

STUDY ON THE EFFECT OF PACKAGING MATERIALS ON THE QUALITY ATTRIBUTES OF DRIED GREEN CHILLI POWDER

Rabia Lal¹, Aasia Akbar Panhwar¹, Saghir Ahmed Shaikh¹, Ayaz Ali Lashari², Rameez Raja Kaleri^{3*}, Aijaz Ali Mastoi⁶, Shakeel Ahmed⁵, Nazar Muhammad², Deepesh Kumar Bhuptani⁴, Niaz Muhammad² and Majid Ali⁷

¹Institute of Food Sciences and Technology, Sindh Agriculture University, Tandojam

²Agriculture Research Department, Usta Muhammad Government of Balochistan

³Department of Animal Breeding and Generics, Sindh Agriculture University, Tandojam

⁴Department of Meat Technology, Shaheed Benazir Bhutto University, of Veterinary and Animal Sciences, Sakrand

⁵Directorate of Agriculture Research Usta Muhammad, Balochistan.

⁶Department of Industries & Commerce, Turbat, Balochistan.

⁷Department of Farm Water Management, Balochistan.

*corresponding author: rameezkaleri@gmail.com

ABSTRACT

The Present study was aimed to ascertain better packaging materials for the storage of shelf life under ambient temperature. Present experiment was performed at Laboratory of Institute of Food Sciences and Technology, Sindh Agriculture University, Tandojam. In this study green chillies powder was treated with various treatments including three treatments, T1 (control), T2 (aluminum foil) and T3 in (transparent glass bottle) for 90 days at room temperature to observe the better color and shelf life. The green chili powder samples were evaluated on the basis of physicochemical properties. The finding of our study revealed that shelf life of aluminum foils was better as compared to bottle and open without packaging. It is concluded that dry green chili powder can be stored in aluminum foil packing for 3 month with better taste and quality.

Key words: Green chilli, packaging, quality attributes

INTRODUCTION

Chilli (*Capsicum annum* L.) belonged to the family of Solanaceae is vegetable and spice crop have significant values in Pakistan economy. The chilli is widely used as a major ingredient in everyday curries, chatnies and pickles. It is considered a highly important remunerative that brought a better net return to the agriculture farmers. In Pakistan chilli has been cultivated in southern part of country with production increasing about 89% of total production of Sindh province. The chilli produced by Punjab, KPKP and Balochistan 6.3, 3.4, and 0.6%, respectively only of the total production (Khokhar, 2013). Chilli is mainly cultivated in Sindh, Hyderabad, Badin and Mirpur khas and its adjoining areas of Sindh province. The drying of plants or vegetables can be defined as process to reduce the level of moisture due to heat and mass transfer; this is an oldest procedure of food preservation (Gupta *et al.*, 2002). Packaging material has a very important role in maintaining the quality and shelf life of food items for long period of time. It is necessary to develop and design the package in such a way that not only contains food products but also protects the food from its added values. The packaging material should be made in such a method that its design may directly affect the purchase design of consumer (Falik *et al.*, 2009; Da Cruz, 2007). Food packaging plays a major role for determining the stability of food items by affecting on those factors which may attributes the quality of food during storage time (Robertson, 2006). Food packaging is an important technology for addressing the always increasing demand for freshness, ease, convenience, safety, shelf life and security of food items (Farheen *et al.*, 2018; Janna, 2012). Keeping in the view of importance of packaging material and its influence on the quality of chillies present study was designed to observe the effect of packaging materials on the quality attributes of dried green chilli powder.

MATERIALS AND METHODS

Preparation of Experiment

The experiment was conducted at the laboratory Institute of Food Sciences and Technology, Sindh Agrivulture University, Tandojam. For this purpose, chillies were washed, cleaned dried and sliced into two equal parts using stainless steel knife and placed in an aluminum trays in a single layer for shade drying. After drying, chilli was grinded into a commercial grinding machine and was stored at room temperature in different packaging materials. It was evaluated for its quality and characterization of green chilli powder.

Treatment materials

T₁ = Control (i.e without packaging material)

T₂ = Transparent glass bottle

T₃ = Aluminum foil

Sample collection

Fresh green chilli were collected from farmer field from Thallari (Thallari variety) and processing was laboratory Institute of Food Sciences and Technology, Sindh Agrivulture University, Tandojam.

Processing of Green Chillies

Green chilli was washed to remove the impurities. The green chilli were cut into two pieces with steel knife, than cutted green chilli were kept in shade for dehydration purpose at room temperature for good color and better shelf life.

The determination of physico-chemical properties of green chilli powder was performed by the procedure as suggested by (Ansari *et al.*, 2020).

Following physico-chemical properties of green chili powder were observed.

Determination of moisture content (%), Determination of protein (%), Determination of fat (%), Determination of titratable acidity (%), Vitamin C (ascorbic Acid) determination (mg /100 g), Determination of pH, Determination of Total Soluble Solids (%), Determination of Ash (%), Determination of Crude Fiber (%), Determination of Total Carbohydrates (%), Determination of Energy value (kcal 100/g).

RESULTS

In order to observe the influence of various packaging material on the quality attributes of dry green chillies powder, this study was performed at the laboratory Institute of Food Sciences and Technology, Sindh Agrivulture University, Tandojam. The treatments included: T1 = Control (i.e without packaging material), T2 = Transparent glass bottle, T3 = Aluminum foil.

During this study, the following parameters of economic importance were also studies:

Moisture (%), ash (%), pH, Total soluble solids (^oBrix,) ascorbic Acid (vitamin c mg 100g⁻¹), titratable acidity (%), fat (%), protein (%) and carbohydrates (%) were recorded for analysis. Detailed information about the paramters has been given in (Tables 1-10) and analysis of variance as (Appendix I-X).

Moisture (%)

The results are presented in Table 1. The results are significantly (P<0.05) influenced by different packing materials. The result revealed that the highest chillies moisture (9.72%) was recorded under control (i.e without packaging material), followed by fresh dried chili powder with (9.30 %) moisture. The results further showed that the dried chillies packaged in transparent glass bottle after 90 days storage was noted (8.39%) moisture, the minimum moisture (7.92%) when the chilli packed with aluminum foil. It was observed that aluminum foil was favourable packing for chillies; it is therefore moisture % LSD test showed that moisture % was recorded significantly differed in different packagings (P ≥ 0.05).

Ash (%)

The results revealed that the maximum chilli ash (8.53%) was observed under control (i.e without packaging material), followed by aluminum foil with 8.52 % ash. However, transparent glass bottle after 90 days storage was noted minimum ash (8.42 %). The LSD test showed that moisture % was recorded non-significantly differed in different packagings (p ≤ 0.05) (Table 1).

Total soluble solids (^oBrix)

The results revealed that the maximum total soluble solids (2.63^oBrix) were observed under control (i.e without packaging material), followed by transparent glass bottle after 90 days storage with 2.58 ^oBrix total

soluble solids. However, chilli powder packed in Aluminum foil after 90 days storage was recorded (2.41°Brix) total soluble solid. The LSD test demonstrated that the total soluble solids (°Brix) under different packing materials were not significant ($p \leq 0.05$) (Table 1).

Treatments	Moisture content (%)	Ash (%)	Total Soluble Solids (%)	pH	Vitamin C (ascorbic Acid) (mg/100 g)	Fat (%)	Protein (%)	Titratable acidity (%)	Crude Fiber (%)	Total Carbohydrates (%)	Energy value (kcal/100g)
Control	9.30 B	8.56	2.65	5.51 B	28.20 C	2.83 A	7.45	0.142 B	2.19	4.02	61.17 B
T1	9.72 A	8.53	2.63	5.45 C	29.60 C	2.0 B	7.34	0.142 B	2.53	4.02	89.96 AB
T2	8.39 C	8.42	2.58	5.47 C	35.72 B	2.73 A	7.65	0.143 B	2.44	4.41	97.05 A
T3	7.92 D	8.52	2.41	5.58 A	43.24 A	2.73 A	8.50	0.324 B	2.62	4.84	101.63 A
LSD _{0.05}	0.3784	NS	NS	0.0352	3.0674	0.5671	NS	0.057	NS	NS	34.679

The values are expressed on a dry weight basis; T1 = Control (i.e without packaging material); T2 = Transparent glass bottle; T3 = Aluminum foil. Similar letters in each column are not significantly different according to Duncan Multiple Range Test at $p < 0.05$.

Table 1. Effect of packing materials on physico-chemical characters of dried green chilli powder.

pH value

The results revealed that the maximum chilli pH value (5.58) was recorded in chilli packed with aluminum foil after 90 days storage followed by transparent glass bottle having 5.47 pH values. However, the lowest pH values were recorded to be 5.45 without any packaging. It was observed that aluminum foil was found favorable packaging, so pH values were observed better. The LSD test showed that pH values % for various packaging material were recorded non-significantly differed in differed ($p \leq 0.05$) among T1 (control group without packaging) and T2 (Transparent glass bottle) (Table 1).

Ascorbic Acid (Vitamin C) (mg/100g)

It was observed from the findings of our study that the highest chilli vitamin C (43.24 mg/100g) when the chilli packed with aluminum foil after storage 90 days, followed by transparent glass bottle after 90 days storage with 35.72 mg/100g vitamin C. However, the minimum vitamin C (29.64 mg/100g) was observed from control (i.e without packaging material). It was found that aluminum foil was optimum for chilli so far, vitamin C (mg/100g). The LSD test demonstrated that the vitamin C (mg/100g) various packaging material were observed significantly differed ($p \geq 0.05$) (Table 1).

Fat (%)

It was observed from the findings that the highest chilli fat (2.73%) was recorded in Aluminum foil after 90 days storage. The results further revealed that the minimum 2.00% fat was recorded in control (without packing materials). It was observed that aluminum foil was observed favorable packing material for fat %.

It was found that aluminum foil was optimum for chilli so far, the fat (%). The LSD test demonstrated that fat % was observed non-significantly ($P \leq 0.05$) differed among Control and Transparent glass cover and Significant differed was observed between aluminum foil packaging ($p \geq 0.05$) (Table 1).

Crude fiber %

The results revealed that the maximum crude fiber (2.62 %) was recorded in Aluminum foil after 90 days of storage followed by control (without packing materials) after 90 days storage with 2.53 % crude fiber. However, the minimum crude fiber (2.44 %) was observed under transparent glass bottle after 90 days storage.

It was observed that aluminum foil for chilli was favorable. The LSD test showed that crude fiber % in various packing materials were non-significantly differed ($p \geq 0.05$) (Table 1).

Protein (%)

It was observed from the findings of our result that highest chilli protein (8.50%) when the chilli packed with Aluminum foil after 90 days storage followed by transparent glass bottle after 90 days storage with 7.65% protein. However, the minimum protein (7.34%) was observed under control (i.e without packaging material). It was observed that aluminum foil was observed favorable for chilli protein. The results of LSD test showed that protein % for various packing material was observed non-significant differed ($p \leq 0.05$) (Table 1).

Titrateable acidity (%)

The results revealed that the maximum chilli titrateable acidity (0.324%) when the chilli packed with aluminum foil after 90 days storage, followed by transparent glass bottle after 90 days storage with (0.143%) titrateable acidity. However, the minimum titrateable acidity (0.142%) was observed under control (i.e without packaging material). It was observed that aluminum foil was observed favorable for chilli titrateable acidity (%). The results of LSD test showed that titrateable acidity (%) various packing materials significant differed ($P \leq 0.05$).and non-significant ($p > 0.05$) between T2 = Transparent glass bottle and T3 = Aluminum foil (Table 1).

Total carbohydrate (%)

The results revealed that the maximum chilli total carbohydrate (4.84%) when the chilli packed with aluminum foil after 90 days storage, followed by transparent glass bottle after 90 days storage with (4.41%) total carbohydrate. However, the minimum total carbohydrate (4.02%) was observed under control (i.e without packaging material). It was observed that aluminum foil was observed favorable for chilli so far the total carbohydrate (%).The results of LSD test showed that total carbohydrate (%) various packing materials were observed non significantly differed ($p \geq 0.05$) (Table 1).

Energy value

The results revealed that the maximum chilli energy value (101.63 Kcal 100g⁻¹) when the chilli packed with aluminum foil after 90 days storage, followed by transparent glass bottle after 90 days storage with 97.05 (Kcal-100g⁻¹) energy value. Whereas the lowest energy values were observed Kcal 100g⁻¹ energy value. However, the minimum energy value 89.96 (Kcal-100g⁻¹) is under control (i.e., without packaging material) after 90 days storage. It was found that aluminum foil after 90 days storage was optimum for chilli so far the energy value (Kcal 100g⁻¹). The results for LSD test showed that % of energy value for various packing material was observed significantly differed ($p \geq 0.05$) (Table 1).

Table 2. Influence of various packaging material on sensory score of green chilli powder.

Attributes	Control	Glass bottle	Aluminum foil
Colour	7.20 ± 0.21 ^{Ab}	7.53 ± 0.12 ^{Ab}	8.33 ± 0.32 ^{Aa}
Heat level intensity/pungency	6.07 ± 0.14 ^{Ac}	6.87 ± 0.39 ^{Ab}	7.60 ± 0.17 ^{Aa}
Flavor	7.27 ± 0.12 ^A	7.87 ± 0.42 ^{Ab}	8.40 ± 0.12 ^{Aa}
overall acceptability	6.20 ± 0.42 ^{Bc}	7.33 ± 0.18 ^{Ab}	8.33 ± 0.05 ^{Aa}

All the value are Mean ± SD (N = 15)

Various superscripts (small letters) in row are significantly different ($p \leq 0.05$)

Various superscripts (small letters) in column are significantly different ($p \leq 0.05$)

Sensorial analysis

The results for sensory attributes such as color, level of heat intensity, pungency, flavor of green chilli powders were observed by panel of 10 jurors. All the samples were packed under a glass bottle and aluminium foil packaging materials. The LSD test demonstrated that the sensorial analysis packed under different packing materials were statistically significant ($p \leq 0.05$) (Table 2).

DISCUSSION

The process of packaging can be defined as placing a commodity in to protective container or wrapper to store for longer time or transportation from one place to other place without making change in its ingredients. The packaging material contains 3 fold functions for protecting and merchandising. The packaging provides protection to food items against various contamination, loss, damage as well as from degradation that occurs due to microbial contamination. It protects it from light, moisture, heat, oxygen and evaporation also including the help in selling of these items. Packaging material forms a strong link between manufacturer and consumer or buyers. The result for moisture %, ash % and total soluble solids in 90 days stored in aluminium foil was observed in agreement with the findings of Ansari *et al.*, (2020) and Baldwin *et al.*, (2015), they reported that in different types of storage have varied significantly moisture % at 60 to 90 days, whereas it was same during the storage in aluminium foil. The results of Farheen *et al.*, (2018), are differed from the current findings, who suggested that moisture % varied in various packaging material at different storage times. The variation between the findings might be due to presence of different packaging materials and hygroscopic nature of the chili powder. It is also reported that reduction of moisture percentage with relative humidity of environment prevailing during the storage period at different times. In similar way the results for total carbohydrate, energy values, protein %, crude fiber, fat vitamin C, pH, titratable acidity and total soluble solids were observed under control in the packing of aluminum foil material. These findings were supported by Falik *et al.*, (2009). The results for moisture % was observed 7.44- 9.26%, reported by Krishnamurthy and Natarjan (1973), suggested that moisture content of green chilli powder was observed 8 to 10%. The findings of our study agree with results reported by Singh *et al.* (2015). The results for protein content are also in favor of results shared by Rani and Usha Rani (1996), they reported protein content ranged 4.53 to 7.39 percent in green chilli powder. Similar results showed by Luhadiya and Kulkarni (1978), who observed that results for ash % was recorded 5.60%. The results of Singh were observed higher as compared with findings of our study for ash content in green chilli powder. Our results on protein agreed with results of Srivastava and Kumar (1994) who reported 15.4% protein content. The findings of proximate chemical analysis for fresh green chilli were observed similar as shared by Srivastava *et al.*, (2005), who reported 85.5% moisture %, 1.1% fat, 5.4% protein and 110 mg per minerals and vitamin C. The findings of Baldwin *et al.*, (2015) and Ozgur and Ozcan (2011), were higher as compared with the findings of our study, they reported higher values for moisture percentage, total ash, ascorbic acid, total phenol, minerals, fat percentage, vitamin C, protein content (Take *et al.*, 2012). The results for reducing sugar were (2.8-3.6 g/100g), Ascorbic acid (23.25-29.33 mg/100g) were agreed with this research.

Conclusions

On the basis of nutritional parameters and sensory attributes, it is concluded that shade dried green chili powder retained its quality best in aluminum foil packing up to 3 months.

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