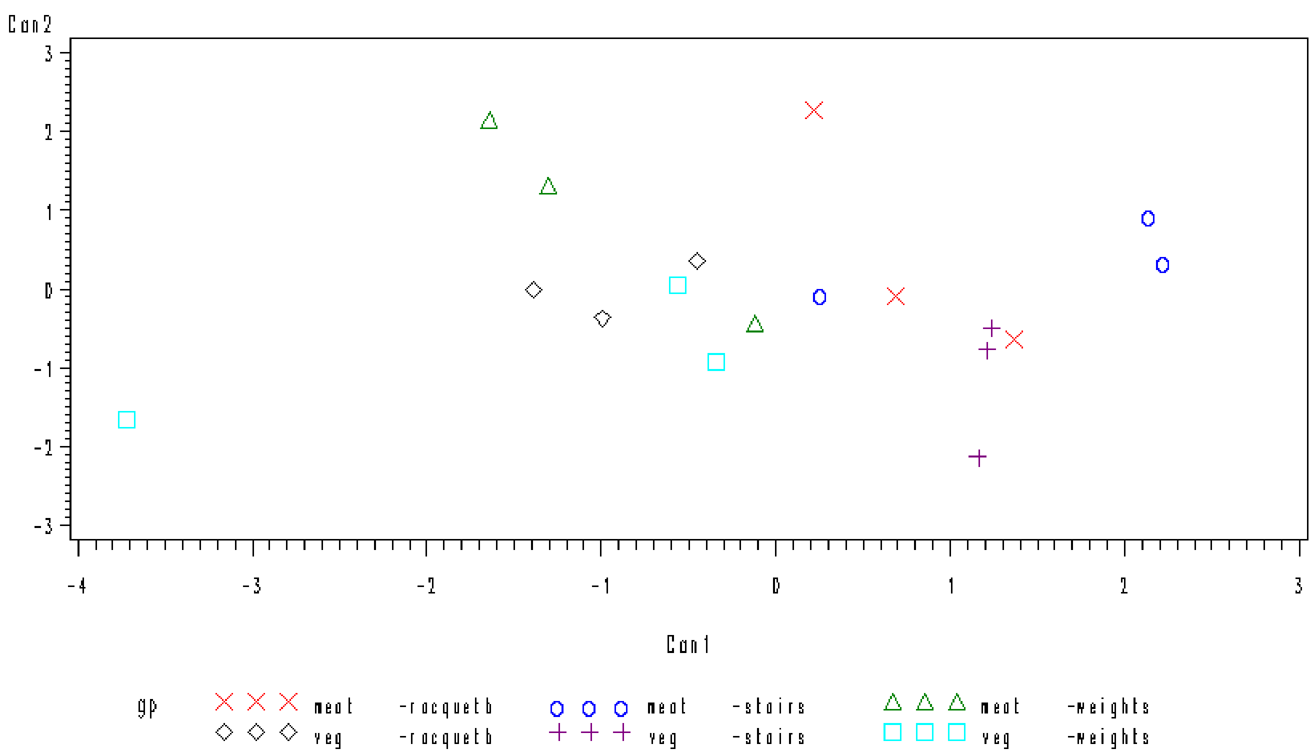
| Obs | g | p | meat_____racquetb | meat______stairs | meat_____weights | veg______racquetb | veg_______stairs | veg______weights |
|---|---|---|---|---|---|---|---|---|
| 1 | meat | -stairs | 0.13770 | 0.77947 | 0.00180 | 0.00467 | 0.07608 | 0.00028 |
| 2 | meat | -stairs | 0.25337 | 0.68596 | 0.00503 | 0.00485 | 0.05059 | 0.00020 |
| 3 | meat | -stairs | 0.34811 | 0.13063 | 0.11847 | 0.19098 | 0.15494 | 0.05687 |
| 4 | veg | -stairs | 0.25831 | 0.28436 | 0.01226 | 0.04113 | 0.39391 | 0.01003 |
| 5 | veg | -stairs | 0.03924 | 0.04843 | 0.00096 | 0.01759 | 0.87601 | 0.01778 |
| 6 | veg | -stairs | 0.24437 | 0.12467 | 0.01025 | 0.02856 | 0.58268 | 0.00948 |
| 7 | meat | -racquetb | 0.32225 | 0.20603 | 0.37332 | 0.09132 | 0.00322 | 0.00386 |
| 8 | meat | -racquetb | 0.48368 | 0.07753 | 0.06972 | 0.06051 | 0.29235 | 0.01620 |
| 9 | meat | -racquetb | 0.20082 | 0.34074 | 0.00714 | 0.03384 | 0.40909 | 0.00837 |
| 10 | veg | -racquetb | 0.12599 | 0.09311 | 0.19375 | 0.43418 | 0.02208 | 0.13090 |
| 11 | veg | -racquetb | 0.04244 | 0.00423 | 0.27034 | 0.37524 | 0.00911 | 0.29863 |
| 12 | veg | -racquetb | 0.06944 | 0.00977 | 0.18520 | 0.38139 | 0.03172 | 0.32249 |
| 13 | meat | -weights | 0.06891 | 0.00348 | 0.70775 | 0.17292 | 0.00171 | 0.04523 |
| 14 | meat | -weights | 0.16749 | 0.09678 | 0.09419 | 0.34370 | 0.12551 | 0.17232 |
| 15 | meat | -weights | 0.02769 | 0.00245 | 0.80732 | 0.14137 | 0.00015 | 0.02102 |
| 16 | veg | -weights | 0.00003 | 0.00000 | 0.00630 | 0.07856 | 0.00004 | 0.91506 |
| 17 | veg | -weights | 0.14777 | 0.03807 | 0.22633 | 0.37720 | 0.04105 | 0.16958 |
| 18 | veg | -weights | 0.13810 | 0.02505 | 0.08622 | 0.27658 | 0.21368 | 0.26036 |

Obs 1 clearcut meat-stairs, obs 2 less so, obs 3 misclassified as meat-racquetball. Obs 4 correct but very close call. Obs 14 totally wrong!

Plotting 1st 2 canonical variables gives nice 2-dimensional picture of data & how well groups are separated:

```
goptions reset=all;
symbol1 c=red v=x;
symbol2 c=blue v=o;
symbol3 c=green v=triangle;
symbol4 c=black v=diamond;
symbol5 c=purple v=plus;
symbol6 c=cyan v=square;

proc gplot;
    plot can2*can1=gp;
```




Groups rather mixed up. Can2 sometimes helps (racquetball) but not significant.

Actually exercise type not significant, so really only need discriminant analysis by diet:

```
proc discrim data=ex can out=ginger;
    class diet;
    var pulse1--pulse3;

proc print;
    var diet pulse1 pulse2 pulse3 can1 meat veg _into_;

proc gplot;
    plot one*can1=diet;
```

output:

```
          Test of H0: The canonical correlations in the
            current row and all that follow are zero

          Likelihood    Approximate
               Ratio        F Value    Num DF    Den DF    Pr > F

      1   0.56370159           3.61         3        14    0.0404
```

Only one canonical variable (2 groups), which is significant. (With 2 groups, same test as MANOVA.)

What does canonical variable depend on?

```
Raw Canonical Coefficients

Variable                 Can1

pulse1           0.0199203412
pulse2           -.0305445631
pulse3           0.0631215151
```

Mainly pulse3 now. (Different.)

## How are groups distinguished on Can1?

Class Means on Canonical Variables

| diet | Can1 |
|---|---|
| meat | 0.8294513579 |
| veg | -.8294513579 |

Meat-eaters +, veg-eaters -.

## How well can observations be classified back into groups?

Number of Observations and Percent Classified into diet

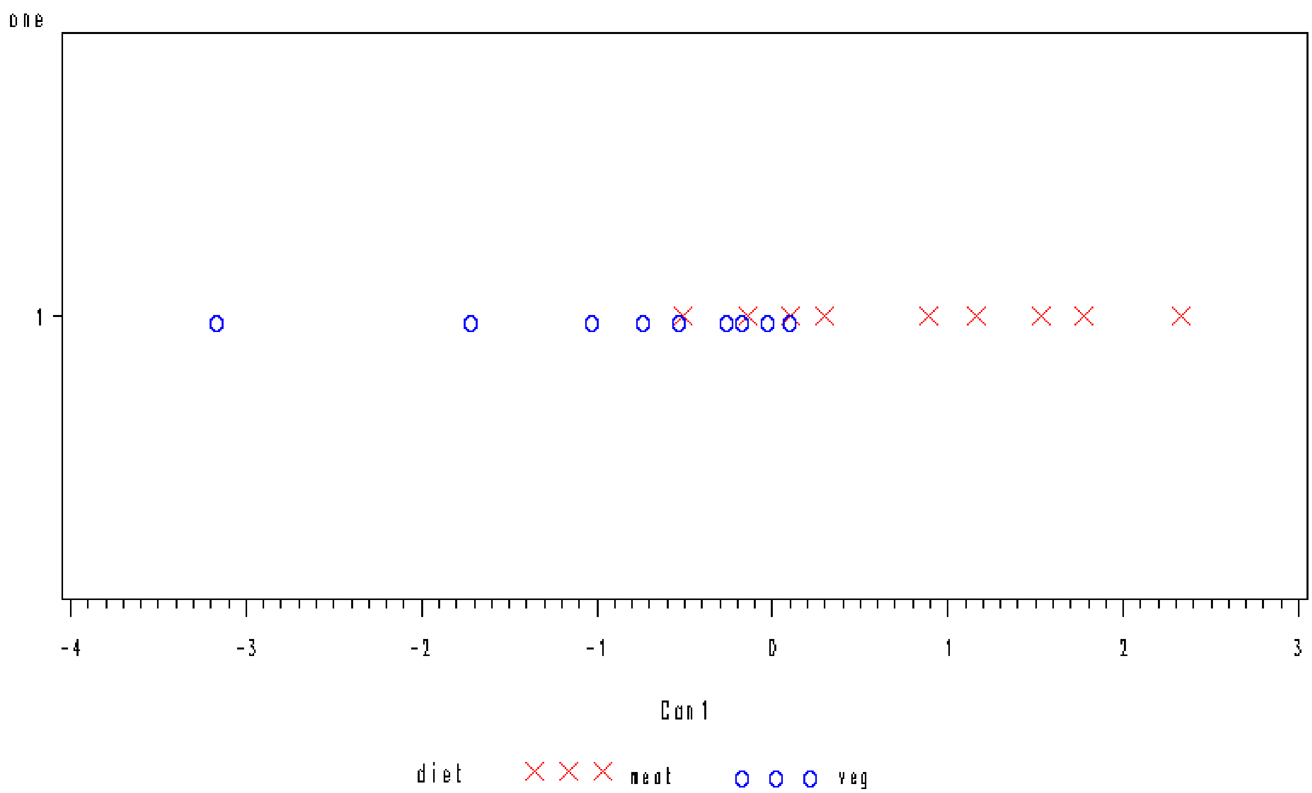
| From diet | meat | veg | Total |
|---|---|---|---|
| meat | 7 | 2 | 9 |
| | 77.78 | 22.22 | 100.00 |
| veg | 1 | 8 | 9 |
| | 11.11 | 88.89 | 100.00 |
| Total | 8 | 10 | 18 |
| | 44.44 | 55.56 | 100.00 |
| Priors | 0.5 | 0.5 | |

Error Count Estimates for diet

| | meat | veg | Total |
|---|---|---|---|
| Rate | 0.2222 | 0.1111 | 0.1667 |
| Priors | 0.5000 | 0.5000 | |

About as well as before, though simpler to see.

On a graph:




Now see purpose of “one”. Shows distinction difficult in middle but easy at the ends.

Output data set:

| Obs | diet | pulse1 | pulse2 | pulse3 | Can1 | meat | veg | _INTO_ |
|---|---|---|---|---|---|---|---|---|
| 1 | meat | 112 | 166 | 215 | 1.16811 | 0.87411 | 0.12589 | meat |
| 2 | meat | 111 | 166 | 225 | 1.77940 | 0.95035 | 0.04965 | meat |
| 3 | meat | 89 | 132 | 189 | 0.10730 | 0.54438 | 0.45562 | meat |
| 4 | veg | 95 | 134 | 186 | -0.02363 | 0.49020 | 0.50980 | veg |
| 5 | veg | 86 | 109 | 150 | -1.71168 | 0.05523 | 0.94477 | veg |
| 6 | veg | 89 | 119 | 177 | -0.25308 | 0.39656 | 0.60344 | veg |
| 7 | meat | 105 | 177 | 241 | 2.33384 | 0.97960 | 0.02040 | meat |
| 8 | meat | 85 | 117 | 186 | 0.29642 | 0.62051 | 0.37949 | meat |
| 9 | meat | 97 | 137 | 185 | -0.13855 | 0.44279 | 0.55721 | veg |
| 10 | veg | 93 | 151 | 197 | 0.11160 | 0.54615 | 0.45385 | meat |
| 11 | veg | 77 | 122 | 178 | -0.52064 | 0.29657 | 0.70343 | veg |
| 12 | veg | 78 | 119 | 173 | -0.72469 | 0.23109 | 0.76891 | veg |
| 13 | meat | 81 | 134 | 205 | 0.89679 | 0.81573 | 0.18427 | meat |
| 14 | meat | 88 | 133 | 180 | -0.51126 | 0.29982 | 0.70018 | veg |
| 15 | meat | 88 | 157 | 224 | 1.53302 | 0.92711 | 0.07289 | meat |
| 16 | veg | 58 | 99 | 131 | -3.16331 | 0.00523 | 0.99477 | veg |
| 17 | veg | 85 | 132 | 186 | -0.16175 | 0.43332 | 0.56668 | veg |
| 18 | veg | 78 | 110 | 164 | -1.01788 | 0.15596 | 0.84404 | veg |

- Sometimes classification clear (obs 1, 2, 5);
- sometimes very unclear (obs 3, 4, 9)
- when pulse3 high, “meat”,
- when low, “veg”,
- when middling, hard to tell
- but look at obs 8 and 10