CHI-SQUARE AND FISHER'S EXACT TEST ON SPSS

Chi-Square Test (X^2)

- Hypothesis;
  - Comparing two or more proportion
  - $H_o : P_1 = P_2$
- Assumption

  - Random samples
  - Observations are independent

  - The number of cells with **_Expected Count (EC)_** less than 5, must be less than 20% of the total number of cells.
  - The smallest EC must be at least 2.

> The chi-square test for independence, also called Pearson's chi-square test or the chi-square test of association, is used to discover if there is a relationship between two categorical variables.

> Based on study design & method

> Calculate expected count for each cell (SPSS will do it)

Example Chi-Square Test (X^2) – (1)

- Hypothesis;
  - Association between gender and Knowledge on Nutrition (KoN)
  - Comparing the proportion of Low KoN between gender
  - $H_o : P(KoN)_{male} = P(KoN)_{femafe}$
- Assumption
  - Random samples [√]
  - Observations are independent [√]
  - The number of cells with **_Expected Count (EC)_** less than 5, must be less than 20% of the total number of cells
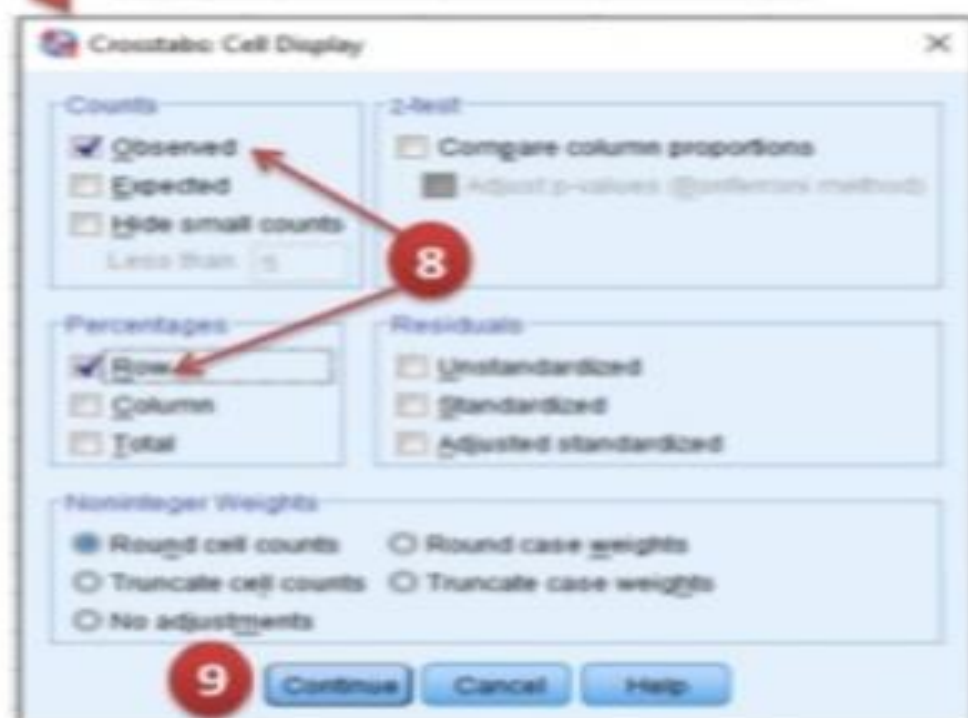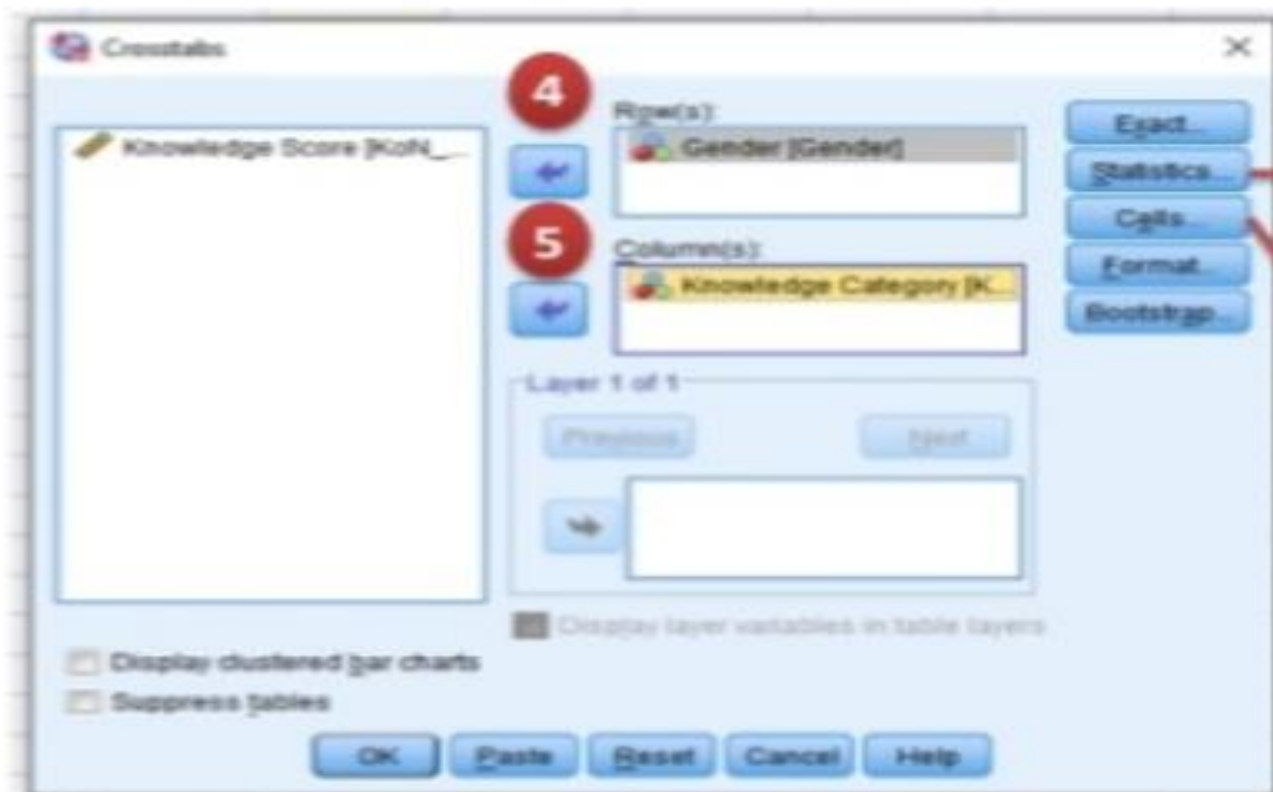 - The smallest EC must be at least 2

Calculated by SPSS

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Chi-square using SPSS - procedure:

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Chi-square using SPSS – Output:

Descriptive statistics for each group

Gender * Knowledge Category Crosstabulation

| | | | Knowledge Category | | Total |
			High	Low	
Gender	Female	Count	20	14	34
		% within Gender	58.8%	41.2%	100.0%
	Male	Count	20	19	39
		% within Gender	51.3%	48.7%	100.0%
Total		Count	40	33	73
		% within Gender	54.8%	45.2%	100.0%

Chi-square statistic = 0.417
df = 1; P-value = 0.518

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.417[a]	1	.518		
Continuity Correction[b]	.168	1	.682		
Likelihood Ratio	.418	1	.518		
Fisher's Exact Test				.638	.341
Linear-by-Linear Association	.411	1	.521		
N of Valid Cases	73				

Must be ≥ 2

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.37.
b. Computed only for a 2×2 table

2 EC assumptions is met

Must be < 20%

Chi-square using SPSS – Table and Interpretation:

Table 1: Factors (categorical variable) associated with Knowledge on Nutrition

Variable	n	Low KoN Freq (%)	High KoN Freq (%)	χ^2 statistics [a] (df)	P-value
Gender					
Male	39	19 (48.7)	20 (51.3)	0.417 (1)	0.518
Female	34	14 (41.2)	20 (58.8)		
Ethnicity					
Malay					
Others					
Education Level					
Low					
High					

> **The prevalence (proportion) of Low Knowledge on Nutrition between male and female is not significantly different ($P = 0.518$). Therefore, there is no significant association between gender and Knowledge on Nutrition.**

[a] Chi-square test for independence

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What if assumptions were not met?

- **Combine** adjacent columns or/and rows to increase the EC if possible.

- If still did not meet expected cell assumption, Fisher's exact (FE) test can be applied (only for 2 x 2 table in SPSS).

Fisher Exact Test

- **Fisher's Exact Test** is a test for independence in a 2 X 2 table.
- It is most useful when the total sample size and the expected values are small.
  - Useful when E(cell counts) < 5.
- The output consists of more than one p-values:
  - **Choose Exact Sig. (2-sided)**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.072[a]	1	.788		
Continuity Correction[b]	.001	1	.976		
Likelihood Ratio	.072	1	.788		
Fisher's Exact Test				.816	.489
Linear-by-Linear Association	.071	1	.790		
N of Valid Cases	73				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13.56.

b. Computed only for a 2x2 table