

| Factor B: Fullness  |        |  |  |                    |  |
|---------------------|--------|--|--|--------------------|--|
| Factor A:<br>Weight |        | Empty                                      | Full                                       |                    |  |
|                     | Normal | n=20<br>$\bar{X} = 22$<br>T=440<br>SS=1540 | n=20<br>$\bar{X} = 15$<br>T=300<br>SS=1270 | $T_{obese} = 740$  |  |
|                     | Obese  | n=20<br>$\bar{X} = 17$<br>T=340<br>SS=1320 | n=20<br>$\bar{X} = 18$<br>T=360<br>SS=1266 | $T_{normal} = 700$ |  |
|                     |        | $T_{empty} = 780$                          | $T_{full} = 660$                           |                    | G=1440<br>N=80<br>$\Sigma X^2 = 31836$ |

$$\bar{X}_t = 18$$

$$\bar{X}_t^2 = 324$$

$$N = 80$$

$$N * (\bar{X}_t^2) = 25920$$

$$\Sigma X^2 - N * (\bar{X}_t^2) = 31836 - 25920 = 5916$$

step 1. Build hypotheses

1) Weight 에 따른 차이

$$H_0 : \mu_{A_{nor}} = \mu_{A_{obe}}$$

$$H_1 : \mu_{A_{nor}} \neq \mu_{A_{obe}}$$

2) Fullness 에 따른 차이

$$H_0 : \mu_{B_{emp}} = \mu_{B_{full}}$$

$$H_1 : \mu_{B_{emp}} \neq \mu_{B_{full}}$$

3) Weight \* Fullness 에 따른 차이

H0 : Factor A,B 간 상호작용은 존재하지 않는다. 각각의 평균의 차이는 두 Factor 가 갖는 주효과에 의해서만 설명된다.

H1 : Factor A,B 간 상호작용은 존재한다. 각각의 평균의 차이는 두 Factor 가 갖는 주효과에 의해서만 설명되지 않는다.

step 2. Locate the critical range for F-ratio. calculate the *dfs*

1.  $df_{total} = N - 1 = 79$
2.  $df_{within} = \sum df_{treatment}$   
 $= 19 + 19 + 19 + 19$   
 $= 76$
3.  $df_{between} = k - 1$  (k is number of cells)  
 $= 3$
4.  $df_A = \text{number of levels of A} - 1 = 1$
5.  $df_B = \text{number of levels of B} - 1 = 1$
6.  $df_{AxB} = df_{bet} - df_A - df_B$   
 $= 3 - 1 - 1$   
 $= 1$

Compute F-ratio  
SS

$$\begin{aligned}
 1. \ SS_{total} &= \sum X^2 - \frac{G^2}{N} \\
 &= 31836 - \frac{1440^2}{80} \\
 &= 31836 - 25920 \\
 &= 5916
 \end{aligned}$$

$$\overline{X}_t = 18$$

$$\overline{X}_t^2 = 324$$

$$N = 80$$

$$N * (\overline{X}_t^2) = 25920$$

$$\sum X^2 - N * (\overline{X}_t^2) = 31836 - 25920 = 5916$$

$$\begin{aligned}
 1. \ SS_{within} &= \sum SS_{treatment} \\
 &= 1540 + 1270 + 1320 + 1266 \\
 &= 5396
 \end{aligned}$$

$$SS_{within} = SS_{within} = 1540 + 1270 + 1320 + 1266 = 5396$$

$$1. \ SS_{between} = \sum \frac{T^2}{n} - \frac{G^2}{N}$$

$$= \frac{440^2}{20} + \frac{300^2}{20} + \frac{340^2}{20} + \frac{360^2}{20} - \frac{1440^2}{80}$$

$$= 9680 + 4500 + 5780 + 6480 - 25920$$

$$= 520$$

$$1. \quad SS_A = \sum \frac{T_A^2}{n_A} - \frac{G^2}{N}$$

$$= \frac{740^2}{40} + \frac{700^2}{40} - \frac{1440^2}{80}$$

$$= 13690 + 12250 - 25920$$

$$= 20$$

$$2. \quad SS_B = \sum \frac{T_B^2}{n_B} - \frac{G^2}{N}$$

$$= \frac{780^2}{40} + \frac{660^2}{40} - \frac{1440^2}{80}$$

$$= 15210 + 10890 - 25920$$

$$= 180$$

$$3. \quad SS_{A \times B} = SS_{between} - SS_A - SS_B$$

$$= 520 - 20 - 180$$

$$= 320$$

MS

$$1. \quad MS_A = \frac{SS_A}{df_A} = \frac{20}{1} = 20$$

$$2. \quad MS_B = \frac{SS_B}{df_B} = \frac{180}{1} = 180$$

$$3. \quad MS_{A \times B} = \frac{SS_{A \times B}}{df_{A \times B}} = \frac{320}{1} = 320$$

$$4. \quad MS_{Within} = \frac{SS_{within}}{df_{within}} = \frac{5396}{76} = 71$$

F-ratio

$$1. \quad F_A(1, 76) = \frac{MS_A}{MS_{within}} = \frac{20}{71}$$

$$2. \quad F_B(1, 76) = \frac{MS_B}{MS_{within}} = \frac{180}{71}$$

$$3. \quad F_{A \times B}(1, 76) = \frac{MS_{A \times B}}{MS_{within}} = \frac{320}{71}$$

| Table 1. Mean number of crackers eaten in each treatment condition |        |                  |                  |                       |
|--|--------|------------------|------------------|-----------------------|
|  |        | Fullness         |                  |                       |
|  |        | Empty stomach    | Full stomach     |                       |
| Weight   | Normal | M= 22<br>SD=9.00 | M=15<br>SD=8.18  |                       |
|  | Obese  | M= 17<br>SD=8.34 | M= 18<br>SD=8.16 |                       |
| Result   |        |                  |                  |                       |
| Source   | SS     | df               | MS               | F                     |
| Between treatment  | 520    | 3                | 520/3            |                       |
| - Factor A (weight)  | 20     | 1                | 20               | 20/71 $\approx$ 0.28  |
| - Factor B (fullness)  | 180    | 1                | 180              | 180/71 $\approx$ 2.54 |
| - A x B interaction  | 320    | 1                | 320              | 320/71 $\approx$ 4.51 |
| Within treatment   | 5396   | 76               | 71               |                       |
| Total  | 5916   | 79               |                  |                       |
| weight x fullness factorial design                                 |        |                  |                  |                       |

$$F_{A \text{ critical value}}(1,76) > F_{A \text{ calculated value}}(1,76)$$

영가설 부정하지 못한다. 따라서 연구가설을 지지하지 못한다.

$$F_{B \text{ critical value}}(1,76) > F_{B \text{ calculated value}}(1,76)$$

영가설 부정하지 못한다. 따라서 연구가설을 지지하지 못한다.

$$F_{AxB \text{ critical value}}(1,76) < F_{AxB \text{ calculated value}}(1,76)$$

영가설 부정한다. 따라서 연구가설을 지지한다.

Weight에 의한 차이는 없고 Fullness에 의한 차이도 없지만 weight와 fullness간의 상호작용은 존재한다.