ORIGINAL RESEARCH

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Comparative Study on Effectiveness of Wine Vinegar Over Commercially Available Vinegar Using Chemical Titration Technique for Chicken Quality Analysis

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ABSTRACT

Aim: Vinegar producers are still on a mission to find acetic acid bacteria fermentation that produces extremely strong vinegar. Vinegar fermentation is caused directly by the acetic acid bacteria alcohol respiratory chain, which is found on the intracellular membrane. In the alcohol respiratory chain, enzyme activity is increased through Acetobacter pasteurianus' semi-permanent vinegar biodegradation, so did the acetification rate. Acetic acid bacteria alcohol respiratory chain activity was increased in a series of experiments with the goal of achieving a high strength fermentation process. **Materials and methods**: Precursors of alcohol respiration-associated components (ferrous ions and hydroxybenzoic acid) were added, and the air flow rate was increased, to further improve acidification. Researchers examined the color and physical/chemical properties of the finished product, as well as the sensory quality of the vinegar-preserved whole chicken. Two groups are taken with 7 samples per group, G power 80%, coincidence interval will be 95%. **Results And Discussion:** The pH was found to be 2.37, with an acetic acid content of 8.2%. According to the present study the amount of acetic acid in vinegar was increased by 3.2% using this production method. and the statistical (p=0.001). **Conclusion**: Three parameters were discovered to increase alcohol oxidation into acetic acid in acetic acid bacteria cells: enzyme activity in the alcohol respiratory chain, precursor of ubiquinone production.

Keywords

Acetobacter, ***Saccharomyces cerevisiae***, Wine, Fermentation, Innovative Grape Vinegar

Imprint

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INTRODUCTION

Acetic acid bacteria (AAB) are a type of acidophilic bacteria that belong to the Proteobacteria subgroup. They belong to the Acetobacteraceae family, which includes the genera Acetobacter, Gluconobacter, and Gluconacetobacter. Gomes et.al reported that classifications of the bacteria (Gomes et al. 2018). Qiu et.al reported that acetic acid bacteria categorization and acid resistance mechanisms (Qiu, Zhang, and Hong 2021). When growing in acetic acid, bacteria are well-known for their oxidative fermentation abilities that contribute to the rapid sugars that have been oxidized and alcohol products, However, these substrates will not be assimilated. Mamlouk and gullo et.al reported about the aerobic conditions for growing acetobacter (Mamlouk and Gullo 2013). De Ross and De Vuyst et.al reported the role of acetobacter in foods and beverages (De Roos and De Vuyst 2018). Bacterial respiration systems directly contribute to oxidative fermentation in these microbes. Doelle et.al reported that the bacterial respiratory system (Doelle 2014). Prust et.al reported the whole genomic sequence of the acetobacter (Prust et al. 2005).

In the past five years, the total number of articles published by google scholar is 827 articles and science direct contained by 651 articles. In bacteria, there are two types of respiratory systems: cytochrome c oxidase and ubiquinol oxidase, which are differentiated by the type of terminal oxidase they use to produce energy. Gao et.al reported that types of respiratory systems in bacteria (Gao et al. 2012). Many studies on acetic acid bacteria have shown that membrane-bound dehydrogenases connect to ubiquinol oxidases to carry out oxidative fermentation. Adachi and yakushi et.al reported that they showed dehydrogenases in acetic acid bacteria that are membrane-bound (Adachi and Yakushi 2016). Acetic acid bacteria have a respiratory chain classified as the ubiquinol terminal oxidase system. Matsushita et.al reported that in acetic acid bacteria's respiratory chain (Matsushita, Toyama, and Adachi

2004). Deppenmeier et.al reported that the of the acetic acid bacteria physiology (Deppenmeier and Ehrenreich 2009).There are four different ubiquinol terminal oxidases found in bacteria that aren't exclusive to those found in acidic bacteria, including the well-studied cytochrome-a1 and cytochrome-d oxidases, as well as the CN-resistant bypass oxidase. Musser et.al reported that the different types of the ubiquinol terminal oxidases (Musser, Stowell, and Chan 1993).Our team has extensive knowledge and research experience that has translate into high quality publications (Chellapa et al. 2020; Lavanya, Kannan, and Arivalagan 2021; Raj R, D, and S 2020; Shilpa-Jain et al. 2021; S, R, and P 2021; Ramadoss, Padmanaban, and Subramanian 2022; Wu et al. 2020; Kalidoss, Umapathy, and Rani Thirunavukkarasu 2021; Kaja et al. 2020; Antink et al. 2020; Paul et al. 2020; Malaikolundhan et al. 2020)

There has never been a study done that uses *Saccharomyces cerevisiae* and *Acetobacter pasteurianus* grains to make wine vinegar. The chain of alcohol respiration, an innovative grape vinegar-production mechanism exclusive to acetic acid bacteria, is a typical oxidative fermentation system. Many studies on the respiratory chains of acetic acid bacteria have been done, but few have attempted to use the findings from those studies to improve vinegar biodegradation. As a result, understanding the role of the alcohol respiratory system in innovative grape vinegar fermentation regulation is important. Researchers looked at correlations between the alcohol respiratory chain activity of enzymes and the rate at which vinegar was being acetified in the current study. The relationship found was then used to carry out high-strength vinegar fermentation by boosting the alcohol respiratory chain.

MATERIALS AND METHODS

The research was conducted at the Saveetha School of Engineering's Microbiology Lab at the Saveetha Institute of Medical and Technical Science in Chennai. Number of groups is 2 (Commercial vinegar and Wine vinegar). The sample size is 14, G Power at 80% and Coincidence interval at 95% ((Gao et al. 2012)).

Microbial strain: The acetic bacterial culture used in acetic acid fermentation was donated by the microbiology lab at Saveetha School of Engineering, Saveetha University in Chennai. A sterile swab is used to inoculate the Acetobacter aceti strain into a primary culture plate containing non-selective agar medium, which is then cultured at 26°C for 48 hours.

Acetic acid fermentation: According to the flowchart representation in Fig. 1, the production of wine vinegar was assessed.

The researchers inoculated Acetobacter aceti into a secondary culture plate using nutritional agar base as the maintenance medium and incubated the plate at 35 °C for 48 to 72 hours before seeing growth. After the process was complete, the inoculum for acetic fermentation was 25 mL of the incubated broth containing 105 CFU/mL. We began the fermentation by mixing 100 mL of the fermented juice with 162 CFU/mL solution in an acidic medium. For the generation of acetic acid, the fermented mixture was kept at 32°C for 30 days.

Determination of acetic acid: Every 24 hours, acetic acid production was determined by titrating a 1 ml sample with sodium hydroxide 0.1 N and phenolphthalein as an indicator. The acidity of novel grape vinegar in degrees of acetic acid was calculated using the mass in grams of acetic acid in 100g pure vinegar.

Statistical Analysis

Statistical comparison of acetic acid concentration concentration between the Beer/wine vinegar and commercial innovative grape vinegar (fermented by *Saccharomyces cerevisiae)* through the SPSS software version 26 is used. There are no dependent variables and they have the independent variables like standard deviations and Mean differences ((Gao et al. 2012)).

RESULTS

Acetic acid concentration in innovative grape vinegar was analyzed and shown in Table 1. With the parameters like pH, Temperature, Acetic acid concentration and ethanol concentration for both Beer/wine vinegar and commercial vinegar. The mean potential difference between the acetic acid concentration of Beer/wine vinegar (8.2%) and commercial vinegar (5%.) is 3.2%.

Table 1

Acetic acid concentration in vinegar was analyzed and shown

S.NO	Vinegar	pH	Temperature	Acetic acid %	Ethanol %
1.	Beer/wine vinegar	2.5	30ºC	8.2%	1%
2.	Commercial vinegar	2.4	30ºC	5%	0.5%

Comparison of Beer/wine vinegar acetic acid concentration and commercial vinegar acetic acid concentration in Table 2. The acetic acid concentration is slightly higher in Beer/wine vinegar (8.2%) when compared to commercial vinegar (5%).

Table 2

Comparison of Beer/wine vinegar acetic acid concentration and commercial vinegar acetic acid concentration in table.

S.NO	Vinegar	Acetic acid %
1.	Beer/wine vinegar	8.2%
2.	Commercial vinegar	5%

In Table 3, compared the mean values, standard deviations and standard error deviations for commercial vinegar and Beer/ Wine vinegar.

Table 3

The mean values, standard deviation and standard error mean for commercial vinegar and grape vinegar.

	Group	N	MEAN	Std.Deviation	Std.Error Mean
Acetic acid percentage	Commercial vinegar	7	5.0000	0.00000	0.00000
	Wine/Beer vinegar	7	8.2143	0.08997	0.03401

Independent sample test shows the statistical significance (P=0.01) for acetic acid concentration between the Beer/wine vinegar and Commercial vinegar in Table 4.

Flowchart representation in Fig. 1 shows the production of wine vinegar. Bar chart represents the acetic acid concentration of the Beer/wine vinegar and commercial vinegar in Fig. 2. They show the mean potential difference between the Beer/wine vinegar and commercial vinegar. Beer/wine vinegar is slightly more in acetic acid concentration when compared to commercial vinegar.

DISCUSSION

The pH was found to be 2.37, with an acetic acid content of 8.2%. According to the current study the level of acetic acid in vinegar was increased by 3.2% using this production method. and the statistical (p=0.001). The acetic acid concentration in Beer/wine vinegar is slightly high in Beer/wine vinegar when compared to the commercial vinegar.

Kosseva et.al reported that the wine production quality is premier for commercialization of the same (Kosseva, Joshi, and Panesar 2016). Mas et.al reported the standard of the wine vinegar (Mas et al. 2014). They increase the acetic acid concentration because the food preservation and chicken marination process undergoes the tenderization process. Matsumoto et.al reported that the meat tenderization process (Matsumoto 2012). After marination the meat will be very soft and smooth. Increasing the acetic acid concentration for maintaining the quality of the food without spoilage. Babic et.al reported that the acetic acid in the food industry (Babic 2013).

The limitations of the Wine/beer vinegar reduce the time in the production process. In a certain period of time we can produce a large amount of Beer/wine vinegar. The future scope will be that genetically modified organisms will be used for producing acetic acid concentration in Beer/wine vinegar in a short period of time.

CONCLUSION

This study shows Beer/Wine vinegar has better quality than commercial vinegar with a statistical significance of p=0.001. Beer/wine vinegar has a high

Table 4

Independent sample test shows the statistical significance (P=0.01) for acetic acid concentration between the Beer/wine vinegar and Commercial vinegar.

Independent Sample Test										
		Levene's Test for Equality of variances		T-test for Equality of Means						
		F	Sig.	t	df	Sig (2.tailed)	Mean diff	Std. diff error	5%confidence interval of the difference	
									Lower	Upper
Acetic acid percentage	Equal variances assumed	21.016	0.001	-94.519	12	0.000	-3.21429	0.03401	-3.28838	-3.14019
	Equal variances not assumed			-94.519	6.000	0.000	-3.21429	0.03401	-3.29750	-3.13107

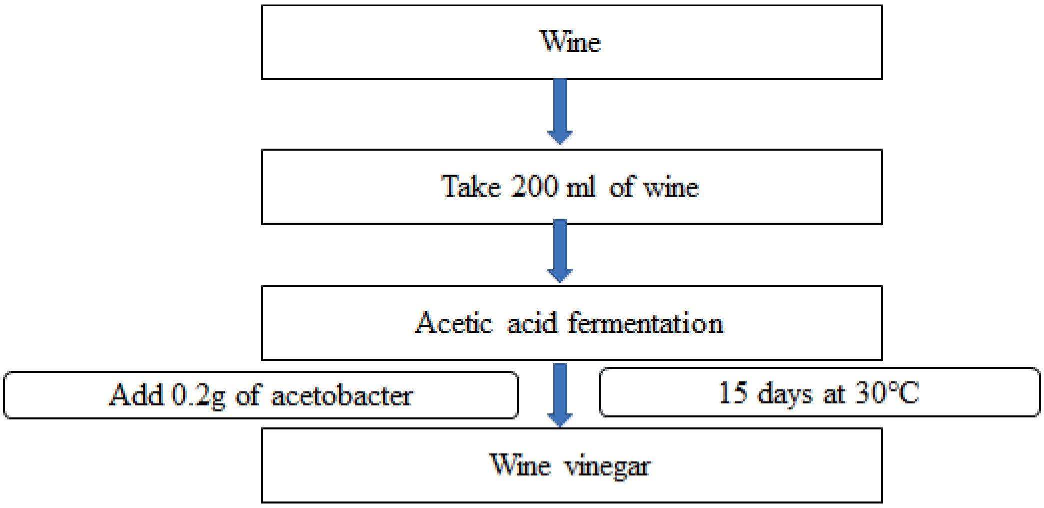

Fig. 1.roduction of wine vinegar Production of wine vinegar

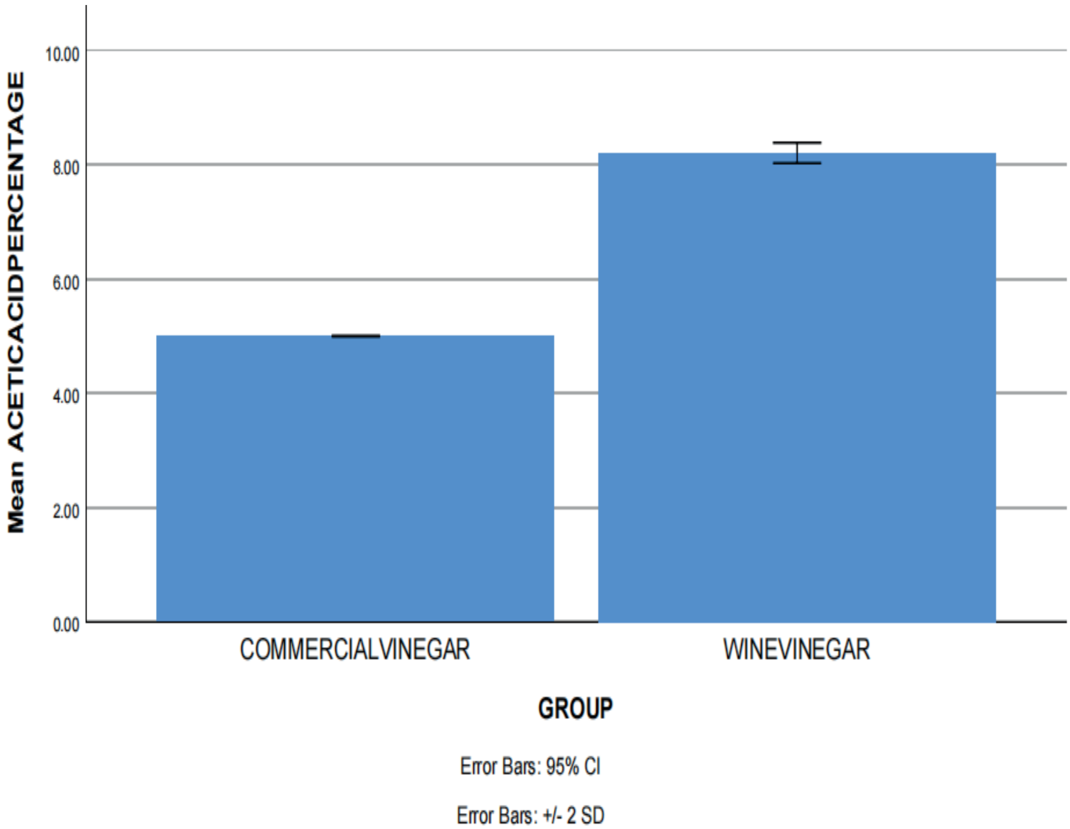

FIG. 2..Acetic acid concentration between the Beer/wine vinegar and commercial vinegar. X axis:Commercial Vinegar and wine vinegar; Y axis: Mean Acetic Acid Percentage. SD+-2.

acetic acid (8.2%) content when compared to commercial vinegar (5%). Chemical titration technique will be used for measuring acetic acid concentration. Higher acetic acid concentration improves the quality of the food.

DECLARATION

Conflict of Interest

No conflict of interest in this manuscript.

Authors contribution

Author VP was involved in data collection, data analysis and manuscript writing. Author MS was involved in the conceptualization, data validation and critical review of the manuscript.

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