Journal of Food Technology 3 (3): 308-313, 2005

Develop an Appropriate Mandarin Sensorial Profile of Wine Made in Burgundy, France

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Abstract: The objective of this study is to develop an appropriate mandarin sensorial profile of red wine for Taiwan's wine dealers/consumers by using descriptive method and TI technique. Twelve subjects from Kaohsiung Hospitality College students with previous experience evaluating red wine were pre-selected on basis of interest, availability and ability to articulate. Subjects were trained to evaluate three different production-year red wine from Burgundy, France. The appropriate Mandarin Terms to describe the aroma, flavor and mouth-feeling of red wine were developed by subjects. After further exposure to the wine samples, a basic aroma, flavor and mouth-feeling sensorial profiles of red wine (Burgundy) were determined. The sensory retention of mouth-feel in "bitter" and "astringent" perceptions was also determined by Time-Intensity (TI) technique.

Key words: Wine, sensory descriptive analysis, time-intensity analysis

INTRODUCTION

Wine consumption in Taiwan/China has become more and more popular within last five-year, this significant growth has attracted more than 6,000 enterprises get into the wine market in Taiwan (DGBAS Taiwan, 2003). Many local hotels and restaurants now offer their customers wine instead of other traditional alcoholic beverages such as rice liqueur, sake, or beer. Base on this consumption trend, the imported wines have become competitive beverage products in China/Taiwan alcoholic beverage market after they joined the World Trade Organization (WTO) in the year 2002. There are extensive literatures on aromas and tastes of wine[1-4]. In 1980, Noble developed an "wine taste wheel" for describing the flavor characteristics of wine which involving 94 terms under of 12 categories and 29 sub-categories but most of terms won't be understood by customers whose mother language is mandarin. People from different races may have different sense perception of wine and describe wine flavor attributes in different ways, therefore, it is of concern how to show the appropriate terms of aroma and taste for wine in local language to consumers for local wine dealers, but there is rare literature relate to this subject. Wu[5] indicated that the attributes of wine will influence the consumer preference when they try purchasing the wine; however, it is difficult for wine dealers to describe wine characteristics by using local language when they explain and sell their products to customer.

Descriptive analysis is a sensory method most utilized in sensory analysis for product characterization. By this method, the attributes referring to particular sensory sensations in a food product are identified and quantified by human subjects with training and experience. Descriptive sensory analysis has been applied in many food researches for developing the common terms to describe the aroma/flavor of food or measuring flavor changes and perception of food. King *et al.*[6] studied on the effects of aspartame and fat on sweetness perception in yogurt by using descriptive technique. Hulin-Bertaud *et al.*[7], reported the sensory and compositional relationships between various cheese. In the year 2001, Torres-Penaranda and Reitmeier researched on sensory profiles of soymilk by using descriptive analysis technique.

The flavor of wine as it is swallowed is often markedly different from their initial perception. Some of flavor attributes change as the food is manipulated and this change may affect the consumer preference of selecting food. Time Intensity (TI) techniques provide nearly continuous measures of an attribute's intensity

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from the time action on the beginning of the food to the time that food is swallowed[8,9]. Thus, attributes that change during eating should be wellsuited for TI measurement. TI sensory evaluation has been primarily used for evaluating chemical produced sensations such as sweetness and flavor[8-9]. In the recent research, Desobry-Banon and Vickers[10] applied time intensity technique for determined cohesiveness of mass of three commercial food products.

The objective of this study is to develop an appropriate basic mandarin sensorial profile of red wine for local wine dealers/consumers by using descriptive method and TI technique. The result can be utilized for promoting the wine into alcoholic beverage market of China/Taiwan. The flavor profile of red wine built in this study may help researchers to modify the wine taste wheel for oriental people sensation. On the other hand, the local wine consumer will realize the specific characteristics of each wine before they purchase; moreover, wine trader will market their wine better if they are able to describe the wine flavor to their customers by local descriptive language.

MATERIALS AND METHODS

Wines: The commercial red wines made in Burgundy, France were purchased from local imported company in Kaohsiung (Taiwan). They were selected basis of availability and intensity, quality and representativity of their aroma by an expert panel composed of five individuals. Three commercial red wines from same village were used:

Chambolle-Musigny (1997), Les Sentiers, Robert Groffier.
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Twelve bottles of each type of wine from the same lot were used. For each session a new bottle in each type of wine was opened. The wines were checked for defects such as cork taint by panel leader before the sensory analyses took place. The panel assessed the wines at room temperature.

Selection of Panelists for Sensory Evaluation: Twelve judges from Kaohsiung Hospitality College students with previous experience evaluating red wine were pre-selected on the basis of interest, availability and ability to articulate. Pre-screening questionnaires[11] for aroma and flavor were initially used to screen individuals. Three additional screening tests were used: a basic taste test, an odor recognition test and an intensity ranking test, as described by ASTM[12,13].

Table 1: Descriptors developed by panelists by initial consensus

Term	Description
Aroma	
Spicy	Cinnamon, chinese medicine
Sour	Lemon juice
Complexity Aroma	Citrus, cherry, tropical fruits
Smoke	Smoking salmon
Tree	Oat, green
Earthy	Earth or dust
Sweet	Fructose
Flavor	
Spicy	Red pepper
Wood	Oat, green
Astringent	Dry, clean tongue
Acerbity	tonic water
Acid	Lemon juice, citrus juice
Complexity Fruit Flavor	Apple, citrus, tropical fruit
Smoke	Smoking salmon
Bitter	Black coffee
Sweet	Sweet as graph juice
Mouth-Feeling	Any tastes and feel which remain and endure in mouth after the tasting
Pungent	Rice liquor
Astringent	Dry, clean tongue
Acerbity	Tonic water
Acid	Lemon juice, citrus juice
Complexity Fruit Flavor	Apple, citrus, tropical fruit
Smoke	Smoke wood
Bitter	Coffee
Oriental Sweet (Throat Feel)	Wu-long tea

Training of Panelists for Sensory Evaluation: Panelists were trained for period of 3 months in 2 h sessions once a week (24 h total). Judges were exposed to a variety of wines including three different types of wine. They were asked to evaluate sensory difference among samples and made list of the descriptors for aroma, flavor and mouth-feel. The appropriate descriptors of red wine from Burgundy, France generated after initial consensus were listed in Table 1. After further exposure to the products and more familiarity with those wine products, panel arrived at consensus for the final descriptors for the sample as illustrated in Table 2. Panelists also defined the type of scale to use for evaluation. A 10 cm line scale anchored from not detectable to intense was defined.

Descriptive Analysis: Three red wine samples were used for evaluation by descriptive analysis. They were significantly different in sensory perceptions based on the previously evaluation by triangle test. The Descriptive Analysis as described by Meilgaard *et al.*[11] and ASTM[11] were conducted for 6 wk immediately following training in this study. Samples were presented in partitioned tables under red light at room temperature. Fifteen mL red wine at 7°C was presented in un-transparent plastic cups labeled with 3-digit random numbers. Cups cover with lids before taste to avoid volatilization of aroma compounds. Within the evaluation, water and un-salted crackers were used for plate cleansers between evaluations.

Table 2: Final list of sensory attributes used for description of red wine

Attributes	Definition	References
Aroma		
Pungent	Physically penetrating sensation in nasal cavity (sharp and irritating)	Ethanol, Menthol, Acetic acid, Sulfur Dioxide
Woody	Smell associate with oak wood/Cork	Phenolic, Resinous
Earthy	Smell associate with earth	Earthly (dusty/mushroom), mouldy (musty)
Acid	Smell associate with volatile acid	Lactic acid, butyric acid, acetic acid...etc.
Fruity	The aromatic blend of different fruity identities	Citrus, berry, tree fruit, tropical fruit...etc.
Smoky	Penetrating aromatics of charred wood. Tainted by exposure to smoke	Burned wood, coffee
Sweet	Blend of sweet aromas	Fructose solution
Flavor		
Pungent	Physically penetrating sensation (sharp and irritating)	Ethanol, menthol, acetic acid, sulfur dioxide
Woody	Smell associate with oak wood/cork	Phenolic, Resinous
Astringent	Mouth drying, harsh. The complex of drying and shrinking sensations in the low cavity causing contractions of body tissue.	Alum at 0.1% in water
Acerbity	Astringent cause by acid sensation	Pure lemon juice
Acid	Smell associate with volatile acid	Lactic acid, butyric acid, acetic acid
Fruity	The aromatic blend of different fruity identities	Citrus, berry, tree fruit, tropical fruit
Smoky	Penetrating aromatics of charred wood. Tainted by exposure to smoke	Burned wood, coffee
Bitter	Chemical-like, disprin, asprin. Taste sensations of which caffeine and quinine are typical	Caffeine in water
Sweet	Fundamental taste sensation of which sucrose is typical	Sucrose
Mouth-Feeling	Any tastes and feel which remain and endure in mouth after the tasting	
Pungent	Physically penetrating sensation (sharp and irritating)	Ethanol, menthol, acetic acid, sulfur dioxide
Woody	Smell associate with oak wood/Cork	Phenolic, resinous
Astringent	Mouth drying, harsh. The complex of drying and shrinking sensations in the low cavity causing contractions of body tissue.	Alum at 0.1% in water
Acerbity	Astringent cause by acid sensation	Pure lemon juice
Acid	Smell associate with volatile acid	Lactic acid, butyric acid, acetic acid.
Fruity	The aromatic blend of different fruity identities	Citrus, berry, tree fruit, tropical fruit.
Smoky	Penetrating aromatics of charred wood. Tainted by exposure to smoke	Black coffee
Bitter	Chemical-like, disprin, asprin. Taste sensations of which caffeine and quinine are typical.	Caffeine in water
Oriental Sweet (Throat Feel)	Sweet feeling in the throat	Wu-Long Tea

Panelists rested for 5 min or longer, if needed, between samples evaluations. The attributes of aroma, flavor and mouth-feeling generated from pre-evaluation were evaluated for three samples in 4 replications. The 3 samples were presented in different random order for each judge during each replication.

Judges sipped and expectorated a warmed up sample of wine before the assessment. They recorded their responses of each attribute on a 10 cm intensity line scale. Standards were available for comparison to samples; panelists were allowed to change their responses during the period of evaluation.

The results were translated from Mandarin to English by using the double translation technique[14]. This technique requires the material to be translated from Mandarin to English by one person and then translated back from the English to Mandarin by another person. Any differences between the two translations must be rectified to ensure the accurate translation.

Time Intensity Analysis: The sensory retention of overall bitter and astringent sensations was determined by Time-Intensity (TI) technique described by ASTM. Panelists consumed approximately 10 mL of choose red wine sample, swirled it in their mouths for 5 sec and then swallowed. After swallowing, panelists began to rate the bitterness and astringent after taste intensity for a total of 90 sec. They rated the intensity of bitter and astringent on a 60 pixels line labeled the words none at the left and extreme at the right. The definition of intensity in bitter and astringent has been defined in training section. Water and un-salted crackers were used for plate cleansers between evaluations. Panelists rested for 5 min or longer, if needed, between samples evaluations.

Data Analysis: Results of quantitative descriptive analysis data were analyzed using analysis of variance (ANOVA) performed for the significant attributes[15]. Four parameters, maximum intensity (Imax), time at maximum intensity (Imax), Reaction time (Rx) and total duration (DUR) were extracted from TI curves. ANOVAs and Tukey's HSD tests were used to determined significant difference among the three samples.

RESULTS AND DISCUSSIONS

The vineyards of Burgundy extend across 4 departments southeast of Paris. In general, the wines of Burgundy are less uniform in style than those of Alsace or Champagne, but less diverse than wines from Lorie or Rhone valleys[16]. The fine red Burgundy wine can be the most seductive of all red wines. It should be fragrant and fruity, with tones of raspberry, strawberry, cherry or plum when they were tasted. Great red Burgundy wine should have concentration and depth, remarkable impressive texture and structure, but it should not be heavy[16].

Overall: The terminology for description generated by panelists after initial consensus consisted of more common consumer languages (Table 1), while a development the final list of terms (Table 2) developed after judgment were extensively exposed to the samples showed the use of more technical vocabulary. Civille and Lawless[17] indicated that the fractionation of a perception into its component sensory impressions might be very difficult. This may explain the terminology for wine description generated by panelists in the initial consensus consisted of more common consumer languages than those of finial list of terms described by judgments after they exposed to the samples and standards extensively. In the sensation of flavor and mouth-feeling, there was high a positive correlation (r=0.832) between the terms of astringent and acerbity was found. Lawless and Heymann[18] mentioned that the terms used for sensory description of products should not correlate to each other. The possible reason for this contrast result was difficult to define these two terms in "Mandarin" for the panelists. However, the panelists insisted that they were two different sensations.

In this study, the assessors were able to describe typical characteristics of the three wines reflecting production years. The wine made in different years showed different sensorial characteristics in aroma, flavor and mouth-feeling after taste. The result indicated that the wine made in year of 1999 had more pleasure flavors (using attributes of fruity and acidity as indicator) than those of made in year of 1997 and 1998 (Table 3). Chen (2002) indicated that red Burgundy wine produced in 1999 generally has better quality than those produced in 1997 and 1998. Regardless of production years, the panelists gave higher scores in fruity description term than others and the sensory scores of most sensorial attributes were under 60 (total 100). These results agreed with the general taste characteristics of Burgundy wines.

Table 3: Mean values for descriptive attributes used to describe wines made in three vary years (12 assessors, 4 replications)

Attributes	1999	1998	1997
Aroma			
Pungent	9.4^a	8.8^a	9.2^a
Woody	12.3^a	11.8^a	12.8^a
Dusty	3.8^a	4.2^a	4.1^a
Acidity	34.2^a	28.5^b	22.2^c
Fruity	52.6^a	40.3^b	35.8^c
Smoky	10.2^a	10.4^a	9.8^a
Flavor			
Pungent	11.3^a	12.1^a	11.8^a
Woody	14.5^a	13.8^a	14.2^a
Astringent	49.1^a	44.2^b	45.3^b
Acerbity	48.2^a	43.1^b	45.0^b
Acidity	42.1^a	35.4^b	30.2^c
Fruity	78.3^a	51.2^b	52.0^b
Smoky	13.2^a	13.1^a	12.8^b
Bitter	22.5^c	31.8^a	28.6^b
Sweet	34.8^c	41.5^b	45.6^a
Mouth-Feeling			
Pungent	3.9^a	4.2^a	4.5^a
Woody	12.1^a	11.8^a	12.4^a
Astringent	46.1^a	40.2^b	41.2^b
Acerbity	46.2^a	41.1^b	42.0^b
Acid	38.1^a	21.5^b	22.1^b
Fruity	56.4^a	40.2^c	43.2^b
Smoky	20.2^a	19.4^a	19.0^a
Bitter	36.8^a	37.4^a	36.5^a
Sweet	7.2^a	6.1^a	6.5^a
Oriental Sweet (Throat Feel)	22.1^b	34.1^a	35.3^a

Means with different superscripts are significantly different. 0 = not detectable to 100 = intense ($p<0.05$)

Table 4: Mean values of time intensity parameters in bitter perception

	1999	1998	1997
Imax (pixel)	24.5^b	36.2^a	35.4^a
Mean±SE	4.2	3.2	4.1
Tmax (sec)	12.6^a	13.2^a	12.8^a
Mean±SE	3.6	4.4	5.1
Rx (sec)	2.1^a	2.3^a	2.2^a
Mean±SE	0.4	0.1	0.3
DUR (sec)	52.0^a	51.2^a	51.8^a
Mean±SE	3.8	3.5	4.6

Table 5: Mean values of time intensity parameters in astringent perception

	1999	1998	1997
Imax (pixel)	36.6^c	40.9^b	47.5^a
Mean±SE	3.8	4.4	5.1
Tmax (sec)	6.2^b	8.6^a	8.9^a
Mean±SE	3.8	4.1	3.1
Rx (sec)	1.2^a	1.1^a	1.3^a
Mean±SE	0.1	0.2	0.2
DUR (sec)	54.1^b	53.8^b	61.3^a
Mean±SE	1.7	2.3	2.1

Means with different superscripts are significantly different

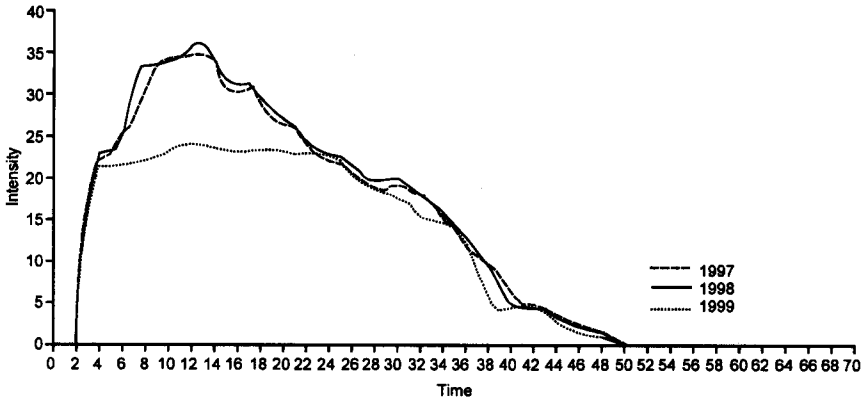

Fig. 1: Representative profiles of time-intensity measurement of bitter aftertaste perception. The curve displayed were selected from 10 available curves because the values for the four parameters closely matched the means of the parameters

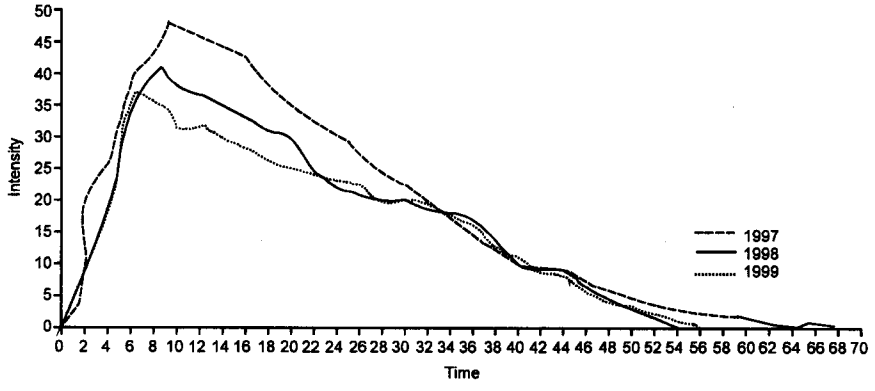

Fig.2: Representative profiles of Time-Intensity measurements of astringent aftertaste perception. The curve displayed were selected from 10 available curves because the values for the four parameters closely matched the means of the parameters

Aroma: The aroma result showed significant difference ($p<0.05$) in intensive scores of across three variety wines for fruity and acidity sensorial attributes (Table 3). The attribute of dusty was perceived at a related low intensity in all three wines. In the attributes of acidity and fruity, the wine made in the year 1997 has the lowest intensive scores among three variety wines. The highly significant differences ($p<0.05$) were observed among subjects.

Flavor: The flavor result showed that significant difference ($p<0.05$) in intensive scores across three variety wines for astringent, acerbity, fruity, bitter, acidity and sweet attributes (Table 3). The wine made in the year 1999 has higher intensive scores in acidity attributes than those of the year 1998 and 1997 but has lower intensive scores of sweet attribute than those of other two wines. Due to sugar fermentation mechanism, there was an inverse relationship existing between acidity and sweet perceptions of wine[19]. The panelists also indicated that the wine made in 1999 has higher intensity score in "fruity" attribute than those of 1997 and 1998.

Mouth-Feeling: The mouth-feeling result showed a significant difference intensive score across three variety wines for astringent, fruity and oriental sweet attributes (Table 3). The attribute of sweet was perceived at a very low intensity in all three wines. However, panelists indicated an interesting attribute (oriental sweet) in the sensation of mouth-feeling. This attribute was unusual describe by western panel groups but it was used frequently for describing tea (one of major beverages for oriental country) from oriental nation.

TI Responses: Representative TI curves of bitter and astringent for all three wines were shown (Fig. 1 and 2). Four parameters extracted from TI curves were summarized in Table 4 and 5. Wine made in the year 1997 had the greatest Means with different superscripts are

significantly different ($p<0.05$) maximum intensity (Imax) as well as the longest duration (DUR) in astringent perception. Also, wine made in the year 1997 had the lowest ($p<0.05$) mouth-feeling maximum intensity (Imax) in bitter perception among three wines but there was no significant difference in duration (DUR) parameter. There was also no significant different in time at maximum intensity (Tmax) among three wines regarding bitter and astringent perception. The astringent perception TI curve showed longer duration time (DUR) than that of bitter perception curve. Time-related measurements have proven the trigeminal flavor sensations such as hot pepper flavor[18] and astringency[20,21] have longer duration experience for subjects. Based on the result of TI responses, the Tmax of bitter perception of wine was not reached as quickly as those of astringent perception. Henkin and Christiansen[22] demonstrated that the base of the tongue is particularly sensitive for "bitter" was the possible reason.

CONCLUSIONS

The people from different races may have different sense perception of wine. The creation flavor profile in this study may help researchers to modify the wine aroma wheel for oriental people sensation. Base on this study, the wine consumer will understand the way to enjoy the wine easier, moreover, wine trader will promote their wine better if they are able to describe the wine flavor by using customer understandable descriptive language with consumers.

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