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Comparative analysis and nutritional evaluation of ripened and unripened honey during storage of different packaging materials

Sonia Minhas[1], YS Dhaliwal[2]
[1, 2] Department of Food Science Nutrition and Technology, CSKHPKV, Palampur, Himachal Pradesh, India

Abstract
Effect of the packaging materials on the sensory attributes of the processed honey was evaluated on the 9.0 point basis. The highest mean values for colour were recorded for honey processed at 60^0C for 12 hours and stored in glass jars (7.73 and 7.67) and the corresponding values for honey stored in plastic jars were 7.74 and 7.68 and those packed in polypack pouches were 7.73 and 7.67 respectively. Similarly the values for taste of honey stored in glass jars were 7.83 and 7.79 and those stored in plastic jars and polypack pouches were 7.83 and 7.79 and 7.82 and 7.78 respectively. Similarly the scores for consistency of honey stored in glass jars were 8.06 and 8.00, plastic jars 8.07 and 8.01 and polypack pouches 8.06 and 8.00 respectively. The value of minerals contents viz sodium, potassium, calcium, magnesium, iron and zinc of present study in honey ranged from 1.80 to 2.30, 190 to 310, 7.00 to 14.50, 16.00 to 24.83, 1.00 to 1.76 and 4.00 to 5.10 mg/100g, respectively.

Keywords: ripened honey, unripened honey, sensory attributes, processing, minerals, storage

Introduction
Natural honey is one of the most widely sought products due to its unique nutritional and medicinal properties, which are attributed to the influence of the different groups of substances it contains. (Buba *et al.,* 2013) [3]. Honey is the food derived entirely from the work of honey bees operating upon the nectar of flowers and other sweet exudation of plants. (Adeniyi *et al.,* 2014) [2]. 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, and 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 (Surendra 2008) [8]. 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 (Surendra 2008) [8]. 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.
Sensory analysis is the examination of a product through the evaluation of the attributes perceptible by the five sense organs (organoleptic attributes), such as colour, odour, taste, touch, texture and noise (Piana *et al.,* 2004) [6]. The sensory analysis evaluates the correspondence with consumer expectations and complements the determination of botanical origin and physicochemical characteristics. In sensory terms, honey properties may be scored and described using the senses of human beings as an analytical tool (Ciappini *et al.,* 2013) [5].
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 minimized.

Materials and Methods
Materials
The honey samples (Ripened and Unripened) required for the present study were procured from the local market and Bee Keeping Research Station, of CSKHPKV Nagrota Bhagwan, Distt Kangra, H.P. The other ingredients required for the research study and preparation of food products were purchased from the local market.

Processing and packaging of honey
Ripened and unripened honey samples were processed at 60^0, 70^0 and 80^0C for 12, 24, 36 and 48 hrs. The sample of raw and processed honey were packaged in different packaging materials (glass jars, plastic jars and polythene pouches) and analysed fresh and after every 3.0, 6.0, 9.0 and 12.0 months of storage intervals for chemical, microbiological and sensory evaluation. Figure 1 indicates the steps followed in processing of honey.

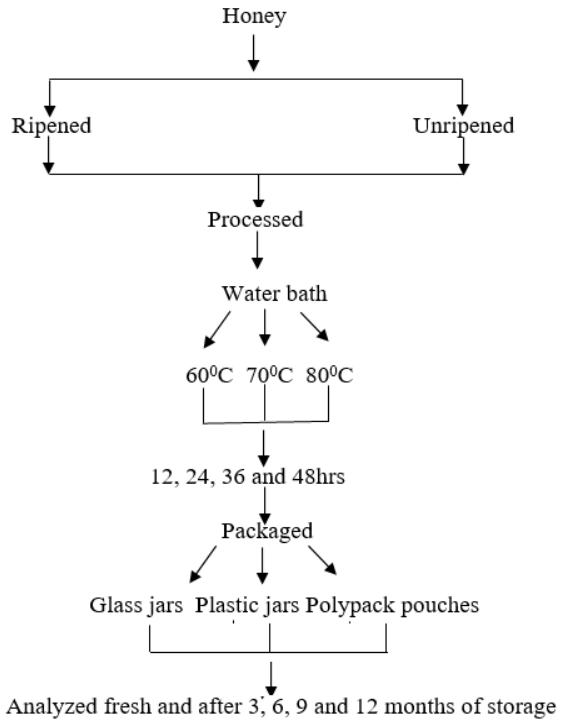

Fig 1: Steps involved for the processing of honey

Results and Discussion

Organoleptic evaluation of honey

Colour

The data pertaining to colour of honey packaged in glass jars, plastic jars and polypack pouches as affected by type of honey, processing temperature, processing time and storage intervals are given in Tables 1, 2 and 3 respectively. The ripening of honey had significant effect on the colour of honey packaged in glass jars. The mean values of colour of ripened and unripened honey packaged in glass jars were 7.66 and 7.62 (on the basis of 9.0), respectively. Similarly, in case of honey packaged in plastic jars and polythene pouches, the ripened honey had slightly higher values of colour as compared to unripened honey. The processing temperature had significant effect on the colours of honey packaged in glass jars. The honey processed at 80^{0}C the colour was 7.54, followed by the lower values of honey processed at 70^{0}C and 60^{o}C which were recorded as 7.64 was 7.73. Similar trend was observed of honey packaged in plastic jars and polythene pouches.

Table 1: Mean values of colour (on the basis of 9.0) of honey packaged in glass jars as affected by type, processing temperature, processing time and storage interval

Particulars	**Storage interval (months)**					
Honey	**Fresh**	**3**	**6**	**9**	**12**	**Mean**
Ripened	7.70	7.67	7.66	7.65	7.64	7.66
Unripened	7.66	7.63	7.62	7.61	7.60	7.62
Mean	7.68	7.65	7.64	7.63	7.62	7.64
Processing Temperature (^{0}C)						
60	7.77	7.74	7.73	7.72	7.71	7.73
70	7.68	7.65	7.64	7.63	7.62	7.64
80	7.59	7.55	7.54	7.53	7.52	7.54
Mean	7.68	7.65	7.64	7.63	7.62	7.64
Processing Time (hrs)						
12	7.71	7.69	7.67	7.66	7.65	7.67
24	7.70	7.66	7.66	7.64	7.63	7.65
36	7.67	7.64	7.63	7.62	7.60	7.63
48	7.64	7.61	7.60	7.59	7.58	7.60
Mean	7.68	7.65	7.64	7.63	7.62	7.64

Honey	Processing Time (hrs)				
	12	24	36	48	Mean
Ripened	7.63	7.65	7.67	7.69	7.66
Unripened	7.57	7.60	7.63	7.66	7.62
Mean	7.60	7.63	7.65	7.67	7.64

Processing Time (hrs)	Honey			Processing Temperature (^{0}C)			
	Ripened	Unripened	Mean	60	70	80	Mean
12	7.69	7.66	7.67	7.58	7.68	7.77	7.67
24	7.67	7.63	7.65	7.56	7.66	7.74	7.65
36	7.65	7.60	7.63	7.54	7.63	7.72	7.63
48	7.63	7.57	7.60	7.49	7.61	7.71	7.60
Mean	7.66	7.62	7.64	7.54	7.64	7.73	7.64

Honey	Processing Temperature(^{0}C)				CD (P≤0.05) Between
	60	70	80	Mean	Type of Honey: 0.43
Ripened	7.57	7.65	7.75	7.66	Processing Temperature: 0.53
Unripened	7.51	7.63	7.71	7.62	
Mean	7.54	7.64	7.73	7.64	Processing Time: 0.61 Storage interval: 0.69

Table 2: Mean values of colour (on the basis of 9.0) of honey packaged in plastic jars as affected by type, processing temperature, processing time and storage interval

Particulars	**Storage interval (months)**					
Honey	**Fresh**	**3**	**6**	**9**	**12**	**Mean**
Ripened	7.70	7.68	7.66	7.66	7.65	7.67
Unripened	7.66	7.62	7.62	7.62	7.61	7.63
Mean	7.68	7.65	7.64	7.64	7.63	7.65
Processing Temperature (^{0}C)						
60	7.77	7.75	7.73	7.72	7.71	7.74
70	7.68	7.66	7.65	7.64	7.63	7.65
80	7.59	7.56	7.55	7.54	7.53	7.56
Mean	7.68	7.65	7.64	7.64	7.63	7.65
Processing Time (hrs)						
12	7.71	7.69	7.68	7.68	7.67	7.68
24	7.70	7.67	7.66	7.65	7.64	7.66
36	7.67	7.65	7.64	7.63	7.61	7.64
48	7.64	7.62	7.61	7.60	7.58	7.61
Mean	7.68	7.65	7.64	7.64	7.63	7.65

Honey	Processing Time (hrs)				
	12	24	36	48	Mean
Ripened	7.63	7.66	7.68	7.70	7.67
Unripened	7.59	7.62	7.64	7.66	7.63
Mean	7.61	7.64	7.66	7.68	7.65

Processing Time (hrs)	Honey			Processing Temperature (^{0}C)			
	Ripened	Unripened	Mean	60	70	80	Mean
12	7.70	7.66	7.68	7.59	7.69	7.77	7.68
24	7.68	7.64	7.66	7.57	7.66	7.75	7.66
36	7.66	7.62	7.64	7.55	7.64	7.73	7.64
48	7.63	7.59	7.61	7.52	7.61	7.70	7.61
Mean	7.67	7.63	7.65	7.56	7.65	7.74	7.65

Honey	Processing Temperature (^{0}C)				CD (P≤0.05) Between
	60	70	80	Mean	Type of Honey: 0.49
Ripened	7.58	7.66	7.76	7.67	Processing Temperature : 0.60
Unripened	7.54	7.64	7.72	7.63	Processing Time: 0.69
Mean	7.56	7.65	7.74	7.65	Storage interval: 0.77

The processing time had significant effect on the colour of honey and slightly decreased with the increase in processing time. The colour of honey processed for 12 hours and packaged in glass jars, plastic jars and polythene pouches were 7.67, 7.68 and 7.67 which decreased to 7.60, 7.61 and 7.60, respectively.

Table 3: Mean values of colour (on the basis of 9.0) of honey packaged in polypack pouches as affected by type, processing temperature, processing time and storage interval

Particulars	**Storage interval (months)**					
Honey	**Fresh**	**3**	**6**	**9**	**12**	**Mean**
Ripened	7.70	7.67	7.65	7.64	7.63	7.66
Unripened	7.66	7.63	7.62	7.60	7.59	7.62
Mean	7.68	7.65	7.63	7.62	7.61	7.64
Processing Temperature (^{0}C)						
60	7.77	7.73	7.72	7.71	7.70	7.73
70	7.68	7.65	7.64	7.63	7.62	7.64
80	7.59	7.55	7.54	7.53	7.52	7.55
Mean	7.68	7.65	7.63	7.62	7.61	7.64
Processing Time (hrs)						
12	7.71	7.68	7.67	7.66	7.65	7.67
24	7.70	7.66	7.65	7.64	7.63	7.65
36	7.67	7.64	7.63	7.61	7.60	7.63
48	7.64	7.61	7.60	7.59	7.58	7.60
Mean	7.68	7.65	7.63	7.62	7.61	7.64

Honey	Processing Time (hrs)				
	12	24	36	48	Mean
Ripened	7.62	7.65	7.67	7.70	7.66
Unripened	7.58	7.61	7.64	7.65	7.62
Mean	7.60	7.63	7.65	7.67	7.64

Processing Time (hrs)	Honey			Processing Temperature (^{0}C)			
	Ripened	Unripened	Mean	60	70	80	Mean
12	7.70	7.65	7.67	7.58	7.68	7.76	7.67
24	7.67	7.64	7.65	7.56	7.66	7.74	7.65
36	7.65	7.61	7.63	7.54	7.63	7.72	7.63
48	7.62	7.58	7.60	7.51	7.60	7.69	7.60
Mean	7.66	7.62	7.64	7.55	7.64	7.73	7.64

Honey	Processing Temperature(^{0}C)				CD (P≤0.05) Between
	60	70	80	Mean	Type of Honey: 0.49
Ripened	7.57	7.66	7.75	7.66	Processing Temperature: 0.60
Unripened	7.53	7.63	7.70	7.62	Processing Time: 0.69
Mean	7.55	7.64	7.73	7.64	Storage interval: 0.78

The storage of honey irrespective of packaging materials also had significant effect on the colour. The mean values of fresh honey was 7.68 which decreased to 7.62, 7.63 and 7.61 after 12 months of storage of honey, packaged in glass jars, plastic jars and polypack pouches, respectively**.**

Taste

Tables 4, 5 and 6 indicate the taste of honey packaged in glass jars, plastic jars and polypack pouches as affected by type of honey, processing temperature, processing time and storage intervals. The ripened honey had significantly higher values of

taste packaged in glass jars, plastic jars and polypack pouches with mean values of 7.78, 7.78 and 7.78 (on 9.0 point hedonic scale), respectively.

Table 4: Mean values of taste (on the basis of 9.0) of honey packaged in glass jars as affected by type, processing temperature, processing time and storage interval

Particulars	**Storage interval (months)**					
Honey	**Fresh**	**3**	**6**	**9**	**12**	**Mean**
Ripened	7.83	7.79	7.78	7.77	7.75	7.78
Unripened	7.78	7.75	7.74	7.73	7.71	7.74
Mean	7.80	7.77	7.76	7.75	7.74	7.76
Processing Temperature (^{0}C)						
60	7.86	7.84	7.83	7.82	7.80	7.83
70	7.80	7.78	7.77	7.76	7.74	7.77
80	7.73	7.70	7.69	7.67	7.66	7.69
Mean	7.80	7.77	7.76	7.75	7.74	7.76
Processing Time (hrs)						
12	7.83	7.80	7.79	7.78	7.77	7.79
24	7.81	7.79	7.77	7.76	7.75	7.77
36	7.79	7.76	7.75	7.74	7.73	7.75
48	7.76	7.74	7.73	7.72	7.71	7.73
Mean	7.80	7.77	7.76	7.75	7.74	7.76

Honey	Processing Time (hrs)				
	12	24	36	48	Mean
Ripened	7.76	7.77	7.79	7.81	7.78
Unripened	7.69	7.72	7.76	7.77	7.74
Mean	7.73	7.75	7.77	7.79	7.76

Processing Time (hrs)	Honey			Processing Temperature (^{0}C)			
	Ripened	Unripened	Mean	60	70	80	Mean
12	7.81	7.77	7.79	7.74	7.79	7.85	7.79
24	7.79	7.76	7.77	7.70	7.78	7.83	7.77
36	7.77	7.72	7.75	7.67	7.76	7.82	7.75
48	7.76	7.69	7.73	7.63	7.75	7.80	7.73
Mean	7.78	7.74	7.76	7.69	7.77	7.83	7.76

Honey	Processing Temperature (^{0}C)				CD (P≤0.05) Between
	60	70	80	Mean	
Ripened	7.73	7.78	7.84	7.78	Type of Honey: 0.50
Unripened	7.65	7.75	7.81	7.74	Processing Temperature: 0.62
Mean	7.69	7.7	7.83	7.76	Processing Time: 0.71
					Storage interval: 0.79

The processing temperature used for processing of honey had significant effect on the taste. Taste score decreased with increase in processing temperature irrespective of different

Table 5: Mean values of taste (on the basis of 9.0) of honey packaged in plastic jars as affected by type, processing temperature, processing time and storage interval

Particulars	**Storage interval (months)**					
Honey	**Fresh**	**3**	**6**	**9**	**12**	**Mean**
Ripened	7.83	7.79	7.77	7.76	7.76	7.78
Unripened	7.78	7.75	7.75	7.74	7.72	7.74
Mean	7.80	7.77	7.76	7.75	7.74	7.76
Processing Temperature (^{0}C)						
60	7.86	7.84	7.83	7.82	7.81	7.83
70	7.80	7.78	7.76	7.75	7.74	7.77
80	7.73	7.70	7.69	7.68	7.67	7.69
Mean	7.80	7.77	7.76	7.75	7.74	7.76
Processing Time (hrs)						
12	7.83	7.80	7.79	7.78	7.77	7.79
24	7.81	7.79	7.78	7.76	7.75	7.78
36	7.79	7.76	7.75	7.74	7.73	7.75
48	7.76	7.74	7.73	7.72	7.71	7.73
Mean	7.80	7.77	7.76	7.75	7.74	7.76

Honey	Processing Time (hrs)				
	12	24	36	48	Mean

Ripened	7.76	7.77	7.79	7.81	7.78
Unripened	7.70	7.73	7.76	7.78	7.74
Mean	7.73	7.75	7.78	7.79	7.76

Processing Time (hrs)	Honey			Processing Temperature (^{0}C)			
	Ripened	Unripened	Mean	60	70	80	Mean
12	7.81	7.78	7.79	7.73	7.79	7.86	7.79
24	7.79	7.76	7.78	7.72	7.77	7.84	7.78
36	7.77	7.73	7.75	7.68	7.76	7.82	7.75
48	7.76	7.70	7.73	7.64	7.74	7.80	7.73
Mean	7.78	7.74	7.76	7.69	7.77	7.83	7.76

Honey	Processing Temperature (^{0}C)				CD (P≤0.05) Between
	60	70	80	Mean	
Ripened	7.72	7.78	7.84	7.78	Type of Honey: 0.53
Unripened	7.66	7.75	7.82	7.74	Processing Temperature: 0.60
Mean	7.69	7.77	7.83	7.76	Processing Time: 0.69
					Storage interval: 0.82

Packaging materials used. The mean values of taste of honey processed at 60^{0}C packaged in glass jars, plastic jars and polythene pouches were 7.83, 7.83 and 7.82 which decreased to 7.69, 7.69 and 7.69 (on the basis of 9.0 point) of honey processed at 80ºC, respectively.

Table 6: Mean values of taste (on the basis of 9.0) of honey packaged in polypack pouches as affected by type, processing temperature, processing time and storage interval

Particulars	**Storage interval (months)**					
Honey	**Fresh**	**3**	**6**	**9**	**12**	**Mean**
Ripened	7.83	7.79	7.78	7.77	7.75	7.78
Unripened	7.78	7.74	7.72	7.71	7.70	7.73
Mean	7.80	7.76	7.75	7.74	7.73	7.75
Processing Temperature (^{0}C)						
60	7.86	7.83	7.82	7.81	7.79	7.82
70	7.80	7.76	7.75	7.74	7.73	7.76
80	7.73	7.69	7.68	7.67	7.66	7.69
Mean	7.80	7.76	7.75	7.74	7.73	7.75
Processing Time (hrs)						
12	7.83	7.79	7.78	7.77	7.76	7.78
24	7.81	7.78	7.76	7.75	7.74	7.77
36	7.79	7.75	7.74	7.73	7.72	7.75
48	7.76	7.73	7.72	7.71	7.70	7.72
Mean	7.80	7.76	7.75	7.74	7.73	7.75

Honey	Processing Time (hrs)				
	12	24	36	48	Mean
Ripened	7.75	7.76	7.78	7.80	7.78
Unripened	7.69	7.73	7.75	7.77	7.73
Mean	7.72	7.75	7.77	7.78	7.75

Processing Time (hrs)	Honey			Processsing Temperature(^{0}C)			
	Ripened	Unripened	Mean	60	70	80	Mean
12	7.80	7.77	7.78	7.73	7.78	7.85	7.78
24	7.78	7.75	7.77	7.71	7.76	7.83	7.77
36	7.76	7.73	7.75	7.67	7.76	7.81	7.75
48	7.75	7.69	7.72	7.64	7.74	7.79	7.72
Mean	7.78	7.73	7.75	7.69	7.76	7.82	7.75

Honey	Processing Temperature(^{0}C)				CD (P≤0.05) Between
	60	**70**	**80**	**Mean**	
Ripened	7.72	7.77	7.84	7.78	Type of Honey: 0.55
Unripened	7.65	7.75	7.81	7.73	Processing Temperature: 0.62
Mean	7.69	7.76	7.82	7.75	Processing Time: 0.71
					Storage interval: 0.79

The processing time had significant effect on the taste of honey slightly decreased with the increase in processing time. The taste of honey processed for 12 hours and packaged in glass jars, plastic jars and polythene pouches were 7.79, 7.79 and 7.78 that decreased to 7.73, 7.73 and 7.72 (on the basis of 9.0 point) after 48 hours of processing time, respectively. The storage of honey also had significant effect on the taste of honey. The mean value of taste of fresh honey packaged in glass jars, plastic jars and polyback pouches was 7.80 which decreased to 7.74, 7.74 and 7.73 (on the basis of 9.0) after 12 months of storage, respectively.

Consistency

The data pertaining to consistency of honey packaged in glass jars, plastic jars and polypack pouches as affected by type of honey, processing temperature, processing time and storage intervals are given in Tables 7, 8 and 9 respectively. The ripened honey had non-significant effect on the consistency of honey packaged in glass jars, plastic jars and polypack pouches.

Table 7: Mean values of consistency (on the basis of 9.0) of honey packaged in glass jars as affected by type, processing temperature, processing time and storage interval

Particulars	**Storage intervals (months)**					
Honey	Fresh	3	6	9	12	Mean
Ripened	8.01	7.99	7.98	7.97	7.96	7.98
Unripened	7.99	7.98	7.96	7.95	7.94	7.96
Mean	8.00	7.98	7.97	7.96	7.95	7.97
Processing Temperature (^{0}C)						
60	8.10	8.07	8.06	8.05	8.04	8.06
70	8.01	7.98	7.96	7.95	7.94	7.96
80	7.91	7.89	7.88	7.87	7.86	7.88
Mean	8.00	7.98	7.97	7.96	7.95	7.97
Processing Time (hrs)						
12	8.04	8.00	8.00	7.99	7.98	8.00
24	8.01	7.99	7.98	7.97	7.96	7.98
36	8.00	7.97	7.96	7.95	7.94	7.96
48	7.97	7.95	7.94	7.93	7.92	7.94
Mean	8.00	7.98	7.97	7.96	7.95	7.97

Honey	Processing Time (hrs)				
	12	24	36	48	Mean
Ripened	7.95	7.97	7.99	8.00	7.98
Unripened	7.92	7.95	7.97	7.99	7.96
Mean	7.94	7.96	7.98	8.00	7.97

Processing Time (hrs)	Honey			Processing Temperature (^{0}C)			
	Ripened	Unripened	Mean	60	70	80	Mean
12	8.00	7.99	8.00	7.90	7.99	8.09	8.00
24	7.99	7.97	7.98	7.89	7.98	8.07	7.98
36	7.97	7.95	7.96	7.86	7.96	8.06	7.96
48	7.95	7.92	7.94	7.86	7.93	8.03	7.94
Mean	7.98	7.96	7.97	7.88	7.96	8.06	7.97

Honey	Processing Temperature (^{0}C)				CD (P≤0.05) Between
	60	**70**	**80**	Mean	
Ripened	7.89	7.97	8.07	7.98	Type of Honey: NS
Unripened	7.87	7.95	8.05	7.96	Processing Temperature: 0.57
Mean	7.88	7.96	8.06	7.97	Processing Time: 0.69
					Storage interval: 0.74

The processin temperature had significant effect on the consistency and slightly decreased with the increase in processing temperature irrespective of different packaging materials used. The mean values of consistency of honey processed at 60ºC packaged in glass jars,

Table 8: Mean values of consistency (on the basis of 9.0) of honey packaged in plastic jars as affected by type, processing temperature, processing time and storage interval

Particulars	**Storage interval (months)**					
Honey	**Fresh**	**3**	**6**	**9**	**12**	**Mean**
Ripened	8.01	7.99	7.98	7.97	7.95	7.98
Unripened	7.99	7.97	7.96	7.95	7.94	7.97
Mean	8.00	7.98	7.97	7.96	7.95	7.97
Processing Temperature (^{0}C)						
60	8.10	8.08	8.07	8.06	8.04	8.07
70	8.01	7.98	7.97	7.96	7.95	7.98
80	7.91	7.89	7.88	7.87	7.86	7.88
Mean	8.00	7.98	7.97	7.96	7.95	7.97
Processing Time (hrs)						
12	8.04	8.02	8.00	7.99	7.99	8.01
24	8.01	7.99	7.98	7.97	7.96	7.98
36	8.00	7.98	7.96	7.95	7.94	7.96
48	7.97	7.95	7.94	7.93	7.92	7.94

Mean	8.00	7.98	7.97	7.96	7.95	7.97
Honey	Processing Time (hrs)					
	12	24	36	48	Mean	
Ripened	7.95	7.97	7.98	8.03	7.98	
Unripened	7.94	7.96	7.98	7.99	7.97	
Mean	7.94	7.96	7.98	8.01	7.97	

Processing Time (hrs)	Honey			Processsing Temperature(^{0}C)			
	Ripened	Unripened	Mean	60	70	80	Mean
12	8.03	7.99	8.01	7.91	8.01	8.10	8.01
24	7.98	7.98	7.98	7.89	7.98	8.07	7.98
36	7.97	7.96	7.96	7.87	7.97	8.06	7.96
48	7.95	7.94	7.94	7.84	7.94	8.04	7.94
Mean	7.98	7.97	7.97	7.88	7.98	8.07	7.97

Honey	Processing Temperature (^{0}C)				CD (P≤0.05) Between
	60	70	80	Mean	
Ripened	7.88	7.98	8.08	7.98	Type of Honey: NS
Unripened	7.87	7.97	8.06	7.97	Processing Temperature: 0.65
Mean	7.88	7.98	8.07	7.97	Processing Time: 0.75
					Storage interval: 0.83

Plastic jars and polythene pouches were 8.06, 8.07 and 8.06 which decreased to 7.88, 7.88 and 7.87 (on the basis of 9.0) of honey processed at 80°C, respectively.

Table 9: Mean values of consistency (on the basis of 9.0) of honey packaged in polypack pouches as affected by type, processing temperature, processing time and storage interval

Particulars	**Storage interval (months)**					
Honey	**Fresh**	**3**	**6**	**9**	**12**	**Mean**
Ripened	8.01	7.98	7.97	7.96	7.95	7.97
Unripened	7.99	7.96	7.95	7.94	7.94	7.94
Mean	8.00	7.97	7.96	7.95	7.94	7.97
Processing Temperature (^{0}C)						
60	8.10	8.07	8.06	8.04	8.04	8.06
70	8.01	7.97	7.96	7.95	7.94	7.97
80	7.91	7.88	7.87	7.86	7.85	7.87
Mean	8.00	7.97	7.96	7.95	7.94	7.97
Processing Time (hrs)						
12	8.04	8.00	7.99	7.99	7.99	8.00
24	8.01	7.98	7.97	7.96	7.95	7.97
36	8.00	7.96	7.95	7.94	7.93	7.95
48	7.97	7.94	7.93	7.92	7.91	7.93
Mean	8.00	7.97	7.96	7.95	7.94	7.97

Honey	Processing Time (hrs)				
	12	24	36	48	Mean
Ripened	7.94	7.96	7.97	8.02	7.97
Unripened	7.93	7.95	7.97	7.98	7.96
Mean	7.93	7.95	7.97	8.00	7.97

Processing Time (hrs)	Honey			Processsing Temperature(^{0}C)			
	Ripened	Unripened	Mean	60	70	80	Mean
12	8.02	7.98	8.00	7.90	8.01	8.10	8.00
24	7.97	7.97	7.97	7.88	7.97	8.06	7.97
36	7.96	7.95	7.95	7.86	7.96	8.05	7.95
48	7.94	7.93	7.93	7.84	7.93	8.03	7.93
Mean	7.97	7.96	7.97	7.87	7.97	8.06	7.97

Honey	Processing Temperature (^{0}C)				CD (P≤0.05) Between
	60	70	80	Mean	
Ripened	7.87	7.97	8.07	7.97	Type of Honey: NS
Unripened	7.86	7.96	8.05	7.96	Processing Temperature: 0.72
Mean	7.87	7.97	8.06	7.97	Processing Time: 0.83
					Storage interval: 0.92

The processing time had significant effect on the consistency of honey that slightly decreased with the increase in processing time. The consistency of honey processed for 12 hours and packaged in glass jars, plastic jars and polythene pouches were 8.00, 8.01 and 8.00 that decreased to 7.94, 7.94 and 7.93 (on the basis of 9.0 point) after 48 hours of processing time, respectively. The consistency of the honey also significantly decreased with increase in storage time. The

mean values of fresh honey was 8.00 that decreased to 7.95, 7.95 and 7.94 (on the basis of 9.0 point) after 12 months of storage of honey packaged in glass jars, plastic jars and polypack pouches, respectively.

From the results of the study it has been observed that colour of honey darkens as processing temperature increases it also affects the taste and consistency of honey. Chukwu *et al.*, (2012) studied the sensory evaluation of honey and reported range of colour 4.81-6.13, taste 4.9-5.69 and consistency 4.63-5.25 respectively. Ciapinni *et al.*, (2013) studied lower values of honey range from 0.11-1.0 as compared to present study.

Minerals

Table 10 indicate the minerals content of honey as affected by type of honey, processing temperature, processing time and storage intervals. The ripening of honey had significant effect on the minerals content of honey. The mean values of sodium, potassium, calcium, magnesium, iron and zinc present in "ripened and unripened" honey were "1.90 and 2.10", "290.00 and 310.00", "7.00 and 9.00", "21.00 and 16.00", "1.00 and 2.00" and "4.00 and 5.00 mg/100g", respectively.

However, the mean values of sodium and potassium of honey processed at 60^0C were 2.20 and 240.00 mg/100g which slightly decreased to 2.10 and 190.00 mg/100g of honey processed at 80^0C. The processing time had significant effect on the minerals content of honey. The minerals content viz calcium, magnesium, iron and zinc of honey processed for 12 hours were 12.48, 22.00, 1.00 and 4.00 mg/100g which increased to 14.50, 24.30, 1.70 and 5.00 mg/100g of honey processed after 48 hours, respectively. However, the mean values of sodium and potassium of honey processed for 12 hours were 2.30 and 230.00 mg/100g which decreased to 1.80 and 200.00 mg/100g of honey processed after 48 hours, respectively. The value of minerals contents viz sodium, potassium, calcium, magnesium, iron and zinc of present study in honey ranged from 1.80 to 2.30, 190 to 310, 7.00 to 14.50, 16.00 to24.83, 1.00 to 1.76 and 4.00

Table 10: Minerals (mg/100g) of honey as affected by type of honey, processing temperature and processing time.

Honey	Sodium	Potassium	Calcium	Magnesium	Iron	Zinc
Ripened	1.90	290.00	7.00	21.00	1.00	4.00
Unripened	2.10	310.00	9.00	16.00	2.00	5.00
Mean	2.00	300.00	8.00	18.50	1.50	4.50
Processing Temperature (^{0}C)						
60	2.20	240.00	11.67	23.33	1.20	4.20
70	2.20	210.00	12.50	23.70	1.38	4.55
80	2.10	190.00	12.83	24.83	1.76	5.10
Mean	2.20	210.00	12.33	23.95	1.45	4.62
Processing Time (hrs)						
12	2.30	230.00	12.48	22.00	1.00	4.00
24	2.10	210.00	12.57	23.10	1.30	4.35
36	2.10	210.00	13.20	23.80	1.49	4.75
48	1.80	200.00	14.50	24.30	1.70	5.00
Mean	2.07	212.50	13.19	23.30	1.37	4.52
CD (P≤0.05) Between	Sodium	Potassium	Calcium	Magnesium	Iron	Zinc
Type of Honey	0.01	0.55	0.42	0.47	0.01	0.02
Processing Temperature	0.02	0.64	0.53	0.58	0.02	0.03
Processing Time	0.02	0.71	0.60	0.62	0.02	0.03

To 5.10 mg/100g, respectively. Adeniyi *et al.*, (2014) [2] and Addi *et al.*, (2017) [1] reported higher values of minerals as compared to present findings.

Conclusion

It can be concluded from the study that the honey processed at 60 and 70^0C was highly acceptable as compared to honey processed at 80^0C which produced slightly dark coloured 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.

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