

# The Effect of Storage Duration on Fruit Juices Made With or Without the Addition of Yeast Towards Its Alcohol Content

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## ABSTRACT

*Fruit juice is a healthy beverage. However, we must be careful in handling or consuming such juice, especially in relation to its storage time. The Prophet of Muhammed PBUH in his hadith prohibits to drink fruit juices that have been stored for more than 3 days, as its legal status changes from Halal into Haram. In accordance with the development of science and technology, many methods could be used to measure alcohol content in a sample; such as Gas Chromatography-Mass Spectroscopy method (GC-MS). Therefore the objective of this research was to analyze the alcohol content of various fruit juices made with or without the addition of yeast and being stored within 1, 2, and 3 days using GC-MS, as well as its relation to the hadith Matn of the Prophet Muhammad PBUH regarding its law. Results showed that alcohol (ethanol) content of various fruit juices : red grapes, green grapes, dates, pomegranate and durian, made without the addition of yeast which stored for 3 days, in consecutive order were 0.524; 0.144; 0.214; 0.143 and 0.314%  $v/v$ . While alcohol (ethanol) content of various fruit juices : red grapes, green grapes, dates, pomegranate and durian, made with the addition of 10 g/L yeast were and stored for 3 days were 0.618; 0.921; 0.901; 0.575 and 1.202%  $v/v$  constitutively. Alcohol content of red grapes fruit juices of 0.524%  $v/v$  was the highest alcohol content (in juices) which is still Halal to be consumed.*

**Keywords:** fruit juices, GC-MS, Hadith Matn., the law of Halal and Haram.

## 1. Introduction

Ethanol (alcohol) is naturally present in fruits (Riswiyanto, 2009). Fruits are often processed into juice. The Prophet Muhammad in his hadith forbade the drinking of fruit juice that had been left/fermented for more than 3 days, because it was intoxicating (became khamr), and its legal status changed from being halal to haram.

With the rapid development of science and technology in the manufacture of various food products, beverages, medicines and cosmetics, many producers of these products have to use alcohol (ethanol) or deliberately add alcohol (ethanol) to the product made. Therefore the Indonesian Ulama Council (MUI) has enacted several fatwas related to alcohol (ethanol), including the 2009 MUI Fatwa which decided the law on the use of alcohol (ethanol) for the manufacture of food products, beverages,

medicines, and cosmetics, as follows :

- 1) The use of alcohol (ethanol) from non-chemical products (whether they are chemical synthesis product/from petrochemicals, or khamr industry) for the production of food, beverages, drugs, and cosmetics categorized as "mubah" if medically harmless,
- 2) The use of alcohol (ethanol) from khamr industry (whether they are chemical synthesis product/from petrochemicals, or non-chemical products) for the production of food, beverages, drugs, and cosmetics categorized as "haram" if medically harmful, (MUI, 2009).

However, the MUI does not clearly state or specify how much the alcohol content (ethanol) that can still be permitted in these products, so the fatwa might confuse Muslim producers and consumers.

From the habit of the Prophet Muhammad (PBUH) above, who did not drink fruit juice after more than 3 days of storage, implies that drinking fruit juice that has been stored for more than 3 days may harmful for health.

Therefore, the purpose of this study was to analyze the alcohol content of various fruit juices made with or without the addition of yeast and stored for 1, 2 and 3 days using the GC-MS method and analyze the relevance of alcohol content in these juices in accordance with the Hadith Matn of the Prophet Muhammad PBUH about the law changing of fruit juice.

## 2. Materials and Methods

The research experiment used various fruit juice samples with various long storage time made with or without the addition of yeast. A factorial experimental design (5x2x3) with 3 replications was used in this experiment. The first factor was the type of fruit that is made into juice. The second factor was juice made with or without the addition of yeast. The third factor was the duration of juice storage, namely: 1, 2 and 3 days. (Gaspersz, 1991; Steel & Torrie, 1989).

### Sample Preparation

#### a. Fruit Juice Making (Red Grapes, Green Grapes, Dates (Arab), Pomegranate (India), and Durian).

The fruits were washed in the running water, and then rinsed with distilled water. 0.5 kg of fruit that has been cut into small pieces was blended for 5 minutes after the addition of 200 ml of distilled water. The juice was filtered with a stainless steel filter/muslin cloth, the residue was removed, and the filtrate volume was then measured.

#### b. Samples

Table 1. The level of alcohol (ethanol) in fruit juice with or without the addition of yeast and stored for 3 days

Day	Without Yeast (% v/v)					With Yeast (% v/v)				
	Red Grapes	Green Grapes	Dates	Pomegranates	Durian	Red Grapes	Green Grapes	Dates	Pomegranates	Durian
0	undc*	0,028	0,067	0,011	0,642	0,044	0,043	0,101	0,014	0,725
1	0,043	0,049	0,068	0,024	0,435	0,618	0,795	1,467	0,527	1,408
2	0,103	0,064	0,115	0,041	0,694	0,669	0,877	1,846	0,512	1,585
3	0,524	0,144	0,214	0,143	0,314	0,618	0,921	1,901	0,575	1,202

\*undc = undetected

The filtrate was divided into 2 with the same volume.

Part I : stored at room temperature, without adding yeast

Part II : stored at room temperature, with the addition of yeast (as much as 10 g/L of solution) (Crueger & Crueger, 1984)

The filtrates (Parts I & II) were then put into small, closed bottles (volume 150 mL) and stored until ready for analysis. The filtrate was mixed with 1% acetonitrile in a ratio of 1: 10. The samples were filtered with Millipore filter or with syringe filter (size 2 µm). 0.2 µl sample was then injected into the GC-MS.

### Data Collection

The parameter measured was the alcohol concentration in various fruit juices made with or without the addition of yeast and stored for 1, 2 and 3 days. Measurement of alcohol content based on the method of Wang et al. (2003) using Gas Chromatography-Mass Spectroscopy (GC-MS) (Thermo Scientific).

### Data Analysis

Data measured analyzed using ANOVA SPSS portable 16. While the analysis of Hadith Matn using a critic's study of Hadith Matn with a scientific approach (chemically) by the analytic description method together with literature study.

## 3. Results and Discussion

### The Level of Alcohol (Ethanol) in Fruit Juice With or Without The Addition of Yeast and Stored for 3 Days

The analysis results of alcohol content (ethanol) in various fruit juices made with or without the addition of yeast and stored for 1, 2 and 3 days (Table 1)

The analysis results of the alcohol content of fruit juices made without the addition of yeast and stored for 3 days (Table 2)

Table 2. The alcohol content in various fruit juices made without the addition of yeast and stored for 3 days

Day	Repetition	Without yeast (% $\forall_v$ )				
		Red Grapes	Green Grapes	Dates	Pomegranates	Durian
0	1	undc	0,028	0,067	0,011	0,658
	2	undc	0,028	0,067	0,011	0,639
	3	undc	0,028	0,067	0,011	0,629
	Average	undc	0,028	0,067	0,011	0,642
1	1	0,043	0,049	0,068	0,024	0,409
	2	0,043	0,049	0,068	0,024	0,438
	3	0,043	0,049	0,068	0,023	0,458
	Average	0,043	0,049	0,068	0,024	0,435
2	1	0,101	0,064	0,115	0,042	0,688
	2	0,103	0,065	0,115	0,040	0,697
	3	0,105	0,064	0,115	0,042	0,697
	Average	0,103	0,064	0,155	0,041	0,694
3	1	0,534	0,142	0,210	0,138	0,305
	2	0,515	0,147	0,217	0,137	0,314
	3	0,524	0,144	0,215	0,154	0,324
	Average	0,524	0,144	0,214	0,143	0,314

undc = undetected

The types of fruits used for juice making in this study were: red grapes, green grapes, pomegranate (India), dates (Arabic), and durian (local). The selection of grapes, pomegranates, and dates in this study refers to the types of fruits found/mentioned in the Quran, besides those types of fruits often made into juices. The durian fruit was chosen because today many durian juices are sold, and often consumers get drunk after consuming durian fruit. So it is interesting to find how much alcohol content (ethanol) in the durian which made many consumers get drunk due to drinking juice from durian fruit.

Table 1 showed that both fruit juice made with or without the addition of yeast have contained alcohol since the 0th day (zero), even though no alcohol detected in red grape juice in the same day. However, it can not be concluded that the grape juice does not contain alcohol on day 0 (zero). Undetectable alcohol in red grape juice is due to the limitations (limit detection) of the tools used in this study, as the lowest alcohol content that can still be detected is 0.011%  $\forall_v$  (Table 1). So the alcohol content on day 0 (zero) in red grapes might lower than 0.011%  $\forall_v$ .

The presence of alcohol (ethanol) in fruit juices that were not given the additional yeast on 0<sup>th</sup> day (zero), gives evidence that alcohol is actually present in fruits, and what forbidden by Allah SWT is not alcohol (ethanol) but khamr.

After three days of storage, the levels of alcohol (ethanol) from fruit juices made with or without the addition of yeast tend to increase compared to previous days, except for red grape juice (added yeast) and local durian juice (with and without yeast). The alcohol (ethanol) content of fruit juice made without the addition of yeast, after being stored for 3 days ranges between (0.143 - 0.524)%  $\forall_v$ , which is lower than the alcohol content (ethanol) in yeast-added fruit juices, which ranges from (0.575 - 1.901)%  $\forall_v$  (Table 1). This happened because in the yeast-added fruit juices occurred fermentation of alcohol (ethanol), whereas in non-yeast-added fruit juices only occurred the spontaneous fermentation.

The ANOVA results on alcohol (ethanol) content of 5 fruit juice samples made with or without the addition of yeast and stored for 1, 2 and 3 showed that the p-value was 0 for all sources of diversity, at alpha testing 5% (p-value <0.05). Therefore, H<sub>0</sub> is rejected (with H<sub>0</sub> saying that the source of diversity does not affect alcohol content). The effect of interaction between storage days, the use of yeast and fruit types significantly affected alcohol content. Therefore, the effect of storage days differs depending on the use of yeast and the type of fruit.

### Alcohol Content in Fruit Juice and Its Relation to The Hadith of The Prophet Muhammad PBUH

Alcohol or ethanol can be produced through the fermentation process of fruits or grains such as dates, grapes, apples, or wheat. The benefits of fermented products are to provide a benefit for the future through bio-nutritional technology, minerals, flavor and aroma enhancement. This process also improves health. However, if the alcohol content produced during fermentation is high, the fermentation product can be intoxicating and become haram for consumption (Riaz & Chaudry, 2004)

In Islam, the determination of justified alcohol levels can be investigated based on a hadith of the Prophet Muhammad PBUH related to the ripening of Nabidh (juice). In the hadith it is explained that:

"From Yahya bin' Ubaid. Abu Umar Al-Bahrani, he said: "I heard Ibn Abbas say:" *Usually Rasulullah PBUH was made Nabidh at the beginning of the night and he drank it in the morning, in the day and night, in the next morning and the following night, and the following day until Ashr. If there still something left, then he gave it to the servant or asked him to throw it away*" (HR. Muslim).

Nabidh comes from the word "nabadha" which means water immersion from dates, raisins or grapes. And based on the hadith above, the rest of the nabidh which was stored by the Prophet Muhammad PBUH on the third day of the evening after Ashr will be discarded or given to his servants, because the nabidh can be intoxicating and make drunk for those who drink it.

Therefore, in order to obtain justified alcohol content more clearly, an approach based on scientific studies is needed to support the view of Fiqh correctly and impressively. In this study, the focus of scientific studies was conducted on determining the alcohol content of fruit juices made without the addition of yeast and stored for 3 days. The alcohol content of various fruit juices made without the addition of yeast and stored for 3 days is presented in Table 2.

Based on table 2, the alcohol content in fruit juices increased to coincide with the length of storage. However, on the 0<sup>th</sup> day (zero), the alcohol content in local durian juice was already

high, by 0.642%  $\%_v$  and it did not increase afterward, alcohol content should be higher than 0.642%  $\%_v$  after 3 days of storage. this alcohol content (0.642%  $\%_v$ ) was greater than the alcohol content in red grape juice made with the addition of yeast and stored for 3 days at (0.618%  $\%_v$ ) (Table 1), which the law has changed from halal become haram. Therefore local durian juice which was made without the addition of yeast and stored for 3 days was not included in the study of alcohol content that is still halal, based the Hadith Matn of the Prophet Muhammad. In other words, the fruit juice was analyzed its halal status in accordance with the Prophet Muhammad PBUH in this study were red grapes, green grapes, dates, and pomegranates.

Based on ANOVA results and Duncan's comparison alcohol content from juices of red grapes, green grapes, dates (Arabic) and pomegranate (India) after 3 days of storage, respectively were 0.524; 0.144; 0.214; and 0.143%  $\%_v$ . These are the highest alcohol content of each fruit juices that were stored for 3 days. In other words, the highest alcohol content of fruit juice that can still be consumed by Muslims is 0.524%  $\%_v$ . This result was different from Rizqiyah (2007) that reported the halal highest alcohol content of fruit juice of 0.51%  $\%_v$ ; Aditya et al (2005) in the amount of 0.95% (for grapes), 0.45% for apples and 0.56% for date palm; Najiha et al. (2010) in the amount of 5.81%  $\%_w$  for grapes, 4.70%  $\%_w$  for apples, and 0.636%  $\%_w$  for dates.

It also differs from the MUI fatwa on Halal Fatwa Standardization which states that "The use of ethanol in the form of pure compound that is not derived from the Khamr Industry for the industry of the food production process:

- a. Mubah, if alcohol is **not detected** on the final product
- b. Haram, if alcohol is **detected** on the final product

These differences are caused by several things, such as:

- a. Differences of date palm species such as dates: Medina, Tunisia, Egypt, and Arabic and the maturity of dates such as ruthab (fresh dates) and tamar (processed dried dates)
- b. Differences in the preparation of fruit juice samples, such as the addition of yeast, sugar

and others

- c. Differences in the methods used to identify and measure alcohol content, such as Micro Conway Diffusion, HPLC, and GC- MS.

#### 4. Conclusion

Fruit juice of red grapes, green grapes, dates (Arabic), pomegranates (India), and local durian have been contained alcohol (ethanol) since the first day. Alcohol content (ethanol) from various fruit juices mentioned above, whether made with or without the addition of yeast increase with the length of storage. The alcohol content (ethanol) from the fruit juices above, which were made without the addition of yeast, range between (0.143 - 0.524) %  $v/v$  after 3 days of storage. The alcohol (ethanol) content of the fruit juices above, which were made by adding yeast after 3 days of storage have higher the alcohol content (ethanol) of fruit juice without the addition of yeast and stored for 3 days

Suggestion, Due to differences results from the previous studies in term of in alcohol content (ethanol) from date palm juice (Arabic) after 3 days of storage, we suggest to do a repetition study, especially the determination of alcohol content (ethanol) from various types of dates stored for 3-5 days, either fresh dates (ruthab) or dried dates (tamar); and various types of grapes with or without the addition of yeast, so that we can give recommendations to the MUI regarding the levels of alcohol (ethanol) in the final products of food, drinks, cosmetics, and drugs that do not endanger health.

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