

Research Article

Determination of the Best Formula Apple Cider Beverages in the Production Process through Consumer's Acceptance and Laboratory's Integration (Case Study in Apple Cider Beverages Cluster in Batu City, East Java)

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Abstract: The purpose of this research is to identify the best apple cider's formula in Batu city based on SNI by using consumer's acceptance and laboratory test. One of the product components which must come into consideration in obtaining the consumers' trust and attention is quality. There are 7 existing of SMEs (Small and Medium Enterprise) as the subject of this research. Each SMEs cider had a problem in setting the standardization of its process for the product. This is due to broad production, each SMEs must take care of and thus the inconsistency in the quality of this apple cider occurs during the production. Therefore, the improvement of quality is required to meet the requirements of SNI. The purpose of this research is to identify the best apple cider, each SMEs must take care of and thus the inconsistency in the quality of this apple cider occurs during the production. Therefore, the improvement of quality is required to meet the requirements of SNI. The results of the study presented that the best formula was obtained through the improvement in the pasteurization process with temperature of 65°C and in 30 min time. The scores of consumer color show following results: color is 4, 00 (liked), sense is 3, 57 (liked) and the scent is 3, 87 (liked). In addition, the laboratory test result demonstrates that the value of TPT is appropriate with SNI of 10, 80% Brix.

Keywords: Apple cider beverages, consumer's, formula, integration, laboratory's

INTRODUCTION

Based on the report issued by the Ministry of Industry and Trade of the Republic of Indonesia in Batu city, East Java Province in 2002 showed that Micro Small Scale Enterprises (MSEs) were one of the support of the regional economy based on the utilization of natural resources of the local area. In the year of 2006, the role of MSEs for the creation of the national gross domestic product in current prices amounted up to IDR. 1778.75 trillion or 53.28% of total national Gross Domestic Product (Mustanirah *et al.*, 2014). Fruit juice is one of the instant product that can be consumed as soft drinks with a prospective consumer demand. The manufacture of soft drinks including fruit juice has been growing more rapidly than fast food in Western societies (Endrizzi *et al.*, 2009) and even possesses a highly competitive products such as a health drinks not only because of the taste and nutritional properties, but also because of an effects on health (Muntean and

Muntean, 2010). Furthermore it also has a potential in the innovation and rapid development (Jayalakshmi *et al.*, 2011).

The agricultural sector plays an important role in supporting the country's economy. Apple cider beverages is one of the potential products of the apple processing industries in Batu city. This fact relates to the Agro-industry development in the creative industry sectors, which closely links with community development through Small and Medium Enterprise (SMEs) (Dhiman and Rani, 2011). SMEs in Batu City, East Java has been popular for selling and processing apple cider beverages. Based on previous research, the industrial sector of apple cider beverages in 7 SMEs in Batu remains active which are: Farmers Group Holding (KTMA), Brosem, Good Agriset, Harum Sari, Sari Lucky, R. Rovit and Apple Cider Nanda.

The raw materials of apple, which are used by SMEs vary, among other apple varieties ranging from Manalagi, Rome beauty and Anna which are obtained

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from apple growers, apple collectors and the market in Batu city. It is apparent and unquestionable that quality becomes one of the essential factors to obtain consumer trust and attention. Quality itself is defined as everything that meets the desires or needs of customers. To achieve a high degree of quality of expected product, several supporting materials is required, including information systems, management and also the technology that has been applied by the company (Evans and Board, 2013).

However, the marked obstacle faced by *SMEs* when producing the apple cider beverages is the production process which often results in quality inconsistencies of apple cider beverages. Direct impact on consumers satisfaction as a result of the variation in the production process, reflected by the variation in the quality of products which include differences in taste, color, flavour leading to differences in prices to reach consumer segments. There are several factors affecting the diversity of the apple beverages, such as the quality of apples, the level of food additives, the condition of pasteurization and the quality of beverages. The use of food additives is considered for the maximum economic benefit as shown in the optimization of the use of additives to the amino acid content (Sun *et al.*, 2014). Types and quantity of food additives used by different MSEs resulted in various quality of apple beverages such as taste, color, flavor and consequently the differences in price. The use of food additives must follow the Ministry of Health of the Republic of Indonesia Number 033 of 2012 and the regulation of Food and Drug Regulatory Agency Number 27 in 2013 and Codex General Standard For Food Additives Codex Stan 192-1995, Rev. 7-2006 about preservative, acidity regulator, sweetener and flavour (Mustaniroh *et al.*, 2014). The diversity of the production process are also seen in thermal pasteurization process conducted by MSEs. Pasteurization is used to reduce the levels of pathogenic microbes (Olubukola *et al.*, 2011) to extend the shelf life of beverages (Gandolfi *et al.*, 1994; Maji *et al.*, 2011; Torkamani, 2011) as well as to maintain sensory products (Baldwin *et al.*, 2012). This was supported by the findings from (Rattanathanalerk *et al.*, 2005; Cañumir *et al.*, 2002) showing that the pasteurization process also resulted in a decrease in fruit quality such as loss level of vitamin C, total acidity (acid) and total dissolved solids in °Brix. At this moment there is no standard of optimum pasteurization temperature and time for fruit juices in Indonesia (Mustaniroh *et al.*, 2014). Optimum pasteurization can minimize damage to the quality of the resulting product, during the process loss a little amount of aroma and flavor due to the evaporation process. However, a decrement in aroma and flavor can be anticipated with the addition of flavor and taste enhancer in the form of acid and flavor enhancers. This was supported by the findings from (Rattanathanalerk *et al.*, 2005).

Establishing a standardized production in process by including a formulation of apple beverages is important to produce optimum quality products that can meet both the producer and consumers satisfaction (Mustaniroh *et al.*, 2014). Hence, the need to restore the quality of the product for apple cider beverages must be in accordance with the quality standard (SNI). The purpose of this study is to determine the best formula for apple cider beverages in Batu city based on SNI by conducting the test on consumer acceptance and the laboratory tests that were compared to SNI 01-3719-1995.

MATERIALS AND METHODS

Data issued by the Department of Cooperatives Small Medium Enterprises, Industry and Trade of Batu City, between 2011-2016 there were 20 MSEs producing apple beverages in Batu City. The research was conducted on SMEs in Batu city, East Java that produces an apple cider beverages are 7 SMEs. The selection of the respondent were based on the purposive sampling techniques with a consideration of less than 100 (20 people). The method used in the study was the consumer acceptance test by applying Effectiveness Index and the Multiple Attribute laboratory tests to determine the first best formula and consumer acceptance and laboratory test to determine the second best formula. The parameters used in the consumer test were: accepted of the color, flavor and scent, while the parameters of the laboratory tests included total sugar, total acid, total dissolved solids and total plate count.

RESULTS AND DISCUSSION

The apple, raw materials used by each *SMEs* vary from *Manalagi*, *Romebeauty*, to *Anna* varieties which are obtained from farmers, supplier and distributor in Batu city. The *Manalagi* apple varieties have the sweetest taste among other apples, while *Romebeauty* varieties have sourer flavor compared to other types of apples, but *Anna* has a wry sense of less sharp scent (Sa'adah and Estiasih, 2015). The consideration of the apple plant site becomes a very important decision as it will affect the availability of raw materials. The production capacity varies among *SMEs* in Batu city, due to various abilities of *SMEs* in producing the apple cider beverages. The result of production capacity of *SMEs* will affect the selling price affecting the results of sales and profits.

This study used 30 respondents to determine the consumer acceptance of apple cider beverages. In determining the best formula, the researchers firstly performed the test on the consumer acceptance (organoleptic) by employing Effectiveness Index and conducted laboratory tests on apple cider beverages from 7 *SMEs* by applying Multiple Attribute. The

Table 1: The average score of the panelists towards apple cider beverages

No.	SMEs	Average score		
		Color	Taste	Scent
1.	A	3,27	2,67	3,40
2.	B	3,37	3,40*	3,53*
3.	C	3,27	3,23	3,40
4.	D	3,63*	3,20	3,33
5.	E	3,00	2,63	2,53
6.	F	3,27	2,27	3,00
7.	G	3,23	2,80	3,23

Data of Analysis (2016); *means the higher score

parameters used in the organoleptic tests include color, flavor and scent. Results of the average score of the panelists towards apple cider beverages from 7 SMEs can be seen in Table 1.

Based on Table 1, it is noted that the average score of the parameters includes color, flavor and scent at 7 SMEs which produced apple cider beverages in Batu city. In the color parameters, the best value is obtained by SMEs D with a value of 3.63 (like), meaning that the respondents liked the color of the apple cider beverages from *Manalagi* varieties. The desired color as preferred by the respondents is not too dark. Longer heating time might influence the final appearance of the apple cider beverages. The longer the heating time, the darker the product will be (dark red) (Khurniyati and Estiasih, 2015). Color becomes an important characteristic of a food product because the color can influence consumer acceptance of the food product.

In the taste parameters, the best value is obtained by SMEs B which has a value of 3.40 (a bit like), which means that the respondent rather liked the taste of the apple cider beverages from *Romebeauty* varieties. A flavor which is desired by the respondents are balanced sweet and sour flavors. *Romebeauty* apple varieties have a sense of being between sweet and sour balance (Khurniyati and Estiasih, 2015). According to Susanto and Bagus (2011), the three varieties of apples have different characteristics in which *Manalagi* tends to have a sweet fruit, while *Romebeauty* has a taste of balanced sweet and sour with high level of acidity. The *Anna* apple has the highest acid content. Therefore, an apple cider beverages made from *Romebeauty* varieties is mostly preferred by respondents. Taste gives a strong stimulus to the level of consumer preferences. The more fond of the taste of a food, it can increase the interest of consumers to have more products (Hapsari and Estiasih, 2015).

Table 2: Laboratory test on apple cider beverages

Indicator	SMEs						
	A	B	C	D	E	F	G
Total sugar (%)	8,00	9,02	9,97	10,15	8,67	2,93	6,20
Total acid (%)	0,22	0,25	0,33	0,15	0,13	0,10	0,28
TPT (% Brix)	8,20	9,40	10,0	10,60	9,00	4,40	6,27

Laboratory test (2016)

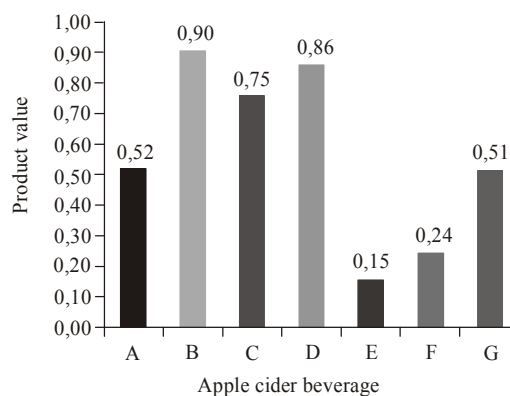


Fig. 1: Result of analysis on effectiveness index in apple cider beverages

In the scent parameters, the best value is obtained by the B sample with a value of 3.53 (like), meaning that the respondents liked the smell/scent of apple cider beverages from *Romebeauty* varieties. The respondents' desired scent is distinctive scent of apples. Scent is something that can be perceived by the senses of smell. Scent is a component that is considered important in determining the delicacy of a foodstuff because before people enjoy a product, the scent of the food will smell first (Rahmawati and Sri Luwihana, 2013). The results of the average score of panelist towards apple cider beverages will be used for calculations through applying Effectiveness Index to get the best formula from 1 of 7 SMEs. The Effectiveness Index analysis results can be seen in Fig. 1.

Based on Fig. 1, it can be seen that the best brands is acquired by SMEs B from the analysis of the effectiveness index. Having obtained the best brands based on effectiveness index, the researchers then integrated the result by conducting laboratory tests on total sugar, total acid and Total Dissolved Solids (TPT). Results of laboratory tests on apple cider beverages can be seen in Table 2. The best formula is obtained if the minimal total score is achieved. The best formula based on multiple attributes is obtained by SMEs C.

The results in determining the best formula based on the index of effectiveness is obtained by SMEs B. However, when based on multiple attribute, it is SMEs C which scores the highest. Therefore, it will be the integration between the two SMEs with the effectiveness index for SMEs B and C. The effectiveness index analysis of apple cider beverages^{2nd} can be seen in Fig. 2.

Table 3: Comparison of laboratory test

Parameter	SMEs B	SNI 01-3719-1995	Research by (Mustaniroh <i>et al.</i> , 2014)
Total sugar content (%)	9,02	-	18,94
Total acid content (%)	0,25	-	0,273
TPT (% Brix)	9,40	Min. 10/11	11,9
Total plate count	1×10^1	Max. 2×10^2	$6,5 \times 10^1$

Data of analysis (2016)

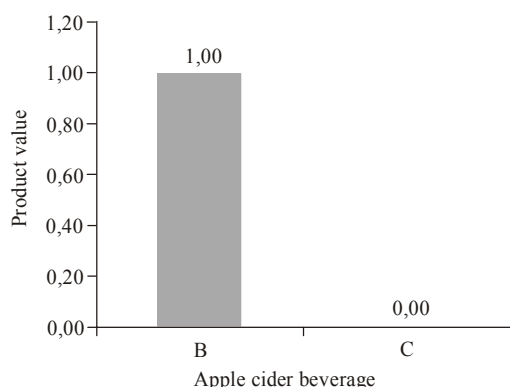


Fig. 2: Results on effectiveness index analysis apple cider beverages 2nd

Based on Fig. 2, it can be seen that between the 2 SMEs, the products of SMEs B has the highest value of apple cider beverages. Thus, the first best formula obtained is based on the index of effectiveness and multiple attribute. Having obtained the first best formula, the researchers then do a comparison of results between the laboratory test and the SNI 01-3719-1995. This result is in line with the studies that had been conducted by Mustaniroh *et al.* (2014). The comparison of laboratory tests is shown in Table 3.

Based on Table 3, it can be seen that the results of laboratory tests on apple cider beverages with a parameter of total dissolved solids do not meet the standards of ISO, as research was ever conducted by Mustaniroh *et al.* (2014). Therefore, it is a need to conduct improvement in processing apple cider beverages, which is pasteurization. The results of the first best formula would be used as the basis for determining the best formula of a second analysis, applying different time and temperature in the pasteurization process.

The total amount of sugar derived from apple juice in SMEs B is 9.02%. The total sugar in food products is associated with consumer/respondent tastes in the use of different sugars. Many consumers tend to like sweet and some others tend to not like sweet. Therefore, the total level of sugar in the apple cider beverages is said to be relative, depending on the respondent preference in sweet or not-less-sweet taste. According to Khurniyati and Estiasih (2015), *Romebeauty* varieties have balanced sweet and sour taste, in which it is preferred by most respondents as it contains both kinds of taste.

This result is in accordance with the previous research conducted by Mustaniroh *et al.* (2014). At the total plate count, it is SMEs B which obtains 1×10^1 with max limit. 2×10^2 based on SNI 01-3719-1995, meaning that apple cider beverages is still suitable for consumption because the total amount of microbes is below the maximum threshold. The content of total microbes must be in accordance with the established standards for microbial content in a product. This consideration is vital as the quality of food products also determine the product's safety for consumption (Herawati, 2008).

Before running the CCP process, improvement on analysis must be conducted. Analysis on CCP (Critical Control Point) is done to reduce the risks that will occur during the process. CCP is the stage that would cause risk or harm to consumers, if it fails to perform or to control measures. CCP production processes apple cider beverages into pasteurization. CCP is obtained by identifying hazards in each production process of apple cider beverages by using a CCP decision tree. The pasteurization process is used by the 2 treatments in 85C for 25 min and 65C for 30 min. The results of average score of the panelists and laboratory test are shown in Table 4.

Based on Table 4, it can be seen that there is an average score of parameters of color, flavor/taste and scent of the apple cider beverages by the pasteurization process. In the color parameters, the best value is obtained by treatment of apple juice beverages 2nd with a value of 4.00 (like), meaning that respondents liked the color of the apple cider beverages, made from *Manalagi* varieties. The desired color which is most preferred by respondents is the-not-too-dark color. Color is a physical parameter that will be formed when light hits an object and is reflected on the sense of vision (eye). The assessment of color for a beverages ingredient is very important because color as one of the parameters that determine the quality of the material (Mayani *et al.*, 2014). According to Hatcher and Simons (2000), a color associated as a factor that describes the level of freshness, maturity, purchasing power and the safety of a product.

The value of SSC at treatment 1 and 2 are 11.2% and 10.80%. Brix had qualified from SNI 01-3719-1995. Average scores on the calculation of the highest value, is obtained by treatment of II on all parameters, while the laboratory tests are qualified both of SNI. Thus, the treatment II is considered as the second best formula. The time spent by all SMEs is 100C for 20 min while in the second treatment process, it takes 65C for 30 min. According to Meikapasa and Seventilofa

Table 4: Results of average score of panelist preference and laboratory test on apple cider beverages based on pasteurization

No.	Treatment	Average score			Lab TPT	SNI TPT
		Color	Taste	Scent		
1.	I	3,57	2,90	3,50	11,2	Min. 10/11
2.	II	4,00*	3,57*	3,87*	10,8*	

*: The second best formula; Data of Analysis (2016)

(2016), the longer the heating time, the greater the levels of dissolved solids will be. Longer heating on sugar will increase the total dissolved solids.

In addition to increasing the value of TPT to fit the SNI, it needs not only the pasteurization process, but also other supporting factors such as by adding the composition of the material which is sugar. The high sugar content that is added to a product, may contribute to higher component of dissolved solids (Osundahunsi *et al.*, 2007). According to Siregar *et al.* (2016), the higher the concentration of sugar is added, the total dissolved solids will increase. The increase in total dissolved solid results in dissolved sugar in water. Therefore, it increases the sugar concentration of total dissolved solids.

The other point is the extraction process, in which, if the temperature and the extraction time are higher, the total dissolved solids will be higher as well. Components of foodstuffs are composed of total solids and water. The Total Solid (TS) is defined as the total amount of dissolved solids and suspended solids, both organic and inorganic. The temperature and length of time of extraction are all factors that affect the rate of extraction. In the process of extraction rate, extraction will increase as the temperature increases during the extraction. Additionally prolonged contact with the solvent will increase the solubility of the material to be extracted so that the extraction rate also increases (Ibrahim *et al.*, 2015). According to Trisnawati (2006), it is stated that the increase in the value of total dissolved solids is basically due to the complex components like carbohydrates and protein breaking down into simpler compounds resulting in an increase in total dissolved solids.

CONCLUSION

The study states that the best formula is obtained on process by improving the time and temperature of pasteurization of 65°C for 30 min with an average score of consumer acceptance testing of the color of 4.00 (like), a taste/flavor of 3.57 (a bit like) and scent 3.87 (a bit like) and laboratory test results that have met the value of SNI is 10.80% Brix.

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