Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.2718

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (3):** 1011-1017 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Shelf Life Study of Guava Milk Chocolate

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Received: 18.03.2017 | Revised: 30.03.2017 | Accepted: 1.04.2017

ABSTRACT

Chocolate is a luxury food that evokes a range of stimuli which activate pleasure during its consumption. It is not only popular among children, but also consumed by youth and old age people. Considering the popularity of chocolates, the present project was taken up to study the shelf life of guava milk chocolate at different temperature. For shelf life study, chocolate samples were wrapped in aluminum foil and stored at three different temperatures (2, 10 and 25°C) for 56 days. Stability of chocolate was studied based on sensory parameters, hardness; chemical parameter, and microbial quality. During storage sensory scores of color and appearance, body and texture, flavor and overall acceptability of guava milk chocolate decreased. Hardness of chocolate increased from 3817g to 4577g, 3590g and 2898g at 2°C, 10°C and 25°C respectively. FFA of guava milk chocolate increased during storage. Total plate count (TPC) and yeast-mold count also increased during storage of 56 days. It was concluded that Chocolate stored at low temperature (2°C) was found to be best when compared with other chocolates stored at 10°C and 25°C.

Key words: *Guava milk chocolate, Shelf life, Temperature, Sensory score, Hardness.*

INTRODUCTION

India is one of the largest producers of the guava fruit (*Psidium guajava* L.) in the world. Guava belongs to family Myrtaceae which contains about 100 species of tropical shrubs and small trees. Guavas are mainly cultivated in tropical and sub-tropical countries. It is an important fruit crop of India and called the "Apple of the Tropics". Guava is mainly grown for its edible fruits that are eaten raw or made into purée (pulp), jam, jelly, paste, juice, syrup, chutney, etc[15]. Guava fruits are rich in dietary fibre, vitamin A, vitamin C, folic acid and dietary minerals mainly potassium, copper and manganese. It is rich in ascorbic acid (vitamin C), which is 4 to 10 times greater than in many citrus fruits[12]. It also contains a fair amount of phosphorous, calcium, iron, potassium and sodium[11]. Chocolate may be defined as a homogeneous product made with cocoa and variable amounts of sugars, cocoa fat, milk powder, milk fat, etc.[6], and should contain more than 30% of cocoa butter.

Cite this article: Mishra, D., Chauhan, A.K., Bhardwaj, R. and Deshmukh, G.P., Shelf Life Study of Guava Milk Chocolate , *Int. J. Pure App. Biosci.* **5(3):** 1011-1017 (2017). doi: http://dx.doi.org/10.18782/2320-7051.2718

Chocolate contain around 70% of fine particles such as cocoa powder, sugar and milk solids in a continuous phase made up of fats, generally cocoa butter and milk fat, depending on the specific formulation[7]. There are three main types of chocolate: dark, milk and white, with notable differences between them[1,4]. Chocolate is a complex emulsion based on cocoa, the consumption of which activates pleasure centers of the human brain through its flavor. It may also contain sugar and nuts depending on product category. The shelf life of chocolate depends on several parameters including: storage temperature and humidity, availability of oxygen in the immediate environment, directly related to packaging material used, as well as the addition of other ingredients such as fats, nuts etc[16]. Chocolate has a shelf life of approximately 12 to 24 months[18]. Optimization of guava milk chocolate had already been done by using response surface methodology in Department of Food Science and Technology, Banaras Hindu University[14]. The aim of this work was to study the shelf life of this optimized guava milk chocolate when stored at different temperatures.

MATERIAL AND METHOD

Prior to storage, guava milk chocolate was rapped properly in aluminum foil and kept at three different temperatures (2°C, 10°C and 25°C). The stability of the optimized chocolate was studied based on sensory parameters *viz*., color and appearance, body & texture, flavor and overall acceptability; physical parameter like hardness; and chemical parameter *i.e*. free fatty acid and microbial quality of the product. These parameters were evaluated during storage to check the quality of chocolate.

Sensory evaluation: - Chocolate samples were evaluated for sensory characteristics like color, body & texture, flavor, graininess and mouth feel using 9-point Hedonic scale[10]. Sensory evaluation of the chocolate was performed by a panel of 7 semi trained judges from the Centre of Food Science and Technology at Banaras Hindu University, Varanasi, India.

Texture analyses[5]:- Hardness of chocolate samples were analyzed using Texture Analyzer (TA.XT *plus* texture profile analyzer, Stable Micro Systems, UK).

Chemical analysis: Free fatty acids (FFA) contents were quantified by the official method 42-1993[8].

Microbial analysis: The chocolate samples were analyzed for total plate count (TPC) and yeast-mold as per the procedure given in AOAC[3].

RESULT AND DISCUSSION

Effect on color and appearance

Color and appearance score decreased in the chocolate samples stored at temperature 25°C from 8.8 to 7.1 (Fig.1). While no visible color change was observed in samples stored at 10°C up to 7 days and there after a slight color change was encountered. Score of chocolate samples stored 10°C decreased from 8.8 to 7.6. No further changes in color were observed in chocolate sample stored at 2°C up to 56 days storage. Similar results were reported by Khan and Rousseau[9] during storage of chocolate at temperatures (11, 20 and 25°C).

Effect on body & texture

Body and texture score of chocolate samples decreased during storage at temperature 2, 10 and 25°C (Fig. 2). Score of sample decreased from 8.5 to 7.2 at 25°C and from 8.5 to 7.6 at 10°C due to slightly decrease in hardness. Slight change in body and texture was also observed in chocolate stored at 2°C up to 56 days. Score decreased from 8.5 to 8, it may be due to increasing hardness of samples. Ali[2] reported that color and texture of filled dark chocolate stored at 30 °C were less preferred than the control and the chocolate stored at 18°C.

Effect on Flavor

The change in flavor scores were measured by the semi trained sensory panel using 9 point hedonic scale (Fig. 3). No change in the score was observed in chocolate up to 56 days storage at temperature 2°C. Flavor score decrease linearly in the chocolate samples

stored at 25°C from 8.5 to 6.7 in 56 days. No change in flavor was observed in sample stored at 10°C upto 7 days and there after a slight degradation in flavor was observed. Mexis[13] also reported slight change in taste in chocolate stored at 4°C with respect to chocolate stored at 20°C.

Effect on overall acceptability

From Fig. 4 it is clear that overall acceptability of guava milk chocolate decreased during storage period. Score of samples decreased from 8.7 to 7.9, 7.5 and 7 at 2, 10 and 25°C in 56 days. Degradation in overall acceptability was observed very fast at 25°C and it is continued during storage period. No change in overall acceptability was observed in chocolate at temperature 2°C upto 56 days storage.

Effect on Hardness

Hardness is one of the important physical parameter that needs to be determined in the stored chocolate samples. Fig. 5 shows the variation in hardness of chocolate samples stored at 2, 10 and 25°C temperature during storage. Hardness decreased rapidly in the first week, in the sample which was stored at 25°C. Hardness was decreased slightly with time in the samples stored at 10°C. Hardness of chocolate sample decreased from 3817 g to 3590 g and 2898 g at 10°C and 25°C, respectively. Chocolate samples stored at 2°C showed a slightly increase in hardness with time. This occurred due to freezing effect at low temperature. Hardness increased from 3810 g to 4577 g in 56 days at 2°C. Similar results were reported by Nightingale[17] in dark chocolate.

Effect on free fatty acid

FFA content in chocolate samples increased with increasing the storage period but the effect was found more prominent in the chocolate sample stored at 25°C (Fig. 6). A small variation in FFA content was noted in chocolate stored at 10°C and 2°C.The increase in FFA content (expressed as % oleic acid) during storage is presented in the Fig. 6. From initial value of 0.60, the FFA content increased to 0.85, 0.92 and 1.25 % oleic acid at temperature 2, 10 and 25°C, respectively after 56 days storage of guava milk chocolate.

Microbial analysis

Guava milk chocolate was analyzed for microbial counts viz. total plate count (TPC) and yeast-mold count (Table: 1). Initial TPC and yeast-mold count was 0.21×10^2 and 2, respectively. From table it was found that TPC and yeast-mold count increased during storage. TPC of guava milk chocolate increased from 0.21×10^2 to 0.57×10^2, 0.73×10^2 and 1.01×10^2 at 2, 10 and 25°C, respectively while yeast-mold count increased from 2 to 19, 25 and 31 at 2, 10 and 25°C, respectively.

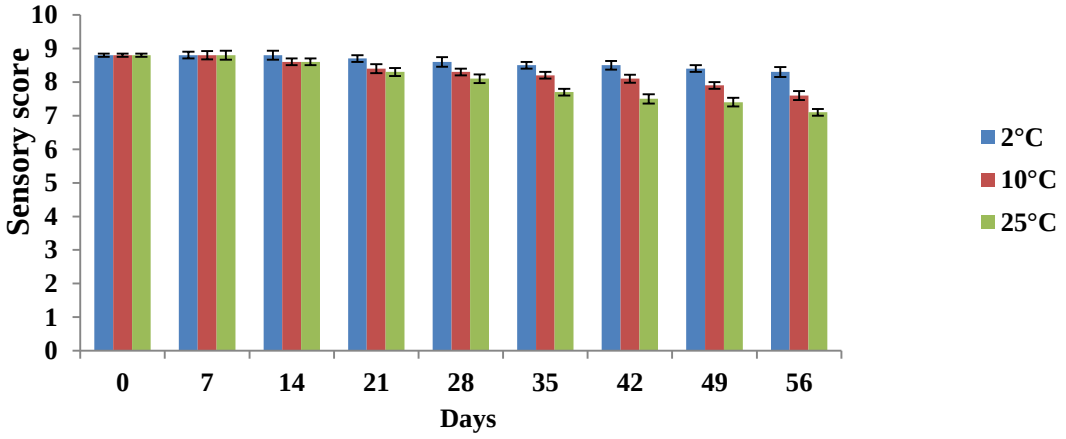

Fig. 1: Effect of different temperature on color and appearance of guava milk chocolate during storage

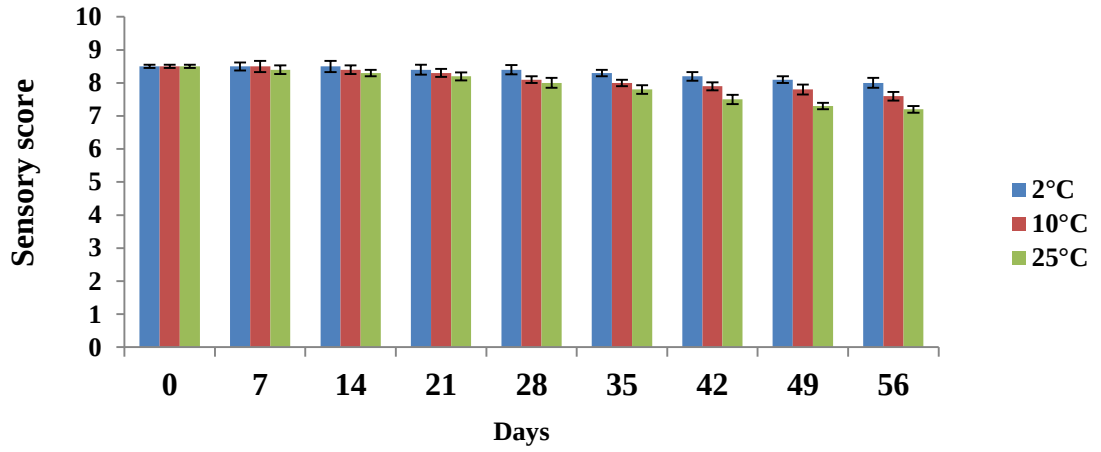

Fig. 2: Effect of different temperature on body and texture of guava milk chocolate during storage

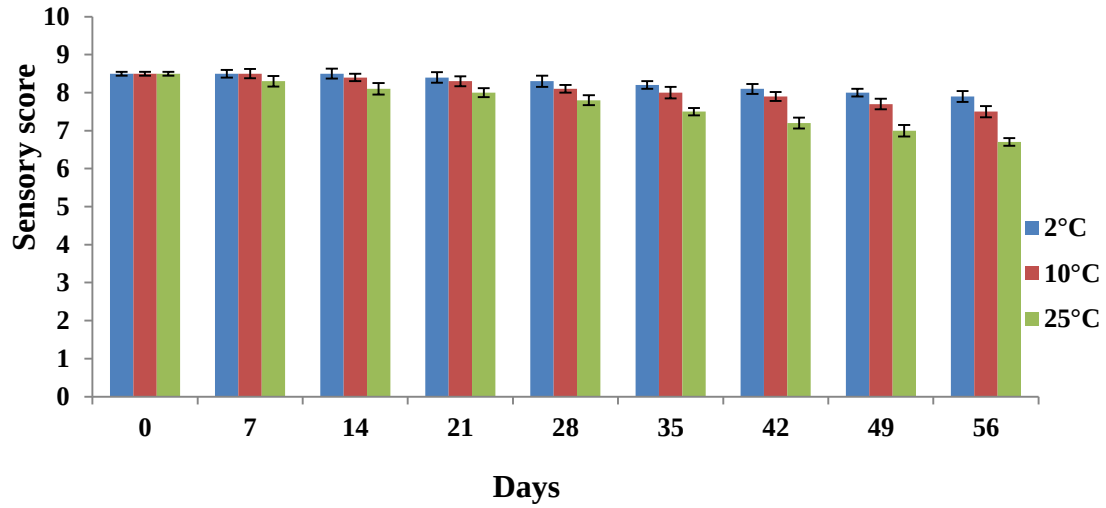

Fig. 3: Effect of different temperature on flavor of guava milk chocolate during storage

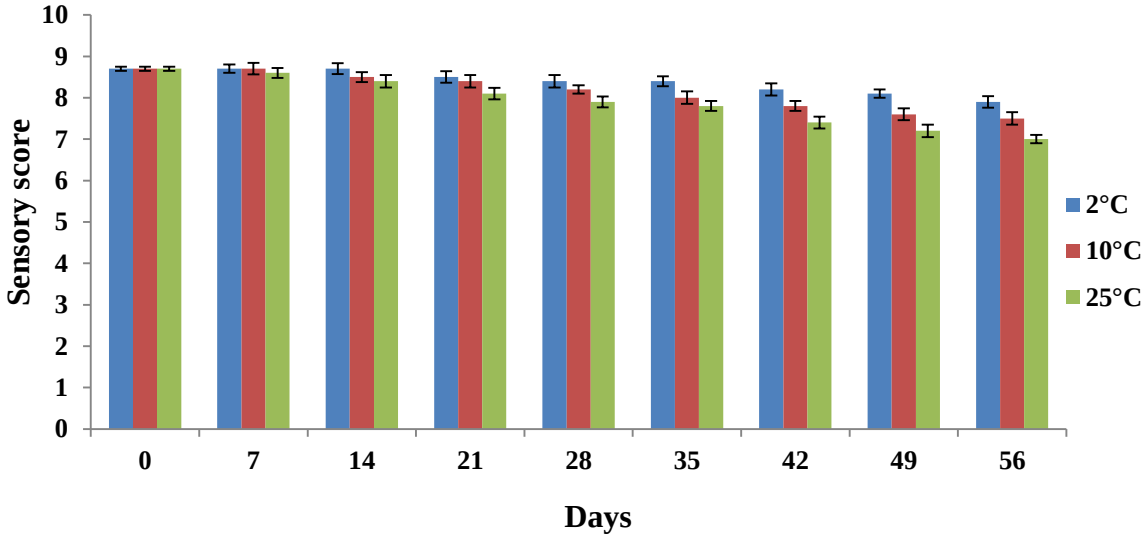

Fig. 4: Effect of different temperature on overall acceptability of guava milk chocolate during storage

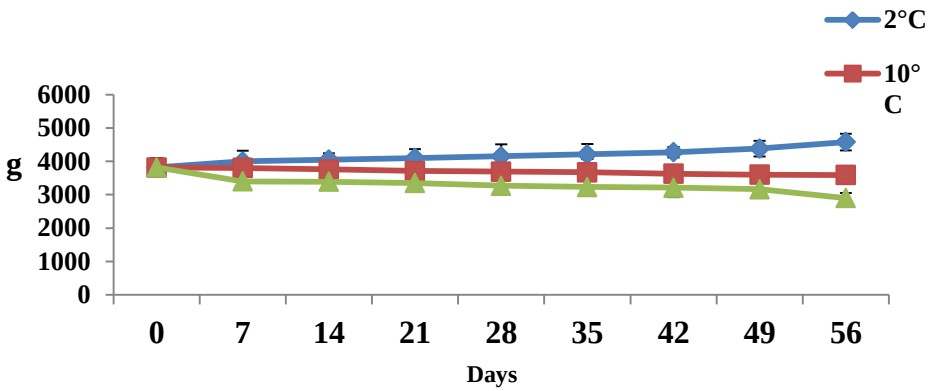

Fig. 5: Effect of different temperature on hardness of guava milk chocolate during storage

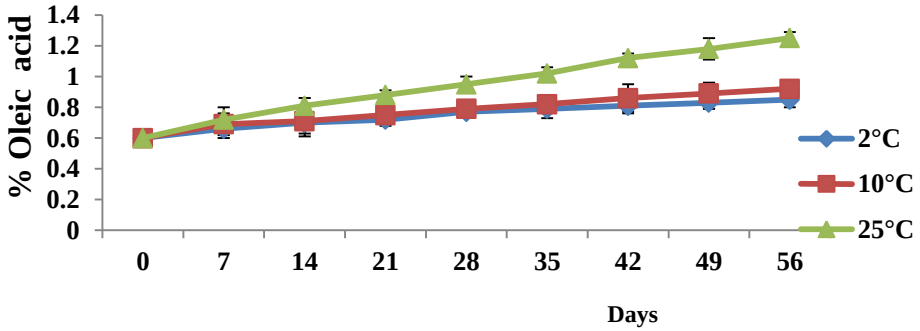

Fig. 6: Effect of different temperature on free fatty acid of guava milk chocolate during st

Table 1: Change in TPC and yeast-mold count of guava milk chocolate at different temperature during storage

Days	Storage temperature	TPC (cfu/g)	Yeast-mold (cfu/g)
0	02°C	0.21×10^2	2
	10°C	0.21×10^2	2
	25°C	0.21×10^2	2
7	02°C	0.24×10^2	3
	10C	0.28×10^2	4
	25°C	0.30×10^2	6
14	02°C	0.26×10^2	4
	10°C	0.31×10^2	5
	25°C	0.39×10^2	9
21	02°C	0.29×10^2	6
	10°C	0.37×10^2	7
	25°C	0.51×10^2	11
28	02°C	0.33×10^2	7
	10°C	0.42×10^2	8
	25°C	0.63×10^2	16
35	02°C	0.36×10^2	9

	10°C	0.49×10^2	11
	25°C	0.74×10^2	17
42	02°C	0.41×10^2	11
	10°C	0.59×10^2	14
	25°C	0.81×10^2	19
49	02°C	0.52×10^2	13
	10°C	0.67×10^2	23
	25°C	0.96×10^2	23
56	02°C	0.57×10^2	19
	10°C	0.73×10^2	25
	25°C	1.01×10^2	31

CONCLUSION

It was concluded that characteristics of guava milk chocolate like color and appearance, body and texture, flavor, overall acceptability and hardness were acceptable upto 56 days of storage at all the three temperatures (2, 10 and 25°C) taken for study. Chocolate stored at low temperature (2°C) was found to be best with respect to the chocolate samples stored at 10°C and 25°C.

Acknowledgements

I acknowledge Department of Biotechnology, Government of India for funding this research in Centre of Food Science and Technology, Banaras Hindu University (Varanasi), India.

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