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Development of dehydrated acid lime pickle

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Abstract

Acid lime is one of the commercially important citrus fruit grown in the country. It has multiple health benefits and nutritionally very rich. Fermented fruits and vegetables contain a diverse group of prebiotic compounds which attract and stimulate the growth of probiotics. Pickling is one of the most ancient methods of preserving food and is good appetizer and adds variety to daily diet. Acid lime has good commercial potential and cultivation area is gradually increasing because of high returns on the other hand, processing units are not available in growing area is one of the back drop under value addition sector. So to reduce post harvest loss the study was taken to develop dehydrated pickle. Optimization of lime pickle was carried out for all ingredients and optimized lime pickle recipe included 15 percent of salt, 1 percent turmeric powder, 5 percent chilli powder, 1 percent mustard dhal and 1 percent fenugreek powder. Standardization of temperature for dehydrating pickle revealed that 60°C for 10 hours found to be optimum. For rehydrating dehydrated pickle, 1:1 (pickle: water) ratio for 24 hours found to be optimum.

Keywords: Acid lime, dehydration, rehydration

Introduction

Acid lime (*Citrus aurantifolia* Swingle) belongs to Family Rutaceae, is one of the four commercially important citrus fruits grown in the country, besides sweet orange, mandarin and lemon. Lime is a versatile tropical fruit with multiple health benefits and gives relief from numerous diseases. Acid lime fruit is nutritionally very rich and have acidic property (light) that possesses natural antioxidants, antibacterial, anticarcinogenic properties and boosts immune system in human body. Fermented fruits and vegetables contain a diverse group of prebiotic compounds which attract and stimulate the growth of probiotics. Basic understanding about the relationship between food, beneficial microorganism, and health of the human being is important to improve the quality of food and also prevention of several diseases.

Pickling is one of the most ancient methods of preserving food. The word pickle is derived from the Dutch word “Pekel”, meaning brine. It is good appetizer and adds variety to daily diet. Pickles are very famous in India among all groups of people and they form an essential dietary part as an adjunct.

Pickles prepared from variety of fruits and vegetables are also being exported to other countries. They are basically prepared by brining or fermentation and/or using different types of spices, salts, vinegar, sugar and edible oil etc. It is one of the oldest and most successful method of food preservation known to human. The optimization of pickle quality depends on maintenance of proper acidity, salt concentration, temperature and sanitary conditions. Pickles add spice to meals and snacks. The skillful blending of spice, sugar and oil with fruit and vegetable gives crisp, firm texture, pungent taste and sweet-sour flavour.

Pickles serve as appetizers and help in digestion by aiding flow of gastric juices. Fermented pickles also have beneficial bacteria that can control harmful intestinal microbes. Acid lime has good commercial potential and cultivation area is gradually increasing because of high returns on the other hand, processing units are not available in growing area is one of the back drop under value addition sector. That is causing post harvest loss. The documentation about development of dehydrated acid lime pickle is unavailable. Hence, the present study was undertaken with the following objective to develop the dehydrated acid lime pickle.

Materials and Methods

Selection of raw material

Acid lime fruits at yellow ripe stage were procured from local market of Dharwad for the standardization of ready to use dehydrated acid lime pickle.

The ingredients salt, chilli powder (MTR brand), turmeric powder, mustard oil, spices like mustard dhal and fenugreek seeds were also purchased from local market.

Rehydration of dehydrated pickle

Optimized dehydrated pickles were subjected for rehydration with water in the ratio of 1:0.5, 1:1.0 and 1:1.5. The measured pickle and water were taken in the glass beaker, left for 24 hours for rehydration. Further, highly acceptable ratio of dehydrated pickle: water was taken for standardization of rehydration time.

Organoleptic evaluation of rehydrated pickle

All the rehydrated pickles from different pre-treatments and acid lime varieties were subjected for organoleptic evaluation on 9 point Hedonic scale. Evaluation was carried out by 10 semi-trained judges.

Results and Discussion

Optimization of salt

For the development of dehydrated pickle the optimization was done for salt incorporation. Fresh lime pieces were mixed with different proportion of salt (10, 15, 20 & 25%) and cured for one week (Bansal and Rani 2014). Further mixed with the spices and cured for 15 days. Later pickles were partially dried. Observations revealed that lime pieces treated with 10 percent were not cured well and peel was little hard. With addition of 15 per cent salt, lime pieces were cured well and after dehydration texture was firm with good flavour and acceptable salty taste. The lime pieces cured with 20percent and 25percent were too salty, had good flavour but salt crystals were found after dehydration. Highly acceptable proportion of 15percent salt addition was used for further experiment (Table 1).

Optimization of turmeric powder.

Optimization of turmeric addition was carried with 0.50, 1.00 & 1.50 percent. The lime pieces treated with 0.50 percent were light in colour and after dehydration this was not acceptable. Addition of 1.00 percent turmeric powder had pleasing colour and after dehydration the colour was acceptable and used for further study. Addition of 1.50 percent turmeric powder resulted dark in colour and after dehydration yellow colour was dominating (Table 2).

Optimization of chilli powder

Optimization of chilli powder for pickle development was carried out at 2.50, 5.00 & 7.50 percent. The lime pieces cured with 7.50 percent were dark in colour and after dehydration appearances were dull, too pungent in taste and were not acceptable. Addition of 2.50percent chilli powder, pickle was light in colour and after dehydration, added chilli powder was not sufficient and did not give pungent taste. The lime pieces treated with 5.00percent had acceptable colour and pungent taste, after dehydration had good colour so it is used for further study (Table 3).

Optimization of mustard dal.

The lime pieces were mixed with the mustard dhal at different

proportion i.e 1.00, 1.25 & 1.50 percent. The lime pieces were cured & then dried. The lime pieces treated with 1.25 and 1.50 percent were not acceptable, it affected taste and mouth feel. The lime pieces treated with 1.00 percent of mustard dhal were appealing in appearance and was used further experiment (Table 4).

Optimization of Fenugreek powder

The lime pieces were mixed with the fenugreek powder at different ratio i.e 1.00, 1.25 and 1.50 percent. The lime pieces were cured & then dried. The lime pieces treated with 1.25 percent and 1.50 percent were not acceptable, bitter in taste and had strong aroma. The lime pieces treated with 1.00 percent of fenugreek powder were appealing with good aroma and taste and are used further experiment (Table 5).

Optimization of dehydration temperature

The cured lime pieces were dehydrated in cabinet dryer at 60, 80 & 100 °C for ten, eight and six hours respectively (Singh *et al.*, 2016)^[3]. The lime pieces dehydrated at the temperature of 80 °C were shrunken and not acceptable in appearance. The lime pickles dehydrated at the 60 °C for 10 hours were less shrunken soft and firm in texture. The lime pickles dehydrated at 60 °C temperature are used for further study (Table 6).

Optimized recipe of dehydrated acid lime pickle

Optimized dehydrated pickle recipe included 15 percent salt, 5 percent chilli powder, 1percent turmeric powder, 1percent mustard dhal and 1percent fenugreek powder

Optimization of water for rehydration of dehydrated pickle

The dehydrated lime pickles were rehydrated with water in the ratio of 1:0.5, 1:1.0 & 1:1.5. The proportion of 1:0.5 ratio was not enough to rehydrate lime pickle completely. The dehydrated lime pickles rehydrated with 1:1.5 were very soft in texture and watery in appearance, while those rehydrated with 1:1.0 ratio were soft in texture, water was fully absorbed hence was used for further experiment (Table 7). For the development of dehydrated pickle, optimization was done for all ingredients such as salt, chilli powder, turmeric powder, mustard dhal and fenugreek powder (Table 1 to 5). The standardized recipe of dehydrated pickle included 15percent - salt, 1percent -turmeric powder, 5percent - chilli powder, 1 percent - mustard dhal, 1percent - fenugreek powder for 100 g lime pieces. The developed product had firm texture, good flavour with acceptable salty taste, bright colour with pungent taste (Plate 1). Temperature standardization for dehydrated pickle at the 60°C for 24 hours retained firm texture and less shrunken with acceptable sensory attributes (Table 6).

Rehydration of dehydrated pickle at 1:1 ratio had acceptable soft texture with good quality sensory attribute (Table 7). Similar observations were made by Bulla *et al* (2012)^[2] in rehydration of dehydrated mango pickle in 1:1 (pickle: water) ratio. The amount of water used for rehydration vary with difference in the drying method, size of the fruit, type of vegetables and spices used for pickle making (Tomar *et al.*, 1989)^[4].

Table 1: Salt optimization in preparation of acid lime pickle

Salt (%)	Before dehydration	After dehydration	Overall acceptability
10	Less curing	Less salt crystals, acceptable to some extent.	Acceptable
15	Optimum curing	Optimum Salt crystals were present	Highly acceptable
20	Excess curing, softening of pickle	More salt crystals were present	Not acceptable
25	Excess curing, softening of pickle	More salt crystals were present	Not acceptable

Table 2: Turmeric powder optimization in preparation of acid lime pickle

Turmeric powder (%)	Observations	Overall acceptability
0.5	Pickle was light in colour with less attractive appearance	Not acceptable
1.0	Acceptable colour with good appearance	Acceptable
1.5	Dark yellow in colour which affected appearance	Not acceptable

Table 3: Chilli powder optimization in preparation of acid lime pickle

Chilli powder (%)	Observations	Overall acceptability
2.5	Light in colour and less pungent in taste	Not acceptable
5.0	Attractive in colour with optimum pungent taste	Acceptable
7.5	Dark red colour with more pungent taste	Not acceptable

Table 4: Mustard dhal optimization in preparation of acid lime pickle

Mustard dhal (%)	Observations	Overall acceptability
1.00	Acceptable appearance with good mouth feel	Acceptable
1.25	Unacceptable appearance, mouth feel was affected	Not acceptable
1.50	Unacceptable appearance, mouth feel was affected	Not acceptable

Table 5: Fenugreek powder optimization in preparation of acid lime pickle

Fenugreek powder (%)	Observation	Overall acceptability
1.00	Appealing appearance with good taste and aroma	Acceptable
1.25	Unacceptable with bitter taste	Not acceptable
1.50	Unacceptable with bitter taste and strong aroma	Not acceptable

Table 6: Optimization of temperature for dehydration of acid lime pickle

Temperature (° C)	Time (hours)	Observation	Overall acceptability
60	10	Soft in texture with juicy retention and acceptable flavor	Not acceptable
80	8	Acceptable firm texture with good flavour and taste	Acceptable
100	6	Unacceptable Hard texture with acceptable flavor	Not acceptable

Note: 50 percent of moisture

Table 7: Rehydration of dehydrated lime pickle

Water percentage	Results	Overall acceptability
1:0.5	Water is not sufficient for rehydration	Not acceptable
1:1	Water is absorbed fully	Acceptable
1:1.5	Water is absorbed, lime pickle is very soft and pickle feel watery	Not acceptable

Note: Rehydrated for 24 hours



Before dehydration



After dehydration



After rehydration

Plate 1: Dehydrated acid lime pickle

Conclusion

Optimization of lime pickle was carried out for all ingredients i.e. salt, chilli powder, fenugreek powder, Mustard dal. Dehydration lime pickle and rehydration of dehydrated pickle had good flavour, appearance and firm texture with pleasant aroma. Acid lime pickle was prepared along with whole fruit and is consumed along with the peel hence post harvest wastage will be reduced. The dehydrated pickle is easy to carry, stored for longer period thus it is more beneficiary for consumers.

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