An Investigaton on the Deterioration of Packaged Chicken Doner

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Abstract

The aim of this study was to investigate the deterioration in packaged chicken doner related to microbiological and chemical analyses when stored under normal, vacuum and modified atmospheric (MAP) conditions at 0, 10 and 20^0C temperatures. For each storage temperature 16 samples of freshly cooked doner were taken each one packaged with 100 g Polypropylene (PP) packages. The results were evaluated according to Salmonella spp; *Listeria monocytogenes*, total volatile nitrogen (TVN) and pH for each sample and temperature were analyzed in two days intervals in duplicate according to Turkish food regulation. The deterioration value related with microbial and chemical analysis were reached within 20, 14 and 7 days at 0^0C under modified atmospheric (MAP), vacuum and normal storage conditions respectively but it was deteriorated in one day when stored at 20^0C at any storage conditions

Keywords: *Deterioration, packaged chicken doner, Salmonella spp, TVP, MAP.*

Introduction

Factors such as increase in living standards, the orientation of more women to business life, practical solutions for daily food needs, the variety of ready-made meals and the increase in well-made advertisements also increase the consumption of fast foods. Fast foods that have the highest consumption rate are hamburger, pizza, and döner (Öksüztepe and Beyazgül, 2014).

To begin with, meat doner kebab, a traditional Turkish meal, was first serviced in 1820 by Sinegin Hafız (a nickname) in Kastamonu. Chicken doner, on the other hand, first appeared in Saudi Arabia. It was prepared from chickens brought from Denmark and it is said that turkey meat was also added for obtaining a different flavor (Kuscu, 2007). There are doners made from various materials such as fish, pekins duck and vegetables in Turkey (Kuşçu, 2007). Doner's raw material is made from lamb, veal, poultry meat which is also mixed with onion, water, milk, yogurt, fat, tomato paste, lemon juice, vinegar and spices in order to get high flavor and nutrition value during cooking (Kayaardı et al., 2013; Jöckel and Stengel, 1984; Acar 1996). The same manner is also used for the preparation of the poultry meat doner (TGK Meat and Meat Products Communiqué, 2012). In the production of poultry meat, non-animal origin proteins, starch and starchy materials and soy and soy products cannot be used (Cebirbay and Aktaş, 2007). After the meats are arranged in the DONER platform, the excess on the edges can be shaped by cutting with a knife into an oval, cut conical (TSE, 1995; TSE 2003). Modified Atmosphere Packaging (MAP) is a study with the aim of reducing the microbiological reactions and biochemical events that occur in the product by changing the gas rates in the atmosphere of the environment where the product is located (Tülin and Sülfer, 2017). The MAP has started to be widely used in a variety of products such as fruits and vegetables, meat and meat products and also in dairy products in accordance with the demand for fresh vegetables (Doğu, 2009). The first report on MAP studies to increase the shelf life of the fish was observed in the 1930 (Özoğul et al., 2006). The French company Scope used the MAP for the packaging of the food products in 1974. This was to inhibit the development of aerobic microorganisms in white meat products (Kılıç and Çaklı, 2004). Chicken products are preferred more due to their high nutritional value, low price, and

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low-fat content, but their shelf life is very short even in the refrigerator. Therefore, the use of MAP is quite common for preserving chicken products (Mood et al., 2016).

The purposes of this research was to investigate the deterioration of the packaged chicken doner related to microbiological and chemical effect on the quality of doner when stored at different temperatures such as 0, 10 and 20^{0}C and under normal, vacuum, (MAP) conditions.

Material and Methods

Sample Preparation

All samples of cooked chicken doner were obtained from a doner processing company (Gursoy Gıda Ltd.Co. Istanbul,Turkey), all products were collected randomly from the same batch and were immediately brought to laboratory in portable refrigerated containers. Then each sample was weighed in 100 g pieces on the clean bench of the lab. All 72 samples were put in sealed polypropylene bags under normal vacuum and MAP conditions and were kept at 0, 10 and 20^{0}C until further analysis. For modified atmosphere packaging Food 35 gas was used and set at 20% gas mixture (35% CO2, 65% N2) that was provided by Habaş company in Turkey. Following the 24 days for each temperature, the samples were taken out of the refrigerator every three days for experiment.

pH measurement

The pH values of the samples were measured at three days intervals by Mettler Toledo, Seven Compact S210-K and results were given in figures 1, 2 and 3.

Estimation of Volatile Nitrogen

10 g of comminuted sample was taken with 50 ml of fresh tap water into homogenizer (Ultraturrax, IKA, Yellowline D125), after 10 seconds of homogenization the sample was washed in the 250 ml distillation flask of macro apparatus with 250 ml fresh tap water and 1-2 g of added MgO (Sigma-Aldrich, 13138). The solution placed in the distillation apparatus was connected to receiving flask added 25 ml of 2% boric acid solution. The flask containing the sample in the heater was set to boil exactly for 10 minutes and distilled for 25 minutes after it starts boiling. After distillation, a few drops of methyl red (Merck, 1.06076.0100) were added dropwise and titrated with 0,1 N sulfuric acid. The amount of 0,1 N sulphuric acid consumed for the color change was determined and calculated TVN values are given in Figures 4, 5 and 6 (Wiley, 1973).

Microbiological Analysis

For determining *Salmonella spp predence* and *Listeria monocytogenes* microorganisms were estimated according to TS EN ISO 6579 and TS EN ISO 11290-1 standards respectively and the total number of microorganisms were counted (TS EN ISO 4833-1) as given in figures 7, 8 and 9.

For each storage condition, 72 specimens were used, 100 g each, in parallel. All samples were stored at 0, 10 and 20 degrees for 24 days (FRITERM refrigerant, FEM 30 32 type).

((ΣC) / ((1. number of dilution Petri dishes * 1) + (number of dilution Petri dishes * 0,1)) * (1st dilution coefficient)

Results and Discussions

PH value of cooked chicken doner samples, that analyzed at 0, 10 and 20^{0}C, were changed from 6.37 to 6.61, 6.68 and 7.98 under MAP, vacuum and normal conditions, respectively during the 24 days of storage. The cooked chicken doner was not given any pH standards. The other research indicated that pH value of the cooked red meat doner was estimated between 5.4 to 6.3, for mixed doner in range of 5.8-6.79; as mentioned by Cebirbay and Aktaş (2007) and also given in TSE (2003), that differences between two doners may be due to the composition of meats.

The amount of pH changes in chicken doner samples, in accordance with other studies, shows that it is significantly affected by storage temperature (Çiçek et al., 2013).

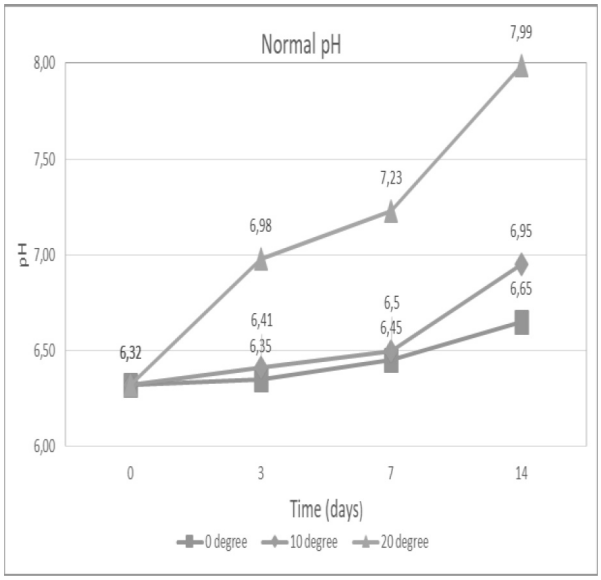

Figure 1: pH values of cooked chicken doner under normal packaging

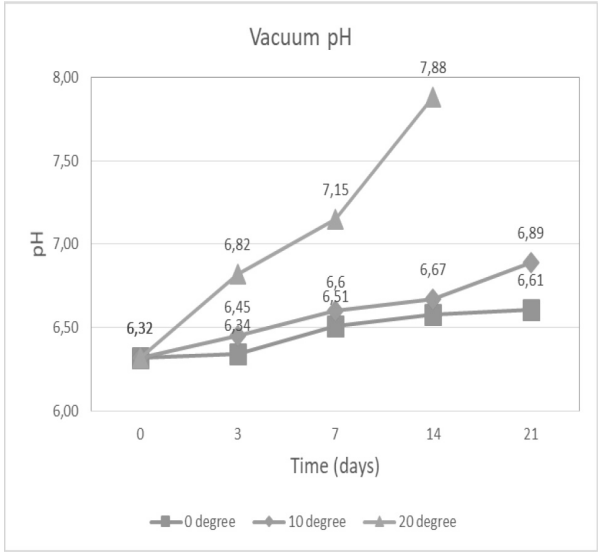

Figure 2: pH values of cooked chicken doner under vacuum packaging

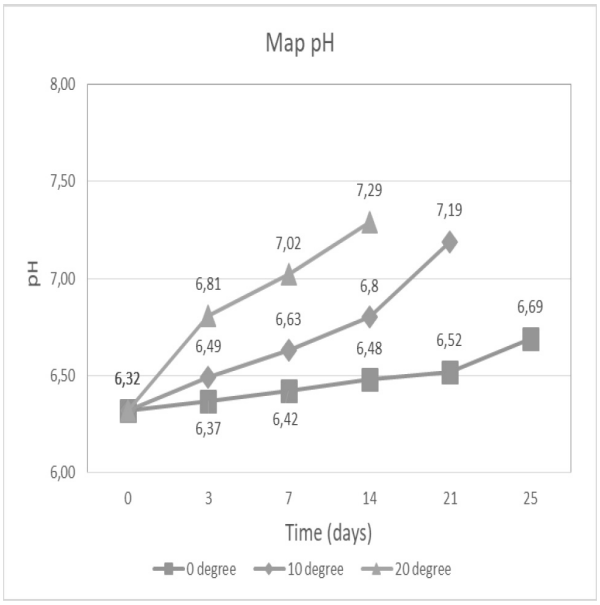

Figure 3: pH values of cooked chicken doner under MAP

TVN value of cooked chicken doner

The amounts of TVN for the cooked doner at different storage conditions at different time and temperatures were shown in Figures 4, 5 and 6. Acceptable limit values of TVN for cooked chicken doner were reported by Economou et al., to be between 4-10 mg mgN/100g 2009)..

The TVN content under normal atmospheric packaged sample initially was estimated to be 6.3 mgN/100g, after being stored at 0, 10 and 20°C for 25 days in time intervals, TVN was increased to the upper limit of 10 mgN/100g and after 7, 5 and 1 days respectively as shown in Fig.4. According to these values, the amount of TVN was significantly increased during storage at 0°C and 10°C but high accumulation TVN occurred when the sample was stored at 20°C.

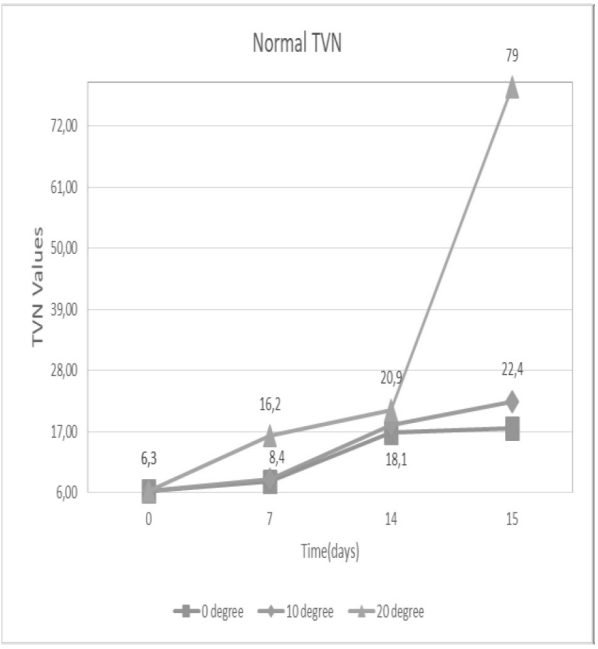

Figure 4: TVN mg N/ 100g cooked chicken doner under normal packaging

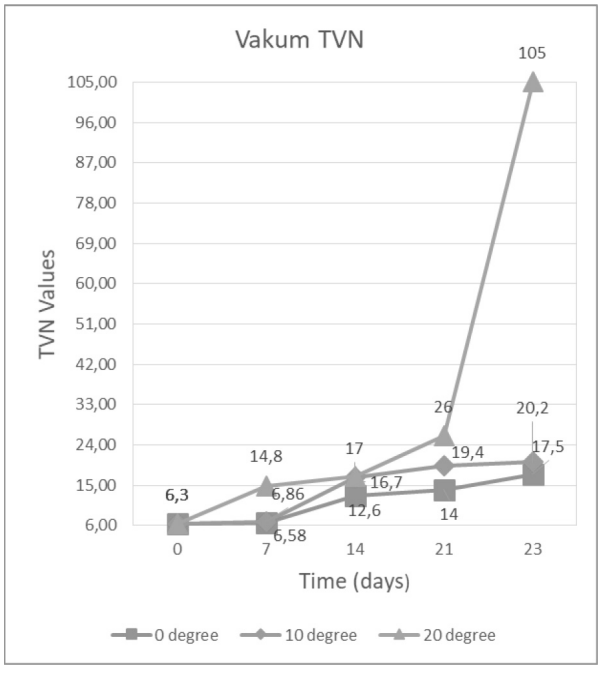

Figure 5: TVN mg N/ 100g cooked chicken doner under vacuum packaging

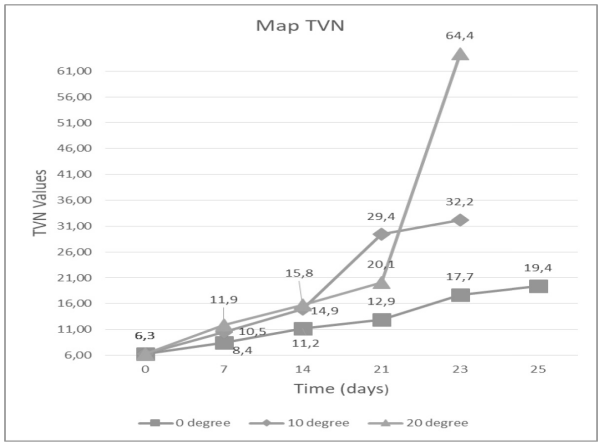

Figure 6. TVN mg N/ 100g Cooked chicken doner under MAP packaging

Initially 6.3 mg N/100g content of TVN in vacuum packaged cooked chicken doner, after storage at 0, 10 and 20°C for 25 days in time intervals, increased above limit value of 10 mgN/100g after 9,8 and 1 days, respectively (**Fig 5**). Comparing this result with normal atmospheric conditioned sample, the amount of the TVN was slightly different during storage at the same time and temperatures, which may be due to the absence of oxygen. For storage under MAP conditions at 0, 10 and 20^0C, cooked chicken doner initially contains 6.3 mg N/100g, after storage for 25 days in time intervals was increased overhead of 10 mgN/100g (Fig 6) It was indicated that for MAP packaged samples TVN was increased when the temperature increased. All the cooked chicken doner spoilage where in agreement a recommended by Economou et al., 2009. All the samples were spoiled at 20^0C after being stored one day at any condition; this data is also supported by others (Fallah et al., 2016).

Salmonella spp and *Listeria monocytogenes* assays were performed but they were determined as negative when the total bacterial counts were taken into account. In the sample that was packed under normal air, vacuum and MAP conditions initial total bacteria content were determined as 3, 3. After being stored at 0^0C in time intervals of 10, 8, and 8 days respectively; total bacteria were increased above the limit value of 10^6. After the storage of packed

chicken doner under MAP, vacuum and normal air conditions at 10 ^{0}C, the sample which initially contains 3,3 total bacteria was increased overhead of 10^6 after storage in time interval and reached the highest value after 6 and 4 days, respectively. All the samples were spoiled after being stored one day at 20^0C under any storage condition, this also is in good agreement with the information given by other researchers (Al-Shadefat and Bassam, 2011; Eker et al., 2011).

Temperature dependence of the Maillard reaction was modelled with the Arrhenius equation as follows:

$k = k_0.e^{-E}{}_0/RT$ by using Arrhenius equations, activation energy for MAP, vacuum and normal air storage conditions were estimated as 41572, 26190 and 25774 j/kmol respectively. The larger the activation energy was given, the slower the degradation rate.

Conclusions

The storage temperature had strong effect on the denaturation of cooked chicken doner at 10 and 20^0C related with TVN, pH and growth of the microorganisms. This investigation indicates that the deterioration of packaged chicken doner happens as fast as one day at 20^0C, however it can be stored about 10 days at 0^0C under MAP conditions.

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