Textural, Chemical and Sensory Properties of Döners Produced from Beef, Chicken and Ostrich Meat

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Summary

In this study, the chemical, textural and sensory properties of beef, chicken, or ostrich meat döners were compared. Ostrich döner samples had lower (P<0.0001) cholesterol content than beef or chicken döners but higher calorific values. It is observed that beef döners had higher (P<0.0001) Warner-Bratzler shear force (WBSF) than chicken and ostrich döners. According to the texture analyses results it is concluded that hardness measured by Texture Profile Analyzer was found to be a better predictor of sensory tenderness than WBSF. Panelists rated ostrich meat with highest point in terms of sensory properties. Ostrich döners had better overall acceptance than beef or chicken döners. Therefore it is concluded that ostrich döner can be taken into consideration as an alternative protein source to beef or chicken döners.

Keywords: Ostrich meat, Döner, Texture

INTRODUCTION

Döner is a traditional Middle Eastern meat product, which is consumed widely in Turkey and many parts of the world [1-3]. Although döner appeals people who are accustomed to the Anatolian culture, it has become a competitor in the fast-food market [4]. Döner is traditionally made from lamb, veal, beef, or poultry meat or by mixing them at certain proportions in the presence of onion, pepper, tomatoes, and other spices [5]. As an extra flavor, several other spices (white pepper, black pepper, cumin, allspice, curry, and thyme), tomato paste or juice, milk powder, lemon juice, yoghurt, chicken egg and sugar may be added [6-8]. Sauce composition may vary [9]. Based on the production style, döners are classified as leaves, leaves and ground, and ground [10]. After the raw döner on a vertical stick is slowly rotated to roast in an open gas or electric oven, cooked portions are removed as thin slices and consumed in bread with sliced tomato, onions and lettuce [1,10-12].

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Although döner made from beef, veal, or lamb meat are the most common, the use of chicken meat in döner production has become very popular because it is cheap and digested easily. However, some quality problems like non-uniform shaped pieces occurred while shaving off, juiciness and texture are not desirable to the consumer. Beef döner is a tasty meal but its comparatively high fat content makes it not a very healthy choice. Therefore, the goals of this study were to determine and compare chemical, textural, and sensory properties of döners made from beef, chicken, or ostrich meat to develop better quality döner. 

**MATERIAL and METHODS**

**Sample Preparation**

The beef, chicken, and ostrich döner samples provided by a local company in Manisa were formulated for this research and prepared complying with retailer’s recipe and cooking conditions. The experiment was repeated 3 times and 9 samples for each treatment were analyzed. Deboned meats were trimmed of skin, connective tissue and visible fat in a processing hall at 4°C. Beef döners had beef, tallow, onion, milk, sunflower oil, black pepper, thyme and salt. Ostrich döners were produced for our research and had ostrich meat with the same formula except for that ostrich meat was used instead of beef. Chicken döners had chicken breast meat, skin, sweet pepper paste, curry, paprika, and salt. Prepared döners were spitted on a döner kebab stick and slowly rotated for 2 min in front of a gas oven. Cooked surface was shaved off using automatic knives in the form of thin slices (0.25 cm). About 250 g of sample was packed in polyethylene bags and transferred with use of this retailer’s cold chain cars to the laboratory. All analyses were performed at Celal Bayar University Food Engineering Department Laboratories.

**Chemical Analysis**

Chemical properties of döner samples including moisture, protein, fat, and ash content were determined using official methods and expressed as %. Cholesterol content was determined using the procedure by Naeemi, Ahmad, Al-Sharrah, and Behbahani. The pH was measured in a homogenate prepared by blending 10 g döner samples with 100 ml of distilled water for 30 s. Readings were taken with a WTW model pH 521, digital pH-meter and a WTW, type E56, combination electrode (WTW-Wissenschaftlich-Technische Werkstaetten GmbH, Weilheim, Germany). Water activity was measured using a portable hygrometer (AM/Wert-Messer, Germany).

**Texture Profile Analysis**

Samples were sheared using a WSBF head with a load cell of 50 kg with crosshead speed and chart speed of 10 cm/min attached to a Texture Analyzer (Stable 80 Micro Systems, England). The texture profile analysis (TPA) parameters, including hardness (peak force on first compression, N), cohesiveness (ratio of the work done under the second fore-displacement curve to that one during the first compression) and gumminess (force to disintegrate a semisolid sample for swallowing, N) were determined according to the procedure suggested by Bourne.

**Color Measurement**

\( L^*, a^*, b^* \) values were determined with a digital Minolta CR300 chromometer (Minolta Co., Osaka, Japan). The samples were homogenized and transferred to petri dishes before taking the readings. It was ensured that there was no gap between the sample and the petri lid and the lenses of colorimeter touched to the lid of the petri dish. Six readings per sample were taken and mean values were calculated.

**Sample Preparation**

**Statistical Analysis**

The design was completely randomized. The treatments were performed at Celal Bayar University Food Engineering Department Laboratories.
were beef, chicken, and ostrich meat döners. Three replications were done. The analysis of variance was done using the PROC GLM procedure of SAS (version 8.2, SAS Institute Cary, NC 2001). LSMEANS for treatments were generated and separated when significant (P<0.05) using the pdiff statement. Correlation coefficients were calculated using PROC CORR procedure of SAS [22].

**RESULTS**

**Chemical Analysis**

Chicken and ostrich döners had statistically similar protein contents, but had higher protein contents than beef döners (Table 1). This finding is in agreement with Kayisoglu et al. [23]. Beef döners had the highest ash content, followed by ostrich and chicken döners. Moisture content was not affected by type of döner (P>0.05), or was water activity (P>0.05). pH was not different (P>0.05) among chicken ostrich, and beef döners. Chicken and beef döners were reported to have similar pH values [23]. Ostrich döners had the highest fat content followed by beef and chicken döners. This observation could be attributed to the fact that ostrich döners cooked fastest and there was not enough time for the added fat to be removed from the ostrich meat. On the other hand, beef döners cooked the slowest resulting in removal of fat, thus having the lesser fat than ostrich döners. As for chicken döners, chicken skin rather than fat was used in the formulation, probably leading to the least amount of fat among the type of döners studied. Chicken döners were also reported to have less amount of fat than beef döners in another study [23].

Cholesterol content was the highest in chicken döners because chicken skin was in the chicken döner formulation and it was lowest in the ostrich döner. Similarily, other authors [15,17] pointed out that ostrich meat was a healthy red meat due to its low cholesterol content [16,24]. However, other study by Hoffman [28] did not agree and suggested that ostrich meat had similar cholesterol values to other lean type meats. Beef döners had lower cholesterol content than chicken döners, which could be attributed to the fact that on the average beef (muscles) had 60 mg/100 g whereas chicken (muscles) had 80 mg/100 g cholesterol [26].

**Color Values**

Beef and ostrich döners had similar L* values (P>0.05), whereas they had lower (P<0.001) L* values than chicken döners. The a* (redness) value was the highest for chicken döners (P<0.0001). This could be explained by the chicken döner formulation because chicken döners contained considerable amount of red pepper paste, which probably resulted in redder color. Similarly, chicken döners had higher (P<0.0001) b*(yellowness) than beef or chicken döners. Inclusion of skin and the color of chicken fat in chicken döner formula could have caused this.

**Warner-Bratzler Shear Force and Texture Profile Analysis**

Beef döners had higher (P<0.0001) Warner-Bratzler shear force (WBSF) than chicken or ostrich döners. Ostrich döners had significantly higher (P<0.01) WBSF (less tender) than chicken döners (Table 3). Hardness followed the same trend with beef döners having higher hardness (P<0.0001) values than ostrich or chicken döners. Chicken döners were found to have the least hardness value. Hardness values for chicken döners were comparable to those reported by Kilic [27]. The type of döner (beef, chicken, or

| Sample   | Protein (%) | Ash (%) | Moisture (%) | Fat (%) | pH   | aw   | Cholesterol | L*  | a*  | b*  |
|----------|-------------|---------|--------------|---------|------|------|--------------|-----|-----|-----|
| Beef     | 34.02a      | 5.15a   | 51.40a       | 9.75a   | 6.37 | 0.93 | 49.16a       | 36.35a | 3.65a | 5.05a |
| Chicken  | 33.73b      | 2.31b   | 54.35b       | 9.25b   | 6.33 | 0.95 | 68.72b       | 60.23b | 8.67b | 23.6b |
| Ostrich  | 31.56c      | 3.45c   | 51.69c       | 14.68c  | 6.42 | 0.93 | 22.77c       | 34.34c | 3.48c | 3.48c |
| P-value  | 0.0002      | 0.001   | 0.073        | 0.28    | 0.37 | 0.0003 | <0.0001       | <0.0001 | <0.0001 | <0.0001 |

*ab*c Means in the same row with different letters differ significantly (P<0.05)

**Table 2. Sensory properties of beef, chicken, and ostrich döners**

| Sample   | Taste         | Ease of Swallowing | Appearance | Juiciness | Overall Tenderness | Overall Acceptability |
|----------|---------------|--------------------|------------|-----------|--------------------|-----------------------|
| Beef     | 6.52a         | 6.05               | 6.26       | 5.75      | 5.73               | 5.93                  |
| Chicken  | 6.28b         | 6.53               | 6.51       | 6.30      | 6.70               | 6.33                  |
| Ostrich  | 6.80c         | 7.22               | 6.97       | 6.98      | 7.47               | 7.40                  |
| P-value  | 0.003         | <0.0001            | 0.008      | 0.0007    | <0.0001            | <0.0001               |

*ab*c Means in the same row with different letters differ significantly (P<0.05)
Textural, Chemical And Sensory Properties

Ostrich döners did not affect (P>0.05) cohesiveness value. Beef döners had higher (P<0.0001) gumminess values than chicken or ostrich döners. However, chicken and ostrich döners yielded similar (P>0.05) gumminess values (Table 4).

Energy Values

Beef and chicken döners had about 232 kcal, and 226 kcal (100-g cooked), respectively, whereas ostrich döners had approximately 262 kcal. The higher caloric content of ostrich döners might pose a problem from nutritional point of view.

Sensory Properties

Ostrich döners had better taste (P<0.01), ease of swallowing (P<0.01), overall appearance (P<0.01) higher juiciness (P<0.01), higher overall tenderness (P<0.01), and better overall acceptability (P<0.01) than beef or chicken döners (Table 2). Beef döners had higher (P<0.05) taste, but lower (P<0.05) ease of swallowing, lower overall tenderness (P<0.0001), lower juiciness (P<0.05) and lower (P<0.05) overall acceptability than chicken döners. Beef and chicken döners had similar (P>0.05) appearance. Overall, panelists clearly chose ostrich döners over beef or chicken döners (Table 2).

Correlation Coefficients

Flavor was not correlated (P>0.05) to any of the textural parameters. Appearance was not highly (P>0.05, r=−0.46) correlated to WBSF, but was highly negatively correlated to hardness (P<0.05, r=−0.72), cohesiveness (P<0.01, r=−0.82), or gumminess (P<0.05, r=−0.79). Overall tenderness was negatively correlated (P<0.05, r=−0.71) to WBSF, hardness (P<0.01, r=−0.89), gumminess (P<0.01, r=−0.9), but was not significantly correlated (P>0.05, r=−0.6) WBSF. Similarly, juiciness was negatively correlated to hardness (P<0.01, r=−0.82), cohesiveness (P<0.05, r=−0.74), and gumminess (P<0.01), but not to WBSF (P>0.05, r=−0.56). Overall acceptability followed the same trend. Overall acceptability was negatively correlated to hardness (P<0.05, r=−0.72), cohesiveness (P<0.05, r=−0.71), and gumminess (P<0.05, r=−0.76), but was not significantly correlated to WBSF (P>0.05, r=−0.44).

Ostrich meat in place of beef or chicken meat can successfully be used in the production of a traditional product (döner) without significantly affecting its eating quality. Ostrich meat was found to produce better döners in terms of sensory properties, and textural characteristics, which further justifies its use in processed meat products although ostrich meat döners were found to have the highest fat content. Moreover, cholesterol content of the ostrich meat döners was the lowest making it as an alternative fast food for the people who suffer from cholesterol related diseases. Our results suggest that ostrich meat döners will be a novel product and will have a promising future in the fast food sectors provided that use of ostrich meat in processed meat products become a common practice in the meat industry.

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