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Determination of the effects of various levels of lemon and pomegranate peels on the microbiological properties of cig köfte

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Abstract

Cig köfte is one of the most accepted traditional food that is widely prepared and consumed in houses or in some shops in almost every cities of Turkey. Cig köfte is prepared using minced beef, bulgur, onions, garlic and various spices. In this study, aside from the control (0% lemon or pomegranate peel), every other cig köfte sample contained either 2.3% or 7.7% lemon and pomegranate peel. Furthermore, all of the spices used to prepare the cig köfte mixture were γ -irradiated at a dose of 9.7kGy according to commercial practices used to prevent contamination risk from spices. Total mesophilic aerobic bacteria (TMAB), total lactic acid bacteria (TLB), total coliforms and total yeast/mold count analyzes were used to determine the microbiological quality during storage (1st, 2nd and 4th days). The coliform count was lower than 3 log₁₀ CFU/g for all samples. TMAB, TLB, and total yeast/mould counts varied from 6.30 to 7.92, from 6.43 to 7.55, and from 4.63 to 7.46 log₁₀ CFU/g respectively, for the pomegranate peel added to the cig köfte samples and values varied from 6.46 to 8.27, from 7.35 to 7.64, and from 5.03 to 7.10 log₁₀ CFU/g respectively, for the lemon peel added to the cig köfte samples.

Keywords: *Cig köfte, γ -irradiation, microbiological quality, coliform count, total mesophilic aerobic bacteria*

1. Introduction

Cig köfte is one of the most accepted traditional Turkish foods prepared from minced beef, bulgur, tomato, onions, garlic and various spices. It is made by hand kneading of minced beef with bulgur and spices, including red pepper, cumin, black pepper, cinnamon, parsley, garlic and onion (Goktan and Tunçel, 1988; Ocal, 1997). The amount and type of additives used in the production of minced meat and bulgur ratio vary according to preference of consumers,

and there is no standard for the preparation recipe (Erol et al., 1993; Gençcelep et al., 2001; Öcal 1997; Sağun et al., 1997). Generally, it is recommended to wrap each piece of cig köfte with a leaf of lettuce and it is mostly consumed with fresh lemon juice (Daglioglu et al., 2005).

The cig köfte is generally consumed within a few hours after preparation. However, they can be kept for up to 24 h in a refrigerator. Because cig kofte is consumed without heat treatment, it may also cause increased public health problems (Göktan and Tunçel, 1988; Daglioglu et al., 2005). Additionally, Göktan and Tunçel (1998) reported the production conditions for that it was prepared and sold under unhygienic conditions in restaurants and restaurant-like places, but nowadays many cig köfte shops apply HACCP principles under the control of the Government. Insufficiency of personnel hygiene during manufacture and contamination of the materials used with microorganisms may lead to food borne diseases. Poor hygienic quality of cig köfte was reported by many authors in previous studies (Ardic and Durmaz, 2008; Cetin et al., 2008; Daglioglu et al., 2005; Sağun et al., 1997; Uzunlu and Yıldırım, 2003). Also, it has been reported that minced beef and spices consumed in Turkey may be highly contaminated with various bacteria. Therefore, the quality of minced beef and spices used for preparing the cig kofte is very important for the hygienic quality of this food. (Güven ve ark., 1997; Sancak et al., 1993; Sağun et al., 1997; Tekinsen and Sarıgöl, 1982). Meat suppliers also revised their production systems and it is not as bad as mentioned in these years.

Bingöl et al., (2014) reported that lactates can be applied successfully in food industry to enhance the microbiological and sensory attributes of cig kofte. And, also they expressed that the usage of sodium lactate (mentioned as GRAS) in the formula does not influence the palatability of cig kofte negatively; in fact, it might not be preferred by the target consumer, while an undesired loss of colour and drying may occur during storage.

It is apparent that, the main subject and the focus of the previous researchers is the potential microbiological risk of cig köfte, on human health, due to raw meat in its ingredients. Therefore, the purpose of this study was to determine the effects of some natural additives on microbiological properties of cig köfte during storage.

2. Material and methods

All of the spices used to prepare the cig köfte mixture were γ -irradiated at a dose of 9.7 kGy according to commercial practices used to prevent contamination from spices. The meat in the form of boneless rounds, bulgur (cracked wheat), lemon and pomegranate were purchased from a local supermarket in Konya, Turkey. All ingredients were transported to the Food Engineering Department in the Faculty of Agriculture of Selçuk University under hygienic conditions and processed to cig kofte immediately upon arrival.

The lean minced meat, black pepper, cumin, red chili pepper, onion and garlic powder and salt were mixed to bring up lean minced meat. Then, half of this mixture was kneaded with bulgur. When the mixture became softer, the rest of the mixture was added and stirred together. Cig köfte was then divided into 3 batches. 0% (control), 2,3% and 7,7% (w/w) lemon peel powder was added to mix and stirred. The same process were performed for the pomegranate peels, too.

Total mesophilic aerobic bacteria (Coppola et al., 2000), total lactic acid bacteria (Komprda et al., 2004), total coliforms (Anonymous, 1998) and total yeast/mould count (Coppola et al., 2000) analyzes were performed in order to observe the microbiological changes. The cig köfte ingredients are shown in Table 1.

Table 1. The ingredients of çiğ köfte used in this study.

Ingredients	Amount (g)
Meat	250.00
Bulgur	268.00
Black pepper	1.72
Cumin	4.85
Onion powder	2.41
Garlic powder	2.41
Salt	4.88
Red chili pepper	19.61
Sunflower oil	33.00

The lemon and pomegranate peels were dried and ground into fine powder using a domestic grinder. The samples were stored in refrigerator temperatures (4 °C) during storage. Two samples taken from each batches at 1, 2 and 4th day of storage and subjected to analyses. All analyses were carried out in duplicate.

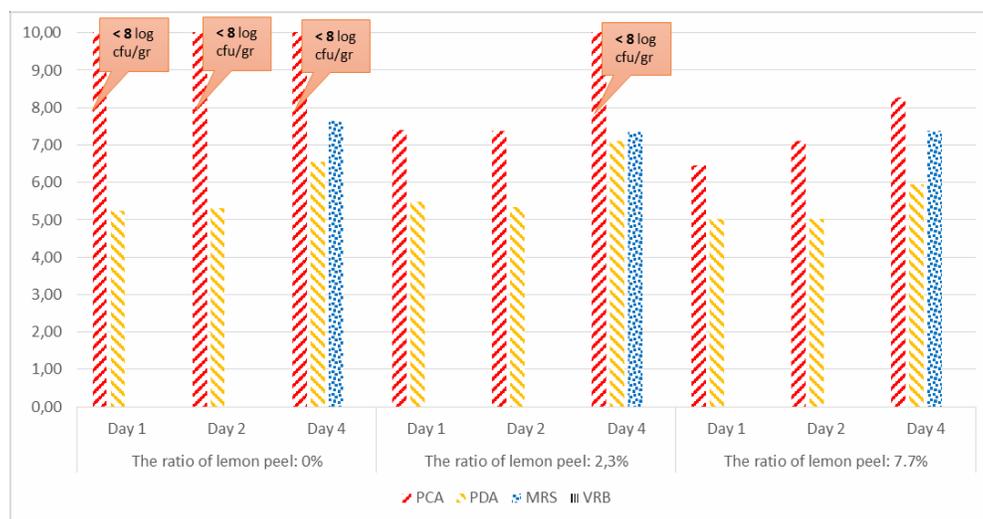
3. Results

The Table 1 shows the microbial properties of the raw materials. The total bacteria load was 7,79 log cfu/g for the bulgur, 7,23 log cfu/gr for the lemon peel, 6,64 log cfu/gr for the pomegranate peel and less than 5 log cfu/g for the meat. Total mold/yeast load was 7,39 log cfu/gr for the bulgur, 4,17 log cfu/gr for meat and less than 4 log cfu/gr for the lemon and pomegranate peel. No coliform bacteria was observed for all of the ingredients. Total lactic acid bacteria load was 6,68 log cfu/gr for the bulgur and 4,69 log cfu/gr for the lemon peel and less than 4 log cfu/gr for the meat and pomegranate peel.

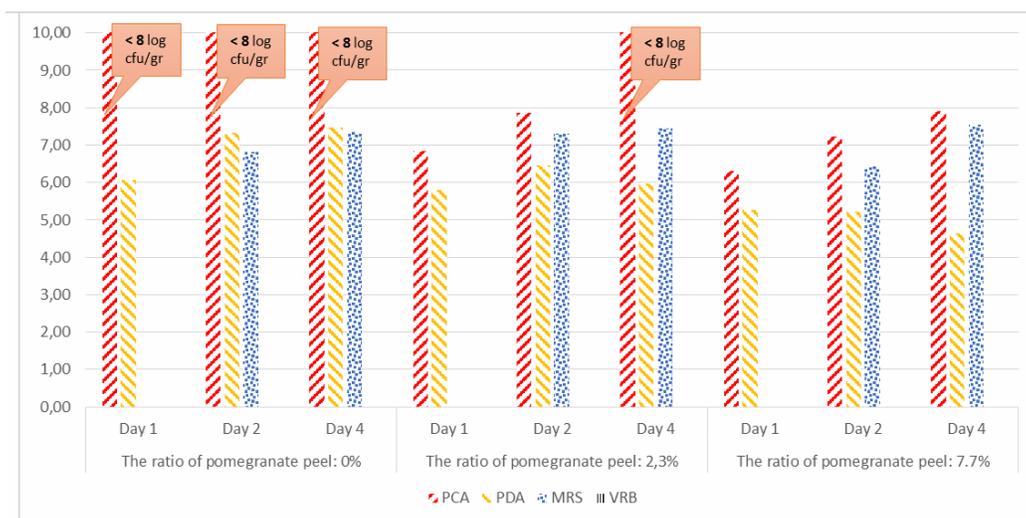
Table 2. Microbial properties of ingredients of cig köfte samples (log cfu/gr).				
	Total Bacteria	Total mold/yeast	Total coliform	Total Lactic Acid Bacteria
Bulgur (Cracked wheat)	7,79	7,39	<3**	6,68
Meat	<5*	4,17	<3	<4***
Lemon peel	7,23	<4	<3	4,69
Pomegranate peel	6,64	<4	<3	<4

According to the results shown in Graphic 1 and Graphic 2, it's clearly seen that the natural additives have antimicrobial effects on cig köfte samples. For the control samples, the total bacteria load was more than 8 log cfu/g. But for the lemon and pomegranate peel added samples with a proportion of 2,3%, the total bacteria load was less than 8 log cfu/gr until 4th day of the storage. On the other hand, for the lemon and pomegranate peel added samples with a proportion of 7,7%, it's less than 8 log cfu/g even in the 4th day of the storage.

Graphic 1. Microbial properties of lemon peel added cig köfte samples



PCA: Total mesophilic aerobic bacteria; PDA: total mold/yeast count; MRS: total lactic acid bacteria and VRB: total coliform bacteria

Graphic 2. Microbial properties of pomegranate peel added cig köfte samples

PCA: Total mesophilic aerobic bacteria; PDA: total mold/yeast count; MRS: total lactic acid bacteria and VRB: total coliform bacteria

It's also clearly seen that the total mould/yeast count of the control group was higher than the samples which have the natural additives. The samples that include the pomegranate peel (7,7%) was the most effective for the total mould/yeast load; the TMY load decreased day by day for these samples.

The total aerobic mesophilic bacteria of çiğ köfte were reported in different studies. In a study of Sancak and Isleyici (2006), total aerobic mesophilic microorganisms of cig köfte samples were $6.40 \log_{10}$ CFU/g. Hampikyan et al., (2008) reported that the total aerobic mesophilic bacteria counts ranged from 2.4×10^5 to 1.7×10^7 CFU/g. In another study examined by Elmali and Yaman (2005), Onganer and Erecevit (2009), Vural and Yesilmen (2003) and Yilmaz et al., (2002), the numbers of the total aerobic mesophiles were determined as 4.3×10^6 , 3.75×10^6 , 6.02×10^6 and 2.3×10^6 CFU/g, respectively. The results of this study are similar with those studies.

The coliform counts of all cig köfte samples were less than 3 log CFU/g. Survey performed by Hampikyan et al. (2008) evidenced that the number of coliforms ranged from 1.1×10^3 to 7.0×10^5 CFU/g in 20% in cig köfte samples. Similar results were reported by Sancak and Isleyici (2006), who found that coliform counts in cig köfte samples were $4.17 \log_{10}$ CFU/g. In other reports done on çiğ köfte samples (Elmali & Yaman, 2005; Vural & Yesilmen, 2003; Yilmaz et al., 2002), coliform numbers were between 1.7×10^4 and 1.1×10^5 CFU/g. The results of this study were lower than those studies. It can be easily explained as the ingredients that were used to prepare çiğ köfte were gamma-irradiated. So it's quite possible to find the total coliform lower than other studies. Also, as it's well known, gamma-irradiation directly decreases the coliform bacteria count.

As a result of our study, it's possible to use these natural additives as an ingredient for the cig köfte. We observed that it'll help to extend the shelf life of the product and it has a potential to inhibit the coliform bacteria which are very important indicator for the food safety.

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