BINDURA UNIVERSITY OF SCIENCE EDUCATION FACULTY OF AGRICULTURE AND ENVIRONMENTAL SCIENCE DEPARTMENT OF NATURAL RESOURCES MANAGEMENT.

PRODUCTION OF WINE FROM TAMARIND FRUIT PULP (*TAMARINDUS indica)*

SUBMITTED BY

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A DESSERTATION SUBMITED IN PARTIAL FULFILMENT OF THE REQUIREMENT OF A BACHELOR OF SCIENCE HONOURS IN NATURAL RESOURCES MANAGEMENT

BINDURA UNIVERSITY OF SCIENCE EDUCATION FACULTY OF AGRICULTURE AND ENVIRONMENTAL SCIENCE DEPARTMENT OF NATURAL RESOURCES MANAGEMENT

RELEASE FORM

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The foregoing individuals attest the fact that they possess reviewed the dissertation titled "Production of wine from tamarind fruit pulp (*Tamarindus indica*)," and have endorsed it for endorsement to the Bindura University of Science Education.

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DEDICATION

I would like to begin by expressing my devotion to God, who has been with me throughout my journey up to this point. I also feel a deep sense of appreciation towards my parents, Bigboy and Jesca Mahaso, for their unwavering support and kindness during my academic pursuit. Moreover, I would like to dedicate this project to my lecturers, whose teachings and guidance have had a lasting impact on my understanding of the subject matter. Additionally, I wish to dedicate this dissertation to my friends, Linience Mataka and Aderlaide Masarakufa, who have stood by me throughout the entire process. I will always be grateful for their support and everything they have done for me

DECLARATION

By submitting this dissertation to BINDURA UNIVERSITY OF SCIENCE EDUCATION, I, Tanyaradzwa D Mahaso, thus certify that I have satisfied the requirements for the Bachelor of Science with Honours in Natural Resources Management. This dissertation is my unique work, and neither a portion of it nor the entirety of it will be submitted for the conferral of any other degree.

ABSTRACT

The purpose of this study was to create tamarind wine prototypes from the pulp of the tamarind fruit (Tamarindus indica), add value to locally grown fruits, and gauge the acceptability of the prototypes.Information was gathered from a sample of 50 people to evaluate the sensory attributes of the wine samples.People responded to stimuli such as flavour, aroma, texture, and appearance. The laboratory experiment produced findings of 2liters of spirit (ethanol) with 35% alcohol, which the researcher decreased to 18% for the cream and 11% for the whisky wine. to create whisky (wine), sour cream and sweet cream liquor prototypes .The findings indicate that almost 70% of the populace strongly welcomed the wine prototypes, demonstrating that native fruits may be used to make alcoholic beverages instead of exotic ones. In order to present the findings, graphs and tables were used.

ACKNOWLEDGEMENT

My sincere gratitude goes to Dr. Mureva, my research supervisor, for providing me with invaluable assistance . Additionally, I would like to thank my family and friends for their everlasting support.It is with immense gratitude and reverence that I acknowledge God for granting me the wisdom, courage, good health, and strength to navigate through this learning period.

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CHAPTER 1: INTRODUCTION

1.1Background to the study

A survey by Zion Market Research in 2021 stated that the global wine market was estimated to be worth $320 billion in (2020). From 2021 to 2028, it is predicted that the market would grow at a compound annual growth rate (CAGR). of about 5.8%, reaching a value of about $423 billion by that year..South Africa is the largest wine producer and exporter of wine in Africa ,and its wine industry is well established and internationally recognized .Other countries , such as Morocco and Tunisia also have small but growing wine industries ("WINE: South Africa," 2021) .According to a report by the International Organisation of Vine and Wine (OIV) in 2020, the wine production in Africa was 7.2million hectolitres which represents only 3% of the wine production.While the wine industry in Africa is relatively small compared to other regions , there is potential for growth.

Zimbabwe's wine industry is small and the country is not a major producer or consumer of wine compared to ther regions (An, 2022) .Most of the wine consumed in Zimbabwe is imported , with South Africa being the main source of imported wine.There are a few small wineris in Zimbabwe that produce wine from locally grown grapes. There are other sources of wine which are going to showed in the paragraph below.

Business Ideas (2019) provides a list of tropical fruits that can be used as sources for wine production , including atis (sugar apple/sweetsop, Anonasquamosa Linn.), bignay (Antidesma bunius Linn.), dalandan (orange, Citrus lanatus), duhat (Philippine plum, Syzygium cumini L. skeels), guyabano (soursop, Anona muricata), kalumpit (Terminalia edulis Lin). However there is potential for growth ,particularly in the production of wine from Indigenous fruits like Tamarind fruits from *Tamarindus indica.*

The tamarind (*Tamarindus indica*)is a long-lived, medium-growth, bushy tree whose fruit are fleshy,and juicy (Hernández-Unzon & Lakshminarayana, 1982).The tree is well adopted to semi arid conditions and can survive in a range of of soil types , from sandy to clay soils.The tamarind fruit pulp is rich in antioxidants ,which can help to protect against oxidative stress and inflammation.It is also a good source of vitamin including vitamin C, vitamin B1 , vitamin B2 and vitamin B3. Minerals such as potassium, calcium, magnesium, iron, and phosphorus are also abundant in tamarind.In addition tamarind fruit is rich in dietary firber , which can help to promote healthy digestion and prevent constipation.Overall

,tamarind fruit is a nutrious and flavourful food that can provide a range of healthy benefits.Hence that is why tamarind is used to prepare foods.

The pulp is used is used in a variety of culinary applications ,including sauces ,chutneys and drinks.The flavour of tamarind is often described as tangy and tart , with a hint of sweetness.In addition , here are some products that are made from tamarind fruit, tamarind paste, which is used as flavouring agent in a variett of dishes. Tamarind juice which is a popular beverage in many countries particularly in the caribbbean.Moreso, tamarind jam is a sweet and tangy spread that is popular in some countries (M. N et al., 2022) . However there is limited information on alcoholic beverages produced from Tamarind fruit, though there are many alcohol beverages made from indigenous fruits like amarula.

1.3 Problem Statement

Currently there is limited information on the feasibility and availability of producing wine from tamarind in Zimbabwe .Therefore the research is aiming at producing prototypes for the production of tamarind wine in zimbabwe that is economically feasible, environmentally sustainable and meets the taste prefernces of consumers.

1.4Significance of Study

Tamarind presents a good potential as a substrate for the production of wine. Tamarind wine if used in tourist locations might operate as a lever for the neighbourhood economy. Small communities in the interior may attract new enterprises as a result of the expansion of tourism opportunities and job creation possibilities. It also helps in policy creation and also it helps to decrease the import cost. This work is meant to create an environment in which value addition for tamarind is promoted through the production of tamarind wine.

1.5 MAIN OBJECTIVE

To produce wine prototype from *Tamarindus Indica* and determine its acceptability in the market.

1.6 OTHER OBJECTIVES

a) To develop three *Tamarindus Indica* flavouredd wine prototypes

b) To determine the accepatability of the diffrerent flavour-prototypes.

CHAPTER 2: LITERETURE REVIEW

2.1Value addition to indigenous fruits in Africa

In developing countries like Namibia, data on product development from indigenous fruits is very scarce and if available, are related only to exotic fruits,(Shackleton *et al* 2005). Natural resources are of great importance to rural communities since they provide many useful materials for their daily life, (Devendra *et al* 2002). One of these important resources is the indigenous fruit trees which provide food in the form of fruit, nuts, and wood for fuel and building material. They also serve as a source of job creation and income generation for the rural communities at large. Consumption of wild fruits that contain antioxidants (phenolic compounds, ascorbate and carotenoids) has been associated with lowered incidences of degenerative diseases ncluding cancer, heart disease, inflammation, arthritis, immune system decline, brain dysfunction and cataracts(Akbari *et al* 2022). Indeed, among the functional compounds in fruits which have been widely studied, apart from vitamins and minerals, is the family of antioxidants, (Cantin *et al* 2009). The importance of wild fruits in the diet depends to a large extent on their availability for domestic use.

According to Bille *et al* (2013), a study was done to add value to three popular indigenous fruits found in Namibia namely, Marula (Sclerocarya birrea), Monkey orange (Strychnos cocculoides) and Eembe (Berchemia discolour) into processed food products and to train rural communities on value addition for job creation, income generation and food security. Indigenous fruits are receiving increasing interests from researchers and scholars because of their nutrition and abundance in most African countries,(Bille *et al* 2013). The fruits are important sources of food for rural communities especially at times of foo,shortage, hunger and other disasters. In addition, they provide enormous health benefits such as antioxidants, vitamins and minerals. They are also known to create jobs and generate income for rural communities. Because of their role in combating food insecurity, nutrition and the problems of seasonality, studies on their value addition were carried out in Namibia. Various food products such as juice, jam, jelly, and muffins were created using different fruits,(Cheikhyoussef *et al* 2013). A pilot study was conducted to determine the ideal ingredient ratios for each product before processing and training community members. The results were analyzed through preference tests, and the best ratios were used. Marula juice received a lower preference score (2.3) due to its low pH,

while jam and jelly were acceptable and preferred in terms of quality, taste, and color. All three products made from monkey orange were preferred, but those from eembe were downgraded due to dark color and lack of flavor. The products were found to be of good quality and safe for consumption through microbiological testing. These products could serve as a viable source of income for rural communities, and the fruit flavor could also be utilized in the dairy and soft drink industries for products like yogurts, sour milk, ice cream, juices, and jams.

According to Ngadze R T (2018) value addition of Southern African monkey orange (Strychnos spp.)In Zimbabwe, over 180 wild food plants were inventoried, of which indigenous fruit trees comprise about 20 % (Akinnifesi et al., 2006; Tredgold, 1986). From these, a number of indigenous fruits have been prioritized for their potential to improve malnutrition problems, especially for rural communities in Zimbabwe. The International Centre for Underutilised Crops (ICUC), nowadays called Crops for the Future, in partnership with The World Agroforestry Centre and the International Plant Genetic Resources Institute through their 'Fruits for the Future' program initiated domestication of indigenous fruit trees (IFTs) and knowledge dissemination programs. The premise of the program was that the health and livelihood of communities could be improved by reduced dependency on expensive exotic fruit imports, through substitution with locally available, cheaper indigenous fruits that the community ranks as important. Indigenous fruits were therefore selected based on farmers' preferences for domestication, ease of access, social and economic importance (Laverdière & Mateke, 2003).

2.2 Some local African Products made from Indigenous Fruits

Fruit	**Main ingredients**	**Served as or with**	**Reference**
Strychnos spp. (monkey orange)	pulp/ maize meal pulp /wheat flour	porridge cakes mahewu	Ngadze et al., 2017
Musa (plantain)	fruit flour/water fruit flour, beans, amaranth leaves and olive oil	porridge porridge	Ekesa et al., 2012
Tamarindus indica (tamarind)	pulp pulp/sorghum/ millet	condiment: chutney porridge/gruel	Leakey, 1999 National Research Council,

			2008
Uapaca (sugar plum)	*kirkiana* pulp/millet or sorghum porridge flour	cakes	Gomez, 1988
~~*Cucumis metuliferus*~~ ~~Pulp~~ (horned melon)		~~condiment: chutney~~	Mabaya et al., 2014

2.2Acceptability of Indigenous Fruit Products

Marula jam is a popular and widely consumed product in Namibian, where marula fruit is native and has cultural difference(Mokgolodi *et al* 2011).Marula jam is generally well accepted in Namibia and many people enjoy its sweet and tangy flavour. In this study, marula, monkey orange, and eembe fruits were used to make four different foods: juice, jam, jelly, and muffins. The score indicating preference for marula juice was not very high (2.3) due to its sour taste with a pH of 3.2-3.5 and unpleasant flavor. To make it more appealing, its pH was adjusted to 4.0 by using a 0.1 N Sodium Hydroxide (NaOH) solution of food quality. On the other hand, Eembe products faced issues with their flavor and color, and all of them were downgraded. Despite adding food flavor and color, Eembe juice received a score of 3.20, jam 2.95, and jelly 2.31,(Cheikhyoussef *et al* 2013). However, the rest of the products were of high quality and were preferred by 90% of the panelists. To improve the acceptability and preference of the products with unappealing look and taste like Eembe, food colors and flavors were added. It could have been further improved by bleaching the natural dark brown color of Eembe before adding artificial food color to enhance its appearance and acceptability. However, this was not done and is left for future research,(Bille *et al* 2013) .

To produce juice, jam, and muffins, monkey orange pulp was used, which had a sweet and delicate taste with a refreshing flavor described as a mix of citrus and pineapple or banana,(Cheikhyoussef *et al* 2013). The products had a stable shelf life, good taste, smell, and appearance, and were well preferred in sensory evaluation by 90% of the panelists. Although the color changed during processing, the addition of artificial flavors and colors made them acceptable. The products were also found to be safe for consumption with no bacterial growth. However, 10% of the panelists found the products too acidic or unattractive in color.

In a 2007 study by Saka et al., sensory panellists preferred monkey orange juice over sugar plum (Uapaca kirkiana), baobab (Adansonia digitata), mango (Mangifera indica), and S. cocculoides juice. These results supported the conclusions of the 2013 study by Bille et al.In a 2007 study by Saka et al., sensory panellists preferred monkey orange juice over sugar plum (Uapaca kirkiana), baobab (Adansonia digitata), mango (Mangifera indica), and S. cocculoides juice. These results corroborated a 2013 study by Bille et al. that found that S. cocculoides juice that had been diluted had a high level of consumer approval, particularly when it had improved liquefaction and clarity. Consumers gave S. cocculoides jam excellent ratings in part due to its flavour (Tumeo et al.,

CHAPTER 3: Methodology

3.1 Study Area

The study is being conductedpl at Astra Campus of Bindura University of science Education and Technology. Bindura University is one of the biggest universities in Zimbabwe. The university is situated in Mashonaland East province of Zimbabwe.

3. 2 Optimisation of tamarind (tamarindus indica) wine.

Juices generated through fermentation are transformed into spirits with a high alcohol content of 75 to 90 percent by the chemical process known as distillation (Luo et al., 2016). A liquid is filtered to remove the alcohol.When separating combinations of liquids with comparable boiling points, a fractional distillation is employed.

As the column heats up from the rising hot vapours, the temperature on the thermometer will eventually reach 78 degrees Celsius. At that point, the vapour at the top of the column will be almost exclusively alcohol. The vapour escapes into the condenser, turns back to a liquid, and can be collected. The researcher adjusted the heating so that the temperature stay at 78 degrees Celsius..

The researcher combined the spirit with fermented juice to produce the tamarind colour and flavour, which had been clarified using bentonite clay, then added distilled water to lower the alcohol content after distillation. In sample B, the alcohol was blended with 100% pineapple juice to create a wine with tamarind, pine apple, and apple flavours.To develop the third sample, tamarind cream that was inspired by amarula, the researcher made tamarind cream using tamarind paste and milk and adding it to the spirit.

3.3 Materials Needed

The production of tamarind wine required a number of resources, including tamarind (Tamarindus Indica) fruit, yeast (Saccharomyces cerevisiae), sugar, and scale. Bentonite clay, an electrical burner, a distiller and two 20-liter buckets of water.

3.4 Collection and Preparation of Materials

Tamarind (Tamarindus Indica) was purchased from street vendors in the market square, while yeast and sugar were also purchased from a shop in Bindura before being transported to the Astra campus for use. The supplies were brought to the lab, where the researcher used a balance scale to weigh the tamarind and peel the fruit to prepare the stock. The tamarind was

then washed to get the dirt off. To ensure there would be no contamination, the researcher cleaned the pots and everything else that will be utilised..

3.5 Procedure

The researcher combined 8 kg of tamarind with 5 litres of water in a large saucepan and then brought it to a boil to create tamarind stock.I took this action to obtain the stock. The researcher used a net and cheesecloth to separate the seeds and pulp from the tamarind juice three times until the extract was clear.The concentrated extract was mixed with five litres of water. Add 4 kg of white sugar to the extract and boil it for 10 minutes to pasteurise it. Seal the fermenting container after adding yeast, 0.02 percent of the total weight, but leave the top air channel open. This will stimulate the generation of yeast and provide the oxygen required for fermentation. Place under cover and leave for two to four days.

3.6 Determination of the Acceptability of Tamarind (tamarindus indica) wine.

The researcher evaluated the acceptance of the prototypes of wine made from tamarind (*Tamarindus indica*) fruit using a quantitative technique. The researcher employed a Likert scale questionnaire, a kind of survey question designed to gauge respondents' attitudes or opinions regarding a specific subject. A series of statements or questions are often included, and the respondent is asked to rate them on a scale of 1 to 5 or 1 to 7, with 1 denoting "strongly disagree" or "very unsatisfied" and 5 or 7 denoting "strongly agree" or "very satisfied." In general, a well-crafted Likert scale survey can yield insightful data on respondents' attitudes or opinions regarding a specific subject (Anjaria, 2022). The likert scale questionnaire was used to assess the wine sample's sensory qualities.Wine sensory evaluation is a scientific field that measures and examines how people react to sensory cues including taste, aroma, and texture in wine. A crucial step in the wine-making process, sensory evaluation determines the wine's consistency and quality.The outcomes of the sensory evaluation are used to pinpoint the wine's sensory traits and assess both its general quality and acceptance.

3.7 Data Collection, Presentation and Analysis

Data was gathered using forms for sensory evaluation. Utilising tables, graphs, and charts, the data will be shown and examined. A data analysis programme named SPSS will be used to acquire these analysis skills.

3.8Method of Data Collection

The researcher utilised a questioner Likert scale chat for sensory evaluation to gather data; see the appendix for the questionnaire.

CHAPTER 4: RESULTS

4.1Lab Results

The laboratory experiment produced findings of 2liters of spirit (ethanol) with 35% alcohol, which the researcher decreased to 18% for the cream and 11% for the whisky wine. Due to the fact that the dry spirit was blended with water, it had a low alcohol content. The fractional distillator used by the researcher could not control heat the temperature rose too high over 78^0C which is the perfect temperature for ethanol to evaporate. The distillatory had no stopper so the researcher improvised.

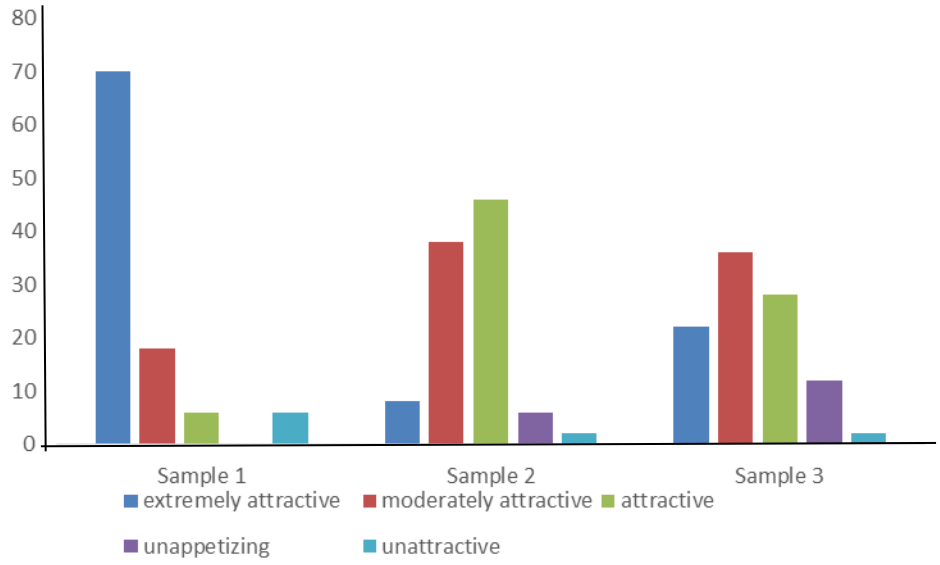


Figure 4.2 Response to the sample's appearance

The response rate to the appearance of wine samples 1 and 2 is depicted in the graph above. Different hues of blue, orange, and grey, respectively, stand in for numbers 2 and 3. The number of respondents is shown on the y-axis, while the variables to which they responded are shown on the x-axis.35 people in the section three of the sample of (very attractive) claimed "the wine is extremely attractive," according to the graph above showing the appearance findings from the 50 people interviewed about the researcher's wine. Less than 5 participants from each of the three trial sites indicated the wine's appearance is unappealing, which increased the researcher's confidence that she was successful in producing the wine that the majority of respondents said was attractive.

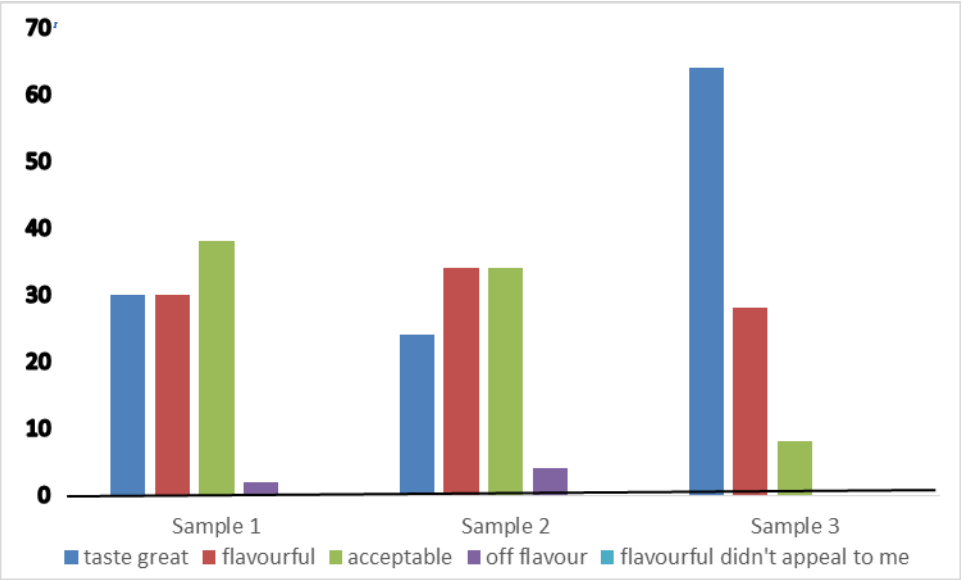


Figure 4.3 represent taste responds

There were no responses from people who didn't like the flavour at the sample locations. The phrase "the taste was off flavour" was said by very few respondents. This is sufficient proof that more than 40 out of 50 persons fall into the "acceptable" and "taste great" categories. The taste of the wine from all three samples was well-liked by more than 90% of the responders.

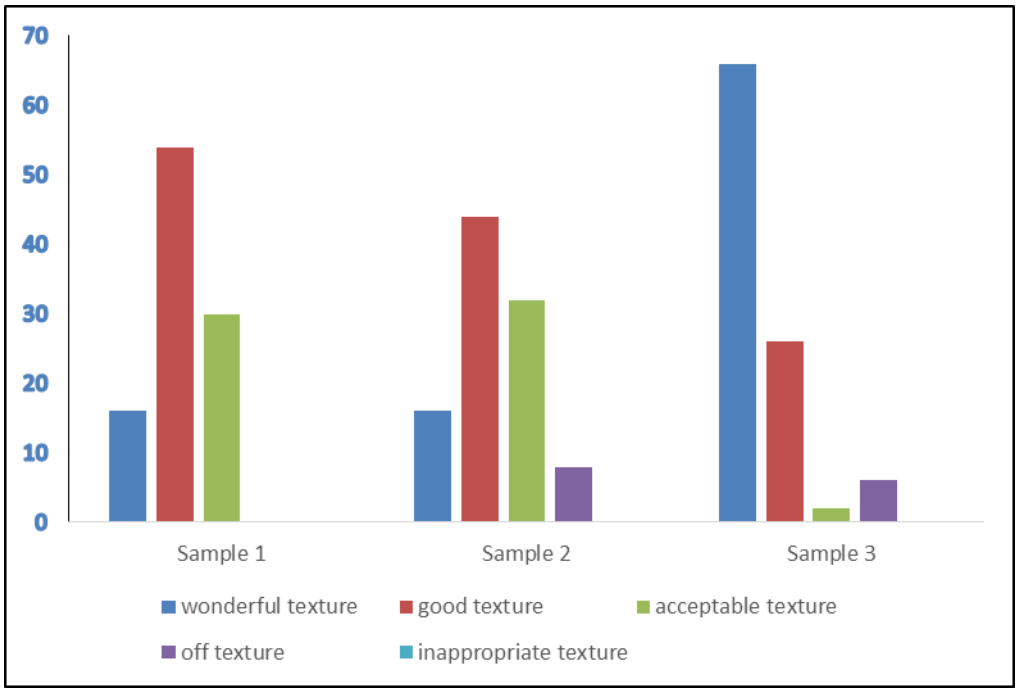


Figure 4.4 represents texture responses

Basing on the information represented by the graph, when it comes to texture of the 3 samples, sample 1 and 2 had more respondents on good texture as compared to sample 3 which had the majority of its respondents saying that is has a wonderful texture. None of the respondents said that the samples' texture is inappropriate.

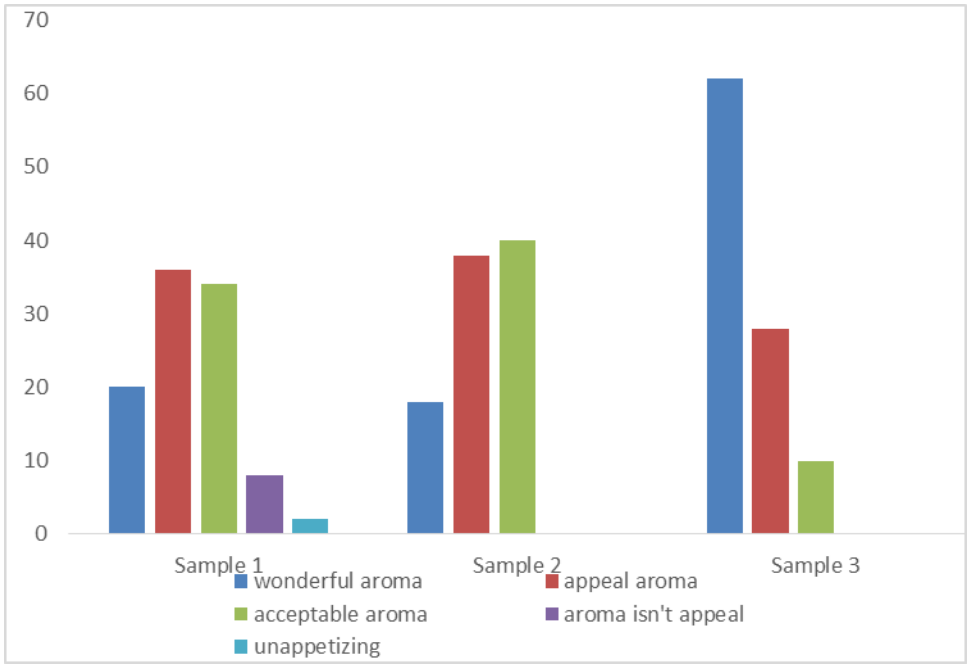


Figure 1.5represents aroma respondents

The above graph shows that sample 3 had the best aroma (wonderful aroma) amongst all samples. Sample 1had most of its respondents between wonderful aroma and acceptable aroma and a few percentage on the fact that aroma wasn't appealing and it was unappetizing. In addition sample 2 has most respondents on appealing aroma and acceptable aroma and a few on the fact that aroma was wonderful.

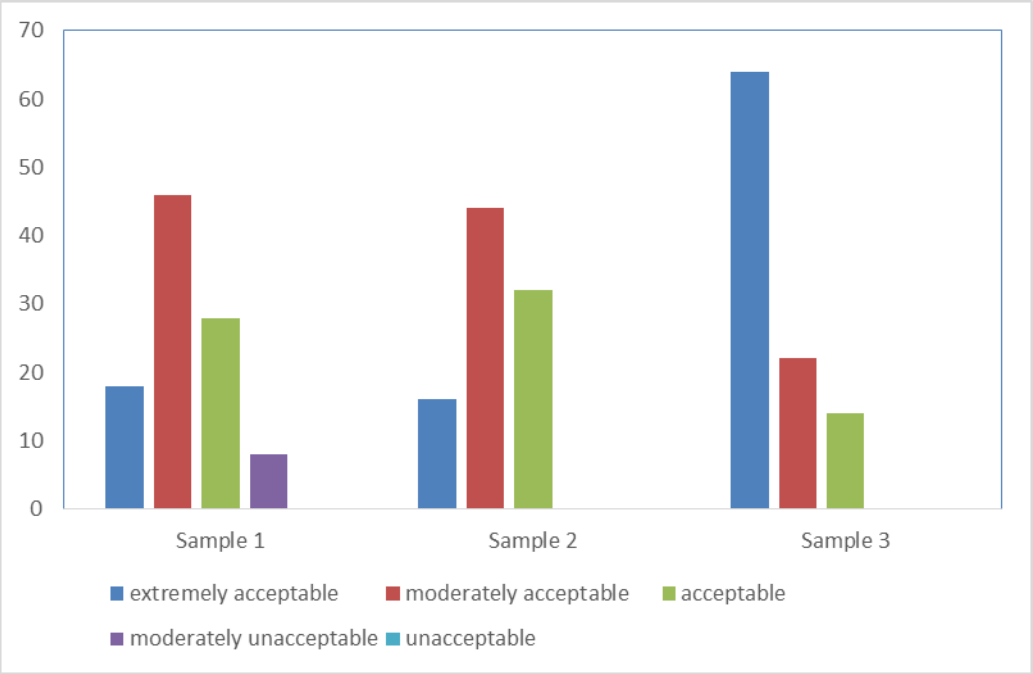


Figure 4.6 shows overall acceptability respondents

Not even a single person denied that the manufactured wine by the researcher was a good brand although very few people disagree on the appearance. On Taste, Texture, and Aroma they were zero respondents against the wine from all three sampling units. However sample C had the highest overall acceptance as compared to others.

4.7Analysis of results from SPSS using Kendall W Test

Beverages	Mean ranks				
	Appearance	Taste	Texture	Aroma	Overall Acceptability
Whisky wine	2.20[a]	2.20[a]	2,22[a]	2,27[a]	2,23[a]
Sour cream	2.38[b]	2.27[b]	2.35[b]	2.30[b]	2.29[b]
Sweet cream	1.42[b]	1.53[b]	1,43[b]	1.43[b]	1.48[b]

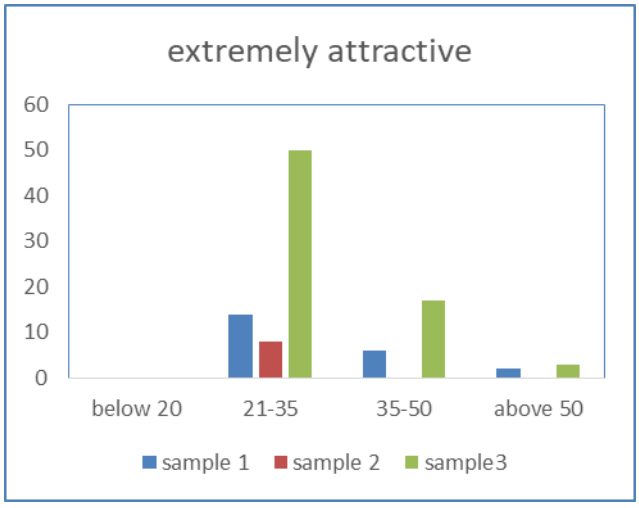
Key $^{a}_{b}$ shows the significance difference between the wines

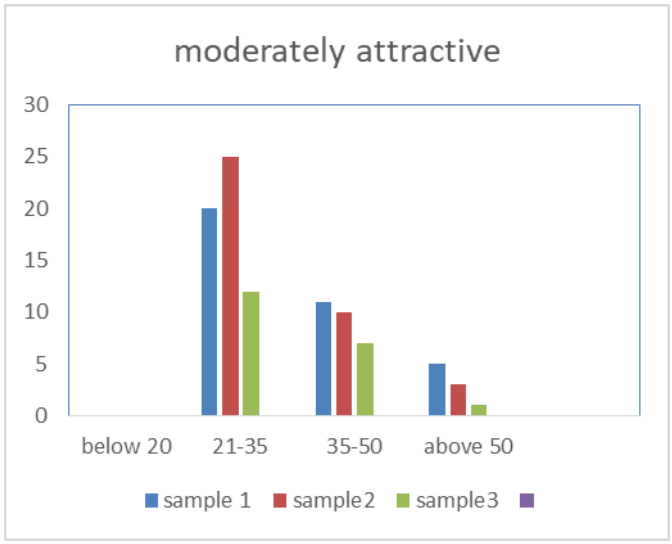
The table displays the mean ranks of four attributes (Appearance, Taste, Texture, Aroma) and Overall Acceptability for three types of beverages (Whisky wine, Sour cream, and Sweet cream).Looking at the mean ranks, we can see that Sweet cream received the highest rank for Taste and Texture, while Whisky wine received the highest rank for Aroma and overall acceptability. Sour cream received the lowest ranks for all attributes except for Appearance, where it received the second highest rank.

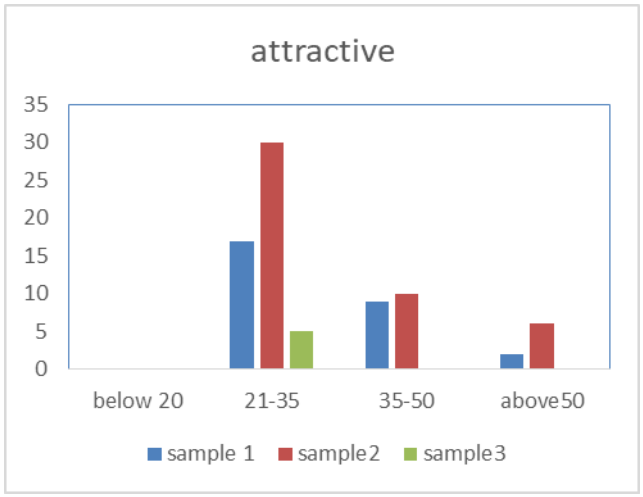
4.8.1Age

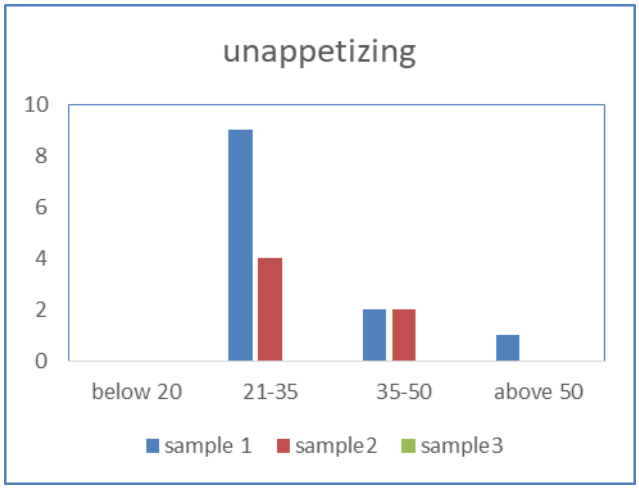
Age is statistically insignificant in determining the appearance, taste, texture, aroma and overall acceptability of the wine.Below are graphs showing the influence of age on different variables.

Appearence









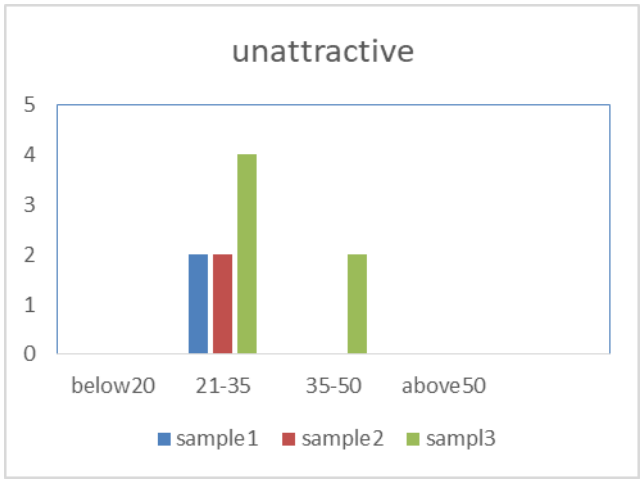
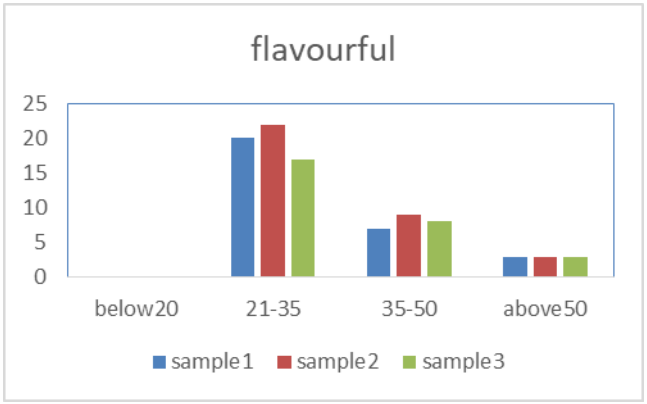
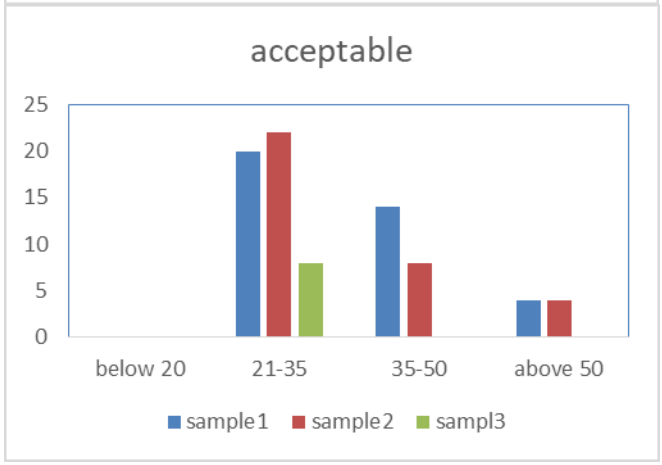
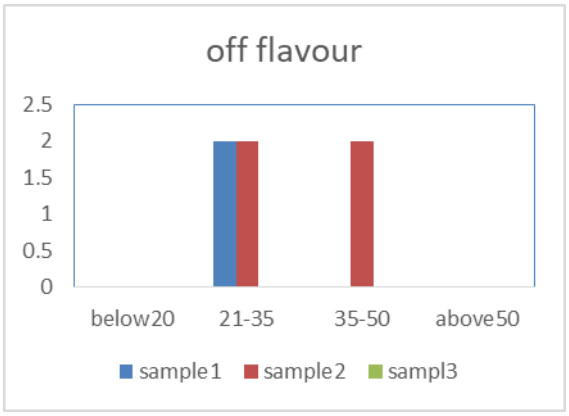


Figure 4.8.2 influence of age on appearence

Taste







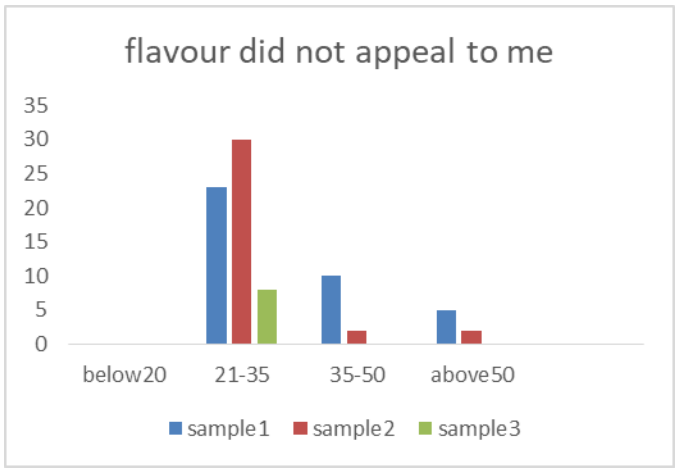


figure 4.8.3 showing the influence of age on taste

Texture

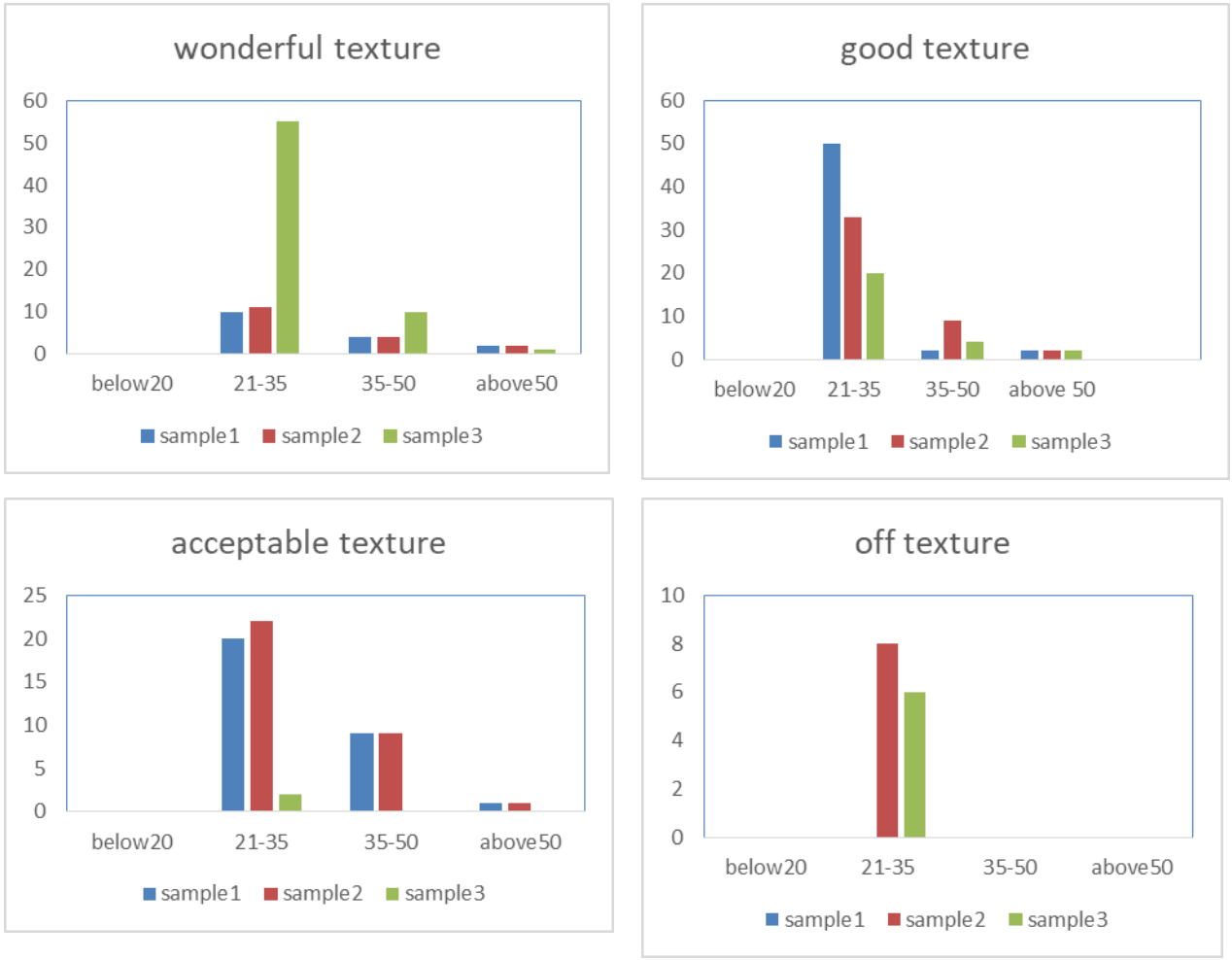


Figure 4.8.4 showing the influence of age on texture

Aroma

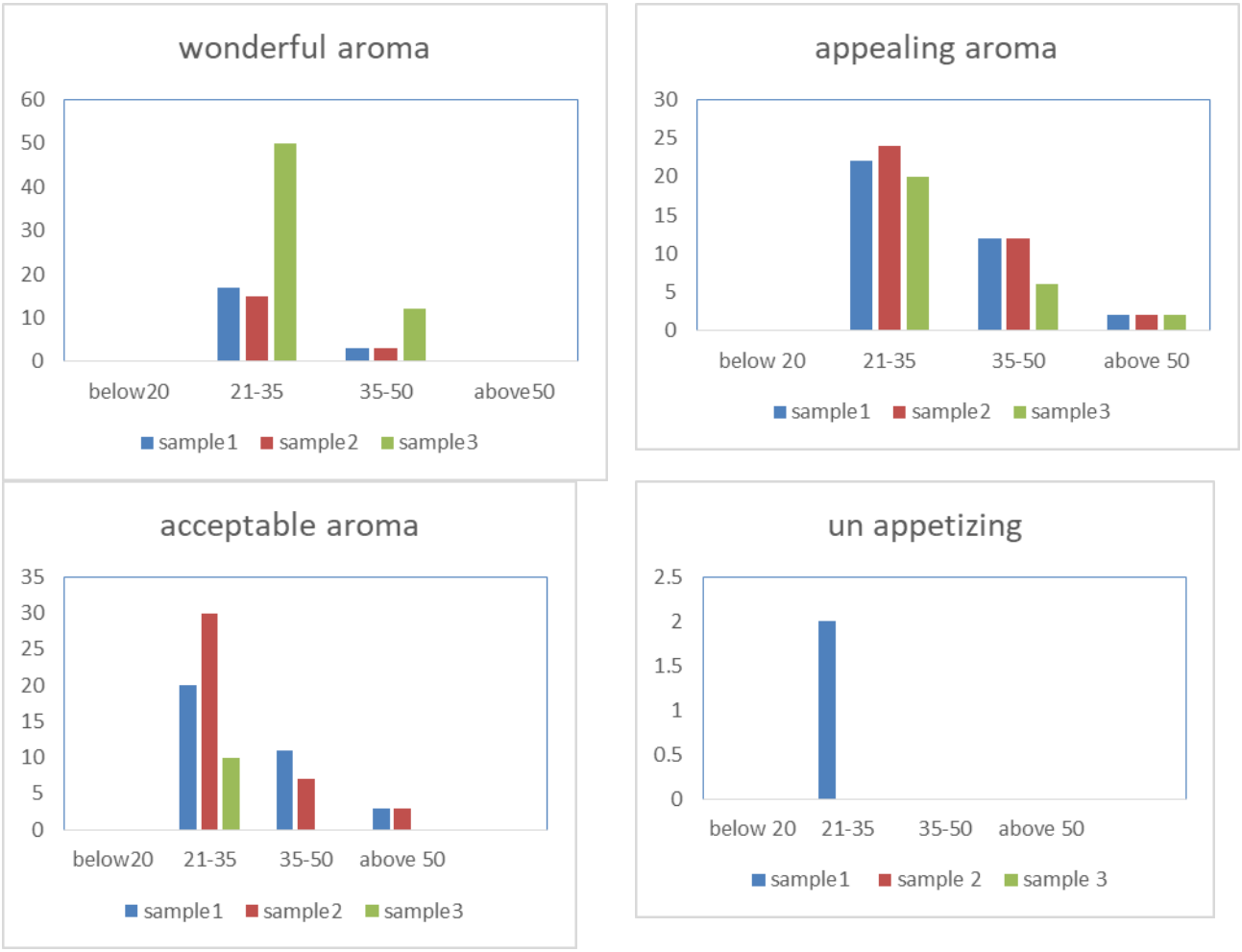


Figure 4.8.5 showing the influence of age on aroma

Overall acceptability

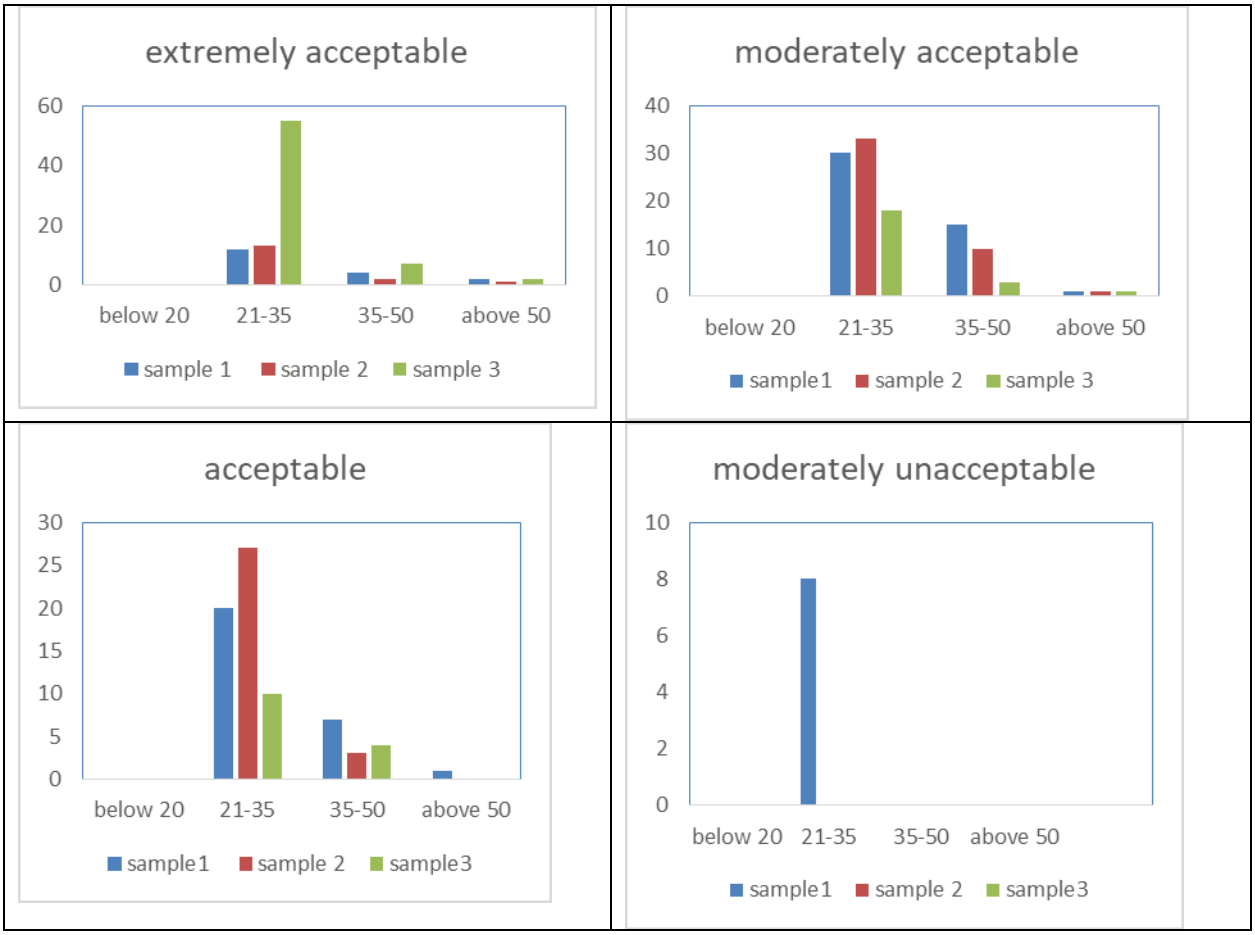
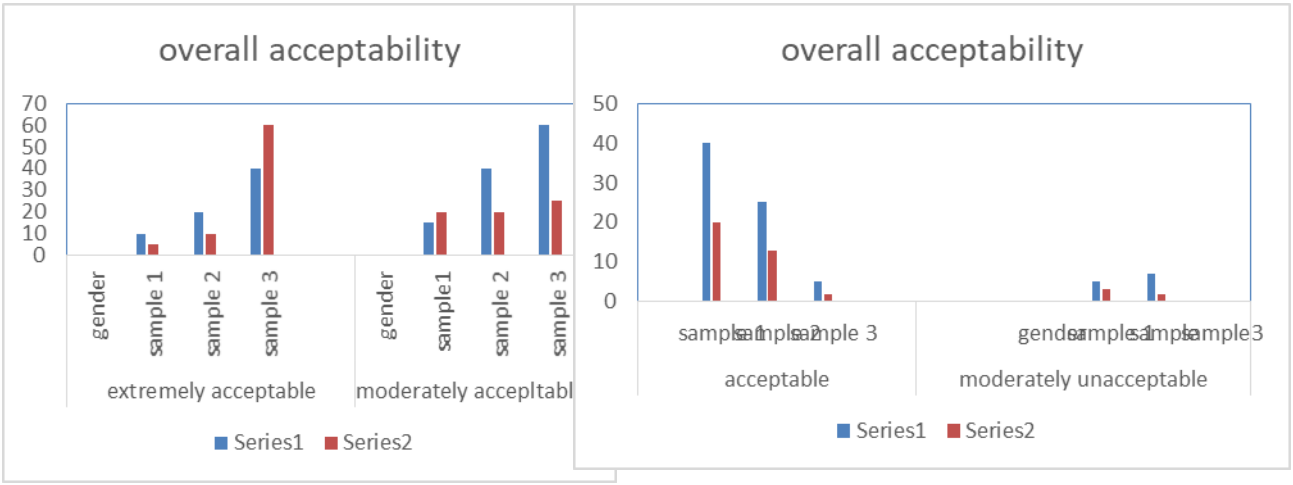


Figure 4.8.6 showing effect on age on acceptability

Effect of gender on overall acceptability



Series 1 represents female and series 2 represents male on the above graphs.

Figure 4.8.7 showing effect of gender on overall acceptability

CHAPTER 5: DISCUSSION.

5.1 Introduction

Wine quality is simpler to identify than to define, according to Maynard Amerine (Amerine, 1972). This is in part because quality is largely arbitrary and heavily influenced by exogenous influences. Consequently, it will never be entirely successful to define wine quality in terms of its chemistry.Nevertheless, the majority of genuine wine aficionados tend to concur on what makes a wine of a certain quality, and that is what they have personally grown to like after lengthy tasting. Fruit quality has a significant impact on wine quality.

To enhance digestion, metabolism, and preservation, indigenous fruit is processed into value-added products (Nayak et al., 2015; Ruffo et al., 2002; Saka et al., 2004). Tamarind (Tamarindus indica) fruit is locally and small-scale processed into juices and wines, where preparation techniques and environmental factors often differ from location to place.Post-harvest processing methods such maceration, drying, heating, and storage are projected to have an impact on nutrient content, bioavailability, anti-oxidant activity of bioactive compounds, and physical characteristics (Chong et al., 2013; Nicoli et al., 1999).

Tamarind, a fruit from the *Tamarindus indica L*. tree, can be used to produce wine, but it is often too acidic and not preferred,(Adeola *et al* 2010). To address this issue, a study tried making a base wine from tamarind fruit (50 g/L) with 0.9% acidity, increasing the TSS to 23 °Brix, and adding 150 ppm sulphur dioxide will turn wine into vermouth of satisfactory grade. Vermouths with a 17% alcohol content, both dry and sweet, were deemed suitab This explains why sample 3 and 1 had a higher overall acceptability of 66% compared to the other samples.

According to the ratings and the comments given by the respondents it proves that sample 3was wonderful and it tasted good. The quality of tamarind wine was improved by the combination of dry wine with condensed milk, full cream milk and tamarind paste to make it creamy. Condensed milk reduced the tartness of tamarind and made it sweet and it also improved the aroma of the product. Therefore, this why sample 3 has highest overall acceptability according to sensory panellists.Few people commented that, the wine was sour and its texture was not silky, it had granules. This might be because when sample 2 was made , the researcher only used full creamy milk , and did not blend the tamarind paste to make it fine , the absents of condensed milk , kept the sourness of tamarind . Most people are not

familiar with the taste of tamarind which made them consider the wine sour and did not really like it vouched for changes. However according to the graphs it also shows that the majority of the people moderately accepted and liked the second sample as it is on the acceptability graph. This also happened to some natural product made from embee by one researcher .

Eembe products faced issues with their flavor and color, and all of them were downgraded. Despite adding food flavor and color, Eembe juice received a score of 3.20, jam 2.95, and jelly 2.31,(Cheikhyoussef *et al* 2013). However, the rest of the products were of high quality and were preferred by 90% of the panelists. To improve the acceptability and preference of the products with unappealing look and taste like Eembe, food colors and flavors were added. It could have been further improved by bleaching the natural dark brown color of Eembe before adding artificial food color to enhance its appearance and acceptability. However, this was not done and is left for future research,(Bille *et al* 2013) .

Sample 1 clear wine, consumers liked wine over other beverages. Based on taste, mouth feel, flavour, and sweetness was moderately attractive in terms of appearance, this might be so, because the researcher, did not provide enough time for the wine to age. The taste was acceptable for the majority of the respondents, texture was good, and the aroma was appealing, it was because the wine was blended with pineapple juice and fermented tamarind juice. Overall acceptance of sample 1 was moderately accepted.

5:2Challenges Faced During the Production of Wine

Materials used in the production of wine such distillers were not always readily available when the researcher wanted to produce wine, this also includes fermenting barrels. The researcher also faced challenges in acquiring resources such as the tamarind itself since it produces once a year, there was need to far and deep. Fruit maturity and ripeness at the time of study were unclear, which may have contributed to the inconsistent data on nutritional composition and sensory quality.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS.

6:1Conclusion

In conclusion this study reveals that tamarind can be used as a raw materials for production of wine. This study can help in adding value to tamarind and produce a healthy wine which benefits consumers since tamarind fruit has many important nutrients. Moreover the produced tamarind wine had a good taste which led to high acceptance from the respondents.

6:2Recommendations

1. There is need to add finish, body and fruit, balance and reduce problems like acid, and alcohol levels.
2. There is need for the university to make resources more available for wine production.
3. There is need to stabilize the creamy samples to avoid fermentation which is leading to separation after a period of time.

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Appendix

Sensory evaluation form for tamarind wine alcoholic beverage

My name is Tanyaradzwa Mahaso, a Bindura University of Science Education fourth year student undertaking a Bachelor of Science Honours Degree in Natural Resources Management. I am undertaking a research on production of wine from tamarind (*Tamarind indica*) at BUSE as a part of my research project. Your responses will inform the researcher on what to improve or remove from the wine. Your participation is entirely voluntary and you can withdraw anytime without penalty. Please answer all questions honestly. Thank you for your participation and time.

Name of the person……

Gender: F ☐ **M** ☐

Age below 20 years ☐ 21-35 years ☐ 35-50 years ☐ above 50 years

Directions: Tick one rating boxes for each of the following: appearance, taste/flavour, texture /consistency, Aroma/smell and overall acceptability.

Sample A (*tamarind alcohol mixed with fermented juice)*

Appearance	Extremely attractive	Moderately attractive	attractive	unappetizing	Unattractive
Taste/flavour	Tasted great	flavourful	acceptable	Off flavour	Flavour did not appeal to me
texture	Wonderful texture	Good texture	Acceptable texture	Off texture	Inappropriate texture
aroma	Wonderful aroma	Appealing aroma	Acceptable aroma	Aroma is not appealing	Unappetizing

Overall acceptability	Extremely acceptable	Moderately accepted	acceptable	Moderately unacceptable	Unacceptable

Comment:

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Sample B:(*Sour tamarind creamy liquor*)

Appearance	Extremely attractive	Moderately attractive	attractive	unappetizing	Unattractive
Taste/flavour	Tasted great	flavourful	acceptable	Off flavour	Flavour did not appeal to me
texture	Wonderful texture	Good texture	Acceptable texture	Off texture	Inappropriate texture
aroma	Wonderful aroma	Appealing aroma	Acceptable aroma	Aroma is not appealing	Unappetizing
Overall acceptability	Extremely acceptable	Moderately accepted	acceptable	Moderately unacceptable	Unacceptable

Comments :

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Sample C:(*Sweet tamarind creamy liquor*)

Appearance	Extremely attractive	Moderately attractive	attractive	unappetizing	Unattractive

Taste/flavour	Tasted great	flavourful	acceptable	Off flavour	Flavour did not appeal to me
texture	Wonderful texture	Good texture	Acceptable texture	Off texture	Inappropriate texture
aroma	Wonderful aroma	Appealing aroma	Acceptable aroma	Aroma is not appealing	Unappetizing
Overall acceptability	Extremely acceptable	Moderately accepted	acceptable	Moderately unacceptable	Unacceptable

Comment:

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