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Formulation of Composite Squash from Selected Herbs and its Evaluation in Terms of Physicochemical, Nutritional and Sensory Qualities

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Abstract: **A developmental study was conducted to formulate composite squash from selected herbs. Aloevera(Aloe indica), Amaranth (Amaranthuscruentus), peppermint (*Mentha piperita*) and Marigold (Calendula officianalis) were the herbs selected for preparing new squash recipes. These herbs were chosen based on the availability, ease of cultivation, attractiveness of color and flavor, nutritional quality and functional properties. No preservatives were added for the squash preparation. The formulated squashes were analyzed for parameters like pH, titratable acidity, total soluble solids and total sugars. pH and total soluble solids are analyzed by using pH meter and refractometer respectively. Moreover, the prepared squashes were analyzed for the presence of vitamin C using redox titration method by iodine solution. Nutritive values of the formulated squashes were computed using United States Department of Agriculture& National Nutrient Database. A composite score card was formulated for evaluating the organoleptic qualities, such as appearance, color, texture, flavor, and taste. Amaranth squash had an overall better sensory acceptance when compared with others .The second better was Aloe Vera squash. The study shows that the developed squash recipes almost meet the Fruit Products Order specification in terms of Total Suspended Solids, Acidity and Juice content.**

Index terms: **- Functional components, Herb, Nutrition, Physicochemical analysis, Squash.**

I. INTRODUCTION

The word "***herb***" was derived from the French word *"herbe" and* Latin word, *"herba".* Herb may be a non tracheophyte or a part of the plant like seed, stem, fruit, flower, leaf or root. The term "herb" was solely applied to non woody plants in earlier which comes from trees and shrubs. They are additionally used as food, pigments, therapeutic purpose or for fragrance purpose and people residing in certain areas and those entrusted with certain religious beliefs use it for non secular purpose additionally (Khan 2016). Herbs provide us with most of the essential dietary nutrient components that our body needs to meet the everyday demands of a healthy life. Many of these plants are normally used as flavoring additives to culinary dishes. In addition to their culinary properties they are now considered as an integral part of various medicinal purposes in many countries (Organic fact, 2018).

Preservation is a process of keeping food materials without changing its state for a long period while not inflicting impairment to their quality to the utmost extent. The main objective is to preserve foods especially perishables like vegetables and fruits to a stage that ensure maximum acceptability especially the taste, color, flavor, quality, and nutritive composition (Lal et al, 1959). Squash, the ready to drink beverage is widely available in market now a days, it is available in the concentrated form and must be reconstituted with water before consumption. Sugar syrup mixed with fruit extract is the main constituent of squash. Nowadays, herbal extracts are added to many recipes so as to enhance the sensory and therapeutic value of the product (Jain et al., 2016).

We are moving away from nature as our life is now getting techno-savvy, but being still part of nature, we cannot escape from

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it. Being natural, herbs are free from side effects and so they are comparatively safe, eco- friendly and on the market domestically. Historically lots of herbs are used for the ailments associated with various seasons. Therefore it is vital to promote them to avoid wasting of human lives (Khan,M.A 2016).

A study by Zahid, 2016 also says that herbal products these days are the symbol of safety in distinction to the artificial medicine that are considered unsafe to human being and atmosphere. The synthetic products of the modern age surpassed the importance of herbs as they are highly prized for their medicinal, flavoring and aromatic qualities. Blind dependence on synthetics is over and nowadays many people are returning to nature with the hope of safety in contrast to the synthetic drugs that are regarded as unsafe to human being and environment. The synthetic products of the modern age surpassed the importance of herbs as they are highly prized for their medicinal, flavoring and aromatic qualities. It's time to promote them globally but the awareness regarding their use as alternatives for foods like fruit squash is very poor.

II. MATERIALS AND METHODS

A. Selection of Sample

A sample is a subset of a population that is used to represent the entire group as a whole (Cherry, 2017). For the purpose of the study, Aloe Vera (*Aloe Indica*), Amaranth (*Amaranthus cruentus*), Pepper Mint (*Mentha* piperita) and Marigold (*Calendula officinalis*) were the herbs selected for preparing new squash recipes. These herbs were chosen based on the availability, cultivation as per our weather conditions, attractiveness of color and flavor, nutritional quality and functional properties.

B. Cultivation of selected plants varieties

Cultivation can be defined as the process of production of food grains or any other agricultural crops. It includes a series of activities like land preparation, sowing, weeding, manuaring, plant protection and harvesting. (Peddi, 2017). Investigator adopted different cultivation methods of each herb. For cultivating Aloe Vera, propagation was done through root were carefully digged without damaging mother plant at the base and then directly planted in the main land. This plant thrives best on dry sandy soils, so watering of plant was limited. For cultivating amaranth, the land was digged followed by fine leveling. Then shallow trenches of width 30 cm to 35 cm were made 30cm apart. 20 to 30 day old amaranth seedlings were transplanted in the shallow trenches at a distance of 20cm in 2 rows. The commercial variety of red amaranth '***Arun'*** was selected as sample for squash preparation due to its color and nutritional components. For cultivating pepper mint, healthy seedlings were collected from healthy mother plant; the land was prepared by ploughing or digging followed by fine leveling. Seedlings were planted in same distance approximate 20cm, watering was done twice in a day. For cultivating Marigold flower, seeds were collected from agricultural farm (Fruits and vegetable society, Sulthanbathery, Wayanad). The land was prepared by ploughing or digging followed by fine leveling. Shallow trenches of width 30 cm to 35 cm were made 30cm apart. The "***Papaya – sp - 109***" variety seeds were chosen due to its colour, nutritional and functional values and they were planted successfully in the trenches. The watering was done twice a day due to hot climate. Marigold flowers were picked up once in 3 days after 60 days of planting. Farm yard manure (FYM) which is well rotten was added for the herbs during cultivation for better yield.

C. Preparation of extract from each plant materials

A plant extract may be a substance with fascinating properties that is being aloof from the tissue of a plant, that is sometimes done by treating it with a solvent, to be used for specific method (Gaillot 2013). Color and flavor of the selected herbs was extracted using different methods, which included boiling, squeezing and alcoholic extraction.

D. Development of squash recipes

Squash or cordial or dilute is non-alcoholic syrup which is usually concentrates and are used widely in beverage making. It is typically fruit flavoured usually made with potable water and sugar and sugar substitutes (Desai, 2016). The common ingredients of the formulated squash recipes were juice or extract of herbs, sugar, water and an acidifier such as citric acid and a small amount of flavoring agents like ginger syrup. No preservatives were added for the squash preparation.

E. Standardization of the recipe

A standardized recipe can be defined as a set of instructions that described as the way a particular establishment prepares a particular dish. It may be outlined as a bespoke instruction developed by for associate degree operation for the employment of its own cooks, using their own instruments and equipments with the aim of serving to its own patrons. (Gisslen et al., 2006). All the formulated squash recipes were standardized. Equipment used and preparation time were noted. For preparing 150ml of squash, the materials herb extracts/ pulp, sugar, lemon juice, ginger syrup & water for reconstituting were standardized.

F. Evaluation of Physicochemical qualities

Physicochemical analysis is the method of evaluation which investigates the physical and chemical parameters that makes possible to determine the type of the interactions between the components of a system's physical properties and composition (Pogodin 2010).

FPO Specification for squash is given below.

Table I:-FPO specification for squash

Physicochemical parameters	**Specification**
TSS	40%
Acidity	1.25%
Juice	25%
SO2	350ppm (KMS)

The formulated squashes were analyzed for the parameters like pH, titratable acidity, total soluble solids and total sugars. Total soluble solids were analyzed by using refractometer, pH was analyzed by using pH meter and titratable acidity was determined by AOAC method respectively.

G. Computation of nutrition value

Nutritive value is an indication of the nutrients that a food in a diet provides. It depends purely on the amount of digested and absorbed food and also the amounts of the essential nutrients (macro and micro nutrients) that the food contains. Redox Titration method by using Iodine Solution was used to determines the vitamin C concentration in squash.

The nutrient composition of herbs or foods can be affected by soil and growing conditions, handling and storage, and processing (Biology dictionary, 2005).Nutritive values of the formulated squashes were computed using USDA National Nutrient Database for Standard Reference Legacy Release nutritive value of foods (2018).Nutritional components like calorie, carbohydrate, protein, fat and vitamin A were also determined by using nutritive value table.

H. Evaluation of organoleptic qualities

Webster 2018, described that organoleptic qualities affects or are related to the qualities such as flavor, colour, odour and mouthfeel of a substance (as a food or drug) that stimulates the sensory receptors. A composite score card was formulated for evaluating the organoleptic qualities of developed squashes. Score card contained scores for all organoleptic parameters such as appearance, color, texture, flavor, and taste.

I. Keeping quality of squashes

Evaluating the keeping quality can be done by Determining of storage period of the food products. This is considered as one of the most important steps in food production. A shelf life can be defined as a period until which the food remains safe to consume and at the same time meeting all its required qualities and criterions. Food safety is the importance criterion that must be fulfilled in any means. The type of approaches to be adopted in determining storage periods depends on a type of food product (Cordo et al., 2006).The developed squash recipes were evaluated by observation method and organoleptically evaluated every 5th day till any change in organoleptic qualities like colour, texture or taste were observed.

J. Popularization of developed recipes

Dissemination of scientific knowledge only to the public at large is the purpose of popularization (Greg Myers, 1996). Popularizations are all texts, through which people relates their academic knowledge to their lives and assess its claims. Laaksovirta (1986) defines popularization as an intersection between or as an attempt to unite scientific knowledge and common knowledge. Two acceptable squash recipes from the developed recipes were popularized among Kudumbasree women. A leaflet was prepared for this purpose which included the required ingredients and its amount, preparation method and time.

K. Analysis & interpretation of data

The data's were consolidated, tabulated and analyzed statistically.

The statistical measures like mean, percentage were used for analyzing the various parameters of the formulated squash.

III. RESULTS AND DISCUSSION

A. Selection of raw materials

The ingredients chosen for formulation of squash which include, the base of which the pulp of Aloe Vera is taken & extract of other three herbs were taken. Sugar syrup is the second most ingredients used for the consistency and taste of squash. Lemon juice (Citric acid) was used for acidity and for flavor ginger syrup was used.

B. Functional properties of selected herbs

Functional components of the selected samples were analyzed by various review studies.

Highly nutritious and bioactive components in aloe vera

are phytochemical constituents including anthraquinones, alkaloids, glycoproteins, vitamins, fatty acids, amino acids, sugars, minerals and enzymes along with mucilaginous polysaccharides. Amaranth contains function components like essential amino acids, antioxidants and flavonoids. The pigmented leaves of amaranth shows that they are very good source of β-carotene. Including the leaves of amaranth in the daily diet can help to prevent the chance of vitamin A deficiency (Sushil N, Suneeta P, (2018). The main constituents of the marigold are: essential oil, flavonoids (rutin and narcissina), resin, mucilage, carotenoids, triterpenoids and saponins. The pigments beta-carotene, lycopene and vilaxantina present in flowers are responsible for its colour. Marigold exhibits moisturizing, soothing and healing properties that against the skin, which is due to the presence of flavonoids. Peppermint has significant antimicrobial and antiviral activities, strong antioxidant and anticancerous properties, and inaddition they exhibits some antiallergenic potential (Ravindran., 2017).The major constituents found in peppermint leaves are fatty acids such as linoleic, linolenic, and palmitic acid. It also contains variety of volatile compounds, such as menthol, menthone and isomenthone(Lv,j et al, 2012)

C. Formulation of squash from selected herbs

Standardized recipe can be defined as the one that has been carefully adapted and tested to ensure the production of a consistent product every time it is used (Gisslen et al, 2006). The recipes were standardized in a specific amount of ingredients. The recipes were developed several times and were organoleptically evaluated by a group of panel members, and then they were formulated according to the instructions given by them. The developed herb squash recipes almost matched the standard fruit squash in terms of organoleptic qualities.

Table II

Standardization of Developed Squashes (For 150 Ml)

Sl. No.	Squash recipes	Pulp/ extract (ml)	Lemon extract (ml)	Ginger syrup (ml)	Sugar (gm)
1.	Aloe Vera squash	30	15	5	100
2.	Amaranth squash	35	10	5	100
3.	Marigold squash	25	15	10	100
4.	Mint squash	25	15	10	100

Pulping, extracting, syruping and filtering are the common preparation methods used for the preparation of herbal squash. Preparation of pulp/ Extraction took more time when compared to other methods and this was the most difficult part of the preparation step. When considering the total time taken it was found that, Amaranth and Aloe Vera squash took less time to preparation while marigold has taken very long time period for its extraction. Moreover the preparation time of squash was up to 7 minutes after preparing pulp/extract.

D. Estimation of Physicochemical qualities

Table III

Estimation of physicochemical qualities

Sl No.	Name of recipes	pH	Titratable Acidity (%)	Vitamin C (mg/l)	Total solubl e solids (^{0}B)
1.	Aloe Vera Squash	2.73	0.8192	52.8	41
2.	Amarant h Squash	2.79	0.9728	120.91	46
3.	Marigold Squash	2.84	0.9856	147.3	42
4.	Mint Squash	2.91	1.1264	90.11	47.5

The physicochemical qualities of the formulated squashes, the parameters like pH, titratable acidity, total soluble solids and vitamin C were analyzed. The pH value shows that all the squashes are acidic in nature. This can be due to the addition of lemon juice.

Titratable Acidity (TA) can be defined as the measure of amount of acid present in a solution. It is evident from the table that the titratable acidity of the mint squash was higher in value and AloeVera squash exhibited lower value.

Estimation of vitamin C showed that marigold squash contains higher amount of Vitamin C followed by amaranth squash, mint squash and aloe vera squash. This might be because of lemon juice added in marigold squash was higher than in others, while amaranth itself posses vitamin C Content. Presence of vitamin C in mint and aloe vera is due to the addition of lemon juice.

Total Soluble solids (TSS) which means the contents of solids dissolved is found to be higher in mint (47.5%) and amaranth squash (46%), while aloe vera squash (41%) showed the least score.FPO specification of the standard squash requires 40 ^{0}Bof TSS; 1.25- 3 % of Acidity: 25 % of Juice: and preservatives {SO2: 350 ppm (KMS)} (FSSAI, 2011). The developed squash recipes approximately show the standard of squash.squash contain nearly 415 calories, carbohydrates, and vitamin C. Mint squash contains

420 K calories, 108.55 g carbohydrate,8.05mg. Vitamin C and 1.66g protein. It also contain low amount of vitamin A and fat.

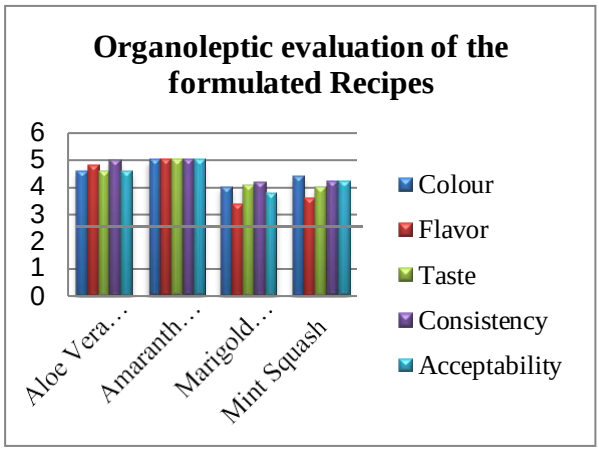

Figure 1 :- Organoleptic evaluation of squash recipes

F. Evaluation of organoleptic qualities

Sensory analysis was conducted using composite scoring, were the specific characteristic of a product are rated separately on a five point scale using composite score card.5 was the maximum score given to each individual parameter ,30semi-trained panelists carried out the sensory acceptance of the formulated product, and it was found that sample 2, i.e. amaranth squash had an overall better sensory acceptance in terms of all the sensory parameters when compared with others. The second better was aloevera squash.

E. Computation of nutrient composition

Table IV
Nutritive value of formulated squashes

Sl no.	Formulated squash	Nutritive value					
		Calories (kcal)	CHO (g)	Protein (g)	Fat (g)	Vitamin C (mg)	Vitamin A (IU)
1	Aloe vera	415	104.8	0.71	0.05	7.92	
2	Amaranth	409.85	106.23	1.57	0.17	22.31	1020.95
3	Marigold	414.5	108.1	1.37	0.05	8.96	2.5
4	Mint	420	108.55	1.66	0.275	8.05	0.21

The nutrient compositions of the formulated squash were estimated using USDA National Nutrient Database for Standard Reference Legacy Release nutritive value of foods (2018).Aloe Vera has only contain calories, it contain more functional components than nutritional components. 150 ml Aloe Vera squash contain 415 Kcal energy, 104.8 g carbohydrate and 7.92mg of vitamin C. Less amount of fat and protein were observed. Amaranth squash was rich in vitamin A and vitamin C, so the squash contain vitamins and minerals. 150ml Amaranth squash contain 409.85Kcalorie, 106.23g carbohydrate and 22.31mg of vitamin C. it contain 1020.95 IU vitamin A. so the product is help to improve nutritional status. Marigold has rich in micronutrients, it does not numerically specify. It contain more functional component than nutrient components.

G. Evaluation of Keeping Quality of the Developed Squashes

The keeping qualities of the formulated squashes were assessed by observation method every 5th day from the day of preparation. On 15th day, the taste of marigold and mint changed slightly. Both exhibited an astringent taste & flavor. This might be because the extractions of these two herbs were done by using vodka (alcoholic extraction). Thus the shelf lives of both these were estimated to be below 15 days. The shelf life of Aloe vera squash and amaranth squash was observed every alternate day after the first 15 days and was found to exhibit slight changes in the acceptability on 21st day. Thus the shelf life of aloe vera and amaranth squash were estimated as 20 days respectively without refrigeration.

CONCLUSION

It could be concluded that, the herbs were rich in functional components than nutritional components. The consumption and use of formulated squash recipes helps to improve overall health of a person. Amaranth squash had an overall better sensory acceptance when compared with others. The second better was Aloe Vera squash. The study clearly shows that the developed squash recipes almost met the FPO specification of the standard squash in terms of TSS, Acidity and Juice content.

Total Soluble solids (TSS) which means the contents of solids dissolved is found to be higher in mint (47.5^{0}B) and amaranth squash (46^{0}B), while aloe vera squash (41^{0}B) showed the least score. Titratable Acidity (TA) is a measure of the amount of acid present in a solution. It is evident from the table that the titratable acidity of the mint squash was higher in value and Aloevera squash exhibited lower value. Estimation of vitamin C showed that marigold squash contains higher amount of Vitamin C followed by amaranth squash, mint squash and aloe vera squash. This might be because the amount of lemon juice added in marigold squash is higher than in others, while amaranth itself posses' vitamin C Content. Presence of vitamin C in mint and aloe vera is due to the addition of lemon juice

Preservatives and other artificial flavors or additives were not included in the recipe, so its preparation and consumption is very easy and healthy. Herbs being available in almost all areas of the state can

be utilized well in recipes like squash which will be well accepted by all age groups especially by adolescents and school going children. Popularizing the importance and benefits of herbs among women and the methods of incorporating it in well accepted recipes like squash can be the best method adopted for the purpose.

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