Study on the Quality of Three Grapes Cultivars in Wine Making

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Abstract

This study attempts to search the fruit quality of three grape cultivars, *Vitis vinefera* Linn., grown in Yamethin, Meiktila and Kyaukse Townships, for wine making. Firstly, it was carried out to get 12% $^{v}/_{v}$ alcohol in wine by using different concentration of sugar and equal amount of grape juices except control bottles. Then, analysis of grape wines were also carried out including color analysis after complete fermentation. During fermentation, the declination rate of sugar content and rising of alcohol percent were measured regularly at every interval of 6 hours apart. It was also made the statistical analysis to compare the sugar concentration, acidity, tartaric acid, light absorbance and light transmittance of three grape cultivars. The situations of fermentation process, in addition, the results were recorded, compared and discussed in this work.

Keywords: Grape Wine, Grape Cultivars, Wine Making

Introduction

Grape plant (*Vitis vinefera* L.) is belong to family Vitaceae, and is a woody, climbing, tendril-bearing vine with large palmate leaves; small, insignificant, sweet-smelling flowers; and large clusters of fruits. The grapes are not only grown widely around the world but the cultivars of grape have been widely grown in Ywatan village of Yamethin, The-gone village of Meiktila, Se-pauk of Kyaukpadaung and a small acre in Inn-gone village of Kyaukse townships in Myanmar. (Tin Myo Htun, 2006)

The cultivated grapes of the present days have been derived from European and American species. The European or wine grape (*Vitis vinefera* L.) is one of the oldest of cultivated plants. They have been grown in Egypt for 6000 years, and were highly developed by the Greeks and Romans. (Hill, 1952)

Glucose and fructose are the main fermentable sugars in grape juice. ^{o}Brix is not a true measure of fermentable sugar. Two juices with identical

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ºBrix may have very different final alcohol concentrations due to varying amounts of fermentable sugars. If making wine from fresh grape juices, DAP 1g/liter dose is recommended and if from a wine kit (ready-made articles for wine making) 0.2 to 0.4 grams DAP/liter is also recommended. (Zoecklein *at el*., 1995)

Although the baker's yeast will ferment sugar and make a sort of wine, usually does not cut it in terms of flavor and it does not settle at the end of its job. (Keller, 2004)

When making wine from grape juices either fresh or packaged nutritional needs are easily met by simply adding "yeast nutrient" or "DAP" (Diammonium Phosphate). (Kraus, 2003)

Alcohol is a waste product for the yeast in fermentation process. The best yeast available in dry wine making is Pinnacle, but if it cannot get the right wine yeast, it can use bakers or brewers' yeast. (Chatterton, 1972)

This research is afford to search which amount of sugar concentration should be used to get the standard alcohol percent (12% v/v) and which kinds of grapes cultivar is the best for grape wine making.

Materials and Methods

Fruit collection

The fresh and undamaged fruits were collected from Yemathin, Meiktila and Kyaukse townships and have been investigated from April 2005 to July 2005. (Figure 1. A, B, C)

Ingredients used in grape wine making are-

(1) grape juice (2) baker's yeast (S.I Lesaffre 59703, Marcq, France) (3) white sugar (4) diamonium phosphate - $(NH_4)_2$ HPO_4 (5) tartaric acid and (6) pure water.

Equipments used in grape wine making (Alexander, 2005) are-

(1) digital balance (2) blender (3) juice extractor (4) graduated cylinder (5) specific gravity hydrometer (6) refractometer (7) colorimeter (8) pH meter (9) fermentation containers (bottles) and (10) racking tube.

Preparation of starter yeast culture (Tin Myo Htun, 2006)

In grape wine testing**,** 1g of Baker's yeast was added in 100ml of grape juice and 0.2 g of $(NH_4)_2HPO_4$ (Diammonium phosphate-DAP). The yeasts were allowed to grow at room temperature for about 24 hours before the starting of fermentation process. (Figure 1. D)

Juice Extraction

The fresh fruits were crushed by blender to obtain the ***must*** (pulps and juice). Then, the *must* were put into squeezer (cotton wool bag) to get the juice only. (Figure 1. E, F, G)

Analysis of original juice

Analysis of sugar concentration, specific gravity, total acidity, pH and acid present of original juices were carried out in this study before the preparation of fermentation medium. (Table 1) and (Fig. 2. A, B, C, D, E, F)

Content	Amount			Unit
	Yamethin	Meiktila	Kyaukse	
Volume of extracted juice	4.15	4.15	4.15	Liter
Sugar (°Brix.)	17.08	16.50	14.50	%($^{w}/_{w}$)
Specific gravity	1.068	1.066	1.057	-
Total acidity	0.035	0.036	0.041	N
pH (at 31°C)	4.23	4.15	4.08	-
Tartaric acid	0.52	0.54	0.61	g/100ml

Table 1. The composition of original juice of three grape cultivars

Preparation of fermentation medium (Tin Myo Htun 2006)

The fruit juices are placed in five containers. Except control bottle (G-1), the external sugars are added into bottle G-2 to G-5 to reach the correspondence initial specific gravity (°Brix) as shown in table, and are stirred thoroughly. Then, yeasts culture and nutrients are inoculated into each container and thoroughly stirred. (Table 2)

Fermentation checkup

Simultaneously, the temperature of fermented liquid was recorded by thermometer and then, decreasing rate of sugar content was measured regularly at the interval of 6 hours apart by specific gravity hydrometer. After taking hydrometer reading, the amount of sugar and alcohol percent were calculated by conversion calculator. (Fig. 2, G & Fig. 3, A, B) and (Table 3)

Analysis of wine after complete fermentation

Analysis of residual sugar concentration and total acidity of resulted wines were carried out as mentioned above.

Alcohol analysis- The actual percentage of alcohol in both commercial (grape) and fruit wines was determined according to Amerine (1954) as cited in Zoecklein *at el*., (1995). (Fig. 3, D)

Color analysis of wines were carried out by colorimeter (Model-6051 Jenway, England) with various wavelength as metioned in ETS Laborites, (2000). (Fig. 3, F)

Statistical analysis- Sugar, acidity, tartaric acid concentration and light absorbance and light transmittance of three grape cultivars were compared by using with student 't' test as stated by Steel and Torrie (1960).

Aging and Bottling- After fermentation, grape wine are allowed to aging (maturation) for about 6 months. Then, the cleared wine are racked into thoroughly sterilized bottles by small, cleaned plastic pipe and the bottles are aging for the year round. (Figure 3. C, E)

Table 2. The composition of ingredients in fermentation medium

Ingredients		G-1 (C)	G-2	G-3	G-4	G-5
Grape juice (ml)		830	830	830	830	830
External added sugar (gm)	Yamethin	-	32.0	67.5	102.5	136.5
	Meiktila	-	35.0	70.0	105.2	140.3
	Kyaukse	-	40.0	75.0	110.3	145.0
Starter yeast culture (ml)		20	20	20	20	20
Nutrients- $(NH_4)_2 HPO_4$ (gm)		0.2	0.2	0.2	0.2	0.2
Specific Gravity	Yamethin	1.068	1.080	1.090	1.100	1.110
	Meiktila	1.066				
	Kyaukse	1.057				
Sugar %	Yamethin	17.08%	19.5%	22.0%	24.2%	26.3%
	Meiktila	16.50%				
	Kyaukse	14.50%				
Acidity	Yamethin	0.035	0.033	0.030	0.029	0.025
	Meiktila	0.036				
	Kyaukse	0.041				
pH	Yamethin	4.23	4.25	4.33	4.40	4.50
	Meiktila	4.15				
	Kyaukse	4.08				

Figure 1

A. Habit of grape (Yamethin)
B. Habit of grape (Meiktila)
C. Habit of grape (Kyaukse)
D. Culture of yeast in grape juice before fermentation process
E. Crushing the grapes by blender
F. The grape ***must*** (a mixture of juice, pulps and seeds)
G. Squeezing the *must* to extract grape juice only

Figure 2

A. [illegible] by h
B. Measurement of specific gravity by hydrometer (Melktila grape juice)
C. Measurement of specific gravity by hydrometer (Kyaukse grape juice)
D. Measurement of sugar (°Brix) by refractometer
E. Measurement of total acidity by titration method
F. Measurement of pH
G. Fermentation process of Yamethin grape

Figure 3

A. Fermentation process of Meiktila grape
B. Fermentation process of Kyaukse grape
C. Racking of wine by siphon method after complete fermentation
D. Pot-Still distillation of grape wine on thermostat to obtain alcohol %
E. Wine bottles (from left to right-Yamethin, Meiktila & Kyaukse)
F. Color analysis of grape wines

Results

In this experiment, control bottles of Yame'thin, Meiktila and Kyaukse' are fermented by its own grape sugar. Sugar percentage of the control bottles are only 17.08 (YMT), 16.50 (MHL) and 14.50% (KS) respectively. (Table 2)

Among the three G-1 bottle, the sugar (Brix) percentage of G-1 of KS dropped to 2.3% from the initial value during 6 hours of fermentation period while the G-1s of MHL & YMT declined to 1.9% respectively. However, they have the same rate of alcohol production about 1.1% at this time. (Fig. 4) and (Table 3)

It was found that the fermentation process of these control bottles was finished up after 36 hours in KS, 42 hours in MHL and 48 hours in YMT. Alcohol percent of resulted wines, therefore, are very low in these bottles. (Table 3)

In all G-2 bottles of YMT, MHL & KS are adjusted to 19.5% sugar (or 19.5 $^{\circ}$Brix.) at the start of fermentation. The level of sugar declined to nearly halves of its initial value (i.e., 10.3) and consequently, the volume of alcohol rises to the halves of total alcohol percent (i.e., 10.5%) after 24 hours (Table 3). After 48 hours, the fermentation process is accomplished in the bottle G-2s, as the fermentable sugar is lost.

The sugar level of G-3s is started at 22.0% (or specific gravity 1.090) and it decline only 1% during the 6 hours. At 30 hours of fermentation, the initial sugar percent was dropped to the halves and 6.4% of alcohol was produced. After 60 hours, the level of fermentable sugar was shown at zero level and the alcohol at 11.9% ($^{v}/_{v}$). (Fig. 4) and (Table 3)

G-4 & G-5 bottles started the fermentation with 24.2 and 26.3% respectively, and it was found the rate of fermentation is very slow at the beginning of process. Due to the percentage of initial sugar in G-5 is more than G-4, therefore the process of fermentation is more delayed than G-4 (i.e. G-4 terminated the fermentation at 78 hours and G-5 at 90 hours).

It was found that the estimate potential alcohol percentages are too high in both G-4 and G-5.

Therefore, it was observed that only the initial value of sugar percentage in G-3 is the righteous ratio to obtain the standard alcohol percentage 12% ($^{v}/_{v}$) in finished wine.

The checks up values of fermentation are listed in table 3.

Table 3: Declination of fermentable sugar (Brix.) and rising of alcohol percentage affected by various concentration of sugar

Hour	G-1 (Control)									G-2			G-3			G-4			G-5		
	S.G			Sugar Brix (%)			Potential Alcohol %			S.G	Sugar Brix. (%)	Poten-tial Alc.%	S.G	Sugar Brix. (%)	Poten-tial Alc.%	S.G	Sugar Brix. (%)	Poten-tial Alc.%	S.G	Sugar Brix. (%)	Poten-tial Alc.%
	YMT	MHL	KS	YMT	MHL	KS	YMT	MHL	KS												
00:00	**1.068**	**1.066**	**1.057**	**17.08**	**16.5**	**14.5**	**0.0**	**0.0**	**0.0**	**1.080**	**19.5**	**0.0**	**1.090**	**22.0**	**0.0**	**1.100**	**24.2**	**0.0**	**1.110**	**26.3**	**0.0**
06:00	1.060	1.058	1.049	15.2	14.6	12.3	1.1	1.1	1.1	1.075	18.5	0.7	1.086	21.0	0.5	1.096	23.2	0.5	1.105	25.2	0.7
12:00	1.053	1.050	1.035	13.3	12.5	9.0	2.0	2.1	2.9	1.061	15.4	2.5	1.072	17.9	2.4	1.082	20.2	2.4	1.098	23.7	1.6
18:00	1.039	1.036	1.027	10.0	9.3	7.0	3.8	4.0	3.9	1.048	12.1	4.2	1.059	14.9	4.1	1.068	17.0	4.3	1.085	20.8	3.4
24:00	1.031	1.028	1.020	8.0	7.3	5.3	4.9	5.0	4.9	1.040	10.3	5.3	1.051	12.8	5.2	1.061	15.4	5.2	1.078	19.3	4.3
30:00	1.025	1.018	1.010	6.5	4.7	2.5	5.7	6.3	6.2	1.030	7.8	6.6	1.042	10.8	6.4	1.050	12.5	6.7	1.066	16.5	5.9
36:00	1.015	1.009	**1.000**	3.6	2.3	0.0	7.0	7.5	**7.5**	1.022	5.8	7.7	1.029	7.8	8.1	1.041	10.5	7.9	1.056	14.0	7.2
42:00	1.005	**1.000**	-	1.3	0.0	-	8.3	**8.7**	-	1.010	2.5	9.2	1.021	5.5	9.1	1.033	8.5	8.9	1.044	11.3	8.8
48:00	**1.000**	-	-	0.0	-	-	**8.9**	-	-	**1.000**	0.0	**10.5**	1.012	3.0	10.3	1.025	6.5	10.0	1.040	10.3	9.4
54:00	-	-	-	-	-	-	-	-	-	-	-	-	1.005	1.3	11.5	1.019	4.9	10.8	1.030	7.8	10.7
60:00	-	-	-	-	-	-	-	-	-	-	-	-	**1.000**	0.0	**11.9**	1.013	3.3	11.6	1.028	7.3	10.9
66:00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.007	1.8	12.3	1.014	3.5	12.8
72:00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.002	0.5	13.0	1.010	2.5	13.3
78:00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1.000**	0.0	**13.3**	1.004	1.0	14.1
84:00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.002	0.5	14.4
90:00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1.000**	0.0	**14.6**
96:00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Alc = alcohol
S.G = specific gravity
YMT = Yamethin
MHL = Meiktila
KS =Kyaukse

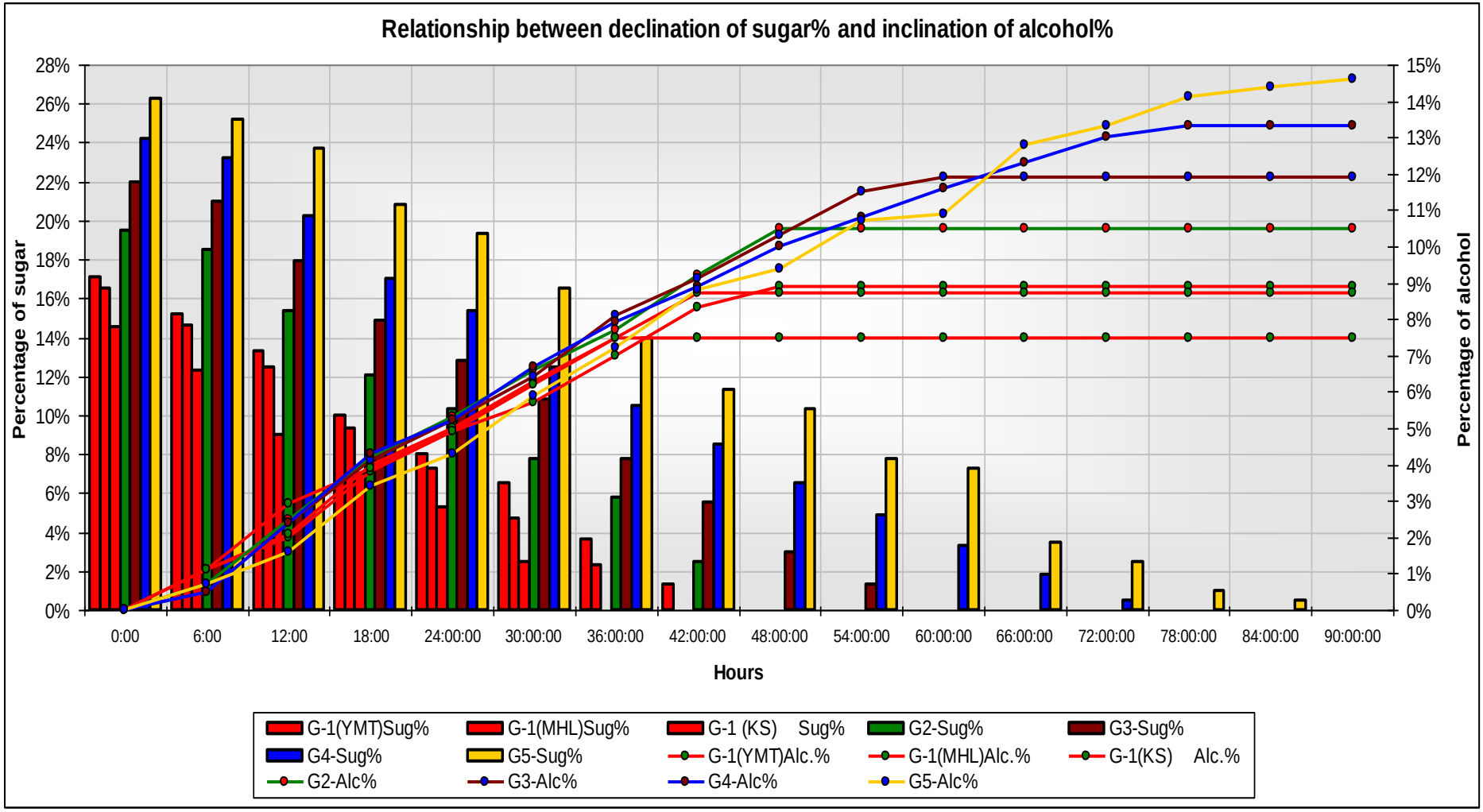

Figure 4: Relationship between declination of sugar percent and inclination of alcohol percent within 90 hours of fermentation period.

Status of finished grape wine

Table 4: The value of grape wine after sugar concentration test

Assessments		G-1 (C)	G-2	G-3	G-4	G-5
Potential alcohol % ($^{v}/_{v}$) (at R.T)	YMT	8.9	10.5	**11.9**	13.3	14.6
	MHL	8.7				
	KS	7.5				
Actual alcohol % ($^{v}/_{v}$) (at 20°C)	YMT	9.5	11.0	**12.2**	13.8	15.0
	MHL	9.3				
	KS	8.2				
Residual sugar % ($^{w}/_{w}$)		Nil	Nil	0.5	0.7	1.8
Total Acidity (N)		0.037	0.035	0.030	0.028	0.026
Tartaric acid (g/100ml)		0.560	0.549	0.523	0.512	0.503

As shown in above table, actual alcohol percent of the samples are varied from 8.2 to 15.0% ($^{v}/_{v}$) (i.e. 8.2ml. alcohol in 100 ml. wine and 15.0ml. alcohol in 100 ml. wine respectively) due to the difference of sugar concentration composed in them. By adding no external sugar and allowed it to ferment with its own sugar Brix., it was occurred that the percentage of actual alcohol in control bottles G-1 of all three varieties has just only 9.5, 9.3 and 8.2% ($^{v}/_{v}$) respectively. As the highest degree of Brix (sugar percent) in container G-4 and G-5, the resulted alcohol percent are too high as shown in above table. Among the container G-1 to G-5, only the G-3 possesses 12.2% ($^{v}/_{v}$) alcohol percent as standardize as in international product of wine.

Color analysis of grape wines

It was analyzed the color of wines only from every G-1 bottles of Yamethin, Meiktila and Kyaukse to get actual wine color by colorimeter.

It was found that the wines of YMT grapes absorb 0.64A and transmit 022% while those of MHL absorb 1.21A and just can only transmit 005% of light intensity when passing through in colorimeter with 490nm wavelength. As a result, the color of the latter is darker (i e. opaque) than the former.

The third sample (i.e. Kyaukse) wine was shown at 0.60A and 024%T, when passed through with 470nm wavelength.

The obtained resulted are represented in following figure 5.

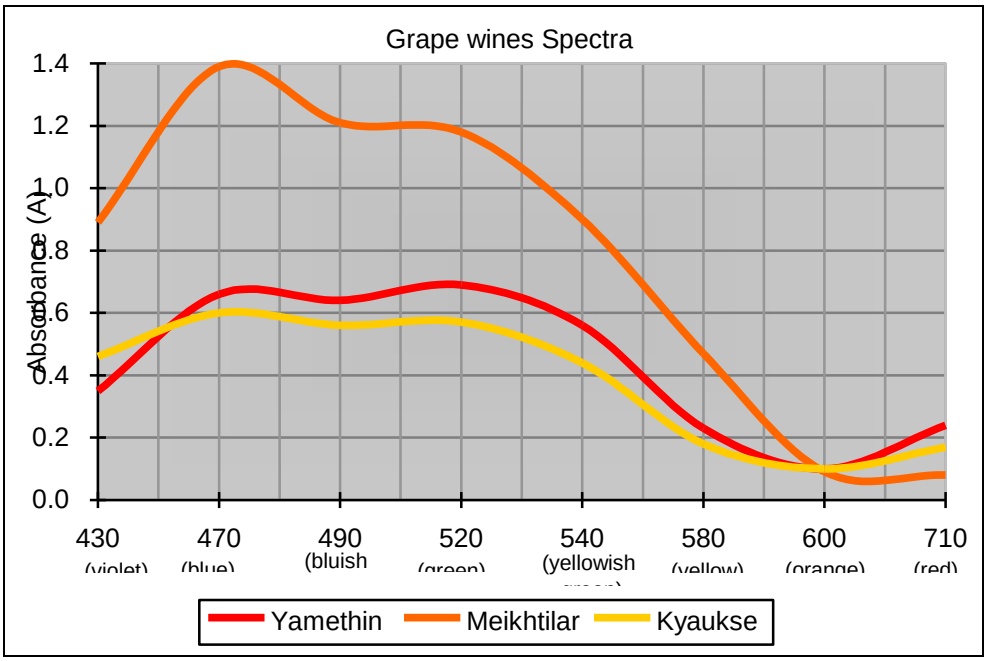

Figure 5: The different level of light absorbance with various wavelengths

Comparison value of wine and three grape cultivars

The value of sugar concentration, acidity, tartaric acid, light absorbance and light transmittance of wine, which made from three grape cultivars are presented as following. (Table, 5 to 11)

Table 5. Comparison of the quality of three grape cultivars after complete analysis of wine

Assessments	Yamethin	Meiktila	Kyaukse
Actual alcohol % ($^{v}/_{v}$) (at 20°C)	12.2	12.2	12.2
Residual Sugar %($^{w}/_{w}$)	0.45	0.50	0.50
Total Acidity	0.035	0.031	0.034
Original fruit's flavor	Aromatic	Aromatic	Aromatic
Light absorbance (A)	0.64	1.21	0.60
Light transmittance (%T)	022	005	024
Wine quality	Good	Moderate	bad

Statistical Analysis

Table 6. The source data of sugar, acidity and tartaric acid content of three grape cultivars

Number of Observation	Sugar concentration (%)			Acidity (N)			Tartaric acid (g/100ml)		
	YMT	MHL	KS	YMT	MHL	KS	YMT	MHL	KS
1	17.4	14.5	15.0	0.030	0.033	0.049	0.54	0.54	0.64
2	18.5	15.2	13.8	0.030	0.030	0.045	0.48	0.56	0.59
3	15.2	17.8	15.2	0.045	0.045	0.035	0.52	0.50	0.65
4	16.3	18.5	14.1	0.030	0.040	0.030	0.54	0.51	0.65
5	18.0	16.5	14.4	0.040	0.034	0.046	0.53	0.59	0.54

Table 7. Comparison on sugar concentration of three grape cultivars

Identity / Comparison	Sugar concentration		Remarks
	Mean ± Sd	"t" value	
Yamethin	17.1 ± 1.33	0.603	ns
Meiktila	16.5 ± 1.68		
Yamethin	17.1 ± 1.33	3.975*	95% level
Kyaukse	14.5 ± 0.59		
Meiktila	16.5 ± 1.68	2.503	ns
Kyaukse	14.5 ± 0.59		

Table 8. Comparison on acidity level of three grape cultivars

Identity / Comparison	Acidity level		Remarks
	Mean ± Sd	"t" value	
Yamethin	0.035 ± 0.007	-0.239	ns
Meiktila	0.036 ± 0.006		
Yamethin	0.035 ± 0.007	-1.250	ns
Kyaukse	0.041± 0.008		
Meiktila	0.036 ± 0.006	0.004	ns
Kyaukse	0.041 ± 0.008		

Table 9. Comparison on tartaric acid content of three grapes cultivars

Identity / Comparison	Tartaric acid content		Remarks
	Mean ± Sd	"t" value	
Yamethin	0.52 ± 0.0198		
		-1.010	ns
Meiktila	0.54 ± 0.0242		
Yamethin	0.52 ± 0.0198		
		-3.719*	95% level
Kyaukse	0.61 ± 0.0271		
Meiktila	0.54 ± 0.0242		
		-2.583	ns
Kyaukse	0.61± 0.0271		

Table 10. The observed data of light absorbance (A) and light transmittance (%T) of finished wine of three grape cultivars

Standard wavelengths (nanometer)	Light absorbance (A)			Light transmittance (% T)		
	YMT	MHL	KS	YMT	MHL	KS
430	0.48	0.45	0.46	036	034	033
470	0.66	1.39	0.60	021	003	024
490	0.64	1.21	0.56	022	005	027
520	0.69	1.18	0.57	020	005	026
540	0.56	0.90	0.44	026	012	034
580	0.23	0.47	0.18	058	032	066
600	0.10	0.09	0.10	123	082	121
710	0.24	0.08	0.17	150	118	135

Table 11. Comparison on the light absorbance (A) and light transmittance (%T) of G-1 wine of three grape cultivars

Identity / Comparison	Light Absorbance (A)		Light Transmittance (% T)		Remarks
	Mean ± Sd	"t" value	Mean ± Sd	"t" value	
Yamethin	0.45 ± 0.23		56.63 ± 135.76		
		-1.453		0.2768	ns
Meiktila	0.72 ± 0.52		36.25 ± 111.59		
Yamethin	0.45 ± 0.23		56.63 ± 135.76		
		0.278		-0.0254	ns
Kyaukse	0.38 ± 0.20		58.25 ± 119.59		
Meiktila	0.72 ± 0.52		36.25 ± 111.59		
		1.633		-0.3804	ns
Kyaukse	0.38 ± 0.20		58.25 ± 119.59		

Discussion and Conclusion

In most wine, the percentage of alcohol is standardized at 12% $^{v}/_{v}$ in international.It was needed to know that how much of initial sugar percent in the *must* or juices could be obtained 12% alcohol in finished wine.

It was occurred that the percentages of alcohol in finished wine were depend only on the percentages of initial sugar which have been composed in the grape or juices before fermentation.

The control bottle G-1s of YMT, MHL and KS are allowed to ferment with its own sugar without any addition of external sugar. As a result, it was found that the actual alcohol percent of these samples are lower than 12% ($^{v}/_{v}$) alcohol in finished wine.

In accordance with the various component of sugar before fermentation, the percentages of actual alcohol are varied from 8.2 -15.0% ($^{v}/_{v}$) (i.e. 8.2ml. alcohol in 91.8 ml. wine and 15.0 ml. alcohol in 85.0 ml. wine respectively) from G-1s to G-5 in finished wines.

According to Chatterton (1972), alcohol is a waste product for the yeast in fermentation process. The high sugar content makes a more alcoholic wine, it also acts as a preservative and this is very important in preventing the wine from turning to vinegar or going moldy. However, like most waste products, will, in excess, kill the yeasts.

Leverett (1995) described that the white films called "flowers of wine" are appeared on the top of a wine and are due to an infection by spoilage yeasts. These live on alcohol and break down to carbon dioxide. Therefore, the wine will not keep well due to the loss of alcohol and should be drunk immediately.

In this present study, it was occurred that, due to very low amount of alcohol, the wines of bottle G-1s are spoiled after 3 months of maturation (storage) period by attacking of fungus that have been entered during bottling of wine from container.

Leverett (1995) also pointed that never keep the wine in direct sunlight that can cause rapid deterioration of wine quality. Lower temperatures than the ideal present less problems than higher temperatures for storage of wine.

Therefore, low percentage of alcohols in G-1are not reliable for long period of storage (maturation, ageing or stabilization) especially in the areas of high temperature fluctuation between 21°C and 32°C.

Only the G-3 possesses 12.2% ($^{v}/_{v}$) alcohol percent as standardize as in international wines. This level of alcohol is not very much as in the wine

of bottle G-4 & G-5 but also secure from the interference of acetic acid bacteria and wild mold.

Even the 11% ($^{v}/_{v}$) alcohol is not secure for wine stabilization and therefore, 12% volume alcohol is standardized for wine in international.

On the other hand, as the highest degree of sugar percent ($^{\circ}$Brix) in container G-4 and G-5, the resulted alcohol percent are somewhat high. However, these levels of alcohol are secure from the spoilage of wine.

Therefore, it can conclude that the sugar percent of G-3 (i.e. Specific Gravity 1.090 or 22.0 Brix.) is the most suitable ratio for about 12% alcohol in winemaking.

Boulton (1996) stated that residual sugar could be sugars either that the yeast did not ferment or sugar that the winemaker added after the wine fermented, or both. Although it is a matter of taste, the level of sweetness should be appropriate for the type of wine. A dry wine should have no perceptible sweetness.

According to Edell, (1999), unfermented residual sugar are left when after fermentation is accomplished that contributes more or less sweetness depending upon the degree to a finished wine.

In this research, it was observed that there are no residual sugars remained in G-1 and G-2 although the percentages of sugar level are indicated at 0.0 in these bottles after complete fermentation.

However, in G-3, G-4 and G-5 bottles, there occurred that a little amount of residual sugar. These sugars cannot ferment by yeast and are already composed in original fruit or added by winemaker and so called residual sugars.

ETS-laboratories stated that the color of wine is determined by the absorbance of light in the entire visible spectrum. The amount of light that wine absorbs at two key wavelengths: 420 and 520 nm. Using these values, winemakers can develop an impression of a wine's redness, brownness, or yellowness. The dark-color liquid such as grape juice or wine will absorb greater amount of light energy and as a result, will transmit less light intensity (denoted by % T).

According to this research, the grape cultivar of Yamethin is the best to make red wine because it can deliver the bright red color juices after crushing of fruits and provide aromatic flavor of grape, the clearness and bright red color after completion of fermentation process than those of Meikhtila and Kyaukse grapes. Another powerful fact of Yamethin grapes is to add fewer amounts of external sugar into the juices to reach to initial

specific gravity 1.090 or 22% of sugar (°Brix.) to get round about 12% of alcohol percent in finished wine. The grapes of Meiktila are better than of Kyaukse for red wine making. The grapes of Kyaukse produced the yellowish juices color and it appropriate for white wine making. However, the value of light absorbance is lesser than Yamethin and Meiktila grapes.

Therefore, as mentioned above, the grape cultivar of Yamethin is the best for making qualified grape wine than those of Meiktila and Kyaukse, if unless to get any right wine grape in Myanmar.

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