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RESEARCH PAPER

Preparation and Evaluation of Seasoned Vinegar– Optimization of Recipe

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Abstract

Seasoned vinegar is plain or natural vinegar to which sugar, salt, and spices are added. Different condiments and spices are added to the vinegar which is used as a salad dressing. Seasoned vinegar was prepared from brewed cider vinegar, using three recipes. After physic-chemical and sensory evaluation, it was found the second recipes (45 ml cider vinegar, 5g each salt, pepper, ginger and mustard, 15 ml olive oil, 10 g mint and honey each) gave a product of acceptable sensory qualities. Further, evaluation showed that the seasoned vinegar possessed both antimicrobial and antioxidant activities.

Keywords: Vinegar, antioxidant, antimicrobial, acetic acid, seasoned, cider vinegar

Vinegar is an ancient fermented food made and consumed by man since Babylons period. Historically, speaking, it has a history of more than 6000 BC (Solieri and Giudici, 2009). The word 'vinegar' is derived from the French word '*Vin*' which means wine and the word '*aigre*' means sour. It was originally made from wine (Joshi and Thakur, 2000; Frazier and Westhoff, 2004; Rosma *et al*. 2016). Vinegars are of two types: synthetic vinegar and brewed vinegar. Synthetic vinegar is the 4 per cent solution of acetic acid in water which is adequately flavoured and coloured while the brewed vinegar is the product obtained by alcoholic fermentation followed by acetification. It is made from various sugary and starchy materials by alcoholic and subsequently, acetic acid fermentation (Okafor, 1987; Downing, 1989). The fermentations are carried out by *Saccharomyces cerevisiae* and acetic acid bacteria, respectively (Kochar *et al*. 2007; Sharma and Joshi, 2005; Joshi and Sharma, 2009). The brewed vinegar can be made from several fruits including apple (Downing, 1989; Joshi and Thakur, 2000; Joshi and Sharma, 2009).

The Holy Bible mentions it and Hypocrites used it as a health food for several remedies (Solieri and Giudici, 2009). Vinegar has been used for thousands of years, both in food preparation and in some cultures to even treat wounds and infections (Mazza and Murooka, 2009). Many healthful properties like lowering of cholesterol and hypertension are associated with consumption of vinegar. Consumption of vinegar decreases the glycemic index (Leeman *et al*. 2005), which is a measure of how the blood sugar is affected by the food. In both healthy people and in diabetes patients, an antiglycemic effect can provide health benefits. A positive correlation has also been demonstrated between vinegar consumption and an increased satiety after having a meal, and this effect can be used for dietary recommendations to treat obesity (Ostman *et al*. 2005). The biochemical mechanism behind the antiglycemic and satiety effects could involve a delayed gastric emptying or effects on enzymes in the metabolism of sugar (Johnston and Gass, 2006). Apart from the apple-

derived polyphenols that are present in vinegar, additional health benefits have also been proposed.

Acetic acid is the predominant flavoring and antimicrobial component in vinegar (Marshall *et al.* 2000). The importance of acetic acid as a direct food additive or more recently as a food processing aid, to decontaminate food prior to distribution and consumption has also been reviewed (Marshall *et al.* 2000). Vinegar is a condiment that impacts the sensory properties of food. Not only this, it acts as a preservative because of its acetic acid content and consequently, lower the pH of food and hence, help in preservation (Thakur *et al.* 2000). The wide diversity of products containing vinegar (sauces, ketchup, mayonnaise, etc.) testifies its usefulness and the current fall in wine consumption have favored an increase in the vinegar production (De Ory *et al.* 2002).

Seasoned vinegar is plain or natural vinegar to which sugar, salt, and spices are added. Seasoned vinegar is made by brewed vinegar, by adding different condiments and spices and used as a salad dressing. However, Gastronomique (1961) stated that to season and to flavor are not the same thing and insisted that seasoning includes a large or small amount of salt being added to a preparation. Seasonings include herbs and spices, which are themselves frequently referred to as "seasonings". It was advocated that, salt may be used to draw out water, or to magnify a natural flavor of a food making it richer or more delicate, depending on the dish. Other seasonings like black pepper and basil transfer some of their flavor to the food. A well designed dish may combine seasonings that complement each other. A suitable recipe for the seasoned vinegar has not been documented so far. These research gaps need more attention and accordingly the investigation was conducted on this aspect and the results have been reported here.

MATERIALS AND METHODS

Cider vinegar was prepared by the method described earlier (Joshi and Sharma, 2009). Apple juice used was extracted and was used to prepare the vinegar by fermentation. Two fermentations were carried out. The alcoholic fermentation was carried out by the yeast i.e. *Saccharomyces cerevisiae* var *ellipsoideus* UCD 595 procured from Indian Institute of Horticultural Research, Bangalore. The second fermentation was carried out by the natural consortia. Other details are the same as described elsewhere (Downing, 1989).

Cider vinegar was seasoned with different herbs and spices as per different recipes. Different concentration of ingredients was used as per the recipes detailed here:

Recipe 1:	Cider vinegar	=	50 ml
	Salt	=	4 g
	Pepper	=	3g
	Olive oil	=	10 ml
	Ginger	=	8 g
	Mustard	=	8 g
	Mint	=	9 g
	Honey	=	8 g
Recipe II:	Cider vinegar	=	45 ml
	Salt	=	5 g
	Pepper	=	5g
	Olive oil	=	15 ml
	Ginger	=	5 g
	Mustard	=	5 g
	Mint	=	10 g
	Honey	=	10 g
Recipe III:	Cider vinegar	=	40 ml
	Salt	=	6 g
	Pepper	=	6g
	Olive oil	=	20 ml
	Ginger	=	6 g
	Mustard	=	3 g
	Mint	=	4 g
	Honey	=	15 g

The samples of seasoned vinegar were bottled and evaluated.

ANALYSES

Physico- Chemical characteristics

Apple juice, apple wine and vinegar were analyzed for various physico-chemical characteristics viz., TSS, titratable acidity, reducing, total sugars, pH, antimicrobial and antioxidant activity. Cider vinegar was also analyzed for various physico-chemical characteristics viz. total soluble solids (TSS), rate of fermentation, ethanol, titrable acidity, pH, reducing sugar, total sugars, antioxidant and antimicrobial activity.

Total soluble solids (TSS) were measured using an Erma hand refractometer (0 to 32°B) and the results were expressed as degree Brix (°B). The readings were corrected by incorporating the appropriate correction factor for temperature variation (A.O.A.C., 1980). Titratable acidity was estimated by titrating a known aliquot of the sample against N/10 NaOH solution using phenolphthalein as an indicator. The total titratable acidity was calculated and expressed as per cent malic acid (A.O.A.C. 1980) while pH was measured with Eutech-2700 pH meter. Prior to pH measurement, the instrument was calibrated with the buffer solutions of pH 4 and 7. The pH of the samples was estimated directly.

The total sugars of cider vinegar were estimated by Lane and Eynon volumetric method (A.O.A.C. 1980) by titrating the sample against Fehlings solutions. The quantity of reducing sugars was determined by Dinitrosalicylic (DNS) acid method (Muller, 1995). Volatile acidity of apple cider vinegar was determined by the standard method (Amerine *et al.* 1980). The distillate was titrated with 0.025 N NaOH and the volatile acidity was expressed as acetic acid (g/100 ml). Ethanol content was determined by spectrophotometric method (Caputi *et al.* 1968).

The ethanol content in the given sample was estimated by referring to standard curve and expressed as per cent (v/v).

Antioxidant activity

Antioxidant activity (Free radical scavenging activity) was measured as per the method of Brand-Williams *et al*. (1995). DPPH (2, 2-diphenyl-1-picrylhydrazyl) was used as a source of free radical. A quantity of 3.9 mL of 6×10^{-5} mol/L DPPH in methanol was put into a cuvette with 0.1 mL of sample extract and the decrease in absorbance was measured at 515 nm for 30 min or until the absorbance become steady. Methanol was used as a blank. The antioxidant activity was calculated as:

$$\text{Antioxidant activity (\%)} = \frac{Ab_{(B)} - Ab_{(S)}}{Ab_{(B)}} \times 100$$

Where, $Ab_{(B)}$ = Absorbance of blank; $Ab_{(S)}$ = Absorbance of sample.

Antimicrobial activity

Antimicrobial activity of apple cider vinegar and seasoned vinegar against all the test microorganisms i.e. *E. coli* and *S. aureus* was determined by Well diffusion method (Schillinger and Luke, 1989) under aerobic conditions.

(a) *Test organism:* A loopful culture of all the test microorganisms i.e. *Escherichia coli* (IGMC), *Staphylococcus aureus* (MRSA 252) was innoculated into 100 ml of nutrient broth in 250 ml Erlenmeyer flask. All the cultures were then, incubated at 37°C till the time they reached 1.0 O.D.

(b) *Screening of antimicrobial activity with well diffusion assay:* In Well Diffusion Method (Schillinger and Luke, 1989), the test microorganisms were first grown in a nutrient broth for 24-36 hrs at 37°C. Wells of 6 mm diameter were cut into prepoured, sterlized nutrient agar petriplates with a sharp and sterile borer. Lawn of respective test microorganisms on these petriplates was prepared by pouring 0.1 ml of inoculum and swabbing it properly with a sterilized cotton buds in such a way that the test microorganism could cover whole of the nutrient agar plate. Lawn of every test organism to be tested against the apple cider vinegar and seasoned vinegar was prepared in the same way. 0.5 ml of apple cider was placed into each well. Plates were then, incubated at 37°C for 24 hrs and results obtained

were in the form of zone of inhibition and the diameter of zone formed by apple cider against the respective test microorganism was measured.

Sensory analysis

The sensory analysis of seasoned vinegar was conducted by a semi- trained panel of judges by using hedonic rating test. Nine point Hedonic scale method as described by Joshi (2006) was followed for conducting the sensory evaluation of seasoned cider vinegar. The panel of 10 judges was selected with care to evaluate the different apple seasoned cider vinegars for sensory parameters such as colour, taste, aroma, and overall acceptability. Seasoned vinegar was used as a salad dressing during sensory evaluation. The samples were presented to the judges and plain water was given to them to rinse their mouths in between the evaluation of samples. No discussion during evaluation was however, allowed.

Statistical analysis

Analysis of variance: Statistical analysis of the quantitative data of chemical parameters obtained from the experiments was done by Completely Randomized Design (CRD) Factorial. The statistical analysis of the data obtained from sensory evaluation of the apple seasoned cider vinegar was done by Randomized Block Design (RBD) as given by Cockrane and Cox (1963).

RESULTS AND DISCUSSION

The results of physic-chemical analysis of seasoned cider vinegar presented in Table 1 showed that, the second treatment/recipe had the highest total soluble solids (TSS) and acid content. These were 13.6 ± 0.88°B and 3.02 ± 0.034% content, respectively. The highest total sugar was recorded as 11.2 ± 0.041% in the sample of second recipe while the highest reducing sugars 1.23 ± 0.032% was recorded in the sample of third recipe. The reducing as well as total sugars have clearly been influenced by the amount used in the respective recipe as these difference are reflected in their concentrations. The minimum acid content of vineagar has been prescribed as 4% (as acetic acid) whereas in the seasoned vinegar it ranged from 2.93 to 3.2%. It is apparently the effect of dilution of cider vinegar by the addition of seasoning material. As can be seen in the table and the results of antimicrobial activity that it was also the highest where the acidity was also the highest. The lowest pH was recorded in 3rd recipe. The acidity and pH are inversely related with each other which is an established fact. Therefore, values obtained in the study are conformity with this fact. The highest antimicrobial activity (40.3 ± 0.882 mm) was recorded in 1st treatment. It has beer reported that the antimicrobial property of vinegar in food preservation is due to the low pH (Marshall *et al.* 2000).

The lowest residual ethanol content was recorded in sample of third recipe while the highest ethanol content was found in the sample of second recipe. The residual alcohol contents, nevertheless ,are comparable, since the base material i.e. cider vinegar used was the same.

The highest antioxidant activity was recorded as 0.22±0.003% in the sample of second recipe. No relationship with other was observed for this parameter. Similar to this, in an earlier report (Tagliazucchi *et al.* 2008), antioxidant properties of traditional balsamic vinegar and boiled must model systems have been described. Moreover, it is known that the antioxidant activity is related with poly phenols contents of a product (Tsao *et al.* 2005) and apple is known for various phenolic compounds.

Results in Table 2 showed that, in sensory evaluation 2nd recipe was the best out of all the recipes tried. **C**ider seasoned vinegar of almost all the treatments fell in 'like moderately' category as per the data presented. However, the highest score for overall acceptability was observed in 2nd recipe having 45 ml cider vinegar, 5g each salt, pepper, ginger and mustard, 15 ml olive oil, 10 g mint and honey each. As reported earlier, Gastronomique, (1961) stated that to season and to flavor are not the same thing, seasoning includes salt may be used to draw out water, or to magnify a natural flavor and other seasonings like, black pepper

Table 1: Physico-chemical characteristics of seasoned vinegar

Treatments	TSS (°B)	pH	Acidity (%)	Residual ethanol (%)	Antioxidants (%)	Antimicrobial (mm)	R.S. (%)	T.S. (%)
1	12.6 ± 0.88	3.20 ± 0.07	2.41 ± 0.052	1.23 ± 0.017	0.21 ± 0.007	40.3 ± 0.882	1.21 ± 0.024	6.41 ± 0.099
2	13.6 ± 0.88	3.08 ± 0.04	3.02 ± 0.034	1.28 ± 0.024	0.22 ± 0.003	36.3 ± 1.202	1.21 ± 0.015	11.2 ± 0.041
3	8.23 ± 0.14	2.93 ± 0.032	2.99 ± 0.032	1.21 ± 0.020	0.16 ± 0.002	35 ± 1.732	1.23 ± 0.032	8.51 ± 0.011

Mean ± SEM; R.S. = reducing sugars; T.S = Total sugars.

Table 2: Sensory evaluation of seasoned vinegars of various treatments

Treatments	Colour	Aroma	Taste	Overall acceptability
Recipe 1	7.6	7.0	7.0	7.20
Recipe 2	8.0	8.0	7.5	7.83
Recipe 3	7.0	7.0	7.0	7.00
Mean	7.53	7.33	7.16	7.34

9 point hedonic scale.

and basil transfer and contribute their flavor. Thus, the second recipe might have given a well designed dish that may have combined the seasonings so that these might have complemented with each other and thus, based on the sensory quality might have led to evaluating the second recipe as the best.

Thus, it can be inferred that the seasoning material addeded to the brewed vinegar might have contributed to the balanced sensory quality especially taste and aroma that made the recipe no 2 as the best recipe.

CONCLUSION

It can be concluded that out of three recipes tried, 2nd recipe proved to be the best, based on physico-chemical and sensory evaluation.

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