Sensory acceptability of sodium caseinate based zinc fortified coated apricots

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Abstract

The current investigation was an endeavor to check the sensory acceptability of zinc fortified apricots using edible coating as a carrier. In this context, fortified apricots were prepared with various levels of sodium caseinate and zinc oxide (ZnO) coating mixtures as T1 & T2 having 1% sodium caseinate fortified with 20 & 40 ppm of ZnO, respectively whilst T3 & T4 having 2% sodium caseinate fortified with 20 & 40 ppm of ZnO, correspondingly. Furthermore, the apricots were stored at controlled climate chamber for a period of six weeks. The sensorial response for apricots was recorded over the storage fortnightly. From the statistical analysis, it is depicted that T3 (Sodium caseinate 2%; ZnO 20 ppm) and T4 (Sodium caseinate 2%; ZnO 40 ppm) were quite promising in maintaining the highest hedonic ratings at the end of the investigation however, both treatments showed results those were quite at par to each other.

Key words: Apricot, edible coating, zinc fortification, sensory evaluation

INTRODUCTION

Apricot (Prunus armeniaca L.) is an important horticultural crop of Pakistan. It belongs to family Rosaceae. The major apricot production areas in Pakistan are Malakand division, Northern areas and Balochistan (Jasra and Rafi, 2002). Apricot is cultivated worldwide for its fruit that can be eaten as fresh, pitted, dried, frozen or canned because it has excellent sensory and nutritional profile (Meratinić et al., 2011). It has delicious taste, potential consumer acceptability and high nutritional value (Hussain et al., 2010).

The post-harvest quality of the fruits is determined by its physical appearance, flavor & taste profile and aromatic attributes. However, during storage losses may occur if the fruit is handled improperly. These losses alter the physicochemical as well as sensory properties of the fruits (Gill et al., 2006). Furthermore, these post-harvest losses cause irreparable economic loss to the country. It is suggested that the proper handling of fruits after harvesting may improve the socioeconomic status of the country (Ali et al., 2011).

However, like other horticultural produces, apricot fruit faces major post-harvest losses owing to improper management practices that restrict its market in Pakistan. In the peak season, these losses go up to 44% of the total fruit produced due to perishability and limited marketing (Ali et al., 2011). To curtail these losses, various preservation approaches have been used. Amongst, edible coating has provided sufficient evidence as promising preservative technology to curtail the post-harvest losses and improving & maintaining the sensory quality of the coated fruits. Edible coating is a technique in which a thin layer of biodegradable/edible materials is applied on the fruit surface that protects it from the harms of external factors (Valencia-Chamorro et al., 2010). It perks up the nutritional worth and overall quality of the product by enhancing the shelf life (Robertson, 2006).

Hypozincemia, commonly known as zinc deficiency has prevailed to larger extent from some previous decades. It has long been overlooked but due to advances in food and nutrition sciences the issue has been identified and various approaches have been devised to overcome this nutritional dilemma (Prasad, 2012). Zinc is required by the body for proper metabolism and immune responses. Moreover, zinc deficiency is related to stunted growth and immaturity of T-lymphocyte cells and mental disorders (Raine, 2010; Prasad, 2012). In this context, there is a dire need to overcome this dietary insufficiency.

The current investigation was carried out to fortify the apricots with zinc and preserve the nutritional quality of the apricot by applying sodium caseinate based edible coating mixtures (Sodium caseinate 2%; ZnO 20 ppm) and (Sodium caseinate 2%; ZnO 40 ppm) as a carrier. In this context, fortified apricots were prepared from the statistical analysis, it is depicted that T3 (Sodium caseinate 2%; ZnO 20 ppm) and T4 (Sodium caseinate 2%; ZnO 40 ppm) were quite promising in maintaining the highest hedonic ratings at the end of the investigation however, both treatments showed results those were quite at par to each other.
coating. However, till date there is no study found that has used this technique to fortify fruits.

MATERIALS AND METHODS

Procurement and preparation of raw material

Fresh apricot fruit was procured from local market in Faisalabad, Pakistan on the basis of uniformity in size, shape, color, absence of physical damage or any evidence of abrasion. Afterwards the fruit was sorted and graded based on its physical appearance followed by washing to loosen the dirt and grits adhered to the surface in the Postgraduate Research Laboratory of the National Institute of Food Science & Technology, University of Agriculture, Faisalabad, Pakistan.

Development of fortified edible coatings

Zinc fortified sodium caseinate based coatings were developed using various additives and zinc oxide (ZnO) as fortificant. The treatment plan is given in Table 1.

Application of coatings on apricot and storage

The prepared coatings were applied on the fruit surface by dipping for 2 min followed by drying for 15-20 min. Afterwards, the coated apricots were stored at controlled climate chamber at 4±6 °C and 85% relative humidity for a period of six weeks.

Table 1: Treatment plan

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Sodium caseinate concentration (%)</th>
<th>ZnO (ppm)</th>
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<td>T₀</td>
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<tr>
<td>T₁</td>
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<td>T₂</td>
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<td>T₄</td>
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Sensory evaluation

Sensory evaluation based on color, flavor, taste and overall acceptability was conducted using 9-point hedonic scale (9 = like extremely; 1 = dislike extremely) according to the method described by Meilgaard et al. (2007). The evaluation was planned to be conducted fortnightly.

Statistical analysis

The data obtained from the observations was analyzed, presented in graphs and expressed as Mean±S.D.

RESULTS AND DISCUSSION

One of the important criteria influencing the product acceptability is its sensory response. Only the product having appealing color, flavor, taste and texture is accepted for consumption. In this study, apricot was subjected to sensory evaluation for color, flavor, taste and overall acceptability at fortnight intervals. Significant variations in hedonic ratings with respect to treatments and storage were observed throughout the trial.

Color of coated apricot

Mean scores for sensory color are depicted in Fig. 1, showing substantial decline in sensory response for color of apricot coated with various levels of zinc fortified sodium caseinate based edible coatings. At initiation, the maximum score was assigned to T₁ (Sodium caseinate 1%, ZnO 20 ppm) as 8.27±0.28 followed by T₄ (Sodium caseinate 2%, ZnO 40 ppm), T₂ (Sodium caseinate 2%, ZnO 20 ppm) and T₃ (Sodium caseinate 1%, ZnO 40 ppm) as 8.24±0.28, 8.21±0.28 and 8.19±0.28, respectively. Moreover, the least score was assigned to T₀ (Control) as 8.13±0.28. There was a visible decline in score for color during storage in sensory response for T₀ ranging from 6.98±0.23 to 5.13±0.17 at 14th and 28th day while 3.30±0.11 at 42nd day. However, T₄ and T₃ served as an impressive attempt to retain the color of coated apricots during storage. Over the storage, T₄ exhibited sensory responses for color of apricot as 7.43±0.24, 7.16±0.22 and 5.89±0.18 at 14th, 28th and 42nd day; moreover, T₃ got the scores as 7.39±0.24, 7.10±0.23 and 5.98±0.20 at mentioned intervals, respectively. For T₁ and T₂, the sensory responses regarding color were 7.25±0.24 and 7.23±0.24 at 14th day, respectively whilst 6.80±0.22 & 6.81±0.22 at 28th day and 5.74±0.20 & 5.87±0.20 at 42nd day of storage.

The findings of the current research are in tune with the earlier investigation of Han et al., (2005), who reported a massive contribution of edible coatings towards sensory perception. Moreover, they found that the coatings had a role in color retention and imparts a shiny gloss to strawberry. Furthermore, they evaluated that wax based coatings led to loss in the color of commodity. Similarly, results of Vargas et al. (2006) narrates that chitosan based coatings had a significant effect in color tonality and overall acceptability.
Figure 1: Mean scores for color of coated apricots

Figure 2: Mean scores for flavor of coated apricots

Figure 3: Mean scores for taste of coated apricots
Flavor of coated apricot

Mean sensory response for flavor of the coated and uncoated apricots are demonstrated in Fig. 2. Inference can easily be made from results that there occurred an appreciable decline in sensory acceptance of apricots for its flavor over the storage. Of the treatments, lowest score for color of apricot was given to T1 (Sodium caseinate 1%, ZnO 20 ppm) as 8.13±0.28 at initiation. However, Maximum of the scores was found to be possessed by T3 (Sodium caseinate 2%, ZnO 20 ppm) as 8.20±0.28 followed by T2 (Sodium caseinate 1%, ZnO 20 ppm) and T4 (Sodium caseinate 2%, ZnO 40 ppm) as 8.17±0.28 and 8.16±0.28, respectively at 0 day. Furthermore, T0 (Control) owned 8.15±0.28 score for the flavor at initiation of the trial. Over the storage, a steady decline was seen in sensory response as evident from the means that declined through 7.42±0.24 to 6.96±0.23, 7.33±0.24 to 6.79±0.22, 7.65±0.25 to 7.09±0.23 and 7.54±0.25 to 6.91±0.23 from 14th to 28th day for T1, T2, T3 and T4, respectively while for T0 the score decreased from 6.97±0.23 to 5.13±0.17 at mentioned intervals. However, T3 and T4 were remained quite impressive in maintain the flavor of apricot by owning the scores as 6.06±0.21 and 6.01±0.20, respectively at 14th day while 6.23±0.21 and 6.18±0.20 at 28th day. Moreover, mean scores for T1 and T3 were declined to 5.11±0.17 and 5.17±0.18, respectively at the termination of trial. The observed values for T0 at 14th, 28th and 42nd day were 6.24±0.21, 4.18±0.14 and 3.17±0.11, respectively.

Taste of coated apricot

Fig. 3 depicts the mean scores for sensory response regarding taste of apricot treated with various levels of zinc fortified edible coatings. It is clear from means that the highest score was given to T4 (Sodium caseinate 2%, ZnO 40 ppm) as 7.61±0.26 followed by T2 (Sodium caseinate 1%, ZnO 40 ppm) T3 (Sodium caseinate 2%, ZnO 20 ppm), T0 (Control) and T1 (Sodium caseinate 1%, ZnO 20 ppm) as 7.58±0.26, 7.57±0.26, 7.46±0.25 and 7.42±0.25, respectively at 0 day. During storage, there occurred a significant decline in the sensory response for taste of apricots as for T4 it declined to 7.00±0.23 at 14th day that further declined to 6.38±0.21 and 5.22±0.18 at 28th and 42nd day.

Likewise, for T3 the similar trend was observed and the scores owned were 6.64±0.22, 6.04±0.20 and 5.09±0.17 at 14th, 28th and 42nd day of storage, respectively. Similarly, T1 and T3 exhibited the mean scores for taste of apricot as 6.74±0.22 and 6.88±0.23, respectively at 14th day while 6.23±0.21 and 6.18±0.20 at 28th day. Moreover, mean scores for T1 and T3 were declined to 5.11±0.17 and 5.17±0.18, respectively at the termination of trial. The observed values for T0 at 14th, 28th and 42nd day were 6.24±0.21, 4.18±0.14 and 3.17±0.11, respectively.

Instant research discovers its resemblance with the previous findings of Del-Valle et al., (2005) who developed cactus mucilage based coatings and applied on strawberry. Furthermore, they were of the opinion that coatings had no appreciable effect on the natural flavor of the fruit while using cactus mucilage based edible coating for application on strawberry.


160
4.2.4. Overall acceptability of coated apricot

Mean scores for overall acceptability of zinc fortified apricots are expressed in Fig 4. From the means, clear depiction can be made that a substantial decrease in hedonic rating was obvious during storage. Of the treatments, T₄ (Sodium caseinate 2%, ZnO 40 ppm) received highest sensory response at 0 day as 7.95±0.27 followed by T₂ (Sodium caseinate 1%, ZnO 40 ppm), T₃ (Sodium caseinate 2%, ZnO 20 ppm) and T₁ (Sodium caseinate 1%, ZnO 20 ppm) as 7.86±0.27, 7.83±0.27 and 7.81±0.26, respectively. Moreover, T₀ (Control) owned 7.79±0.26 hedonic rating at initiation. Over the storage, a considerable decline was observed for sensory response regarding overall acceptability of apricots as evident from the means that fall to 5.75±0.20, 5.64±0.19, 5.41±0.18 and 5.58±0.19 for T₄, T₃, T₂, and T₁, respectively at 42nd day. However, for T₀ the decline was found to be 3.56±0.12 at the termination. Similarly, the recorded values for T₁ at 14th and 28th day were 7.11±0.23 and 6.66±0.22, respectively whilst for T₂ the hedonic rating was 7.10±0.23 and 6.51±0.21, respectively at mentioned intervals. T₄ and T₃ owned sensory response for overall acceptability as 7.37±0.24 and 7.24±0.24, respectively at 14th day. However, mean scores at 28th day of storage for T₄ and T₃ were 6.85±0.23 and 6.63±0.22, respectively. T₀ possessed 6.73±0.22 and 4.81±0.16 hedonic response at 14th and 28th day of storage.

The trend of current investigation resides in harmony with the earlier work of Kantor et al. (2008). They used electronic tongue for checking the sensorial behavior of apricot during storage and concluded that there occurs a decline in overall acceptability of apricot fruit during storage. The loss in hedonic rating may be due to the physicochemical changes that occurred in the fruits during storage rendering them unfit for getting good sensorial response. Similarly, Rojas-Grau et al. (2009) delineated edible coatings as a decisive factor in assuring acceptability for fresh cut fruits.

Conclusion

From the present research, it is deduced that zinc fortified sodium caseinate based coatings proved promising in preserving the hedonic rating of coated apricots. In this context, T₁ (Sodium caseinate 2%; ZnO 20 ppm) and T₄ (Sodium caseinate 2%; ZnO 40 ppm) were quite functional in sustaining the highest sensory response however, both treatments showed results those were quite at par to each other. Furthermore, there exists a need to explore potentials of other edible based coating materials that can be used with varying fortified formulations and additional quality preserving perspectives.

References
