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COMPARISON OF INDIGENOUSLY DEVELOPED TANGERINE-ORANGE MARMALADE WITH BRANDED MARMALADES AVAILABLE AT LOCAL MARKETS

Ambreen Akhtar Saddozai*, Amer Mumtaz*, Nouman Rashid*,
Shahzada Arshad Saleem**, Saeeda Raza*
and Muhammad Naeem Safdar*

ABSTRACT:- The objective of this study was to compare the nutritional composition and microbial quality of both branded and non-branded marmalades. Oranges were purchased from local markets while tangerines were product of in-house farm at Food Science and Product Development Institute (FSPDI), National Agricultural Research Centre (NARC), Islamabad. Juices were extracted and kept in sterilized and sealed glass bottles. Samples were subsequently analyzed for Total Plate Count (TPC), yeast, moulds, pH, sugars and vitamin C contents. Marmalade was prepared from blended juices of orange and tangerine. Branded marmalades i.e., National, Mitchells and Salman's were purchased from local markets and compared with non-branded (orange and tangerine) marmalades. Both marmalades were analysed for microbiological (TPC, yeast and mould), physico-chemical characteristics (pH, Brix, vitamin C and sugars) and organoleptic attributes. TPC count in both samples were nil. Yeast and mould count was nil in branded while it was 600 and 400 cfug^{-1} in orange and tangerine marmalades, respectively. Sugar contents, pH and Brix ranged from 14.97% to 59.70%, 3.00 to 3.46, 15.0 B to 60.2 B in branded and non-branded marmalades, respectively. Organoleptically marmalade developed at FSPDI was non-significantly different from all the branded marmalades except Salman's.

Key Words: Marmalades; Branded; Non-branded: Nutritional Composition: Microbiological Analysis; Pakistan.

INTRODUCTION

Orange belonging to citrus family Rutaceae is a very delicious and juicy fruit. Orange peel contains many volatile oil glands in pits. Interior flesh is composed of segments, called carpels, made up of numerous fluid-filled vesicles that are actually specialized hair cells. It is very delicious and juicy fruit. It contains essential nutrients, vitamins, minerals for normal growth and development and overall well-being in appreciable amounts. It is one of the best sources of vitamin C (120% of the daily value.). It is also a source of folate, vitamin B_1, B_2, B_6, vitamin A, calcium and potassium. It also contains flavonoids such as alpha and beta-carotenes, beta-crypto-xanthin, zea-xanthin and lutein. These compounds are known to have antioxidant properties (Megan,

* *Food Science & Product Development Institute, National Agricultural Research Centre, Islamabad, Pakistan.*
** *Ratta Kulachi Research Insitute, D.I. Khan, Pakistan.*
Corresponding author: ambreen.saddozai@yahoo.com

2004).

Tangerines are related varieties of oranges distinguished by loose, easily peeled shin (pericarp) and sweet juicy flesh (arils). They are also known as mandarin oranges in Europe and satsumas in Japan. Just as oranges, they too belong to the Rutaceae and known scientifically as *Citrus reticulata*. As in oranges, tangerines are very low (53 calories 100 g^{-1}) in calories and are valuable sources of flavonoid anti-oxidants like narin-genin, naringin, hesperetin, vitamin A, carotenes, xanthins and luteins; several times higher than in the oranges. Tangerines help to prevent obesity, but also offer protection against type-2 diabetes, and even atherosclerosis. consumption of 100% orange and tangerine juice is associated with better diet quality, improved nutrient adequacy, decreased risk for obesity, and improved biomarkers of the health in adults (Keast et al., 2011)

Marmalade is a fruit preserve made from the juice and peel of citrus fruits boiled with sugar and water. It can be produced from lemons, limes, grapefruits, mandarins, sweet oranges and other citrus fruits in any combination. Today, the word marmalade is used to describe a citrus jam containing bits of candied rind. Typically marmalade is associated with oranges, but all citrus fruits are good marmalade candidates. Lemons, clementine, grapefruit and limes are just a few of the fruits that can be cooked into excellent marmalades (Cesar et al., 2010). It accounts for 2.4% of the maximum allowable daily calories (2,000). Commonly orange marmalade is consumed as spreading it on a slice of toast as part of a healthy breakfast (Bradbury, 2012). Vitamin C, also known as ascorbic acid, available in marmalade is important for repairing tissues in your body as well as the production of collagen (Lee and Coates, 1999).

Considering the nutritional benefits of orange and tangerine, a study was planned to develop tangerine-orange marmalade at Food Science and Product Development Institute (FSPDI), National Agricultural Research Centre (NARC), Islamabad and compare it with branded marmalades available at local markets and also evaluate its chemical, microbiological and orangoleptic properties.

MATERIALS AND METHOD

Collection of Raw Material

Oranges were purchased from Chatta Bakhtawar market, Federal Capital Area, Islamabad (Pakistan) while tangerines were in-house farm product of FSPDI, NARC, Islamabad. Orange-tangerine marmalade recipe was standardized and prepared at FSPDI, NARC, Islamabad. Branded marmalades were procured from a local super markets.

Development of Recipe for Orange-Tangerine Marmalade

Orange-tangerine recipe was developed at FSPDI, NARC, Islamabad, with the following ingredients composition:

Fruit	45 parts
a) Orange	22.5 parts
b) Tangerine	22.5 parts
Sugar	55 parts
Citrus peel	5g kg^{-1} of pulp
Citric acid	Sufficient to obtain pH 3.0-3.3
Pectin	0.5 % of fruit juice mixture
Sodium benzoate	0.1 % of fruit juice mixture

Preparation of Marmalade

Fruits were washed, cut into pieces, blanched and pulped. Other ingredients were mixed to cooking pans as per recipe. Mixture was cooked till desired consistency as per standard procedures. After cooling, preservative was added to the marmalade. Product was packed in pre-sterilized bottles.

Physico-chemical Analysis of Juices and Marmalade

Juices and marmalade was analyzed for vitamin C, pH, brix and total sugars according to the standard methods as described in AOAC (2010).

Microbiological Analysis of Juices and Marmalade

Total plate count, molds and yeast were determined according to methods described in FAO (1992). According to method 50ml sample was homogenized with Butter fields Phosphate buffer (pH 7.2) Serial dilutions of samples were prepared by transferring 1ml of blend sample in to 9ml of sterile phosphate buffer in test tube. After each dilution, the contents were mixed in vortex-mixer for 10 sec. Of each dilution, 1ml was transferred to petri dish with plate count agar and mixed with medium in triplicate. After solidification petri dishes were incubated at 35°C for 48 h for total plate count and colonies formed on the surface and in the media were counted. The total count was calculated from the mean count of the triplicate petri dishes, considering the dilutions.

For yeast and mold, spread plate method was used. Yeast growth was checked on plate count agar amended with 40 ppm Chloramphenicol (added as antibacterial agent). Potato dextrose agar was used to detect molds. About 0.1ml inoculum of each dilution was placed in the center of solidified potato dextrose agar and plate count agar in a petri plate and used a sterile bent glass rod for spreading. The inoculums were spread on the surface of media and incubated at 25°C for 96 h.

Sensory Evaluation of Marmalade

Sensory evaluation was carried out according to the methods as described by Larmond (1977) on a 9-point hedonic scale.

RESULTS AND DISCUSSION

Physicochemical Analysis

Higher pH (3.46) was observed in orange juice as compared to tangerine juice (2.64). A lower pH in tangerine represented more acid concentration (Table 1). The pH of branded marmalades varied from 3.00 (non-branded) to 3.23 (branded). The pH has a significant role in the gel setting. The pH of non-branded marmalade was lowest due to acidic tangerine.

The brix of branded marmalade was higher than non-branded orange-tangerine marmalade. It might be due to high sugar content of orange juice used in the branded marmalade, addition of more sugar during processing or lower brix of tangerine used in the non-branded marmalade.

Sugar content in fresh orange juice was more than 1.8 times higher in the tangerine juice. Total sugar varied from 56.08 to 66.63 both in branded and non-branded marmalades due to variable addition of sugar during preparation. The sweetness of citrus fruits is due to the presence of

Table 1. Physicochemical analysis of juices and marmalades

Sample	pH	Brix (°B)	Total sugar (%)	Vitamin C (mg $100ml^{-1}$)
Juices				
Orange	3.46 ± 0.05	15.0 ± 0.1	14.97 ± 1.02	41.67 ± 3.1
Tangerine	2.64 ± 0.03	8.8 ± 0.1	8.29 ± 0.22	52.63 ± 2.7
Marmalades				
Branded				
Salman's	3.23 ± 0.04	59.6 ± 1.3	58.90 ± 1.14	Nil
National	3.02 ± 0.02	67.2 ± 1.0	66.63 ± 1.03	Nil
Mitchells	3.00 ± 0.04	58.8 ± 0.75	56.08 ± 0.94	Nil
Non-Branded				
Orange-Tangerine	3.04 ± 0.03	60.2 ± 1.0	59.70 ± 0.78	Nil

Table 2. Microbiological analysis of juices and marmalades

Sample	TPC (cfu ml^{-1})	Mould (cfu ml^{-1})	Yeast (cfu ml^{-1})
Juices			
Orange	$9.9x10^2 \pm 0.65$	Nil	Nil
Tangerine	$8.3x10^2 \pm 0.58$	Nil	Nil
Marmalades			
Branded			
Salman's	Nil	Nil	Nil
National	Nil	Nil	Nil
Mitchells	Nil	Nil	Nil
Non-Branded			
Orange-Tangerine	Nil	400 ± 25	600 ± 30

TPC = Total Plate Count

glucose, fructose and sucrose. In oranges and tangerines the soluble solids consists mainly of sugars and carboxylic acids. In oranges the reducing and non-reducing sugars are present in about equal amounts. Sugar in edible portion of orange varies from 7% to 15% (Curtis, 1988).

Vitamin C was 41.67mg $100ml^{-1}$ in orange juice while in tangerine it was 52.63mg $100ml^{-1}$, however, it was not detected in branded and non-branded marmalade due to the heat treatments. As the temperature increased vitamin C content gradually decreased. Vitamin C is totally lost in heat treatments of foods. To minimize the loss of this vitamin, it is recommended to add the artificial ascorbic acid to produce taste or flavor (Harding et al., 1994).

Total plate count (TPC) of 9.9×10^2 cfu ml^{-1} was observed in fresh orange juice as compared to tangerine juice ($8.3x10^2$ cfu ml^{-1}) mainly due to low acidity and high pH of orange as compared to tangerine. However TPC could not be detected in both branded and non branded marmalade due to high processing temperature and lower pH.

Mould and yeast count in non branded preservative containing marmalade were detected 400 and 600 cfu ml^{-1}, respectively (Table 2). However, in branded marmalade samples mould and yeast count were absent. The values are in agreement with Gulf standards which recommend that yeast and mould count should not be more than 1×10^3 cfu ml^{-1} (Table 3).

According to the Gulf standards the maximum permitted count of total plate count (TPC) for juices is 1×10^4 cfu ml^{-1}. While in this study, the total plate count (TPC) was enumerated lower than the anticipated value (Table 3). The bacterial load might have been decreased with the passage of time because of higher acidity. Bacterial spores cannot germinate in environment with pH less than 4.5 while vegetative cells of pathogenic bacteria cannot grow well in pH less than 4.0 (Smelt et al., 1982).

All branded and non-branded samples were thus found free of any bacterial contamination. Yeast and mold count were also absent except in non-branded marmalade but in allowable limits. Sensory evaluation of branded and non branded marmalades exhibited a fairly acceptable quantity of non branded marmalade composed with other branded marmalades (Table 4). All the branded and non-branded samples were found free from bacterial, yeast and mold contamination of any alarming levels. No significant difference between non-branded developed marmalades and two out of three selected marmalades of branded types was observed.

Table 3. Gulf standard for microbiological criteria for juices

Count (cfu ml^{-1})	Maximum count anticipated	Maximum count permitted
Total plate count	5.0×10^3	1×10^4
Yeast	100	1×10^3
Mould	100	1×10^3

LITERATURE CITED

AOAC. 2010. Official method of Analysis of Association of Official Analytical Chemist International, 18th edn. Washington DC, USA.

Bradbury, K. 2012. Good nutrition is key to living a long and healthy

Table 4. Sensory evaluations of branded and non branded marmalades

Sample	Sensory Attributes				
	Color	Texture	Taste	Flavour	Overall acceptability
Branded					
Salman's	8.0^a	9.0^a	8.0^a	8.5^a	8.5^a
National	7.0^b	8.0^b	7.0^b	7.0^b	7.0^b
Mitchells	7.5^b	8.0^b	7.5^b	6.5^c	7.5^b
Non Branded					
Orange-Tangerine Marmalade	7.5^b	8.0^b	7.0^b	6.5^c	7.5^b

life. The Nutritional Benefits of Fruit, USA. 16: 215-220.

Cesar, T.B., N.P. Aptekmann, M.P. Araujo, C.C. Vinegar, and R.R. Maranhao. 2010. Orange juices decreases low-density lipoprotein cholesterol in hypercholestero lemic subjects and improves lipid transfer to high density lipoprotein in normal and hypercholesterolemic subjects. Nutr. Res. 30 (10): 689-694.

Curtis, G.J. 1988. Some experiments with edible coatings on long term storage of citrus fruits. Proc. 6th Intern. Citrus Congr. Israel Margraf. 3:1515-1516.

FAO, 1992. Manual of Food Quality Control, 4. Review, Microbiological Analysis FAO Food and Nutrition paper. Food and Agriculture Organization of the United Nation, Rome. 338 p.

Harding, P.L., J.R. Winston, and D.F. Fisher. 1940. Seasonal changes in Florida oranges, USDA Tech. Bull. No.1072. p. 89-91.

Keast, D.R., C.E. O'Neil, and Jones J.M. 2011. Dried fruit consumption is associated with improved diet quality and reduced obesity in adults: National Health and Nutrition Examination Survey, 1999-2004. Nutr. Res. 31: 460-467.

Larmond, E. 1977. Laboratory methods for sensory evaluation of food. Publication 1284, Canadian Department of Agriculture, Ottawa, Canada.

Lee, H.S., and G.A. Coates. 1999. Vitamin C in frozen fresh squeezed unpasteurized polyethylene bottle orange juice. Food Chem. 65: 165-168.

Megan, C. 2004. Orange may cut the risk of stomach and cancers. Ladies Home J. 23: 56-70.

Smelt, J.P.P.M., G.J.M. Ratjes, J.S. Crowther, and C.T. Verrips. 1982. Growth and toxin formation by *Clostridium botulinun* at low pH values. J. Appl. Bacteriol. 52 (1): 75-82.

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