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The Effects of Processing Methods on Some Properties of Hot Red and Red-blackish Ground Peppers

[1]Ibrahim Hayoglu, [2]Mustafa Didin, [1]Huseyin Turkoglu and [3]Hasan Fenercioglu
[1]Department of Food Engineering, Faculty of Agriculture, Harran University, Sanliurfa, Turkey
[2]Department of Food Engineering, Faculty of Agriculture, Mustafa Kemal University, Hatay, Turkey
[3]Department of Food Engineering, Faculty of Cukurova Agriculture, Adana, Turkey

Abstract: n the present study, the chemical and organoleptical properties of hot red pepper grown in GAP region in Southeast of Turkey were investigated. Four types of hot red peppers (A-Industrial red ground pepper, B-Industrial deep-red/ blackish ground pepper, C-Traditional deep-red/ blackish ground pepper sold in the market and D-Traditional deep-red/ blackish ground pepper consumed in home only) that were produced from the same pepper variety were taken for analyses. Results obtained indicated that with the exception of sample A, the rest of the samples were found not to contain aflatoxin. No significant differences between test samples were found in terms of chemical properties. Sample A had the highest level of invert sugar (20.8%), while the rest of the samples gave close values to each other. The industrial samples (samples A and B) had higher extractable colour (as ASTA unit) and pungency (as Scoville index) values than their traditional counterparts. To conclude, as long as the optimum hygienic conditions are provided, it is possible to manufacture hot red ground pepper which does not carry any potential health risk for human.

Key words: Pepper manufacture, capsicum, hot-red pepper, properties, aflatoxin

INTRODUCTION

Pepper, which is grown worldwide, is a member of the *Solanaceae* family and has five species and about 300 varieties. Pepper originally comes from south America and the Caribbean and is among the first cultured plants. Growing pepper dates back 2000 BC[1]. Among the pepper-producer countries in the world, Turkey has an important place with 1 080 000 tones pepper production per annum[2], of which 69 000 tones was achieved in GAP (South East Anatolian Project) region[3]. Pepper is mostly grown in and distributed to other regions and exported to many European countries from Southeastern region of Turkey.

Red pepper is an excellent product in terms of nutritional value. While the vitamin A level increases during fruit maturation, the level of vitamin C decreases[4].

Capsicum is, in general, consumed not only for its vitamins and fiber but also for its pungency. Depending on the species, varieties and climate, its characteristics such as colour, pungency, aroma and shape show great variation. Hot flavour stems from capcaisin and dihydrocapcaisin which are elements, generally, present only in the plants belonging to genus Capsicum. Capcaisin is present in all types of peppers. An increase in the level of capcaisin leads to a rise in the level of pungency of pepper[5-7], which plays an important role on preference of consumer.

Typical aroma of red pepper comes from many specific esters and pyrasine, thiazole and alcohol compounds. Capsanthin, a colour pigment, gives the characteristic colour to pepper[7,8].

In a study carried out by Ciric and Vracar[9], a loss in colour of pepper (total redness) was observed depending upon the size, storage conditions and period. The most prominent loss (68%) in colour after 1 year storage occurred in the pepper which was ground finely and stored at uncontrolled room temperature.

During the further stages of maturation of red pepper as a result of oxygen uptake and surplus of oxygen in the tissue, a change in colour depending on oxidation is observed. It was reported that ascorbic acid in tissues preserved the colour of fresh and ground pepper through anti-oxidant activity[10]. Similarly, addition of ascorbic acid had a positive effect on the colour of pepper[11]. Red pepper is recognized as a high risk product with regard to the production of aflatoxin[12,13].

In the south east region of Turkey, red pepper which is produced and consumed largely is generally processed under unhygienic conditions. Consequently, the risk of

Corresponding Author: Dr. Ibrahim Hayoglu, Department of Food Engineering, Faculty of Agriculture, Harran University, 63040 Sanliurfa, Turkey Tel: + 90 (414) 247 03 84

microbial contamination is high. Although there has not been wide cases caused by aflatoxin intake through pepper consumption, some amounts of peppers have been reported to contain aflatoxin.

In the industrial production of pepper, drying is achieved on pulsating trays in a hot air circulated tunnel. Traditionally, hot red pepper is kept in polyethylene bags during day time to perspire and is kept in cloth bags throughout the night. As far as it is known, so far, no study has been carried out to investigate the presence and level of aflatoxin in pepper produced traditionally in south east of Turkey (particularly Sanliurfa region).

Therefore, the present study was designed to investigate some properties of hot red pepper produced traditionally at home and industrially in Sanliurfa region.

MATERIALS AND METHODS

In this study ten samples from each of ground red pepper and deep-red/blackish peppers that produced both at home and industrially from the same pepper variety were investigated. They were coded as:

- Industrial ground red pepper (A);
- Industrial ground deep-red/blackish pepper (B);
- Traditional ground deep-red/blackish pepper sold in market (C)
- Traditional ground deep-red/blackish pepper consumed at home (D).

Red pepper (A) is produced on industrial ground as following: Fresh red peppers are washed to remove dust and soil particles, inconvenient and green peppers are selected and eliminated. The stalks and seeds are also removed. The fruits are sliced and are pre-dehydrated for 24 h on nets which are stretched one meter high from ground and then they are dried for 90 min in drying tunnels with approximately at 70 to 75°C. Ground red pepper is obtained by processing the dried pepper slices with hammer mill.

The colour of pepper is dependent mainly on the method of production. The deep-red/blackish pepper, caused by heat treatment during processing, is preferred obtain dark colour in meal, a unique aroma.

Industrial ground deep-red/blackish pepper (B) is produced from red ground pepper. The ground red pepper is humidified to bring to the correct moisture and heated to 95°C within 1-2 min in heater that is equipped with mixer and then it is promptly transferred into wooden chests. The pepper is kept in chests for two or three days to turn into black and then packed in different size.

Traditional ground deep-red/blackish pepper is generally produced at homesteads in order to sell (C) or to consume at home (D). Both are produced in the same way, but the pepper that produced at home for its own consumption may slightly vary from the other. It contains less seed and salt. It is produced as following: Convenient fresh peppers are selected, cleaned and divided into four parts with knife and then they are spread and kept on concrete surface for a day to evaporate some of its water. They are transferred into plastic bags during daytime and are kept on a cloth during nights. The plastic bags are washed everyday. If the peppers are too dry, convenient amount of a mixture of hot water and salt is sprinkled on it. The sample D is also produced in the same way, but it is additionally kept for 7-10 days until its colour turns into black and then is transferred into a cloth bag and hammered and sieved. 250 to 300 mL of olive oil and 500 g salt are added into 100 kg pepper.

In this study, ten pepper samples that produced from the same variety were collected, stored in glass jars[14] and analyzed for the pH and titratable acidity[15], moisture, ash and protein[16], invert sugar[17], aflatoxin[18], L-ascorbic acid[19], colour[20] and pungency[21]. The research was carried out with three replications and two parallels.

Results were evaluated statistically with simple variance analysis and significant groups were determined by Fisher's Least Significant test[14].

RESULTS AND DISCUSSION

Peppers produced traditionally at home (samples C and D), known as Isot, had higher pH values than their industrial counterparts (samples A and B). In terms of total acidity, significant differences between the samples were found ($p<0.05$) (Table 1).

The moisture contents of the samples were different depending probably on the methods in which pepper were produced. The difference in moisture contents of end products is due probably to the differences in the effectiveness of drying process in industrial and home production conditions as well as differences in the storage conditions. In the sample B, moisture content decreased during processing in wooden chest. On the contrary, the humidification process of the sample D resulted in an increase in moisture content, because the drying process of the samples C and D were achieved under uncontrolled conditions (Table 1).

The ash content was found to be the same in all four samples. The highest protein content was found in the sample B, while the sample D had the lowest protein content, probably due to difference in dry matter contents of the samples.

Table 1: Mean ± SE of some parameters of pepper samples[1]. (Unless otherwise stated expressed as g per 100 g of sample)

	Samples			
Parameters	A (n=10)	B (n=10)	C (n=10)	D (n=10)
pH	4.57 ± 0.03^{b}	4.44 ± 0.01^{a}	4.80 ± 0.01^{c}	4.77 ± 0.02^{c}
Total acidity	2.59 ± 0.02^{d}	2.23 ± 0.01^{c}	1.86 ± 0.01^{b}	1.59 ± 0.01^{a}
Moisture	8.13 ± 0.01^{b}	6.35 ± 0.03^{a}	8.23 ± 0.02^{b}	11.75 ± 0.02^{c}
Total dry matter	91.87 ± 0.01^{c}	93.65 ± 0.03^{d}	91.77 ± 0.02^{b}	88.25 ± 0.02^{a}
Total ash	8.80 ± 0.02^{a}	8.99 ± 0.02^{a}	8.81 ± 0.01^{a}	8.91 ± 0.01^{a}
Protein (Nx6.25)	11.52 ± 0.01^{b}	12.30 ± 0.02^{b}	11.40 ± 0.02^{a}	$11.37^{a}\pm0.02$
Invert sugars	20.83 ± 0.04^{c}	14.18 ± 0.09^{a}	17.50 ± 0.45^{b}	16.05 ± 0.05^{a}
L-ascorbic acid[2]	13.3 ± 0.40^{b}	10.9 ± 0.70^{a}	12.0 ± 0.30^{ab}	10.6 ± 0.25^{a}
Aflatoxin[3]	3	NIL[5]	NIL[5]	NIL[5]
Extracted colour (ASTA)	285.36 ± 1.64^{d}	255.84 ± 1.56^{c}	180.40 ± 1.02^{b}	168.92 ± 1.64^{a}
Pungency[4]	25000	25000	10000	10000

Industrial ground red pepper (A), Industrial ground deep-red/blackish pepper (B), Traditional ground deep red/blackish pepper sold in market (C) and Traditional ground deep-red/blackish pepper produced and consumed in home (D)

[1]Samples within each row showing a common superscript ($^{a, b, c, d}$) do not differ significantly ($p>0.05$), [2]Expressed as mg per 100 mL, [3]Expressed as ppb, [4]Expressed as Scoville Index Unit (SIU), [5]Aflatoxin was below the detectable level

The sample A had the highest invert sugar level (20.8%) that may be due to the fact that this sample was not exposed to high heat treatment, as a result, the level of chemical transformations of invert sugar was low. On the other hand, a decrease in the level of invert sugar in the rest of the samples, which were defined as deep red/blackish pepper, was observed. This is due probably to the heat induced modifications of sugar in these samples (Table 1).

The samples had varying amount of L-ascorbic acid ranging from 10.6 to 13.3 mg in 100 g pepper. Low level of L-ascorbic acid may result from the application of high heat treatment during processing and storage conditions before and after processing.

In terms of the existence of aflatoxin, which is a major concern for the food industry, only in sample A, a low level of aflatoxin (3 ppb) which is lower than figures given in Turkish standards, which permits maximum 5 ppb total amount of aflatoxin, was detected[22]. On the contrary, the rest of the samples were found to be free of aflatoxin. As known, aflatoxin is produced by moulds. Therefore, improper storage and /or transportation conditions may have stimulated the growth of moulds and, consequently, production of aflatoxin.

Of the samples tested, sample A gave the highest extractable colour level (~ 285 ASTA unit). This figure dropped to ~ 169 ASTA units in sample D depending on the colour tone. The low level of extractable colour in the traditional (home-made) red pepper (sample D) may be due to the method of production. As explained earlier, traditional (home-made) pepper (sample D) production includes perspiration and high heat treatment which stimulate the change of colour quickly. As it gives a nice aroma and colour to the traditional products, deep red/blackish pepper is mostly preferred by the consumer.

According to the organoleptic evaluations of products, the samples A and B were found to be hotter than the samples C and D. The representing Scoville values of the samples A, B, C and D were, 25 000, 25 000, 10 000, 10 000, respectively. Andrews[4] suggested that the level of capsaicin in the samples dried under sun-light decreases as a result of chemical transformations of capsaicin stimulated by sun-light. In the present case, the samples C and D were produced by drying under direct sun-light, therefore, these samples had lower Scoville values.

It can be concluded that peppers produced and marketed in south eastern region of Turkey both in industrial scale and at homesteads were suitable for consumption as long as good hygienic storage and transportation conditions are provided. However one of the samples contained 3 ppb aflatoxin, it can be overcome with suitable storage conditions.

Finally, on condition that hygienic condition is provided both of deep-red/blackish and red peppers produced at home and factories can safely be consumed. On the other hand, for the production of red pepper in standard quality, the development of standard methods of production is essential.

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