

CHEMICAL ASSESSMENT AND VALUE ADDITION IN HARICHAL AND MALBHOG VARIETIES OF BANANA

M. J. Thapa, A. Mishra, M. B. Shrestha, C. Bhattra
Food Research Unit, NARC

ABSTRACT

Matured banana of varieties Malbhog and Harichal were collected from Chitwan and Balkhu respectively. Combs separated from bunch were partly used for candy preparation and partly allowed for ripening. Crystallized candy of banana was prepared according to prescribed method having 65 °Bx TSS and dried to moisture content $\leq 10\%$. Dried candy was taken for sensory evaluation for color, flavor, texture and taste and liked by most of the panelists with giving the score (mean values) 7, 6.5, 7.5 and 8 respectively according to hedonic rating method. During ripening, average pH and acidity (%) were observed daily till fully ripened and was found increased gradually with different treatments for ripening M_A , M_B , M_C , for Malbhog variety and H_A , H_B , H_C for Harichal variety to become 4.4 & 0.7787, 4.5 & 0.6668, 4.6 & 0.6065, 4.4 & 0.7639, 4.4 & 0.7615 and 4.5 & 0.7360 respectively. Similarly average TSS (°Bx) was observed at the same time of acidity evaluation and recorded as 21.8, 21.5, 21.3, 21.0, 20.8, and 20.5. Similarly chemical components of both varieties of Malbhog and Harichal were analyzed for moisture 70.25 and 71.72 %, total sugar 18.43 and 17.24%, protein 1.44 and 1.1%, pectin 0.95 and 0.73%, crude fiber 0.38 and 0.39%, total ash 0.89 and 0.96%, vitamin C 15.74 and 12.09 mg/100g, iron 0.4 and 0.55mg/100g, calcium 11.96 and 12.10 mg/100g, phosphorus 0.31 and 0.28 mg/100g and fat content 0.39 and 0.43% respectively. From ripened banana, juice was extracted by the use of pectinase enzyme by incubating at 32°C for 2 hours followed by squeezing. The juice was blended with water 20% by weight, blended with sugar and citric acid to raise TSS to 56°Bx and 1.4% respectively to make a concentrate form of nectar (when diluted to 4 times with water we got the nectar of 20% fruit juice content, 0.35% acidity and 14% TSS). The nectar was then boiled, hot filled, sealed and stored for self life observation and sensory evaluation. Sensory evaluation was carried out in terms of color, flavor, mouth feel and taste and liked by most of the panelists with giving score (mean values) 6, 7, 7 and 6 respectively according to hedonic rating method. The nectar in concentrate form was stored for self life study and found in good condition without any deterioration for 9 months.

Key words: Malbhog, Harichal, ripening, candy, nectar, °Bx(TSS), sensory evaluation

INTRODUCTION

A basic idea on which all nutritional scientists can agree is that the increased consumption of diets rich in a variety of fruit and vegetables will improve the health of almost any human population. This diet (of which the Mediterranean diet is the best example) is known to be beneficial for health, especially with regard to the development of chronic degenerative diseases. Banana is one of the most used fruits in the Mediterranean diet. Therefore, banana appear to be especially important in terms of public health as they are consumed in large quantities and are rich in several compounds believed to provide protection from or reduce the risk of contracting chronic degenerative diseases (Carlo, 2002).

Banana, *Musa sapientum*, is one of the world's most important fruits. It is consumed extensively throughout the tropics, where it is grown, and in the temperate zone, where it is popular because of its flavor its food value and its availability at all times of the year. There are 100 or more varieties of the banana in cultivation in different parts of the world with diverse names applied to same varieties. There is the immense number of varieties of banana in the South Asian region. Bananas thrive naturally on deep, loose, well drained soils in humid tropical climates, but are grown successfully under irrigation in semiarid regions. Suckers and divisions of the pseudobulb are used as planting material. The first crop ripened within 15 months and thereafter production is more or less continuous. Frequent pruning and manuring such as nitrogenous fertilizers are often used to increase quality and quantity of production. Jamaica was the first country to undertake its cultivation on an extensive scale followed by Costa Rica, Panama and Brazil respectively

(Encyclopedia, 1960). West Indies and west coast of Africa are the main producers and exporter whereas USA and UK are the main importers of bananas in the world. For exportation, the degree of maturity they are allowed to attain before harvesting depends upon distance from market and variety of transportation. When ripe, the fruit contains as much as 22% of carbohydrate, mainly sugar; it is high in ash and a good source of several vitamins. So from the banana several value added products such as nectar, candy, chips etc. can be made (Encyclopedia, 1960). Fresh-cut processing causes major tissue disruption as vacuolar, cytoplasmic and nucleic enzymes and substrates become mixed. Processing increases wound-induced C_2H_4 and respiration rates, surface area per unit volume and water activity. Physiological changes may be accompanied by browning, flavor loss, rapid softening, shrinkage and a shorter storage life. Accelerated water loss and increased water activity and carbon supply from freed soluble sugars enhance potential microbial attack, especially in fruits. So, proper handling and storage is required during ripening of fruits and for further processing (King and Bolin, 1989).

In Nepal Chitwan, Nawalparasi, Jhapa, Morang and Saptari districts are the main producers and Kathmandu, Pokhara, Birgunj and Biratnagar are the major areas of banana consumption. Now a days banana cultivation is in increasing trend. In Nepal, with different climatic condition, some of popular varieties of banana having local name *Malbhog*, *Harichal*, *Jhapri*, *Dhusure*, *Chini champa*, *Bhandari*, *Kurkure*, *Tin kesre*, *Marche*, *Jahaji*, *Mungri*, *Ghiu kera*, *Athiya*, etc. are found. Among them *Malbhog* and *Harichal* are high yielding and largely available in market (Personnel communication with 5 banana farmers and entrepreneurs of Chitwan taken in 15 August, 2010).

MATERIALS AND METHODS

Materials and methodologies for ripening, candying and juicing

Malbhog was collected from farms of Chitwan and *Harichal* was collected from fruit collection center Balkhu, Kathmandu at matured stage. The maturity was observed externally by its shape, size and color. Individual combs were separated from bunch. Majority part of separated banana combs were left for ripening with different treatments such as sample M_A & H_A , ripening was carried out by hanging in air without any treatment, sample M_B & H_B , ripening was carried out by wrapping in polyethylene bag. Similarly sample M_C & H_C , ripening was carried out by wrapping with green leaves of *Dhusmeto* (herb) and packed in polyethylene bag. The ripened banana was taken for juicing by treating with enzyme pectinase (0.05% in water by weight) by the rate of 5ml per 100g of peeled banana. The outline for juice preparation is shown in figure 2. Some part of matured green banana of both varieties were taken for candy preparation according to outline mentioned in figure 1.

Physicochemical analysis

Ripened banana of different treatments were analyzed for pH, acidity and total soluble sugar from the day of changing the color of peel, yellowish, in every day till optimum ripening condition. Proximate and some ultimate compositions such as moisture, fat, total sugar, protein, pectin, crude fiber, total ash, vitamin C, iron, calcium and phosphorus contents of both varieties of banana were analyzed. Similarly, the pH, acidity and total soluble sugar of prepared nectar and candy were also examined in different intervals within 6 months. The testing procedures for all parameters were determined according to Handbook of quality analysis for Fruits and vegetable by S. Rangana, 1997.

Sensory evaluation

Sensory evaluation of value added products such as nectar and candy was carried out according to hedonic rating test within the staff of NARC. This rating relates to pleasurable or non pleasurable experiences in choosing and eating a food. One to four samples are served to the panelist at one session. Panelist is asked to rate the acceptability of the product on a scale usually of 9 points, ranging from like extremely (1) to dislike extremely (9). The results are analyzed statistically for preference with data from panels (Rangana, 1997).

Fig.1 Flow diagram to prepare Banana Candy

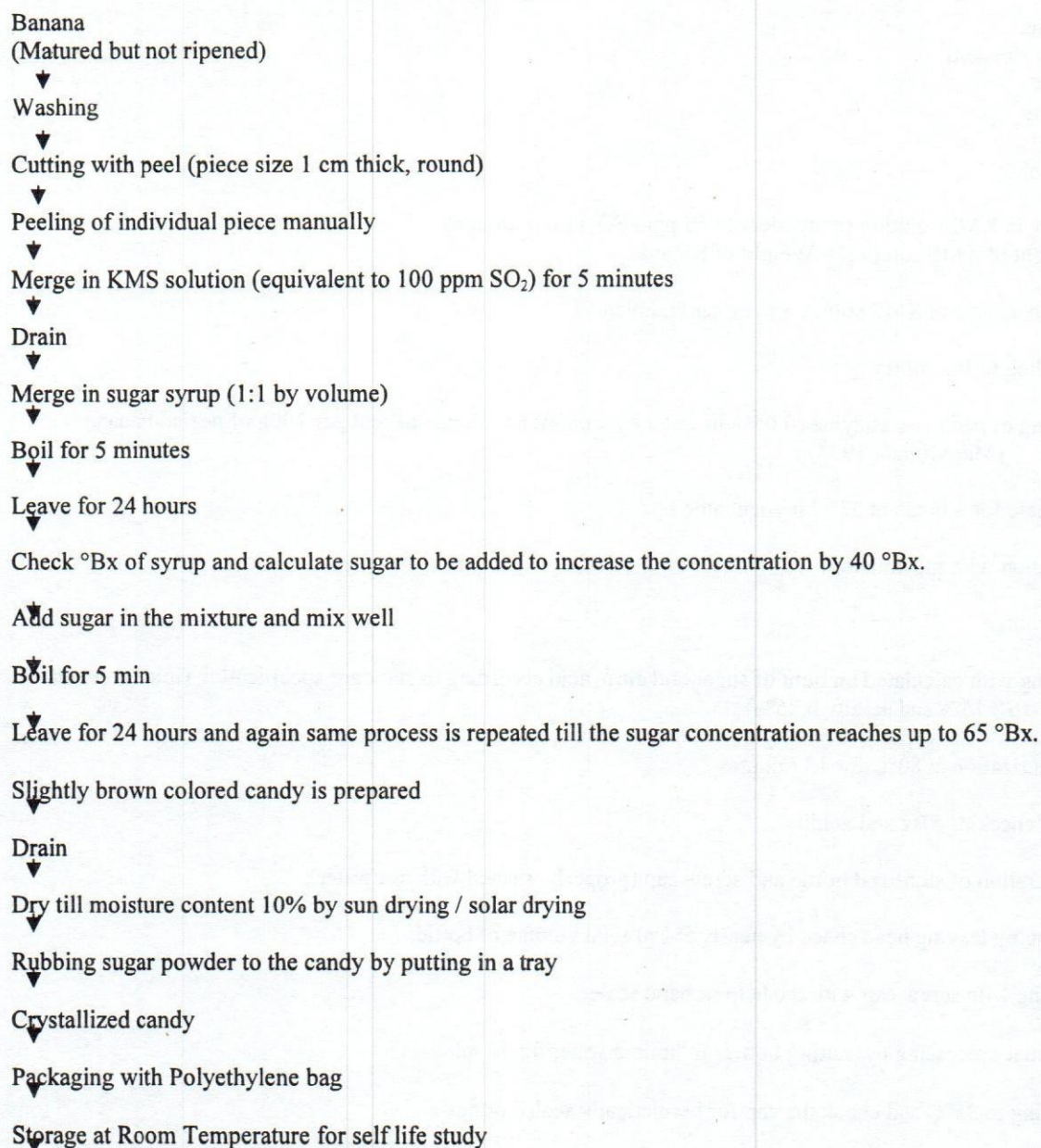
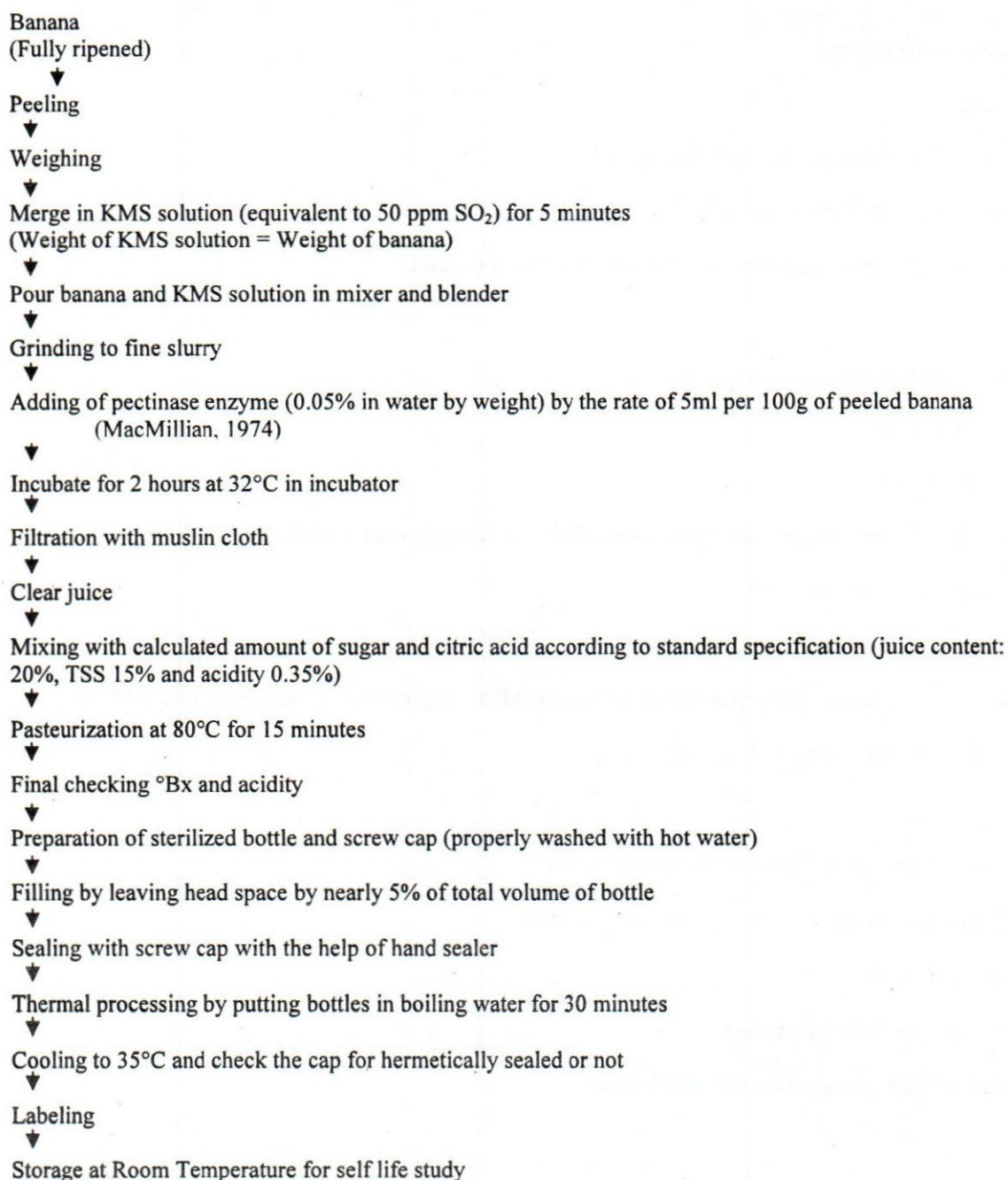


Fig.2 Flow diagram to prepare Banana Nectar in concentrate form



RESULTS AND DISCUSSION

Chemical and Physiological changes

Ripening of *Malbhog* variety started from 3 days at room temperature 27°C and from chemical analysis following result has been obtained. The *Malbhog* variety banana was started for ripening from the 3rd day of the treatment. Sample M_B and M_C were started ripening from 3rd day of the treatment but sample M_A was started from 4th day of the treatment. The chemical changes were found as following patterns shown in Table 1, 2 and 3.

Table 1: Chemical changes at 3rd day of ripening

Samples	pH	Acidity	°Bx
Sample M _A	5.0	0.4102	10.2
Sample M _B	4.7	0.4310	13.2
Sample M _C	4.8	0.4282	11.8

Table 2: Chemical changes at 4th day of ripening

Samples	pH	Acidity	°Bx
Sample M _A	4.6	0.5365	16.4
Sample M _B	4.5	0.6672	19.2
Sample M _C	4.6	0.5405	16.5

Table 3: Chemical changes at 5th day of ripening

Samples	pH	Acidity	°Bx
Sample M _A	4.4	0.7787	21.8
Sample M _B	4.5	0.6668	21.5
Sample M _C	4.6	0.6065	21.3

From the analytical result of *Malbhog* variety banana, it was seen that the pH was decreased with increasing ripening time. Acidity and total soluble sugar were increased with increasing ripening time. At the start of ripening (peel start to change from green to yellow color) of *Malbhog* variety M_A (ripening was carried out by hanging in steel air), the pH was decrease from 5.0 to 4.4, acidity and TSS were increased from 0.4102 and 10.2 to 0.7787 and 21.8 respectively at the time of optimum ripening at 5th day. Similarly M_B (ripening was carried out by packing in P.E bag), the pH was decrease from 4.7 to 4.5, acidity and TSS were increased from 0.4310 and 13.2 to 0.6668 and 21.5 respectively at the time of optimum ripening at 5th day. Similarly sample M_C (ripening was carried out by packing with *dhusmeto* leaves followed by P.E bag), the pH was decrease from 4.8 to 4.6, acidity and TSS were increased from 0.4282 and 11.8 to 0.6065 and 21.3 respectively at the time of optimum ripening at 5th day.

Ripening of *Harichal* variety started from 3 days at room temperature 27°C and from chemical analysis following result has been obtained. All sample H_A, H_B and H_C were started ripening from 4th day of the treatment. The chemical changes were found as following patterns shown in Table 4, 5 and 6.

Table 4 Chemical changes at 4th day of ripening

Samples	pH	Acidity	°Bx
Sample H _A	4.9	0.4232	12.4
Sample H _B	4.9	0.4220	12.7
Sample H _C	5.0	0.4151	11.4

Table 5 Chemical changes at 5th day of ripening

Samples	pH	Acidity	°Bx
Sample H _A	4.6	0.5986	16.6
Sample H _B	4.6	0.5962	16.4
Sample H _C	4.8	0.5305	15.2

Table 6 Chemical changes at 6th day of ripening

Samples	pH	Acidity	°Bx
Sample H _A	4.4	0.7639	21.0
Sample H _B	4.4	0.7615	20.8
Sample H _C	4.5	0.7360	20.5

From the analytical result of *Harichal* variety banana, it was seen that the pH was decreased with increasing ripening time. Acidity and total soluble sugar were increased with increasing ripening time. At the start of ripening (peel start to change from green to yellow color) of *Harichal* variety H_A (ripening was carried out by hanging in steel air), the pH was decrease from 4.9 to 4.4, acidity and TSS were increased from 0.4232 and 12.4 to 0.7639 and 21.0 respectively at the time of optimum ripening at 6th day. Similarly M_B (ripening was carried out by packing in P.E bag), the pH was decrease from 4.9 to 4.5, acidity and TSS were increased

from 0.4220 and 12.7 to 0.7615 and 20.8 respectively at the time of optimum ripening at 6th day. Similarly sample M_C (ripening was carried out by packing with *dhusmeto* leaves followed by P.E bag), the pH was decrease from 5.0 to 4.5, acidity and TSS were increased from 0.41512 and 11.4 to 0.7360 and 20.5 respectively at the time of optimum ripening at 6th day.

Chemical analysis

Proximate and ultimate analysis of ripened banana

The proximate and ultimate compositions obtained from chemical analysis of banana are shown in Table 7. From the chemical analysis, TSS, protein, pectin, vitamin C and phosphorus contents were found higher in *Malbhog* variety and except iron content, higher in *Harichal* (0.5509 mg/100g), other components were found very much similar to both varieties of banana.

Table 7: Chemical components of banana (fully ripened)

S	Parameters	Values (%) (<i>Malbhog</i> Variety)	Values (%) (<i>Harichal</i> Variety)
1	Moisture content	70.2500	71.715
2	Total sugar as invert sugar	18.4275	17.2434
3	Protein content	1.4441	1.1031
4	Pectin content	0.945 as Ca-pectate	0.733 as Ca-pectate
5	Crude fiber	0.3844	0.3959
6	Total ash content	0.896	0.9671
7	Vitamin C content	15.7372 mg/100g	12.0890 mg/100g
8	Iron content	0.4002 mg/100g	0.5509 mg/100g
9	Calcium content	11.9606 mg/100g	12.1031 mg/100g
10	Phosphorus content	37.0550 mg/100g	34.4374 mg/100g
11	Fat content	0.3105	0.2865

Composition of candy

Prepared candy from both variety of bananas were analyzed for their major components such as moisture, total sugar and total ash and result is shown in table 8. From the result the components were found in similar pattern.

Table 8 Major chemical components of candy

Parameter	<i>Malbhog</i>	<i>Harichal</i>
Moisture content	10.36%	11.28%
Total sugar content	66.54%	67.26%
Total ash content	1.68%	1.75%

Composition of nectar

Nectar was prepared in the form of concentrate because of its high storability due to high content of soluble solids and low volume for storage. The product can easily be consumed by diluting it by four times with potable water at any time. Prepared nectar from both varieties of banana were analysed for their major components such as total soluble sugar and titrable acidity as citric acid and result is shown in table 3.9. From the result the components were found in similar pattern.

Table 9: Major chemical components of nectar in the form of concentrate

Parameter	<i>Malbhog</i>	<i>Harichal</i>
Total sugar content as °Bx	56.82	57.75
Acidity %	1.42	1.39

Sensory Analysis

From the statistical analysis of scores obtained from sensorial test of nectar, there was significant difference in terms of taste of *Malbhog* and *Harichal* variety ($p > 0.05$) but in terms of rest parameters, were found significantly indifference ($p > 0.05$). Similarly, from the statistical analysis of scores obtained from sensorial

test of candy, there were found significantly indifference in terms of all testing parameters. The result is shown in figure 3.1 and 3.2.

Fig.3.1 Graphical representation for sensory analysis of nectar
9 point hedonic rating test
Like extremely=9 and dislike extremely=1

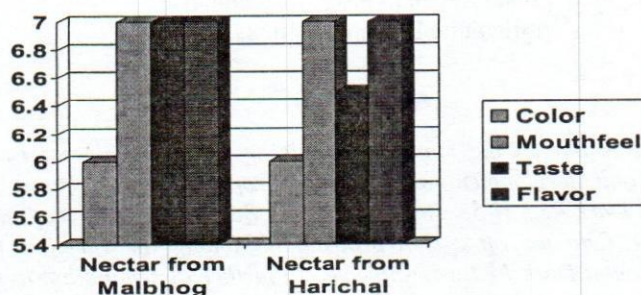
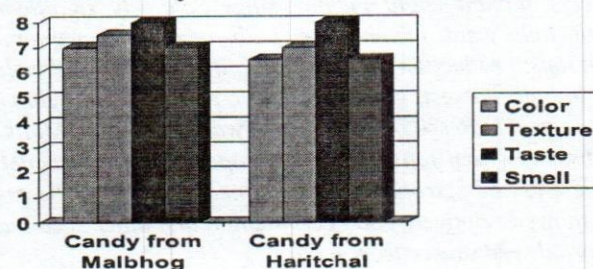


Fig. 3.2 Graphical representation for sensory analysis of candy
9 point hedonic rating test
Like extremely=9 and dislike extremely=1



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