Test on effect of honey as a cough remedy

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October 25, 2015

Introduction

1. Drinking tea or lemon water with honey is proved as a time-honored way to soothe a sore throat. Honey contains a treasure chest of hidden nutritional and medicinal value for centuries, so people wonder honey itself may also be an effective cough suppressant. This case is about to test whether a teaspoon of honey before bed calms a child's cough, with comparison to traditional cough medicine dextromethorphan. Researchers are going to test three treatments to participants who get sore throat and record their improvement through the treatment, there is also a control group to maintain the significance of each treatment.

2. The goal of this study is to understand the cause and effect. In this case, the goal is to find that whether honey is significant on healing sore throat and compare its effectiveness level with other two treatments.

Theory and concepts

1. This study is an experimental study. An experiment is a study in which a treatment, procedure, or program is intentionally introduced and a result or outcome is observed. An experiments includes four elements: manipulation, control, random assignment, and random selection. Since this study has all four elements and conclude an outcome, it is an experimental study.

2. The independent variable in this study is the drug treatment of either honey or dextromethorphan. The dependent variable in this study is the improvement of sick child after the drug treatment. Both variables are quantitative. The independent variable is the value which is manipulated in an experiment while a dependent variable is the value observed by the researcher during the experiment. So independent variable could be a causality of dependent variable.

3. Factor is the independent variable, there are three factors (the honey and dextromethorphan, no treatment). Each factor only has one level as either a dosage of dextromethorphan or a similar dose of honey. The independent variable in this study is the drug treatment of either honey or dextromethorphan. The dependent variable in this study is the improvement of sick child after the drug treatment.

4. In order to use ANOVA analysis, all samples are drawn from normally distributed populations; all populations have a common variance; all samples are drawn independently of each other; within each sample, the observations are sampled randomly and independently of each other; and factor effects are additive. Outliers are prohibited, and sample size has to be large, since ANOVA can tolerate data that is non-normal with only a small effect on the Type I error rate, and it tests on more than two factors and then analyze the variance to test the hypothesis that the means of more than two populations are equal.

5. We test the assumption in three parts. First one is constant variance, we make the graph such as box plots of the residuals for each treatment and test the equality of the treatment variances or use homogeneity of variance tests to see whether the variances across groups are equal or not. Second

one is normality, we can do a leaf plots, or a histogram to check for the shape of the distribution and for outliers, and a normal probability plot of the residuals. Lastly, we check the independence and random selection. This is something controlled and decided by the researchers, so they have to make the data being collected randomly and independently when they planned the experiment. Researchers can use remedial measures such as change the model to account for the unequal variance or non-independence to allow the problem happen.

Hypothesis and Critical Value

1. Null hypothesis: the mean improvement score for the three treatment groups are equal.
   The effectiveness of honey, dextromethorphan and not treatment are same
   Alternative hypothesis: At least one mean improvement score of treatment group does not equal to the other twos.
   The effectiveness is different between either honey and dextromethorphan, honey and no treatment, or dextromethorphan and no treatment.

2. F critical: we choose α level: α =0.05 for this study.
   Degree of freedom for denominator is n-k=105-3=102, degree of freedom for numerator is k-1=3-1=2. From f-distribution graph, we can determine that f-critical is 3.07. A f-critical value is a point on the test distribution that is compared to the test statistic to determine whether to reject the null hypothesis. In this case, the critical value means that if the f-test value is greater than 3.07, we can reject the null hypothesis.

IV. Data Analysis

I use SPSS for data analysis.

1.

Statistics

Treatment of honey

N	Valid	35
	Missing	0
Mean		10.7143
Median		11.0000
Mode		10.00[a]
Std. Deviation		2.85504
Variance		8.151
Skewness		-.217
Std. Error of Skewness		.398
Range		12.00
Minimum		4.00

Maximum		16.00
Sum		375.00
Percentiles	25	9.0000
	50	11.0000
	75	12.0000

a. Multiple modes exist. The smallest value is shown

Statistics

dextromethorphan

N	Valid	33
	Missing	2
Mean		8.3333
Median		9.0000
Mode		4.00
Std. Deviation		3.25640
Variance		10.604
Skewness		.087
Std. Error of Skewness		.409
Range		12.00
Minimum		3.00
Maximum		15.00
Sum		275.00
Percentiles	25	6.0000
	50	9.0000
	75	11.5000

Statistics

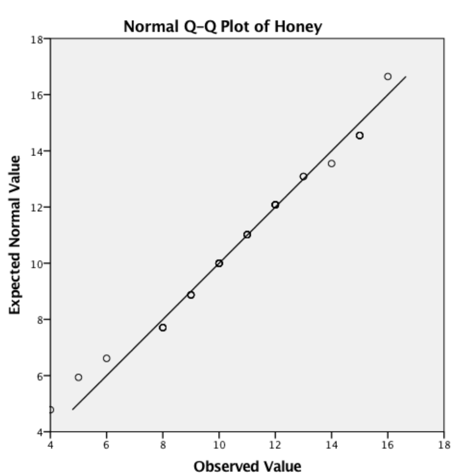
No treatment

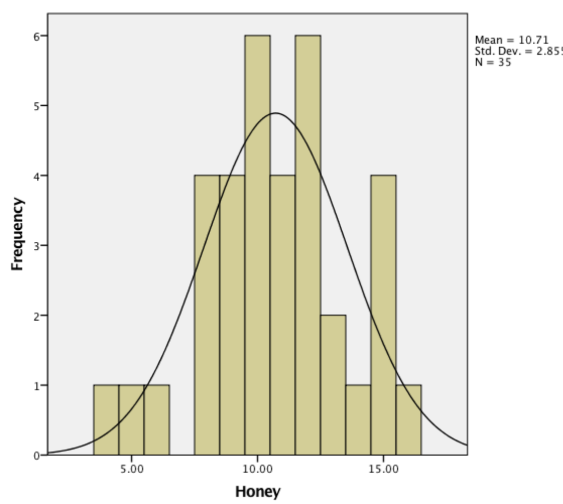
N	Valid	37
	Missing	0
Mean		6.5135
Median		7.0000
Mode		7.00
Std. Deviation		2.94035
Variance		8.646

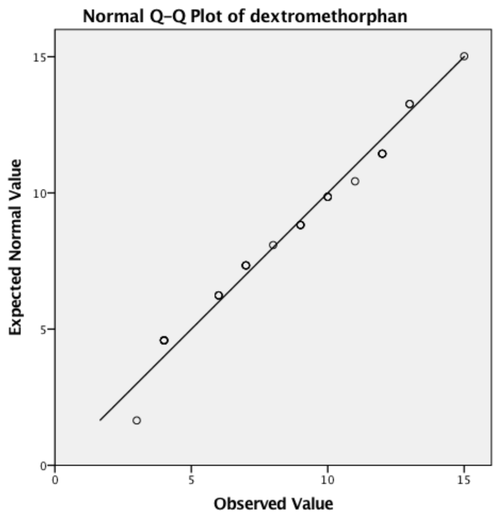
Skewness		-.420
Std. Error of Skewness		.388
Range		12.00
Minimum		.00
Maximum		12.00
Sum		241.00
Percentiles	25	5.0000
	50	7.0000
	75	8.0000

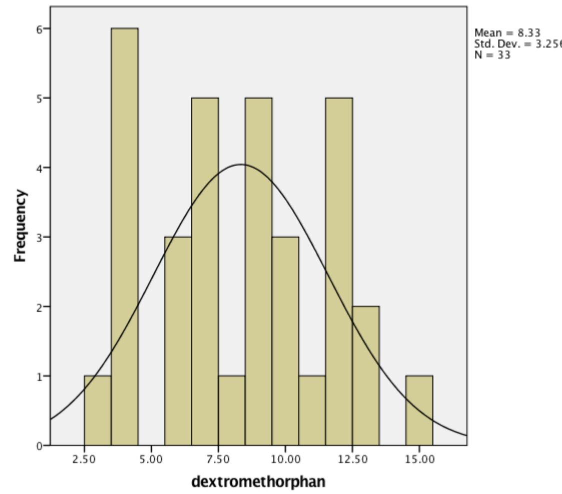
From the frequencies analysis, for treatment of honey, we find the minimum is 4, the maximum is 16, the q25 is 9, median is 11, and q75 is 12. For treatment of dextromethorphan, we find the minimum is 3, the maximum is 15, the q25 is 6, median is 9, and q75 is 11.5. For no treatment, we find the minimum is 0, the maximum is 12, the q25 is 5, median is 7, and q75 is 8. The skewness for three analyses are very small, so we can conclude that the data is roughly normal distributed. So the descriptive statistics shows that we did not violate ANOVA' assumption and are allowed to use it.

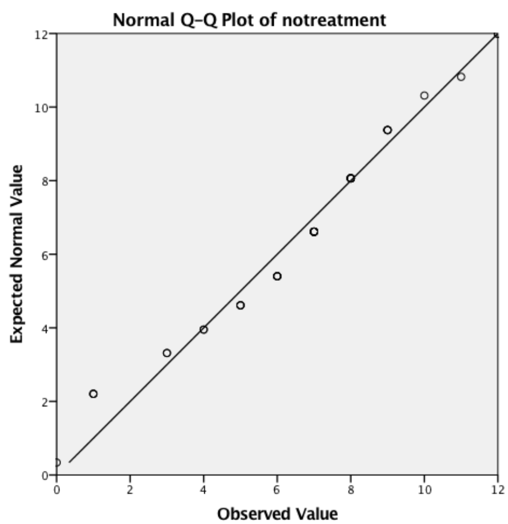
2.

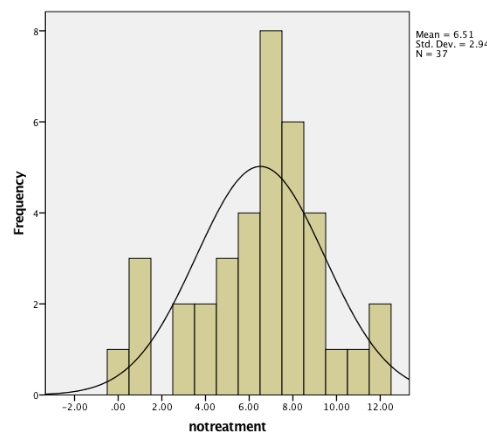


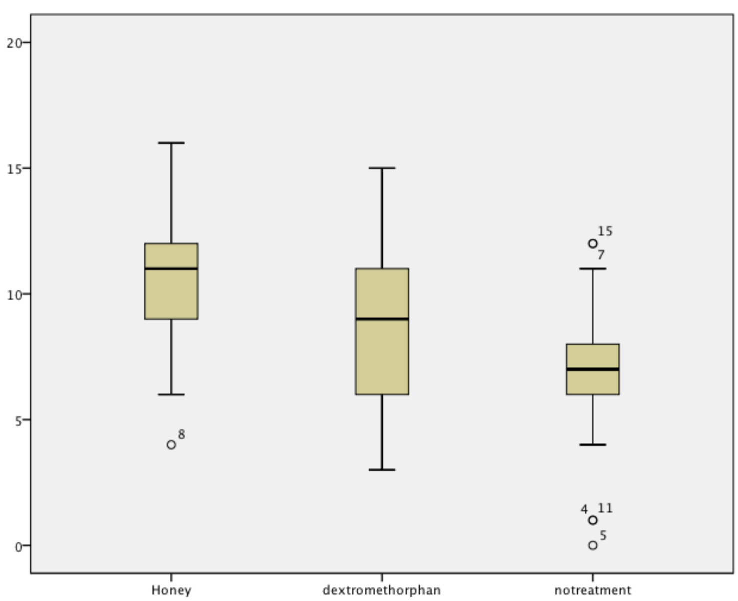



Normal Q-Q Plot of dextromethorphan
Expected Normal Value
Observed Value
0
5
10
15


Mean = 8.33
Std. Dev. = 3.256
N = 33
Frequency
dextromethorphan
2.50
5.00
7.50
10.00
12.50
15.00


Normal Q-Q Plot of notreatment
Expected Normal Value
Observed Value
0
2
4
6
8
10
12


Mean = 6.51
Std. Dev. = 2.94
N = 37
Frequency
notreatment
-2.00
.00
2.00
4.00
6.00
8.00
10.00
12.00


0
5
10
15
20
8
15
7
4 11
5
Honey
dextromethorphan
notreatment

From the histogram, the distribution has a normal bell shape with one peak, though the graph for no treatment is a bit skewed, we can tell that data are normal distributed; from the boxplot, although there are outliers, it does not significantly skew the pattern, so the data is normal distributed; from the Q-Q plot, since most of the point are locating on the line, we can tell the variance within each of the populations is roughly equal. Thus, we can conclude that none of the ANOVA assumption is violate. Since there are unequal number of subjects in the various groups, we have to make sure the assumption of homogeneity of variance is not violate in order to use ANOVA analysis.

3.

Descriptives

Mean improvement score

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
1.00	35	10.7143	2.85504	.48259	9.7335	11.6950	4.00	16.00
2.00	33	8.3333	3.25640	.56687	7.1787	9.4880	3.00	15.00
3.00	37	6.5135	2.94035	.48339	5.5332	7.4939	.00	12.00
Total	105	8.4857	3.46164	.33782	7.8158	9.1556	.00	16.00

ANOVA

Mean improvement score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	318.509	2	159.255	17.510	.000
Within Groups	927.719	102	9.095		
Total	1246.229	104			

Homogeneous Subsets

Tukey HSD[a,b]

Treatment	N	Subset for alpha = 0.05: 1	2	3
3.00	37	6.5135		
2.00	33		8.3333	
1.00	35			10.7143

Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 34.924.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

The data shows that the f statistics is 17.51. The treatment of honey has largest mean, no treatments results smallest mean, and the treatment of dextromethorphan is in the middle. The 95% confidence interval for mean shows that the lower bound of the treatment of honey is still higher than the upper bound of the treatment of dextromethorphan, so there is a significant difference between these two treatments, so as a significant difference between no treatment and treatment of honey.

4. Conclusion
   Since f-statistics 17.51 is larger than f-critical, we can reject the null hypothesis and conclude that there is significant difference of improvement on sore throat among the treatment of honey, treatment of dextromethorphan and no treatment.

V. Comparison of Means

Steps:
Go to analyze, find general linear module, click Univariate, put improvement score in dependent variable and groups of treatment in factors.
Then choose option, put everything to display means for, click compare main effects, descriptive statistics, estimates of effect size, and homogeneity tests, make sure the significance level is 0.05.
Then go to plots, put factors into horizontal axis, continue.
Then click ok.

Pairwise Comparisons

Dependent Variable: improvement score

(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound
1.00	2.00	2.381*	.732	.002	.929	3.832
	3.00	4.201*	.711	.000	2.790	5.611
2.00	1.00	-2.381*	.732	.002	-3.832	-.929

	3.00	1.820*	.722	.013	.388	3.252
3.00	1.00	-4.201*	.711	.000	-5.611	-2.790
	2.00	-1.820*	.722	.013	-3.252	-.388

Based on estimated marginal means

*. The mean difference is significant at the

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

From the pairwise comparison, we find that the mean difference is significant at all six pairs of treatments.

VI. Decisions

From the study, we can conclude that honey itself can be a good cough remedy to improve the sore throat. From the data, we first find out that there is significant improvement under treatment of honey, compare to no treatment. Furthermore, from the data we analyze, the improvement under treatment of honey is greater than the improvement under treatment of dextromethorphan and no treatment. It turns out that treatment of honey recovers the sore throat more significant than cough drug dextromethorphan.