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A Case Study on Nutritional Storage and Heat Processed Honey

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Abstract – Honey is the food derived entirely from the work of honey bees operating upon the nectar of flowers and other sweet exudation of plants. In India, the consumption of honey is mainly restricted to medicinal purposes. Honey is well known for healing of wounds and its effect on nervous system. Honey facilitates better physical performance and resistance to fatigue. Honey is used for treating various digestive and assimilation problems. Honey also helps in calcium fixation in bones, cures anaemia, anorexia, insomnia and reduces fever. Honey is valued also for some of its therapeutic attributes. It improves the resistance of the body by improving the biological processes of organs and systems. It facilitates proteins and fat digestion thus constitutes an excellent anti-dyspeptogenic factor (Shamala and Jyothi 1999). Honey has tonic effect. Its medicinal property neutralizes fatigue, compensatory hypotonia, as well as the adverse effects of the other substances added when used in the preparation of beverages (Shamala and Jyothi 1999). Honey provides immediately available calories, for healthy and sick people. Honey consumption benefits digestive apparatus, respiratory system, skin and wound healing and eye disorders. Honey is also good for diabetics and to normalize kidney function.

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INTRODUCTION

Processing of honey is the practical means for preventing granulation and fermentation, otherwise it can easily deteriorate the quality. Heat processing of honey is essential to extend its shelf life, preventing granulation and arresting fermentation. However, uncontrolled heat processing of honey results into hydroxyl methyl furfural formation which darkens colour of honey. Although raw is the best honey, but processing is needed to meet the market requirements.

Honey with a glucose/water ratio less than 1.7 tends to remain liquid for a long time, while ratio greater than 2.1 usually crystallizes within weeks. During processing, several steps are taken to prolong the liquid state of honey. Pasteurization delays the process of crystallization by dissolving the crystals. It also kills yeast cells and thereby eliminates the possibility of fermentation. To delay crystallization, some researchers recommend heating the honey to 77^0C for 5 minutes, cooling rapidly to room temperature, bottling and storage of honey at 0^0C (Assil *et al* 1991). With an increasing amount of honey production, an understanding of the changes in honey during storage is essential to maintain its quality. In India, however, very little work has been carried out on keeping quality of honey and no comparative studies on ripened and unripened honey have so far been reported. The present studies are aimed to assess the effect of different treatments and storage conditions on the quality of ripened and unripened honey and to find out the optimum storage condition at which the losses occurring during storage are minimumized.

OBJECTIVES OF THE STUDY:

Keeping in view the significance of processing of storage of ripened and unripened honey, the present study was undertaken with the following objectives:-

- To study the nutritional properties of raw and heat processed honey in relation to different packaging materials and storage intervals.
- To utilize processed honey in the preparation of various food products.
- To evaluate the nutritional relevance and consumer's acceptability of the prepared honey based food products.

REVIEW OF LITERATURE:

Honey, a delicious and viscous food, is prepared by bees from the nectar of flowers. It has high viscosity, high sweetness and range of colours. It is valued not only as a food but also for some of its therapeutic attributes. In India, however, very little work has been carried out on keeping quality of honey and no comparative studies on ripened and unripened honey have been reported so far. Therefore, in the present

study various chemical, organoleptic and microbiological parameters of ripened, unripened processed honey samples and honey based food products were determined and compared.

Kalpana and Ramanujan (1997) determined the sugars of honey and the values of total sugars and sucrose were recorded as 70 and 2.5 percent, respectively. Kumari (1998) determined the reducing and total sugar content present in honey and values were 57.99 and 77.75 per cent. Shamala and Jyothi (1999) reported the glucose and fructose content of honey as 31.28 and 38.19 per cent, respectively. Manjunath and Tharanathan (2000) determined the reducing sugars and fructose of honey and values were in the range of 60 to 70 per cent.

Gulati and Kumari (2005) determined the glucose content of commercial Apis mellifera honey and the values of glucose and fructose contents were in the range of 22.4 to 32.2 per cent and 26.6 to 36.6 per cent, respectively. Maulny *et al*. (2005) reported the fructose and glucose contents in the range of 0.27 to 1.24 per cent and 0.32 to 1.13 per cent, respectively. Dimins *et al*. (2006) determined the reducing sugars and reported the values in the range of 73.7 to 82.8 per cent. Singh *et al.* (2006) determined reducing and total sugars in ripened honey and values varied in the range of 60.6 to 60.9 and 68.7 to 69.5 per cent, respectively. Among different sugars, values of glucose and fructose were 32.8 to 33.7 and 39.6 to 39.9 per cent respectively. The unripened honey had lower values of reducing sugars, total sugars, glucose and fructose, compared to ripened honey which were 58.6 to 58.9, 67.6 to 67.8 per cent, 30.1 to 31.0 and 38.6 to 39.5 per cent respectively.

Kumari (1998) prepared fruit nectars by utilizing honey and reported that honey can be used as a substitute for sugar. These products can provide an added alternative of raw material and a variety in the spectrum of sugar based products. It was found that the nectar utilizing honey as a substitute of sugar was a viable alternative for opening up new vistas for surplus honey utilization.

Sood (2000) prepared IMF products from honey, which has therapeutic importance, despite being somewhat odd in flavour. The use of honey and sorbitol as humactancts further increased the therapeutic value and shelf life of the products. There is a need to develop/standardized foods based on raw/processed honey. The author suggested that further studies on the utilization of honey in processed foods will provide basic and applied data for better application of honey.

Chauhan *et al.* (1998) prepared protein-rich mango beverage by blending mango pulp with soy protein isolate and products were analysed for physico-chemical and sensory characteristics and found that higher protein and fat contents having good flavour, taste, body and overall quality. Mandhyan *et al.* (2000) prepared guava squash using different proportions of guava pulp and water and the best organoleptic properties were found in sample having 1:4 (pulp:water) ratio. Srivastava and Kumari (2002) prepared squash from fruit beverage containing 25 per cent fruit juice and 40 to 50 per cent total soluble solids. Whereas, Juan (2008) prepared beverages with high caloric content and limited health benefits from fruit juices, whole milk and fruit smoothies with sugar or honey; and alcoholic and sport drinks based on honey.

Kumari (1998) determined the quantitative and qualitative parameters associated with the honey based fruit nectar. The fruit nectars were prepared from peach, pear and apricot fruits by using sucrose and honey as sweetening agents and the products were filled in glass bottles, cans and polythene pouches and stored for 90 days. Among packaging materials the better results were obtained for fruit nectars stored in glass bottles followed by cans, polythene pouches although HDPE pouches were cheapest modes of packaging. Dogra (2002) found that the addition of various humectants viz sorbitol, manitol and glycerol altered the deep-fat-frying characteristics of doughnuts and reported that the addition of humectants shortened the processing time and increased the shelf-life when stored in craft paper, plastic jars and polyethylene bags.

Vaidya (2002) prepared products of kiwi fruit viz jam, butter, leather, candy and toffees. The products were packed in different packaging materials like wooden box, corrugated fiber box and left open on counters control and observed that products hot glass pack samples behaved better under the aseptic processing condition.

SUMMARY:

Honey is a sweet, viscous liquid made by honey bees using nectar from flowers and gets its sweetness from mono-saccharides fructose and glucose and most microorganisms do not grow in honey. Because of its unique composition and chemical properties honey is suitable for long term storage. Regardless of preservation, honey may crystallize a period of time and this sometime effect colour and consumer's acceptability. However, the colour, flavour and aroma are the important quality characteristics of honey from consumer's point of view. Processing of honey is only practical method to obtain these desirable characteristics and prevent crystallization a period of time. The packaging material also play important role for long term storage with minimum changes in quality attributes. But the delicate aroma and fine flavour of honey are particularly vulnerable to heat and improper storage. Keeping in view the importance of honey, the present study was undertaken proposed with the aim to assess the nutritional attributes, storage stability of processed honey in relation to different packaging materials and utilization in preparation of various value added products.

In the present study, two types of honey viz ripened and unripened were procured from Nagrota Bagwan and from local market and processed at 60, 70 and 80^{0}C for 12, 24, 36 and 48 hours. The processed honey was packaged in glass jars, plastic jars and polypack pouches and analyzed fresh and after every 3, 6, 9 and 12 months of storage intervals for physico-chemical, nutritional, microbiological and consumer's acceptability. The various formulations for the preparation of value added products like RTS beverages, Squash, jam, biscuits and toffees were standardized and efforts were made to replace sugar with honey as sweetener in various foods and beverages. The results obtained during the investigation are summarized below:

1. The result of the present study revealed that the ripened honey had significant effect on its moisture content. Unripe ned honey contained higher value (17.56%) as compared to ripened honey (16.73%) packaged in glass jars. Processing temperature had significant effect on the moisture content. Honey processed at 60^{0}C had higher moisture of (17.98%), followed by the honey processed at 70^{0}C (17.06%) and 80^{0}C (16.40%). The processing time had non- significant effect on the moisture content of honey packaged in glass jars, plastic jars and polypack pouches. The storage had significantly decreasing effect on the moisture content of honey.

2. In case of ripened honey, processing temperature, processing time and storage had significant effect on the ash content of honey. The ripened honey had higher values of ash content with the mean values of 0.32, 0.29 and 0.28 per cent of honey packaged in glass jars, plastic jars and polypack pouches, respectively. The ash content of honey significantly increased with increase in processing temperature as well as time used for heating of honey. However, storage showed significantly decreasing effect on the ash content of honey. The fresh honey had ash content of 0.30 percent which decreased to 0.23, 0.23 and 0.21 percent after 12 months of storage and packaged in glass jars, plastic jars and polypack pouches, respectively.

3. The TSS of ripened honey was significantly higher with the mean values of 82.310B as compared to TSS of unripened honey (81.390B). The TSS of honey processed at high temperature of 80^{0}C was higher i.e. 82.900B followed by honey processed at 70^0 C (81.860B) and 60^0 C (80.780B). Similar trend was observed in honey packaged in glass jars, plastic jars and polypack pouches. A slight increase in TSS was observed with storage and in fresh honey the mean value of TSS was 81.520B which increased to 82.110B and 81.700B after 12 months of storage of honey packaged in glass jars and polypack pouches, respectively.

4. The ripened honey had significant effect on pH of the honey and higher values were observed in ripened honey. The mean values of pH of ripened honey packaged in glass jars, plastic jars and polypack pouches were 5.50, 5.62 and 5.62 as compared to unripened honey with mean values of 4.44, 4.57 and 4.83, respectively. The pH of honey increased with increase in processing temperature as well as processing time. The mean value of pH of fresh honey was 5.41 which decreased to 4.62, 4.97 and 5.10 after 12 months of storage of honey packaged in glass jars, plastic jars and polypack pouches, respectively.

5. The acidity of honey was also affected significantly with ripening process, processing temperature, processing time and storage interval. The mean values of acidity of ripened and unripened honey were 0.33 and 0.40 per cent, respectively. The higher values of acidity 0.44% was observed in honey processed at 80^{0}C followed by acidity 0.37% honey processed at 70^{0}C and acidity 0.29% processed at 60^{0}C. Similar trend was observed of honey packaged in plastic jars and polypack pouches. The storage of honey also had significantly increasing effect on the acidity content of honey. The mean values of fresh honey was 0.29 per cent which increased to 0.44, 0.42 and 0.40 per cent after 12 months of storage and packaged in glass jars, plastic jars and polypack pouches, respectively.

6. Processing temperatures of honey had significant effect on the reducing, non-reducing and total sugars of ripened and unripe ned honey packaged in glass jars and plastic jars, whereas, ripened honey had non-significant effect on the total sugars of honey packaged in polypack pouches. Storage of honey had significant effect on the reducing, non-reducing and total sugars of honey packaged in different packaging material.

Therefore, it can be concluded from the study that the honey processed at 60 and 70^{0}C was highly acceptable as compared to honey processed at 80^{0}C which produced slightly dark colored honey. Among the different processing treatments, the overall acceptability of honey heated for 24 and 36 hour were more acceptable as compared to other combinations. Among the various packaging materials glass jars were highly acceptable followed

by plastic jars and polypack pouches. As per the formulations standardized for the preparation of different products viz. RTS, squash, jam, biscuits and toffees, the honey can be used as a substitute for sugar as sweetener for preparation of highly acceptable value added products. The processing of honey and its utilization in various products has commercial applications in Food Industry.

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