Current Research in Nutrition and Food Science Vol. **3**(2), 150-155 (2015)

Formulation, Standardisation and Shelf Life Study of Water Melon Incorporated Grape Squash

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http://dx.doi.org/10.12944/CRNFSJ.3.2.07

(Received: May 22, 2015; Accepted: July 23, 2015)

ABSTRACT

New product development involves modification of an existing product or formulation of entirely new product. Objective: To formulate a nutritious beverage using water melon. Method: Water melon juice was prepared, and incorporated at four different proportions (25, 50, 75, and 100 ml) along with grape juice in formulation of grape squash. The sensory analysis showed the squash with 75% incorporation was acceptable with a mean over all acceptability score of 4.70±0.47. Nutrient analysis showed that Iron content increased by 7.69 mg in the product. The standard (100ml of grape juice) along with sample was stored in glass bottles and studied for shelf life for a period of three week. Results: No microbial growth in the product on storage and sensory scores were within the acceptable range. Conclusion: Formulated product is a novel, nutritious fruit based beverage.

Key words: Formulation, Grape juice, incorporation, New product, Watermelon.

INTRODUCTION

A formulation of the new product development (NPD) may involve modification of an existing product or its presentation, or formulation of an entirely new product that satisfies a newly defined customer want or market niche (Quigley, 2008). Formulation is developing new products from concept to commercialization. Position of the product will also enhance and improve upon current products. New product formulation serves as a technical expert that supports product improvements, quality improvements, customer requests, and cost savings initiatives (Jasmohan, 2000).

Standardization is the process of developing and implementing technical standard. That involves the process in which the value of a potential standard is fixed by the measurement with respect to a standard whose value is known (Langowski, 2014). Shelf life is an important property of any food and is of interest to everyone in the food chain from producer to consumer. Products can be stored, during which the defined quality of a specified proportion of the goods remains acceptable under expected (or specified) conditions of distribution, storage and display (Akingbemi 2007). Factors affecting shelf life include microbiological, chemical and biochemical changes during storage. Most food products rely on their particular packaging to achieve their expected shelf life (Jenkins, 2007). Sensory analysis or sensory evaluation is a scientific discipline that applies principles of experimental design and statistical analysis to the use of human senses (sight, smell, taste, touch and hearing) for the purposes of evaluating consumer products (Steinberg, 2008).

Squash is prepared by combining one part concentrate with four or five parts water (carbonated or still). Double-strength squash and traditional cordials, which are thicker, are made with two parts concentrate. Some squash concentrates are quite weak, and these are sometimes mixed with one part concentrate and two or three parts water. It is usually made with cold water, but old-fashioned cordials

are often made with warm water (Thomson, 2011). These antioxidants are found to offer protection against colon, prostate, breast, endometrial, lung, and pancreatic cancers. Phyto-chemicals present in watermelon like lycopene and carotenoids have the ability to help protect cells and other structures in the body from oxygen-free radicals. (Samuel, 2008).

Watermelon (*Citrullus lanatus*), family is a vine-like (scrambler and trailer) flowering plant has its orgin from southern Africa. Botanically, the fruit belongs to the family of Cucurbitaceae of the genus: citrullus and has high nutritional and health benefits (Wadsworth, 2004). Being an antioxidant, rich in all the essential nutrients offers protection against stroke, coronary heart diseases and helps the body to develop resistance against infectious agents and scavenge harmful oxygen-free radicals (Collins, 2012 and Horattas 2013). Based on the above mentioned facts, the present study was carried out to formulate Water Melon Incorporated Grape Squash and study the storage stability of the formulated product.

MATERIALS AND METHODS

Preparation of Water melon juice

Procuring

A fully ripened watermelon that feel heavy for its size, and with a relatively smooth rind that is slightly dulled on top was selected.

Washing

Washed the water melon in running tap water to remove the adhering dirt and sand particles.

Cutting

Water melon was first cut into two halves and then cut into four using a sterile sharp knife.

Scooping out of the flesh

Seeds were removed and the flesh was scooped out smoothly using a sterile spoon.

Extraction of juice

The scooped out flesh was made to small pieces and the juice was taken by using a juicer and the extracted juice was filtered well to get clear juice.

Preparation of Grape juice

Procuring

Fully ripened, mature berries, which have good sweet and little sour taste grapes were selected to prepare the juice.

Cleaning

The stalks and inferior quality grapes such as broken and decayed were also removed.

Washing

Selected grapes were washed with running tap water and then washed with saline in order to reduce the microbial load and remove out the pesticide residue**.**

Cooking

The grapes were cooked in open pan at a temperature of 100^0 C with portable water sufficient enough to soak the grapes. It was cooked till the grapes break open and releases the pinkish red colour to the water. Then it kept for cooling.

Mashing and extracting the juice

The cooled grapes were taken and it was mashed with a clean wooden masher and extracted the juice.

Filtration

This juice was filtered using a strainer to separate out the seed and peel residue.

The proportion of water melon juice incorporated with the grape juice in the preparation of squash is given in the Table 1**.** Standard along with 4 variations were used in the squash preparation.

Selection of most acceptable proportion

Sensory evaluation, as defined as a scientific discipline used to evoke, measure, analyze, and interpret reactions to the characteristics of food and materials as they are perceived by the senses of sight, smell, taste, touch, and hearing (Jenkins 2005).

Selection of Panel

Panel members are the members who analyse the food products through properly planned experiments and their judgments are quantified by appropriate statistical analysis. Trained panel, semi trained panel and consumer panel are the different types of panel. Thirty semi trained panel members including staff and students from the Food and Nutrition Department were selected based on their willingness to participate in the study.

Preparation of Score Card

A score card was prepared on the basis of criteria such as appearance, colour, flavour, taste and texture and was given to the panel member.

Conduct of Sensory Analysis

Standard along with four variations were coded and displayed. The score card was given to the panel members to evaluate the products. All the samples were kept at same temperature, optimum level and kept constant during the test. Stainless steel spoons was used for tasting the samples.

Nutrient analysis

Nutrition analysis refers to the process of determining the nutritional content of foods and food products. (Beresford 2006). The standard and selected proportion of squash using calorimetric method was analysed for Iron and phosphorous content

Iron

Water melon contains 7.9 mg per 100g. The iron content of standard (100ml of grape juice) and selected proportion of squash was analysed.

Phosphorous

Water melon contains 12mg per 100g. The Phosphorous content of standard and selected proportion of squash was analysed.

Shelf life study

Shelf Life testing is a process to determine: Expiration Date, Best by Date, and Sell by Date for a food product. The food samples are conditioned and stored in a specific temperature of 4^0C and 10 % of humidity condition. The quality changes caused by the storage condition are evaluated at specific sampling durations and are evaluated through quality analysis testing and microbial safety analysis. (Bijosi, 2000).When considering the several food and beverage packaging alternatives, glass containers are considered more hygienic, healthy and ecofriendly than other material. Glass is a "GRAS" Generally Recommended as Safe packaging material as well as impermeable and retortable. (Guthirie , 2004).

The standard along with selected proportion of squash was kept in heat sterilized glass bottles, and ensured tight capping. Then it was kept for the shelf life analysis for three weeks at refrigeration temperature (-4^0C).

Table 1: Varying Proportion of Watermelon Juice Incorporated With Grape Juice

Ingredient	Standard	A1	A2	A3	A4
			(ml)		
Grape juice	100	75	50	25	0
Watermelon juice	0	25	50	75	100
Total	100	100	100	100	100

Table 2: Mean Score for Various Standard of Varying Proportion of Water Melon Incorporated Grape Squash

Variation	Appearance	Colour	Consistency	Flavor	Taste	Overall acceptability
			Mean ±SD			
Standard	4.7±0.53	4.6±0.56	4.7±0.53	4.7±0.53	4.4±0.50	4.3±0.53
A1	4.3±0.70	4.0±0.60	4.7±0.48	4.7±0.69	4.6±0.72	4.5±0.68
A2	4.6±0.47	4.7±0.44	4.7±0.46	4.7±0.56	4.7±0.40	4.6±0.74
A3	4.7±0.69	4.7±0.77	4.8±0.69	4.8±0.70	4.8±0.69	4.8±0.47
A4	3.9±0.76	4.03±0.78	4.6±0.48	4.1±0.96	3.9±0.76	4.7±0.69

Microbial analysis

Microbiological analysis is important to determine the safety and quality of food. For many years, detection and identification of microorganisms in foods, animal feces, and environmental samples have relied on cultural techniques regarded as the "gold standard". Conventional methods are labor intensive, time consuming, and costly, and advances in these methods have been limited to the development of instruments such as the Stomacher or Pulsifier for sample processing, improved liquid and selective/differential agar media, plating technique and instruments for counting bacteria such as colony counter, and identification test kits which will be working on the basis of chromatographic principle. More recently, advances in biotechnology have led to the development of "rapid methods" that minimize manipulation, provide results in less time, and reduce cost (Koya, 2010).

The standard and the selected proportion of squash was analysed and subjected to Streak plate technique. The samples were subjected to the microbial analysis for three week, and every week for a period of three week.

Sensory analysis

The selected proportion and the standard were analysed for sensory changes on storage after ensuring safe microbial limits. The standard and the sample was display for the sensory analysis along with the score card having the criteria such as appearance, flavor, texture, taste and colour. Sensory analysis were done on every seventh day from the date of preparation.

Statistical analysis

Statistics is the study of the collection, organization, analysis, interpretation and presentation of data. It deals with all aspects of data, including the planning of data collection in terms of the design of surveys and experiments. The data were statistically analysed for mean and standard deviation.

RESULTS AND DISCUSSION

From the table, it can be noted that the mean score of the appearance for standard is 4.7, for sample A1 is 4.3, 4.66 for sample A2 and A3, for sample A4 is 3.96 .When comparing the mean score value of the appearance between standard and samples, the highest and the lowest mean score is 4.7 and 4.3 respectively. Sample A3 had extensively high score than other variation, which may be attributable to incorporation of water melon.

The mean score of the colour for the sample A4 is relatively low (4.0) and samples A1 and A4 with 4.0 and sample A2 is 4.7 as the mean scores. Compared to the standard with a mean score of 4.6 the sample A3 is 4.7The above table shows that the mean score for consistency of standard is 4.7 with a marginal difference in the Samples A1 and A2 i.e, 4.72, and 4.76 respectively, sample A3 had a maximum score of 4.8 followed by the sample A4 with 4.6.

Table 3: Nutrient Analysis of Standard Water Melon Juice Incorporated Grapes Squash

Nutrients	Standard		Sample	
	Calculated value*	Analysed value	Calculated value *	Analysed value
Iron	0.5mg	0.61mg	8.1mg	8.3mg
Phosphorous	23mg	23.5mg	16.6mg	16.8mg

* Nutritive value of Indian Foods, NIN, 2008

Table 4: Observation of microbial growth

Product	Immediate Sample	1st Week	2nd Week	3rd Week
Standard	Nil	Nil	Nil	10^2
Sample	Nil	Nil	Nil	Nil

Table 5: Mean and standard deviation value obtained from the sensory evaluation of Water Melon Juice Incorporated Grapes Squash on Storage

Criteria	Immediate		1st Week		2nd Week		3rd Week	
	Standard	Sample	Standard	Sample	Standard	Sample	Standard	Sample
Appearance	4.96±0.18	4.89±0.30	4.93±0.25	4.89±0.30	4.86±0.35	4.72±0.64	4.48±0.62	4.75±0.57
Colour	4.86±0.57	4.82±0.46	4.82±0.46	4.86±0.30	4.8±0.37	4.79±0.49	4.55±0.68	4.82±0.46
Texture	4.96±0.18	4.93±0.25	4.96±0.18	4.93± 0.36	4.89±0.40	4.68±0.71	4.82± 0.38	4.82±0.53
Flavour	4.96±0.18	4.93±0.25	4.93±0.25	4.96±0.18	4.93± 0.25	4.78±6.57	4.82±0.38	4.65±0.72
Taste	4.96±0.18	4.89±0.40	4.93±0.25	4.7±0.48	4.68±0.79	4.79±0.41	4.68±0.54	4.55±0.78
Over all Acceptability	4.94	4.9	4.91	4.8	4.8	4.7	4.69	4.6

It is obvious from the table that the mean scores of the flavor for all the samples and the standard were on the same range with only a mild significant difference. 4.1 ,4.74, 4.78 and 4.8 were the mean scores of the samples A4,A4,A2 and A3 respectively. The standard value was 4.7. Sample A3 was ranked high. The table also depicts the mean score of the taste with an increasing order like 4.6, 4.7 and 4.8 for the samples A1, A2 and A3 respectively. The lowest mean score value was 3.9 for the sample A4 and standard showed a mean value of 4.4. Mean values of Overall acceptability is also presented in the table. Samples A1, A2 and A3 had scores of 4.5, 4.6 and 4.8 respectively. Comparatively 4.3 was the lowest value i.e., for standard and A4 sample had a value of 4.7. Analyzing this, it is clear that A3 sample was remarkably high.

Nutrient Analysis of Water Melon Incorporated Grape Squash

A perusal of table 3 presents the Nutrient Analysis(Iron and Phosphorus) of standard and selected proportion of Water Melon Juice Incorporated Grapes squash. It is noticed that the calculated value of Iron for standard is 0.5mg as per as Nutritive value of Indian Foods (NIN) and analyzed value is 0.61mg and Comparing with the samples the values of both calculated and analyzed are extremely high i.e., 8.1 mg and 8.3mg respectively. It obviously due to an increased Iron content of water melon (7.9mg/100ml) which when compared to grapes (0.5mg/100ml).In contrast, a decrease in Phosphorous content of the sample was observed in water melon (12mg/100ml) compared to grapes (23mg/100ml).The table present the calculated value of standard and sample for Phosphorous is 23mg and 16.6mg. Analyzed values are 23.5mg and 16.8mg for standard and sample.

A perusal of table 4 represents the sensory evaluation done on an interval of one week of storage right from the immediate preparation to third week showed a mild significant difference. The immediate prepared sample had less acceptability compared to the standard with a marginal difference. 1st to 3rd week of storage showed a marginal decline in the mean score for all the criteria, except for the colour and taste evaluated on second week.

It is well presented in the table 5, that for both immediate sensory analysis and for one week storage, except for colour (4.82-4.86), the average value varied from 4.89-4.93 for sample and for the standard its 4.96. In the 2nd week, standard showed an appreciable mean value in appearance and texture than the sample and vice versa in the 3rd week. From the overall acceptability scores, it is noticed that there was a negligible decrease in sensory score on storage.

New product development (NPD) is the complete process of bringing a new product to market. A product is a set of benefits offered for exchange and can be tangible or intangible .There are two parallel paths involved in the NPD process: one involves the idea generation, product design and detail engineering; the other involves market research and marketing analysis.

Water melon incorporated Grapes squash were prepared by using water melon and grapes as main ingredient. A score card was given to evaluate the acceptability of the product. The score card was prepared on the basis of criteria such as appearance, colour, consistency, flavour, and taste. Based on sensory evaluation the best product was selected for further shelf life analysis. Nutrient analysis was done for the standard and selected product. As part of shelf life study microbial analysis and sensory analysis were done to determine the quality of the product. From our findings, it is concluded that the water melon incorporated grape squash (75:25) is highly nutritious product with overall acceptability and had a good shelf life for three weeks with no microbial activity. The squash stored in glass bottles was fresh and good in taste because of the nonporous and impermeable characteristics.

ACKNOWLEDGEMENT

Authors grateful to all the participants for their kind cooperation during the data collection.

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