

Quality Characteristics and Level of Acceptability of Lemongrass Wine in Mountain Province, Philippines

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ABSTRACT: Wine has been widely produced within Mountain Province, business sector included different variant of wines like bugnay wine, rice wine, mangosteen wine, strawberry wine and a lot more. Production of lemongrass in Mountain Province is abundant, thus, coming up with a new variant of wine, which is lemongrass wine may be an additional array to the business sector. The research may also be extended to the different provinces of Mountain Province that would like to adapt the new variant of wine. The study identified the quality characteristics that best describe lemongrass wine depending on the present lemongrass. The researcher also identified the level of acceptability of the lemongrass wine, wherein the researcher made use of purposive sampling in determining the respondents. Respondents includes knowledgeable panels that determined the quality characteristics of lemongrass, and consumer-type panels that captured the level of acceptability of lemongrass wine. The results that were gathered for the quality characteristics were indication of the standard color, aroma, taste and texture for lemongrass wine, wherein adjustment of composition of lemongrass in wine affected the color variations of the wine. Results and finding indicated that with a composition of 65 grams of lemongrass in wine was accepted by the community. Furthermore, the respondents perceived that having a new variant of wine in Mountain Province may be beneficial to the community.

KEYWORDS: Lemongrass, Wine, Experiment, Bontoc, Bauko

INTRODUCTION

Lemon grass (*Cymbopogon citratus*) or popularly known as “Tanglad” in the Philippines, is a commercially-viable plant that is cultivated mainly for the fragrance that it produces. Lemongrass is native to the Philippines and it is widely used as herb in Asian cuisine. It has a citrus flavor and can be dried and powdered, or used fresh. By nature, tanglad is a permanent or perennial plant, and the benefits of which are not restricted to its fragrance. The utility of tanglad basically lies in its leaves, where all the benefits are derived. What can be seen of this plant are mainly its leaves, which allows easy access to the main part that is needed in order to enjoy tanglad’s health benefits. With this, people started to up come with tea using lemongrass, hence, the municipalities in Mountain Province made the lemongrass tea a part of their everyday delight. The study focuses on coming up with a new variety of wine, since lemongrass is abundant in Mountain Province and coming up with lemongrass wine may be utilized by wine makers and business owners as well.

Lemongrass is an aromatic tropical grass cultivated primarily for culinary use. There are two of the 55 species in the genus *Cymbopogon* that are used almost interchangeably as lemongrass. West-Indian lemongrass (*C. citratus*), is of a Malaysian origin and is more typically used for cooking. When crushed, the fragrance resembles the scent of lemon (Shahzadi, 2017). Extensive breeding programs have developed many varieties of lemongrass but few are available in North America. This perennial herb is widely grown in the tropics and subtropics but can also be grown as an annual in cooler climates. The plants grow in dense clumps up to 6 feet in diameter, with leaves up to 3 feet long. They require warm, humid conditions in full sun to thrive. The coarse, strap-like leaves are ½-1” wide, finely serrated on the edges (rough enough to cut skin), tapered at the end and have gracefully drooping tips. It is not as attractive as many other ornamental grasses but clumps can develop into imposing specimens. Plants will flower with a branched cluster of stalked flowers but usually not when grown as an annual (Simpson & Johnson, 2016). These are not ornamental and rarely set seed. Grow lemongrass in containers or as an annual during the growing season. Plant in full sun in moist, loam soil, preferably with high organic content. Place outside as soon as the danger from frost is past. Clumps will grow slowly until the heat and humidity of summer arrives then the plants will increase in size dramatically. This plant requires a great deal of water, so water regularly if rainfall is sparse. Frost will kill or severely damage the plants, so harvest or dig before

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overnight temperatures get to freezing (Yablonski, 2019). Lemongrass has essentially no pest problems in the Midwest. Propagate lemongrass by root or plant division. You may be able to root grocery store specimens in water or potting medium if enough root plate is left on the stem. Roots should form within two or three weeks if they are going to. To harvest, cut stems at ground level when the stems are about ½" thick. Push an outside stem to the side, then twist and pull it off or cut off with a knife. Discard the leaves and woody outer layers. The entire clump can be harvested (such as at the end of the season just before the first frost), or selected stems can be removed from the edges of the clump. When harvested, the bulbous stems look like scallions, but are pale yellow and more fibrous once the woody outer layers have been removed. The whole stalk itself is too hard to be eaten, so it is usually smashed and simmered in liquid to impart the lemony flavor to the dish, then removed before serving. Select firm stalks with fresh to slightly dry tops and a somewhat heavy and moist base (Iris, 2021). Lemongrass is an important culinary herb in tropical Asia (in India it is cultivated as a medical herb and for perfumes, but not used as a spice). Lemongrass has a light, refreshing, lemony flavor without the bitterness that lemon rind can have and with a hint of ginger. It is a staple in Thai cuisine, used to flavor soups, fish, seafood stews, curry and sauces. It is also an important flavoring in Vietnam, Cambodia and Indonesia, being used with poultry, fish and seafood dishes (Food Roots, 2021).

Cymbopogon citratus is a perennial, shortly rhizomatous grass. Culms tufted, robust, up to 2 m tall, 4 mm in diameter, farinose below nodes. Leaf sheaths glabrous, greenish inside; leaf blades glaucous, 30-90 × 0.5-2 cm, both surfaces scabrid, base gradually narrowed, apex long acuminate; ligule 1 mm. Spathate compound panicle large, lax, up to 50 cm, drooping, branches slender; spatheoles reddish or yellowish brown, 1.5-2 cm; racemes 1.5-2 cm; rachis internodes and pedicels 2.5-4 mm, loosely villous on margins; pedicel of homogenous pair not swollen. Sessile spikelet linear-lanceolate, 5-6 × 0.7 mm; lower glume flat or slightly concave toward base, sharply 2-keeled, keels wingless, scabrid, veinless between keels; upper lemma narrow, entire and awnless, or slightly 2-lobed with 0.2 mm mucro. Pedicelled spikelet 4-5 mm (Flora of China Editorial Committee, 2016).

Lemongrass (*Cymbopogon citratus*) is a tall, perennial grass in a class of about 45 species of grasses native to the tropical and sub-tropical climates of Asia, Australia and Africa. India is the highest producer of lemongrass (producing over 2 million pounds per year), where it is cultivated along the mountain range of the Western Ghats and beside the foothills of Arunachal Pradesh and Sikkim in the Himalayan mountains. Lemongrass grows spectacularly well in Northern Bangladesh, which borders India and is nestled against the Himalayan mountains. Lemongrass has red base stems and can grow up to 10 feet in its favored habitat. The greatest time of growth for lemongrass is during the summer in moist, rich soil. In planting lemongrass, its roots tend to take over in a garden, so physical barriers should be put up whenever planting the grass near other plants. Each stalk of lemongrass has several layers, each growing tightly wrapped around its core. Lemongrass also contains iron, calcium, and vitamin C. Iron is an essential component of hemoglobin, a vital substance that transfers oxygen from your lungs to your blood (Teatulia organic teas, 2021).

Lemongrass might help prevent the growth of some bacteria, it also contains substances that are thought to relieve pain and swelling, reduce fever, improve levels of sugar and cholesterol in the blood, stimulate the uterus and menstrual flow, and have antioxidant properties. Lemongrass is a tropical plant native to Southeast Asia and a common ingredient in Thai cuisine. Now grown in Africa, Australia, and North and South America, lemongrass is widely used as a natural remedy for digestive issues, neurological problems, and high blood pressure. Lemongrass reportedly has antibacterial and antifungal properties. It has traditionally been used as a pain reliever and fever reducer. Lemongrass contains citral, a natural plant compound with anti-inflammatory effects. Lemongrass extract is also used to provide the fresh scent in many soaps, candles, disinfectants, and insect repellants (Brennan, 2020).

Wine is an alcoholic beverage made up of water (80% to 85%), alcohols (mostly ethanol, 9% to 15%), and a variety of minor constituents (~3%) (Revi, Badeka, Kontakos, and Kontomina, 2014). Such minor constituents include organic acids, sugars, phenols, nitrogenous compounds, enzymes, vitamins, lipids, inorganic anions and cations, and a large number of volatile compounds. Of these, organic acids and phenols play a critical role by directly affecting product quality. Wine flavour is a complex mixture of taste and aroma attributes; the first is made up of a subtle balance of sweet (sugars), sour (organic acids), and bitter/astringent (polyphenols) taste attributes; the second is made up of a large number of volatile compounds belonging to alcohol classes (lower and higher), organic esters, volatile organic acids, aldehydes, lactones, phenols, sulphur-containing compounds, methoxypyrazines, norisoprenoids, ketones, and terpenes all of which contribute to wine aroma (Torrens, Riu-Aumatell, Lopez-Tamames, and Buxaderas, 2018). The quality and safety of food products are some of the most important factors influencing consumer choices in modern times (Considine, Kelly, Fitzgerald, Hill, and Sleator, 2018). Today's consumers demand high-quality foods to be additive-free, fresh in flavour, microbiologically safe, and with an extended shelf life (Buzrul, 2016). Since 1985, the US Food and Drug Administration (FDA) has required package labelling for most foods and beverages when sulphites are used as an additive. Due to its antiseptic and antioxidant properties, sulphur dioxide (SO₂) is one of the most versatile and efficient additives used in winemaking. Most wine studies utilizing stated choice methods have focused on variety and placebased factors such as viticultural areas, as well as the individual-specific characteristics that influence these attributes, rather than non-sensory attributes such as a wine's sulfite content (Yaldagard, Mortazavi, and Tabatabaie, 2008). The market share simulation has

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seen how brand size, region of production, price, and quality medals (all external attributes) influence consumer choice. Quality medals listed on the label for lower price points were found to significantly increase the market share, particularly with low-involvement consumers. High-involvement consumers, on the other hand, tended to prefer wine in the higher price categories and were less influenced by the award labeling. The segmented the preferences for wine attributes based on market involvement levels, but found that the wine's origin was important for occasional consumers, while the age of the wine had a relatively larger impact on utility for high-involved consumers. Market-involved consumers also expressed less preference for wines in the lower price ranges (Mtimet & Albisu, 2006).

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Health Benefits of Lemon Grass:

- It contains an antibacterial and anti-fungal properties
- It helps to detoxify the liver, pancreas, kidney, bladder and the digestive tract.
- Helps boost the immune system
- Helps reduce uric acid, cholesterol, excess fats
- It helps alleviates indigestion and gastroenteritis.
- Helps improve the skin by reducing acne and pimples
- It helps tone the muscle and tissues.
- Helps in menstrual troubles
- Helps reduce blood pressure and improve blood circulation
- Helps reduce cellulite
- Act as sedative for the central nervous system.
- May help prevent color cancer.
- Helps in reducing fevers
- Help in flatulence and colic
- Relieves arthritic pain and rheumatism

Lemongrass comes in various names: barbed wire grass, silky heads, citronella grass, camel's hay, cochin grass, and fever grass. In French, it is known as *herbe de citron*, while Indians call it *bhustrina* or *sera*. In Thailand, it is known as *takra*, while Filipinos simply call it *tanglad*. Scientists have given the name *Cymbopogon citratus* for it. Most Filipino farmers neglect this crop as it can be grown anywhere and is a common backyard plant. What they don't know is that the crop can be turned into a profitable venture. That was what Emmanuel Piñol found out when he visited the mountains of Murcia in Negro Occidental recently. The head of Mindanao Development Authority (MinDA) wanted to replicate the technology in the country's second-largest island to help "improve the lives of our people." What most Filipinos don't know that lemongrass is good for those with Type 2 diabetes (Tacio, 2021).

There are a few famous wines and liquors in the Philippines made from things other than grapes with rich historical value: For instance, sugarcane wine (better known as basi) is famous in the province of Ilocos found in the northern region of Luzon. The sugar canes are extracted off for their juice, which is then fermented in 7-gallon (25-L) clay pots or jars that are embedded in the soil, sealed with a nipa sheet, and left for two to three months before consumption. There is also rice wine (better known as tupuy), which is popular in parts of the country where rice is abundant, such as Central Luzon, and the high-altitude regions of Mountain Province and Benguet (Olarie, 2019).

Most wines are processed at home and compose a special home activity of the housewife. Although there is a pending need for a collective stainless tank to process wines to bring standard alcohol content and ensure clean, clear, and safe products. Quality control appraisal of locally made wines is one major function of the Department of Industry to ensure alcohol content, safety, and clarity of wine products who trained some winemakers to do the appraisal. The traditional tapey of Sagada and Besao is also commercialized and packaged as rice wine like the Piitik of Sagada. Fvayash, the sugarcane wine from Sadanga is also sold commercially but of rare supply. Fvayash is called basi (sugarcane wine) in Guinaang and Mainit, Bontoc. Basi is also rarely sold as it is more locally used the whole year round in Guinaang and Mainit. Fruit wines are available in almost any souvenir shop in

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Sagada, Bontoc, and Bauko. Fruit wines are specially sold at the Pasalubong Centre at the second floor of the Multipurpose Building in Bontoc (Dizon, 2009).

Culturally, wine is a vital component in agricultural and social ceremonies of people from the Mountain Province. Tapey is offered during ceremonies such as begnas (agricultural festival) in Sagada, Besao, Sabangan, and Bauko. Tapey is also a ceremonial wine drunk in eastern Barlig and Natonin during weddings and other celebrations. Basi is a cultural wine in Bontoc especially in the sugarcane producing upland barangays of Mainit and Guinaang. It is drunk during special occasions such as weddings and other celebrations (Palangchao, 2022).

CONCEPTUAL FRAMEWORK

With the population continuing to expand, world food innovation is something that's beginning to gain more attention. Food innovation is the development process and the commoditization of new food products and production processes as well as looking for ways to offer consumers more nutritious food products. It can also be used to manufacture unique and sustainable food options. Food and drink companies are looking for ways to bring new products to the markets. And solve many of the issues within food manufacturing today. Food innovations also include the packaging of the products (Bygora, 2021).

This study is anchored from the article under Food Product Innovation which aims to develop products that the customer will accept. Innovation can be defined in many different ways, but probably define as the process of transforming a discovery into goods or services that consumer or customers are willing to purchase (Visperas, n.d.). When developing new food products, the main objective is to ensure that it will be accepted by customers, being that acceptance based on the intimate relationship between the particular characteristics or attributes of the product and human perception and psychological response, develop new product which requires knowledge of ingredients, processing techniques, packaging materials, and consumers' demand (Winger & Wall, 2006).

Paradigm Of The Study

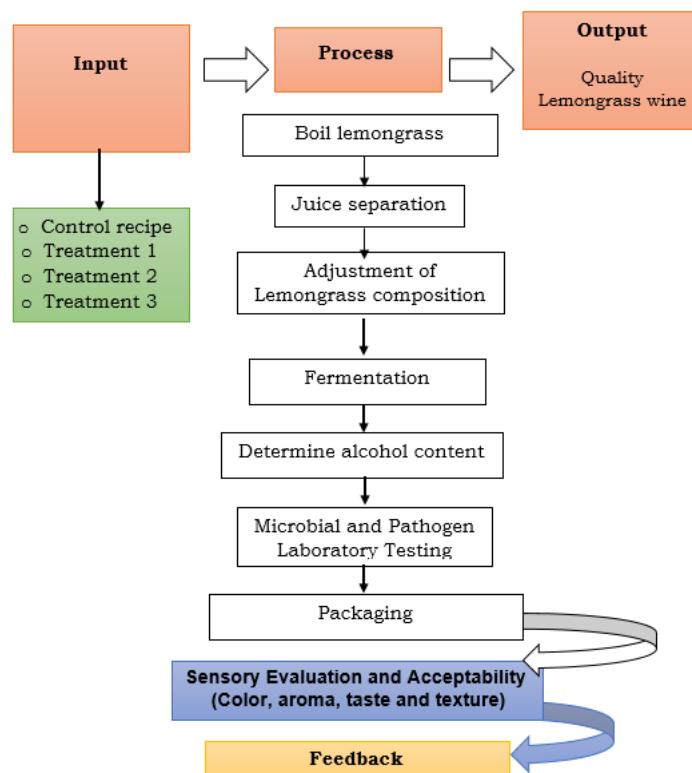


Figure 1. Research paradigm

Significance of the Study

The study aims to come up with a new variant of local wine, which is the lemongrass wine. The study aims to provide quality wine that will be introduced in the market, this will also help the municipalities of Mountain Province to have an additional variant of wine that they may opt to ferment and sell in the market. Lemongrass is commonly seen in Mountain Province, it is usually used in making lemongrass tea, hence, the research study will provide new knowledge to the wine makers and business owners in the Mountain Province.

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Objectives of the Study

The study aims to produce a new variant of wine which is the lemon grass wine. The study aims to seek the following objectives:

- To identify the quality characteristics of lemongrass wine by knowledgeable panels in terms of:
 - a. Color
 - b. Aroma
 - c. Taste
 - d. Texture
- To determine the level of acceptability of lemongrass wine as perceived by consumer-type panel at Bontoc and Bauko, Mountain Province.
- To determine the significant difference between the treatments and control recipe of lemongrass wine as perceived by consumer-type panels in terms of:
 - a. Color
 - b. Aroma
 - c. Taste
 - d. Texture

MATERIALS AND METHOD

Study Design

Quasi-Experimental Approach was used in determining the quality characteristics and the level of acceptability of lemongrass wine. Purposive sampling, also known as judgmental, selective, or subjective sampling was used in the selection of respondents, this is a form of non-probability sampling in which the researcher relies on own judgment when choosing members of the population to participate in the survey.

In-house consumer panels (consumer-type panels) usually consist of 30 to 50 untrained panelists selected from personnel within the organization where the product development or research is being conducted. This type of panel can indicate the relative acceptability of products, and can identify product defects. Results from consumer-type panels testing should not be used to predict product performance in the marketplace, however, because in-house panels may not be representative of the actual consuming population of which the research is being conducted.

Product-oriented testing uses small trained panels that function as testing instruments. Trained or knowledgeable panels are used to identify differences among similar food products or to measure the intensities of flavor (odor and taste), texture or appearance characteristics. These panels usually consist of 5-15 panelists who have been selected for their sensory acuity. Trained panelists or knowledgeable panels should not be used to assess food acceptability. Their knowledge makes them more sensitive to small differences than the average consumer and teaches them to set aside personal likes or dislikes when measuring sensory parameters (Kemp et al., 2018).

Sample/Population of the Study

The study was conducted at Bontoc and Bauko, Mountain Province for the sensory evaluation and level of acceptability of lemongrass wine.

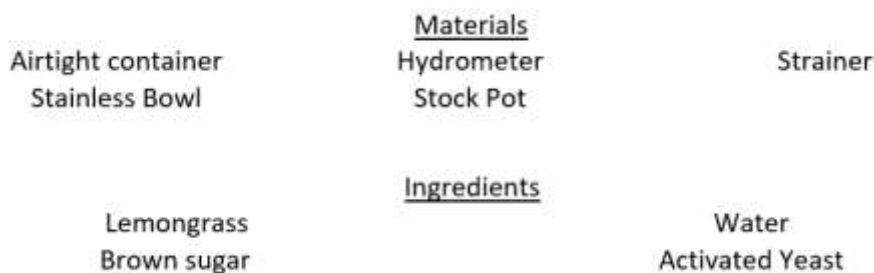
The respondents were composed of 15 knowledgeable panels for the sensory evaluation. Knowledgeable panels were familiar with wines; has a background on production of wine or producers of wine; 19-59 years of age; and not a smoker. The research also had consumer-type panels in determining the level of acceptability of lemongrass wine. Consumer-type panels were composed of 50 panel members which could generally capture the feedback of a typical consumer considering that appropriate age range from 19 – 59 years of age. Ages that did not fall in the range were not allowed since children may not be able to understand the instrument used in the study and people of older age may also have problems with their deteriorating senses which makes them not suitable for the study.



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Data Gathering Tools

The instrument for assessing the sensory characterization of the lemongrass wine was the score card, and for the acceptability hedonic scale was used, the development of the score card was also based on the identified characteristics of the lemongrass which includes the color, aroma, taste and texture. The tools were discussed to the knowledgeable panels to enlighten them on the terms used and how to go about answering the score card. With that, the researcher discussed the attributes that were measured based on the sensory characteristics of the developed lemongrass wine samples. Hedonic scale was also discussed to the consumer-type panels, wherein scales 1-9 were given, 1 is for Dislike Extremely and 9 is for Like Extremely. This part of the tool construction is essential in order to fully describe which attributes that were evaluated. The researcher also provided consent form and permission to conduct the study before proceeding to gathering of data.



Data Gathering Procedures

For the gathering of data, a consent letter was given to the respondents. Score cards and hedonic scale were discussed to enlighten the participants of the study.

For the development of lemongrass wine, a series of experimentation was done in order to standardize suited processing technique wherein it had undergone trial and error until the researcher was able to come up with an acceptable treatment recipe for lemongrass wine. The first step in making lemongrass wine is to wash and clean lemongrass, remove dirt and make sure that it is properly cleaned. Boil the lemongrass for 20 minutes, after which remove lemongrass from the extracted juice, let it cool. Boil the extracted lemongrass juice then add brown sugar, prepare the hydrometer, put the samples in a cylinder, this allows for an easy line of sight to get a measurement and prevents the risk of exposing the entire samples to contamination start dipping the hydrometer into the lemongrass. Spin the hydrometer to eliminate air bubbles that might cling to the side of hydrometer. Reading on day one determines if the lemongrass has the right amount of sugar to ferment out in order to provide the alcohol content appropriately. After knowing the density of water, boil the extracted lemongrass with sugar then add yeast. Let it cool then transfer the extracted lemongrass in a sealed airtight container. Ferment the extracted lemongrass for a month before opening the container seal. After the fermentation, use the hydrometer again to determine the alcohol percentage of the lemongrass wine. The reading must be negative, then the result of final reading must be added to the first reading, the result will be the alcohol content of the lemongrass wine. After which, laboratory testing of microbial and pathogen content of the lemongrass wine samples was done. Lastly, packaging of the final product.

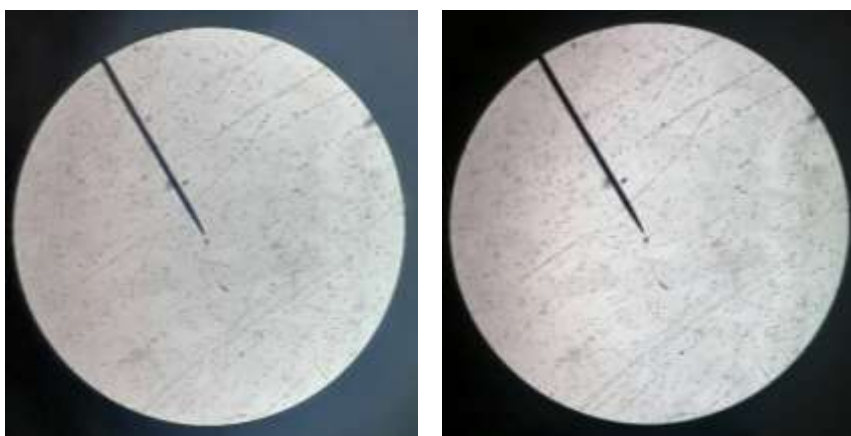


Figure 4. Sample 104 (65 grams) under microbial and pathogen laboratory testing

- Figure 4 has no presence of pathogen under microscope (LPO)
- Presence of few acetic bacteria under microscope (LPO)

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This is caused when the wine was exposed to oxygen in undetermined time, this bacterium is responsible for vinegar of small of the lemongrass wine sample

- Presence of wine sediments

This was caused by the yeast after its test from the fermentation process and thus precipitated with other sediments such as salt, color particles and other phenolic compounds.

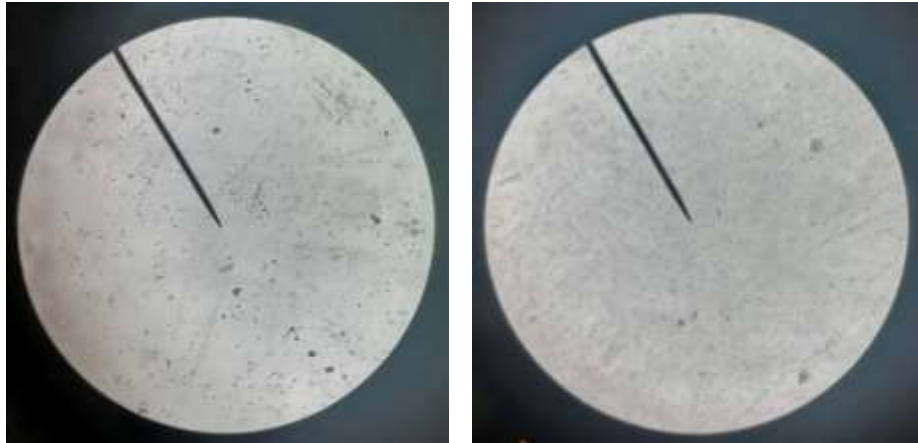


Figure 5. Sample 642 (55 grams) under microbial and pathogen laboratory testing

- Figure 5 has doesn't have any presence of microbes ang pathogen under microscope (LPO)
- Presence of wine sediments

This was caused by the yeast after its test from the fermentation process and thus precipitated with other sediments such as salt, color particles and other phenolic compounds.

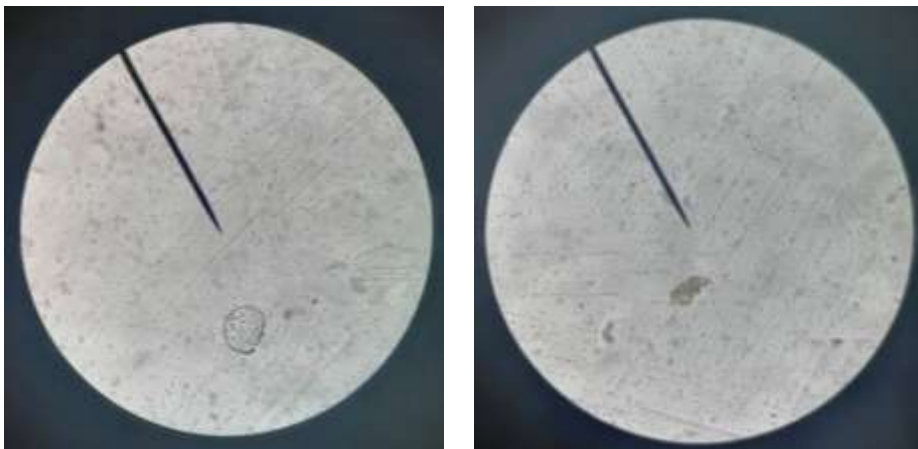


Figure 6. Sample 370 (45 grams) under microbial and pathogen laboratory testing

- Figure 6 doesn't have any presence of microbes ang pathogen under microscope (LPO)
- Presence of wine sediments

This was caused by the yeast after its test from the fermentation process and thus precipitated with other sediments such as salt, color particles and other phenolic compounds.

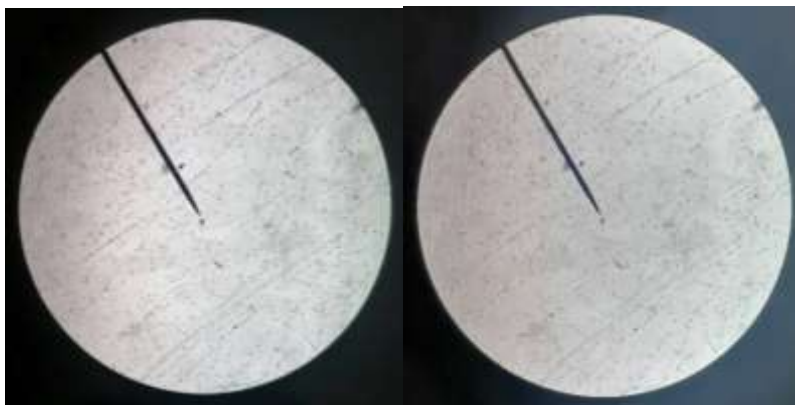


Figure 7. Sample 891 (35 grams) under microbial and pathogen laboratory testing

- Presence of few Brettanomyces bacteria under microscope (LPO)
Brettanomyces is an indigenous yeast that can grow during wine fermentation and impact its flavor which causes smell of barnyard or sweat.
- Presence of wine sediments
This was caused by the yeast after its test from the fermentation process and thus precipitated with other sediments such as salt, color particles and other phenolic compounds.

Sample Size

The sample size that was given to the respondents was about 30ml or adequate for 2-3 sips for the overall assessment of the product. In consumer tests, the quantity is usually doubled. The sensory specialist specifies the sample size keeping in view the objective of study, normal portion size and mouthfeel of the product and number of characteristics to be evaluated (Shariff, et.al, 2017).

		Control recipe	
35 grams	Lemongrass	5 liters	Mineral Water
3.5 kg	Brown Sugar	9.5 grams	Dry Active Yeast
		Treatment 1	
45 grams	Lemongrass	5 liters	Mineral Water
3.5 kg	Brown Sugar	9.5 grams	Dry Active Yeast
		Treatment 2	
55 grams	Lemongrass	5 liters	Mineral Water
3.5 kg	Brown Sugar	9.5 grams	Dry Active Yeast
		Treatment 3	
65 grams	Lemongrass	5 liters	Mineral Water
3.5 kg	Brown Sugar	9.5 grams	Dry Active Yeast

Treatment of Data

Data gathered was tabulated for analysis to find out the quality characteristics of lemongrass wine as perceived by knowledgeable panels and to determine the acceptability of lemongrass wine in the community, this is also to determine if there is significant difference among the control recipe and experiment recipe. This were administered using sensory evaluation and hedonic scale according to color, aroma, taste and texture.

ANOVA was used to determine if there is a significant difference between the control recipe and experiment recipes according to 35 grams of lemongrass (control recipe), 45 grass, 55 grams and 65 grams in terms of color, aroma, taste and texture.

Ethical Considerations

The researcher made sure that the ingredients and materials that were used followed the process of making homemade wine. Steps in making wine were also handled carefully, the researcher made sure that there was no food contamination. For the

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gathering of data, the researcher provided consent form to the respondents, indicating the confidentiality of their data that were retrieved. Health protocols were also followed, like physical distancing, use of sanitizer and separate tools for wine tasting.

RESULTS AND DISCUSSION

The sample 891 is the control recipe (35 grams of lemongrass), sample 642 has 55 grams, sample 370 has 45 grams and sample 104 has 65 grams.

Table 1. Characteristics of lemongrass wine as perceived by knowledgeable panels

Lemongrass wine characteristics	Mode	DE
Color		
Sample 891 (Control recipe)	5.00	Medium Yellow
Sample 642 (55 grams)	8.00	Medium Gold
Sample 370 (45 grams)	8.00	Medium Gold
Sample 104 (65 grams)	6.00	Deep Yellow
Aroma		
Sample 891 (Control recipe)	3.00	Vegetal
Sample 642 (55 grams)	3.00	Vegetal
Sample 370 (45 grams)	3.00	Vegetal
Sample 104 (65 grams)	3.00	Vegetal
Taste		
Sample 891 (Control recipe)	2.00	Moderately Sweet
Sample 642 (55 grams)	4.00	Not so Sweet
Sample 370 (45 grams)	4.00	Not so Sweet
Sample 104 (65 grams)	4.00	Not so Sweet
Texture		
Sample 891 (Control recipe)	5.00	Smooth
Sample 642 (55 grams)	5.00	Smooth
Sample 370 (45 grams)	5.00	Smooth
Sample 104 (65 grams)	5.00	Smooth

Table 1 showed the quality characteristics of lemongrass wine as perceived by knowledgeable panels in terms of color, aroma, taste and texture. Composition of lemongrass has an impact on wine particularly its color effect, the more lemongrass it contains the darker the color of the wine may be.

From the color, the knowledgeable panels rated sample 891 or control recipe with a rating of 5.00 mode interpreted as medium yellow, sample 642 with 55 grams of lemongrass rating to 8.00 interpreted as medium gold, sample 370 with 45 grams of lemongrass rating to 8.00 interpreted as medium gold and sample 104 with 65 grams of lemongrass rating to 6.00 interpreted as deep yellow.

For the aroma knowledgeable panels rate sample 891 or control recipe with a rating of 3.00 mode interpreted as vegetal, and sample 642 with 55 grams of lemongrass, sample 370 with 45 grams of lemongrass, sample 104 with 65 grams of lemongrass with the same rating of 3.00 mode interpreted as vegetal.

For the taste, knowledgeable panels rate sample 891 or control recipe with a rating of 2.00 mode interpreted as moderately sweet, sample 642 with 55 grams of lemongrass, sample 370 with 45 grams of lemongrass and sample 104 with 65 grams of lemongrass with the same rating of 4.00 mode interpreted as not so sweet.

For the texture, knowledgeable panels rate sample 891 or control recipe with a rating of 5.00 mode interpreted as smooth, sample 642 with 55 grams of lemongrass, sample 370 with 45 grams of lemongrass and sample 104 with 65 grams of lemongrass with the same rating of 5.00 mode interpreted as smooth.

The findings indicated that the respondents have different judgement when it comes to the quality characteristics of lemongrass wine in terms of color and taste. Meanwhile, the panels have the same judgement to the quality characteristics of

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lemongrass wine in terms of aroma and texture. From the samples displayed, the panels preferred medium gold for the color, for the aroma the panels preferred vegetal, for the taste panels preferred not so sweet and for the texture, the panels preferred smooth lemongrass wine.

Table 2. Level of Acceptability of lemongrass wine samples and significant difference as perceived by consumer-type panels

Lemongrass Wine Characteristics	Mean	DE	Sig.
Color			
Sample 891 (Control recipe)	8.00	Like Very Much	.028*
Sample 642 (55 grams)	8.18	Like Extremely	
Sample 370 (45 grams)	8.30	Like Extremely	
Sample 104 (65 grams)	8.30	Like Extremely	
Aroma			
Sample 891 (Control recipe)	8.10	Like Very Much	0.015*
Sample 642 (55 grams)	8.16	Like Very Much	
Sample 370 (45 grams)	8.26	Like Extremely	
Sample 104 (65 grams)	8.46	Like Extremely	
Taste			
Sample 891 (Control recipe)	8.34	Like Extremely	0.212 ^{NS}
Sample 642 (55 grams)	8.40	Like Extremely	
Sample 370 (45 grams)	8.46	Like Extremely	
Sample 104 (65 grams)	8.50	Like Extremely	
Texture			
Sample 891 (Control recipe)	8.30	Like Extremely	0.065 ^{NS}
Sample 642 (55 grams)	8.44	Like Extremely	
Sample 370 (45 grams)	8.48	Like Extremely	
Sample 104 (65 grams)	8.54	Like Extremely	
Over-all			
Sample 891 (Control recipe)	8.23	Like Extremely	0.011*
Sample 642 (55 grams)	8.25	Like Extremely	
Sample 370 (45 grams)	8.43	Like Extremely	
Sample 104 (65 grams)	8.44	Like Extremely	

Note. The mean difference is significant at the 0.05 level.

Legend:

*	Significant
^{NS}	Not Significant
8.13 – 9.00	Like Extremely
7.24 – 8.12	Like Very Much
6.35 – 7.23	Like Moderately
5.46 – 6.34	Like Slightly
4.57 – 5.45	Neither like nor dislike
3.68 – 4.56	Dislike Slightly
2.79 – 3.67	Dislike Moderately
1.90 – 2.78	Dislike Very Much
1.00 – 1.89	Dislike Extremely

Quality Characteristics and Level of Acceptability of Lemongrass Wine in Mountain Province, Philippines

The table 2 showed that the first characteristic of lemongrass wine which is the color wherein sample 891 or control recipe has a mean evaluation of 8.00 interpreted as like very much, sample 643 with 55 grams of lemongrass has a mean evaluation of 8.18 interpreted as like extremely, sample 370 with 45 grams of lemongrass has a mean evaluation of 8.30 interpreted as like extremely and sample 104 with 65 grams of lemongrass has a mean evaluation of 8.30 interpreted as like extremely. Compared with the control recipe, sample 370 with 45 grams of lemongrass wine has the nearest similarity to sample 891 or control recipe. Thus, there is a significant difference between the sample 891 or control recipe and sample 370 with a sig value of 0.028, wherein the lesser the lemongrass content the lighter the wine color may become from medium yellow to medium gold.

The second characteristic of lemongrass wine is the aroma, wherein sample 891 and sample 642 were interpreted as like very much with respective means of 8.10 and 8.16. sample 370 and sample 104 were interpreted as like extremely with respective means of 8.26 and 8.46. Thus, there is a significant difference between the sample 891 or control recipe and sample 104 having the sig. value of 0.015, wherein the higher the lemongrass content, the more aromatic the wine may become.

For the taste characteristic, sample 819, sample 642, sample 370 and sample 104 were interpreted as like extremely with respective means of 8.34, 8.40, 8.46 and 8.50. Thus, as shown on the table 2, there is no significant difference between the control recipe and experiment samples.

The last characteristic of lemongrass wine is the texture, wherein sample 891, sample 642, sample 370 and sample 104 were interpreted as like extremely with respective means of 8.30, 8.44, 8.48 and 8.54. Thus, as shown from table 2, there is no significant difference between the control recipe and experiment samples.

Under the over-all, sample 891 has a mean value of 8.19 interpreted as like extremely, sample 624 has mean value of 8.30 interpreted as like extremely, sample 370 has a mean value of 8.38 interpreted as like extremely and sample 104 has a mean value of 8.45 interpreted as like extremely, wherein the sample 104 with sig. value of 0.011 has significant difference between the control recipe.

Statistical analysis revealed that there are significant differences among the mean values of different treatments. In the color and aroma there are significant differences among the samples, while taste and texture have no significant difference. Base from the over-all judgement, sample 104 with 65 grams of lemongrass were liked by most of the respondents, sample 104 is also the closest to sample 891 which is the control recipe. It is analyzed that the more lemongrass content of the wine, the more that it is accepted by the respondents.

In addition, a study published in the website of Medical News Today (2018), lemongrass relieves anxiety simply by smelling, by consuming lemongrass, it can lower cholesterol level.

Table 3. Acceptability of lemongrass wine in the market

Questions	Rel Frequency
Which sample do you prefer?	
Sample 891 (Control recipe)	16.00%
Sample 642 (55 grams)	14.00%
Sample 370 (45 grams)	24.00%
Sample 104 (65 grams)	46.00%
Are you in favor of this kind of product to be out in the market?	
Yes	100.00%
No	0.00%
Do you consider yourself a wine drinker?	
Yes	100.00%
No	0.00%
If yes, how often do you drink wine?	
Once a week	34.00%
Once a month	18.00%
Twice a month	46.00%
Others: Occasionally	2.00%

At what price range would you like to buy lemongrass wine at 750 ml?	
Php.200.00-Php.250.00	
Php.251.00-Php.300.00	6.00%
Php.301.00-Php.450.00	32.00%
	62.00%

Table 3 shows the acceptability of lemongrass in the market, in the first question, 16% of the respondents preferred sample 891, 14% of the respondents preferred sample 642, 24% of the respondents preferred sample 370 and 46% of the respondents preferred sample 104. For the second question, 100% of the respondents were in favor of having lemongrass wine in the market, the third question, 100% of the respondents are wine drinkers. Followed by the question fourth question, wherein 34% of the respondents consumes wine once a week, 18% of the respondents' consumes wine once a month, 46% of the respondents consumes wine twice a month and 2% of the respondents consumes wine occasionally. For the last question, 6% of the respondents were willing to buy lemongrass wine at 750ml with a price range of Php.200.00-Php.250.00, 32% of the respondents preferred Php.251.00-Php300.00, 62% of the respondents preferred Php.301.00-Php.450.00.

Thus, the respondents preferred sample 104 with 65 grams of lemongrass supported by the over-all judgement as seen at table 2. The second question indicated the favorability of lemongrass in the market, 100% of the respondents were open to the possibility of having lemongrass wine in the market. The next question determined that 100% of the respondents drink wine, wherein in respondents were asked how often they consume wine, 46% of the respondents said that they consume wine twice a month. The last question pertains to how much does the respondents willingly pay in buying lemongrass wine at 750ml, 62% of the respondents said that they are willing to pay a range of Php.301.00 – Php.450.00 per 750 ml of lemongrass wine.

CONCLUSION AND RECOMMENDATIONS

Conclusions

The characteristics of lemongrass wine as perceived by the knowledgeable panels according to color, sample 891 obtained the medium yellow, sample 624, sample 370 obtained medium gold and sample 104 obtained deep yellow. For the aroma, sample 891, sample 624, sample 370 and sample 104 obtained vegetal. For the taste, sample 891 obtained moderately sweet, and sample 624, sample 370, sample 104 obtained not so sweet. For the texture, sample 891, sample 642, sample 370 and sample 104 obtained smooth.

The acceptability of lemongrass as perceived by the consumer-type panels according to color, sample 370 and sample 104 obtained the highest mean of 8.30 resulting to like extremely. For the aroma, sample 104 obtained the highest mean of 8.46 resulting to like extremely, for the taste sample 104 obtained the highest mean of 8.50 resulting to like extremely and for texture sample 104 obtained the highest mean of 8.54 resulting to like extremely. For the over-all judgement sample 104 obtained the highest rating resulting to like extremely.

For the acceptability of lemongrass wine in the market, respondents from Bontoc and Bauko, Mountain Province are open to have a new variant of wine. Wherein sample 104 with 65 grams of lemongrass were preferred by the respondents.

Recommendations

Based from the findings and conclusions of the study, the researcher would like to recommend further study on the shelf life of lemongrass wine. It is also recommended to conduct additional study in utilizing lemongrass in making innovative food and beverage products.

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