

## Introduction to Statistics

### 1. Are respondents feeling better (cf. mood) after eating chocolate?

We need to compare two means: **mood before and mood after eating chocolate**. Same respondents took part in both conditions, and hence we will perform **Paired samples T-test**.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	MoodPre	4,8118	178	1,26155	,09456
	MoodPost	5,035	178	1,2755	,0956

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	MoodPre - MoodPost	-,22331	1,04641	,07843	-,37810	-,06853	-2,847	177	,005

In the paired samples test table, we can observe that the means between mood of the participants before and after eating chocolate are significant different. (P-value <0.005). Thus, participants show significantly better mood (Happy/Good Mood/Pleased/Cheerful) after chocolate tasting (**M=5.03, SD = 1.28**) than before tasting chocolate (**M=4.81, SD = 1.26; t(177) = -2.85, p = 0.005**). Hence, our hypothesis is correct and we can say that respondents are actually feeling better after eating chocolate.

### 2. Are respondents evaluating the taste of mass market, premium and super premium chocolate brands differently?

We need to compare the means of taste evaluation for the three different types of chocolate brands. So, we need to use One-way ANOVA procedure, since we will comparing more than two means and we have independent samples.

First, we will check ANOVA table to see if there is significant different between the means of each group to proceed with the further analysis. In this case ANOVA **< 0.05**, so we proceed with the rest of the results.

ANOVA

TasteEvaluation					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	37,859	2	18,929	11,490	<,001
Within Groups	288,307	175	1,647		
Total	326,166	177			

Now, we should evaluate if the variances among the three groups are equal by checking the below table (Test of Homogeneity of Variances)

Tests of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
TasteEvaluation	Based on Mean	6,542	2	175	,002

The hypothesis testing with the previous test is:

$H_0$ = the variance of taste evaluation between the three groups are equal

$H_1$ = the variance of taste evaluation between the three groups are not equal

We can conclude from the above table that the variance between the groups are not equal because p-value= **0.002** thus the hypothesis null is rejected and we should use the test the **Dunnett's T3**.

Multiple Comparisons							
Dependent Variable: TasteEvaluation							
	(I) BrandType	(J) BrandType	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Bonferroni	1	2	-,121666	,234373	1,000	-,68820	,44486
		3	-,1038016*	,235398	<,001	-,1,60702	-,46901
	2	1	,121666	,234373	1,000	-,44486	,68820
		3	-,916350*	,237335	<,001	-,1,49004	-,34266
	3	1	1,038016*	,235398	<,001	,46901	1,60702
		2	,916350*	,237335	<,001	,34266	1,49004
Dunnett T3	1	2	-,121666	,258749	,952	-,74806	,50473
		3	-,1038016*	,222181	<,001	-,1,57686	-,49917
	2	1	,121666	,258749	,952	-,50473	,74806
		3	-,916350*	,220272	<,001	-,1,45074	-,38196
	3	1	1,038016*	,222181	<,001	,49917	1,57686
		2	,916350*	,220272	<,001	,38196	1,45074

\*. The mean difference is significant at the 0.05 level.

From the previous table, we can observe that the group 3: **Premium Brand** is significant different from groups 1 and 2: Mass Brand and Super Premium Brand. The p-value in these cases are  $p < 0.001$ .

Descriptives							
TasteEvaluation							
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		
					Lower Bound	Upper Bound	
1	61	4,52664	1,437974	,184114	4,15836	4,89492	1,000
2	59	4,64831	1,396477	,181806	4,28438	5,01223	1,875
3	58	5,56466	,947134	,124365	5,31562	5,81369	3,000
Total	178	4,90520	1,357477	,101747	4,70440	5,10599	1,000

There is a significant effect of the type brand surveyed on the taste evaluation given ( $F(2,175) = 11.50$ ,  $p < 0.001$ ). **Dunnett's T3** post-hoc tests show that tasting premium chocolate lead to significantly higher test evaluation score ( $M=5.56$ ,  $SD = 0.95$ ) compared to tasting mass brand chocolate ( $M = 4.53$ ,  $SD=1.44$ ;  $p < 0.001$ ), or tasting super premium chocolate brand ( $M=4.65$ ,  $SD= 1.40$ ;  $p < 0.001$ ). Hence our hypothesis is correct and we can say that respondents are evaluating the taste of mass market, premium, and super premium brands differently.

### 3. Is the taste evaluation different for milk and dark chocolate?

Here we will be comparing two taste evaluation means, one for milk and one for dark chocolate, and given the fact that we have independent sample because there are different respondents who took part in both conditions and hence we will use **Independent – Samples T-test**.

First, we need to check if there is difference among the variances, we found that  **$p > 0.05$** , by looking at the first row of equal variances assumed of the independent samples test table.

Independent Samples Test									
		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower Upper
TasteEvaluation	Equal variances assumed	,308	,579	-1,090	176	,277	-,236530	,216974	-,664735 ,191675
	Equal variances not assumed			-1,110	118,088	,269	-,236530	,213168	-,658658 ,185597

Looking at the 1<sup>st</sup> row equal variances assumed, we can conclude that there is not significant difference between the means of the two groups since  $p\text{-value} > 0.05$ .

Group Statistics					
	ChocoType	N	Mean	Std. Deviation	Std. Error Mean
TasteEvaluation	1	120	4,82813	1,378392	,125829
	2	58	5,06466	1,310434	,172068

Tasting milk chocolate ( **$M = 4.83$ ,  $SD = 1.38$** ) does not lead to a higher or lower score in the taste evaluation compared to tasting dark chocolate ( **$M=5.06$ ,  $SD =1.31$ ,  $t(176) = -1.090$ ,  $p = 2.77$** ). Hence, we can conclude that the taste evaluation is not different for milk and dark chocolate.