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Tanu Malik
Chaudhary Charan Singh Haryana Agriculture University, Hisar, Haryana, India.

Priyanka Kajla
Guru Jambheshwar University of Science and Technology, Hisar, Haryana, India.

Correspondence
Tanu Malik
Chaudhary Charan Singh Haryana Agriculture University, Hisar, Haryana, India.

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Development of ready to cook curry from dried vegetables

Tanu Malik and Priyanka Kajla

Abstract
The changes in the traditional family structure and hurried life style have influenced the eating patterns and food choices in the society. Convenience foods are, therefore, becoming increasingly popular in World. The problems of production losses and fluctuation of vegetables prices can be overcome by drying the vegetables and by formulating a shelf stable product which can be stored longer and sold later on. The preservation of vegetables has been done as dried product to overcome the problems associated with vegetables.

The research project was conducted to develop such a ready to cook product which fits the busy lifestyle of people as well as does not compromise on part of their health. The ready to cook curry was prepared by washing, cutting, boiling (till vegetables gets soft) and blanching (5 min in 5%brine solution) and then drying five seasonal vegetables: carrot, peas, potato, cauliflower, beans in hot air dryer at 65±5°C for 10-12 hr. A comparison was made between boiling and blanching, and found that blanched RTC curry was more nutritious then boiled curry. As it have more rehydration ratio, more nutrients retention and less color degradation. A standardized gravy mix powder (onion, garlic, spices and herbs) was used to add flavor. The serving size for one person contained 25 g dried vegetables, 10 g gravy mix powder and 200 ml water was added. The recipe was finalized after trials. The curry was ready in approximately 5 minutes in pressure cooker.

Keywords: cook curry, dried vegetables.

1. Introduction
"India Ready-to-Cook Food Market Forecast & Opportunities, 2019"**,** estimated that the market of RTC food products in India has touched US$ 120 million in 2014. Dessert mixes, snack mixes and curry making enablers have been divided as parts of RTC market, among these three product categories, dessert mixes were at the top position and still expected to continue their dominance till 2019. Vegetables, as well as fruits, have high moisture content and high water activity (a_w). These lead them to be highly perishable since moisture content and water activity are one of the important factors for the growth of different microbes.

One of the possibilities of post-harvest processing of fruits and vegetables is drying. Artificial convective drying is the most frequently applied methods of this ancient preservation method. The main purposes of drying are to increase shelf life, reduce packaging and storage costs, lower transporting weights, improve sensory qualities, store flavors, and preserve nutritional value.

Thus keeping in mind the changing lifestyle, increased need for RTC foods, the present study was carried out to develop nutritious RTC Curry from dried vegetables. Ready to reconstitute foods, also branded as instant or convenience foods, may be distinct as foods which have undergone major processing treatments by the manufacturers such that need little or no cooking before consumption. Separately from refrigeration, they are ready to eat. With a sturdy demand for convenience and take away foods, there has been a marked increase in popularity of ready to reconstitute foods in India (Arya, 1992). Blanching is a pre-treatment technique uses for inactivation of enzymes. Blanching process improves the quality of fruits and vegetables i.e. color, nutritive value, texture.

2. Material and Methods

2.1 Raw material and chemicals

The present study was conducted in the laboratory of the department of Food Technology, GJUS&T, Hisar (India). Seasonal vegetables selected were Potato, carrot, beans, cauliflower, peas and procured from the local market. All chemicals used in the study were of analytical grade. In present investigation, all the vegetables selected were fresh, firm, free from dust, blemishes, insect damage or mechanical injury. After that, all vegetables were washed with clean water, peeled and cut. Carrots were cut into slices with a thickness of 0.5 cm. Beans were cut with a length of 2 cm. Potato into the form of cubes. Each small branch of cauliflower was simply taken out. Peas were shelled. Vegetables were blanched in 5% brine solution for 5 min. After blanching the vegetables were dipped in cold water and excess water was removed with a filter paper.

2.2 Processing of vegetables

Vegetables were washed, peeled, cut and blanched in 5% brine solution. The blanched vegetables were dried at 65±5ºC to a final moisture content between 3.5-4.3 percent and packed in LDPE pouches for storage studies and for further analysis.

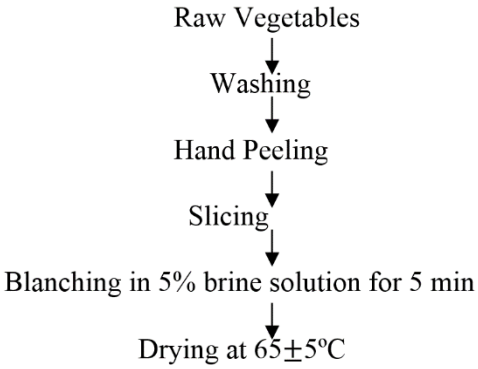

Fig 1: Schematic diagram of drying vegetables

Fig 1: Pouch showing dried and blanched RTC vegetables with gravy mix powder

2.3 Preparation of gravy mix powder

Gravy mix powder was prepared by dry blending the seasonings- cumin seeds, laung, dalchini, amchur, red pepper, turmeric, dried onion, garlic, and salt according to taste. All ingredients were dry roasted except cumin seeds. Cumin seeds can be roasted separately. The mixture was cooled down and ground to fine powder. Prepared mixture was placed in cool, dry place in airtight container.

2.4 Preparation of product

The preparation of the product mainly consisted of making the dried vegetables and preparing the dry blend of curry mix powder, in which rehydrated vegetables were to be put to make it a complete delicacy. The dried product was packed in low density polyethylene laminate sachets.

2.5 Curry preparation

Ready to Cook Curry was prepared by soaking blanched dried vegetables in boiled water for 10 minutes. 2.5 grams of dried bhuna masala was taken in a pressure cooker with a small amount of refined oil and sautéed. The soaked vegetables were then transferred to cooker along with 200 ml of water and cooked till 3 whistles.

3. Quality analysis

3.1.1 Blanching adequacy-peroxidase test

This test was performed using the method described by Ranganna (1986) [9]. The vegetables were cut into small pieces. 10 g of sample was taken and ground in a mortar. Water was added in small portions and filtered. To 2 ml of filtrate, 1 ml of guaiacol solution was added and then 1 ml of H_2O_2 solution. If no color develops in 3.5 minutes, then the peroxidase enzyme is inactivated and the product is adequately blanched.

3.1.2 Rehydration ratio

2 gm of dry material was placed in 500 ml beaker. To the beaker, 80-150 ml of distilled water was added and cover with a watch glass. Vegetables were boiled for 5 min on an electric heater.

3.2 Proximate analysis of dried vegetables

3.2.1 Moisture

The moisture content of the sample was determined by hot air oven method as described in AOAC (2005). 2 gm sample was placed in the oven at 105^0 C for 3 hr till constant weight was achieved.

3.2.2 Ash

The details described in AOAC (2005) were followed for the estimation of total ash contents. The sample was tested for total ash content by taking a 2g sample in tared crucibles and charred on a flame until it turned black and put into a muffle furnace maintained at a temperature of 550 °C for 5 hours or till a grey color of ash was obtained.

3.2.3 Fat

The crude fat content in dried (2gm) sample was determined by Soxhlet apparatus for 3 hours using petroleum ether as a solvent by following the procedure described in AOAC (2005).

3.2.4 Protein

The protein content was estimated according to the Modified Lowry method as described in AOAC (2005).

3.2.5 Crude fiber

The crude fiber was estimated according to the procedure as outlined in AOAC (2005). It was carried out by taking 2g of each fat-free sample and digested first with 1.25% H_2SO_4, washed with distilled water and filtered, then again digested with 1.25% NaOH solution, washed with distilled water and filtered. Then ignited the sample residue by placing the digested samples in a muffle furnace maintained for 3-5 hours at a temperature of 550-650 °C till grey or white ash was obtained.

3.2.6 Carbohydrates
Carbohydrates in the dried sample were calculated by the difference
% Carbohydrates= 100- (% Moisture+ % Crude protein+ % Fat+ % Ash+ % Crude fibre)

3.2.7 Energy
Energy in the dried sample was estimated using following formula:
Protein, 4.0Kcal/g: fats and oils, 9.0 Kcal/g and carbohydrates, 4.0 Kcal/g and the formula used was: FEV=(%CP×4.0) +(%FO×9.0)+(%CHO×4.0) all in Kcal/g.
Where FEV=food energy value, CP=crude protein, FO= fats and oils and CHO= carbohydrates

3.3 Sensory evaluation
The prepared RTC was evaluated for its acceptability on a 9 point hedonic rating scale. Sensory evaluation of RTC curry was done by presenting approximately 25 g of hot reconstituted vegetables curry to semi-trained panelists selected from faculty of food technology department. Panel members were directed to judge each sample on basis of appearance, odour, taste and flavour to find the overall acceptability and indicate their degree of liking on a 9- point Hedonic scale.

3.4 Statistical analysis
The data generated during the formulation of RTC Curry were statistically analyzed using IBM SPSS software for Analysis of variance. Significant differences among the means of the samples for the chemical and physical measurements were determined by one way analysis of variance using Duncan's multiple range comparison at 95 percent of confidence.

4. Results and Discussion
The present study was undertaken with a prime motive to develop a technology to preserve vegetables using a concept of low moisture foods. To make it as a complete convenience food, curry part was also included with it.

4.1 Blanching of vegetables- Effect of blanching on peroxidase enzyme (Blanching Adequacy)
Vegetables obtained from the market were peeled, washed and blanched in water by different time-temperature combinations. The results of blanching studies based on peroxidase enzyme activity are presented in Table 1. Enzyme test for adequacy of blanching reveals that inactivation of peroxidase enzyme was more at high temperature with gradual decrease in time. A blanching time-temperature combination of two minutes at 100ºC and five minutes at 80ºC were used as blanching time durations at these temperatures resulted in the inactivation of peroxidase in the samples. Blanching at low temperature for low blanching time durations showed presence of peroxidase enzyme in the tested samples. Pereira and Thompson (1984) reported that no enzyme activity was detected in peas when blanched at 96ºC for two minutes. On the other hand Polyak- Feher *et al.* (1993) [8] observed complete inactivation of peroxidase enzyme in the temperature range of 80-85ºC.

Fig 2: Representing blanched vegetables

Table 1: Blanching adequacy for five vegetables at a different time

Vegetables	Blanching(2 min)	Blanching(5 min)
Beans	-	+
Carrot	+	+
Cauliflower	-	+
Peas	+	+
Potato	-	+

A negative result indicates the formation of red color on addition of reagents while no color formation indicates a positive result. Two-minute blanching was not efficient for beans, cauliflower, and potatoes which mean that peroxidase enzyme inactivation required more than two minutes. Therefore, five min blanching was done which inactivates the peroxidase enzyme.

4.2 Effect of pretreatment on rehydration ratio of vegetables
The rehydration ratio of dried vegetables in blanched water was 3.16 ±0.20. The blanching in tap water improved rehydration ratio of the dried product. The pre-drying treatments like blanching have improved rehydration ratio. It may be concluded from above discussion that vegetables blanched for five minutes in 5 percent brine solution gave the best color and high rehydration ratio. It is due to fact that blanching is necessary to inactivate peroxidase enzyme (Mahendran and Prasannath, 2008) [5].

4.3 Moisture content
The moisture content of blanched dried vegetables at 65±5ºC was 4.27±0.46 % (db) (Table.2). The increase of drying air temperature has resulted in a decrease of the residual moisture content of vegetables. This might be because that higher the drying air temperature, lower will the relative humidity of the air and more will be the removal of moisture from the product. Abasi *et al.* (2009) [1] reported an increase in operational temperature in a certain time, leads to a decrease in the moisture content of the sample since the evaporation rate increases with increasing temperature.

Table 2: Proximate analysis of RTC Curry

Sample	Moisture (%)	Ash (%)	Fibre (%)	Protein (%)	Fat (%)	Carbohydrates (%)	Energy (calorie)
Blanched	4.27±0.42	6.24±0.28	12.17±1.72	3.17±0.34	0.97±0.17	75.45±0.70	320.66±1.29

4.4 Ash content
The total ash content of blanched vegetables dried at 65±5ºC temperature was 6.24±0.28% (db). Blanching pretreatment resulted in a decrease in ash content of vegetables. This might be due to the loss of minerals during blanching resulted in a decrease in dry matter led to decrease of ash content Nilnakara (2009) [6].

4.5 Crude fiber content
The crude fiber content of blanched vegetables dried at 65±5ºC was 12.17±1.72 % (db), respectively (Table 2). This indicates that the blanching pretreatment resulted in an increase in crude fiber content of vegetables. This might be due to the leaching of soluble solids during blanching which in turn result in a decrease of total dry matter. Therefore, an increase in the proportion of the crude fiber per unit dry matter has been observed in the blanched samples. Nilnakara (2009) [6] also reported the loss of low molecular weight component such as minerals, sugar, and vitamins from the plant cells to hot water during blanching; and a decrease in the total solid thus led to the relative increase in the fiber content on dry basis during a study on cabbage outer leaves.

4.6 Crude protein content
The total protein content of blanched vegetables dried at 65ºC temperatures was 3.17±0.34 % (db), (Table 2). This indicates that the blanching resulted in a decrease of the protein content of the vegetables. This might be due to the reason that there might be thermal degradation and leaching of soluble amino acids during blanching. Similarly, Guida (2013) [4] reported the reduction in protein content during blanching of artichoke heads. The increase of drying air temperature has also resulted in a decrease of total protein content. The reduction of protein content with an increase of drying air temperature might be due to protein denaturation. Pendre, (2012) [7] also reported the decrease of the protein content of dried okra with an increase of drying air temperature.

4.7 Crude fat content
The total fat content of blanched dried vegetables at 65ºC was 0.97±0.17 % (db), (Table 2). This indicates that the blanching resulted in a decrease of fat content in dried vegetables. In a study on the effect of blanching on okra (ladyfinger) was conducted by Eze & Akubor, (2012) [3] reported fiber, fat and carbohydrate content were reduced after blanching.

4.8 Carbohydrate content
The total carbohydrate content of blanched dried vegetables at 65±5ºC was 75.45±0.70 % (db) (Table 2). Blanching pretreatment is responsible to decrease carbohydrate content of dried vegetables. This might be due to leaching of soluble component like minerals, sugar, and vitamins in water during blanching resulting into a decrease in total solid. Nilnakara (2009) [6] also reported that decrease of the carbohydrate content of cabbage outer leaf powder after blanching.

4.9 Energy content
The energy content of blanched dried vegetables at 65±5ºC was 320.66±1.29Kcal/g (Table 2). Blanched vegetable gives this energy content as it contain protein, fat content hence provides high energy.

4.10 Sensory evaluation of the RTC curry
Acceptability of any product is assessed by its sensory evaluation by a trained panel of judges. Ideally, a curry mix should possess a pleasant and fresh flavor with a firm, smooth texture. For evaluating the sensory attributes of the formulated RTC curry from dried vegetables, the 9-point Hedonic scale was used. The sensory characteristics included appearance, taste, texture, aroma and overall acceptability (Table 3).

Table 3: Effect of pretreatment on sensory analysis of RTC curry

Sample	Appearance	Taste	Texture	Aroma	Overall Acceptability
Blanched	8.00±1.05	8.10±0.87	8.20±0.63	8.20±0.63	8.10±0.87

Fig 3: Showing prepared RTC Curry

The consumer acceptance of a RTC blanched curry shows appearance for blanched sample more i.e. 8.00±1.05 on 9-point hedonic scale. This may be due to fact that blanching increases the color efficiency. On the basis of the average sensory score on taste, attribute blanched curry has more score i.e. 8.10±0.87. In the same way, texture and aroma have more score for blanched sample. From all these sensory score overall acceptability for blanched RTC curry is 8.10±0.87. Hence, blanched RTC curry was best and has more sensory attributes very high.

5. Conclusion
India occupies a premium position in the world in vegetable production. But due to lack of improper handling, storage and processing about one fourth are spoiled. The vegetables impart important role in food due to its nutritional value. Drying is one of the most important primary operations for increasing the shelf life of the vegetables by reducing their moisture. Ready to cook curry from dried vegetables, took less than 7 minutes to prepare. It can be concluded that blanched vegetables have retained many nutrients. Therefore, it is recommended that a blanched RTC curry can be best prepared in terms of nutrional, and organoleptically.

6. References

1. Abasi S, Mousavi SM, Mohebi M, Kiani S. Effect of time and temperature on moisture content, shrinkage, and rehydration of dried onion. Iranian Journal of Chemical Engineering 2009; 6(3):57-60.
2. Arya SS, Thakur BR. Instant Halwa (Kesari Bath) Mix—Storage Stability and Packaging Requirements. Indian Food Industry. 1986; 5(4):119-121.
3. Eze JI, Akubor PI. Effect of drying methods and storage on the physicochemical properties of okra. Journal of Food Processing and Technology, 2012, 3(8).
4. Guida V, Ferrari G, Pataro G, Chambery A, Di Maro A, Parente A. The effects of ohmic and conventional blanching on the nutritional, bioactive compounds and quality parameters of artichoke heads. LWT-Food Science and Technology 2013; 53(2):569-579.

5. Mahendran T, Prasannath K. Influence of pre-treatments on quality of dehydrated ripe banana (Musa acuminata cv. Embul). Journal of food and agriculture, 2010, 1(2).
6. Nilnakara S, Chiewchan N, Devahastin S. Production of antioxidant dietary fiber powder from cabbage outer leaves. Food and Bioproducts Processing 2009; 87(4):301-307.
7. Pendre NK, Nema PK, Sharma HP, Rathore SS, Kushwah SS. Effect of drying temperature and slice size on quality of dried okra (Abelmoschus esculentus (L.) Moench). Journal of food science and technology 2012; 49(3):378-381.
8. Polyak-Feher K, Horti K, Koncz A, Kriston A, Meszaros L, Urbanyi G. Modernization of the technology of pre-cooking. Acta Alimentaria-an International Journal of Food Science. 1993; 22(1):54-54.
9. Ranganna S. Handbook of analysis and quality control for fruits and Vegetables 2nd edition Product Published by Tata Mc Graw Hill, New Delhi, 1986.