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

$\overline{X_{t}}= 18 $  
$\overline{X_{t}}^2= 324 $  
$N = 80 $  
$N*(\overline{X_t}^2) = 25920 $  
$\sum{X^2} - N*(\overline{X_t}^2) = 31836 - 25920 = 5916$

step 1. Build hypotheses

1. Weight에 따라 crackers 먹는 양에 차이가 있을 것이다($$\text{H1: } \mu_{A_1} \neq \mu_{A_2}$$)
2. Fullness에 따라 crackers 먹는 양에 차이가 있을 것이다($\text{H1: } \mu_{B_1} \neq \mu_{B_2} $)
3. Fullness와 Weight의 상호작용에 따라 crackers 먹는 양에 차이가 있을 것이다

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

1. $df_{total}$ = 20 + 20 + 20 + 20 – 1 = 79
2. $df_{within}$ = (20-1) + (20-1) + (20-1) + (20-1) = 76
3. $df_{between}$ = 4 – 1 = 3
4. $df_A$ = number of levels of A – 1 = 2 – 1 = 1
5. $df_B$ = number of levels of B – 1 = 2 – 1 = 1
6. $df_{AxB}$ = df(between) – df(A) – df(B) = 3 – 1 – 1 = 1

Compute F-ratio   
SS

1. $SS_{total}$

$\overline{X_{t}}= 18 $  
$\overline{X_{t}}^2= 324 $  
$N = 80 $  
$N*(\overline{X_t}^2) = 25920 $  
$\Sigma{X^2} - N*(\overline{X_t}^2) = 31836 - 25920 = 5916$

1. $SS_{within}$

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

1. $SS_{between}$ = SS(total) – SS(within) = 5916 – 5396 = 520
2. $SS_A$ = [{(440+330)^2}+{(340+360)^2}]/40

= (1440^2)/80

= 20

1. $SS_B$ = [{(440+340)^2}/40] + [{(300+360)^2}/40] – 25920

= 15210 + 10890 – 25920

= 180

$SS_{AxB}$ = 520 – 20 – 180

= 320

MS

1. $MS_{A}$ = SS(A) / df(A) = 20/1 = 20
2. $MS_{B}$ = SS(B) / df(B) = 180/1 = 180
3. $MS_{AxB}$ = SS(A\*B) / df(A\*B) = 320/1 = 320
4. $MS_{Within}$ = SS(within) / df(within) = 5396/76 = 71

F-ratio

1. $F_{A}$(1,76) = MS(A) / MS(within) = 20/71 = 0.2817
2. $F_{B}$(1,76) = MS(B) / MS(within) = 180/71 = 2.5352
3. $F_{AxB}$(1,76) = MS(A\*B) / MS(within) = 320 / 71 = 4.5070

Make decision

1. Weight에 따라 crackers 먹는 양에 차이가 없다
2. Fullness에 따라 crackers 먹는 양에 차이가 없다
3. Fullness와 Weight의 상호작용에 따라 crackers 먹는 양에 차이가 있다

| **Result** | | | | |
| --- | --- | --- | --- | --- |
| Source | SS | df | MS | F |
| Between treatment | 520 | 3 |  |  |
| - Factor A (weight) | 20 | 1 | 20 | 0.2817 |
| - Factor B (fullness) | 180 | 1 | 180 | 2.5352 |
| - A x B interaction | 320 | 1 | 320 | 4.5070 |
| Within treatment | 5396 | 76 | 71 |  |
| Total | 5916 | 79 |  |  |
| weigth x fullness factorial design | | | | |