Quality Evaluation of Plum Ready to Serve Drink during Storage

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**Introduction**

Plum (Prunus domestica) belongs to the group of deciduous fruits commonly known as stone fruit. It is a major fruit of Pakistan and is grown mostly in temperate regions, while some low chilling varieties may be grown in the milder parts of sub-tropical regions of KPK, Quetta and Qallat divisions of Balochistan [1].

Plum cultivated area in Pakistan was 6.7 thousand hectares, in which Khyber Pakhtunkhwa and Baluchistan includes 3.0 and 3.7 thousand hectares. In Pakistan total plum production was 56.2 thousand tons, in which Khyber Pakhtunkhwa and Baluchistan contribute 27.0 and 28.9 thousand tons correspondingly [2].

Plum is a very tender and perishable fruit having high percentage of water content (86.6%), protein (0.5g), carbohydrates (12.3g), Niacin (0.5mg), Riboflavin (0.03mg), calcium (12mg), P (18mg), Fe (0.5mg), Na (1mg) and K (170mg) per 100 grams of edible portion. All this composition makes plum a good nutritious fruit [3].

Plums also enhance the competence of the immune system in combating free radicals, as they have a strong antioxidant impact. Finally, it needs to be mentioned that plums also have cosmetic values, as they improve the condition of the skin [4]. Plums have some health benefits over immune system, nervous and muscular system due to naturally high content of fiber, potassium, magnesium, vitamins, natural carbohydrates, antioxidants also, prevents stress, strengthening the natural mechanisms of stress adaptation [5].

It is rich in iron, vitamin A, vitamin C and fibers and being consumed as fresh, dry, canned, and preserved into jams and jellies. Plum are also key ingredient in preparing cakes, pies, desserts and marmalade. Plum (Prunus domestica L.) is highly perishable climacteric stone fruit and has short shelf-life at optimal temperatures. Decay of plum fruit may be due to mold growth and rapid ripening during storage. Shelf life of plum can be extend through proper handling, transportation and marketing chain and also to kept in low temperature storage to extent postharvest quality of the fruit [6].

Plum also called as stones fruits consist of a hull covering the seed. This under cover seed is rich in proteins and lipids, thus, they maybe a cheap source of different substances that could be useful for food, cosmetic, and pharmaceutical industries. The lipid content of plum seeds has already been explored. Plums contain red flesh and peel and are very exciting fruit due to their high content on bioactive compounds, such as the anthocyanins and other polyphenolic compounds with a high antioxidant capacity [7]. These natural substances found in plum acts to prevent diseases such as diabetes and cancer [8].

Concentrated soft drinks are used for refreshing purpose and are very popular drink contains certain proportion of juice. The summer season of Pakistan is long there for mostly people uses such type of beverages. Such type of activities like production, preservation and sale of these beverages provide commercial importance to our country [9]. Fruit beverages are a combination of products containing pulp, juice and water as well as sweetener, coloring, flavoring, and preservatives. Although fruit ingredient present in beverages has a dominant role of providing flavor and overall character, such types of products differ from fruit juices and are labeled accordingly [10].
Sugar constitutes more than 40% of total weight, an effect that is essential for the physical, chemical and microbiological stability, provides body, improves appearance and makes gelation of pectin. The added sugar acts as a dehydrating agent for the pectin molecules, permitting closer contact between the chain molecules reduces water activity to below 0.8, thus the spoilage organisms in jam do not survive [11].

Pectin is the gelling agent responsible for gel formation in presence of sucrose during fruit jam manufacture. Number of junction zones increased with pectin concentration. Consequently, number of elastically active polymeric chains within the gel network increased with pectin concentration and the structure network formation within the gel, therefore became more rigid [12].

Citric acid is considered necessary to correct the balance, which is needed in jam and jelly production. Lime and lemon juice are high in citric acid therefore they can be used as a replacement of citric acid in jam manufacture [13].

Objectives
1. To produce value added RTS beverage from Plum.
2. To develop suitable combination of Plum RTS.
3. To analyze plum RTS for physicochemical and sensory characteristic during storage.

Review of Literature
2.1 Back ground of plum
Plums also called as stone fruits rich in polyphenol substances. Plums grow all over the world. According to FAO (2012), for the last 10 years the production of plum surpassed 9 million tons yearly. Plum fruits has a desired nature of taste its nutritional value and used as a raw material in many products, like juices, fruit drinks, alcoholic drinks, jams, and dried fruits in many markets, including Europe, [14-17]. There were about 10.1 million tons in 2003 in the world. Approximately, about half of the production is from China, producing about 4.2 million tones. Such amount was about two hundred thousand tones in Turkey than Romania, USA, Serbia, Montenegro, Germany, France, Chile and Turkey respectively (FAO, 2004).

2.2 Plum Production in Pakistan
Plum cultivated area in Pakistan was 6.7 thousand hectares, in which Khyber Pakhtunkhwa and Baluchistan includes 3.0 and 3.7 thousand hectares. In Pakistan total plum production was 56.2 thousand tons, in which Khyber Pakhtunkhwa avnd Baluchistan contribute 27.0 and 28.9 thousand tons correspondingly [2].

2.3 Nutritive Value of Plum
Stone fruits are mostly processed for preparation of juices, concentrates or purees. Plums mainly contain high amounts of polyphenols, acquire high antioxidant capacity. Naturally plum are slightly acidic in nature provided acidic beverages which normally prevent the marketing of 100% natural juices. Presence of highly polyphenols and total acid provides the healthy and economic benefit for the production of plum nectars [5, 18, 19].

2.4 Health Benefits of Plum Juice
Plum also called as stones fruits consist of a hull covering the seed. This under cover seed is rich in proteins and lipids, thus, they maybe a cheap source of different substances that could be useful for food, cosmetic, and pharmaceutical industries. The lipid content of plum seeds has already been explored. Plums contain red flesh and peel and are very exciting fruit due to their high content on bioactive compounds, such as the anthocyanins and other polyphenolic compounds with a high antioxidant capacity [7]. These natural substances found in plum acts to prevent diseases such as diabetes and cancer [8].

2.5 Beverage Background
Beverages can be differentiated from other food by two characteristics. Beverages are consumed in a liquid form and secondly it is used for its stimulating effect which caused by quenching property. Water is an important component of beverages because it contains coloring and flavoring ingredients. Beverages formed by fruit juices or blends or mixture of different juices consumed also a functional food demand increasing. Consumers demand increasing due to its increase level of vitamin A, vitamin C, phenolic compound and antioxidant ability. Beverages are fortified and marketed commercially, it mostly contain micronutrients. The strategy provides good, enjoyable and healthy products beverages [20].

2.6 RTS Characteristics
RTS beverages, nectar etc can be made by mixing two or more fruit juices and pulp [21-23]. Ready-to-serve fruit drink is a type of fruit beverage which contains at least 10% fruit and 10% total soluble solids besides
approximately 0.3% acid, planned for consumption without dilution and prepared from unfermented pure fruit juice with or without some of the pulp and containing any soluble carbohydrate and water. According to approximately 80% of the daily need is fulfilling by beverage such as water and the rest by solid food (Panel on Dietary References Intake for Electrolyte and Water, 2004). Mixing two or more fruits will create a novel flavor and taste. Recently blended beverages are available in different flavors such as orange, mango, strawberry, pineapple, chocolate, banana, Raspberry and vanilla etc. Various blended beverages were prepared using guava papaya and mango and their storage stability was reported [24, 25]. It is challenging to prepare Ready to serve beverage without use of chemical preservatives and coloring. Therefore using fermentation as a method of preservation for preparation of RTS in which the high acid content of the carrot pulp substitute the requirement for additional citric acid has been studied [26].

Shelf life of RTS beverages can be increased by adding Benzoic acid and Sulphur dioxide as preservatives, for increasing attractiveness coloring material can also be used while flavoring ingredients is only allowed in mango based products. The use of milk whey to replace water in the development of delicious and nutritious RTS beverage from ripe banana juice is quite interesting but it produces off-flavor in beverage. To overcome the off-flavor mostly Mentha arvensis extract is used in whey based fruit beverages as a natural flavoring agent. An increased demand of functional beverages, it was seem right choice to use the Marvensis extract as natural flavoring agents in the development of whey based RTS beverage from ripe banana juice to fetch the higher market demand.

2.7 Nutritional Value of RTS

The popularity of Ready to serve beverages is increasing due to health and nutritional benefits. RTS beverages prepared from fruits are not only good source of minerals, vitamins and other nutritive factors also very delicious and having a universal appeal [26]. Beverage may be useful in reducing micronutrient deficiency [20]. Blended drinks are prepared to provide better taste nutritional and medicinal properties. Hence Aloe Vera papaya juice for development of blended beverage with desirable characteristics [27]. Mango pulp when added to soymilk to enhance its vitamin A, C and mineral contents. Aonla, aloe Vera and ginger extracts got good response in market, because they have good nutritional properties and can be used best in those areas where there is lack of nutrition [28].

2.8 Ready to Serve Beverage

RTS beverage was prepared from muskmelon pulp, sugar and water at the ratio of (1:1:3) respectively, 20g citric acid and 610mg of potassium metabisulphite. The RTS was having good flavor and could be preserved for 2-5 months without spoilage [29]. Litchi juice can be used in skim separated milk up to 300g /liter to prepare highly acceptable and nutritious blended beverage. Lime-Aonla juice can blend with ginger juice, mint juice and black pepper extracts along with salt for the development spiced RTS beverage [30]. Dietetic RTS beverage was made from bitter gourd. Bitter gourd juice was 10% in RTS having brix of 12.5%. Sorbitol was used instead of sucrose which reduced the calorific value of RTS by 80 % per serving.

Herbal beverage was prepared from 12 % mango pulp, 8 % sugar, 48 % water, 32% whey and 1.5% lemon grass distillate. The beverage was found to be nutritionally rich and acceptable to consumers [31]. Ready-to-serve beverages prepared from many fruit blends such as mango-papaya and papaya-passion fruit were studied earlier [32, 33]. RTS beverages were prepared using 15% juice blend of guava and papaya. RTS beverages was prepared by blending purple grape juices and falsa juices at 2:1 and 1:1 ratios, respectively [34]. Carambola fruit Juice and sugar was blend along with 1% Citric acid and 0.05% potassium meta bi sulfite as preservatives for preparation of Squash. Bilimbi and carambola fruits juice were used for the preparation of Sherbath. The juices were mixed with sugar and water at the ratio of 4:2:8 respectively along with citric acid as preservative [35]. Cucumber, litchi and lemon were used at the ratio of 65%, 29.2% and 5.8% for preparation of beverage [36].

Conclusion

Preparation of ready to serve drink was studied during storage time of period and with different treatment combination. All the RTS samples were evaluated for total solids, moisture, ash, pH, reducing sugar, ascorbic acid, non-reducing sugar, titratable aciidy, total soluble solids, and sensory attribute (taste, color, flavor and overall acceptability). Statistical analysis revealed that treatment
as well as storage had significant (p < 0.05) effect on physicochemical and sensory properties. Results showed that pH and sugar acid ration of the treated samples was decrease during storage. While TSS, acidity, reducing and non reducing sugar and vitamin C increased were observed during storage. Generally this is observed from the results that sample P1 was more acceptable than RTS of the samples on the basis of physiochemically. On the other hand, in terms of taste, flavor, color and over all acceptability P2 sample was highly acceptable.

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233-245.


