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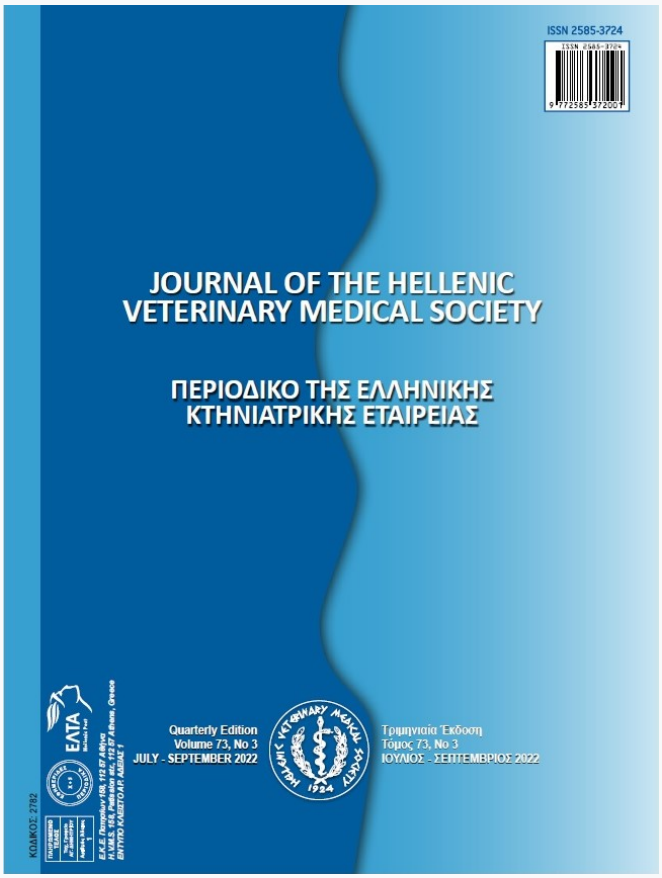

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Quality Characteristics and Oxidative Stability of Chicken *Kavurma* Formulated with Chicken Abdominal Fat as Beef Fat Replacer

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ABSTRACT: *Kavurma* is a traditional cooked ready-to-eat meat product that mainly produce in Middle East countries. In *kavurma* formulation, main ingredients are beef/mutton meat, beef/mutton fat and salt. In this regard, fat has high influence on product's general characteristics. Due to increasing demand on poultry products, food industry working on novel formulations include chicken meat and chicken abdominal fat. Chicken abdominal fat is an important by-product of chicken meat industry and rich in mono and polyunsaturated fatty acids. For this reason, chicken abdominal fat could be used to improve healthier products. In this study, effects of using chicken abdominal fat (CAF) in chicken *kavurma* formulation as partial beef fat (BF) replacer on pH, color, textural and sensorial quality and oxidative stability during cold storage (4°C) for 3 months was studied. For this purpose, one control (C: 100% BF) sample and four modified samples, P1 (87.5% BF+12.5% CAF), P2 (75% BF+25% CAF), P3 (62.5% BF+37.5% CAF) and P4 (50% BF+50% CAF), were produced. Proximate composition and texture profile analysis of samples were determined after production whereaspH, lipid oxidation parameters, color and sensory properties of samples were performed on days 0, 30, 60 and 90. Using CAF in *kavurma* formulations more than 25% resulted higher pH drop during storage, and resulted lower taste and general acceptability scores compared to C samples at the end of storage. P2,P3 and P4 samples had lower TBARS value compared to C during storage period probably result of antioxidative ingredients in chicken fed. As expected, due to the semi liquid characteristic of CAF, using this fat type resulted softer products. To sum up, using CAF as BF replacer resulted lower TBARS compared to C, butit had some negative influence on sensory and quality characteristics at high ratio.

Keywords: chicken kavurma;fat replacement; chicken abdominal fat; beef fat; lipid oxidation

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INTRODUCTION

Kavurma is a traditional cooked ready-to-eat meat product that mainly produce in Turkey and Middle East countries. *Kavurma* has been produced traditionallyat homes for many years because of its long shelf life. Nowadays, in modern plants, *kavurma* is also produced on industrial scale and is sold in can or vacuum packaged form. In traditional production methods, only beef or mutton meat, fat and salt are used, andsome spices for flavoring can be used during serving. According to Turkish Legislation (Anon, 2019), *kavurma* should have moisture, fat and salt ratio lower than 45%, 30%, and 3%, respectively in final product.

Kavurma production method can be explained briefly as dicing meat and fat into small cubic shapes and mixing with salt (2-3%) then cooking. After cooking, *kavurma* is filled into large casingsand then kept in anaerobic conditions at low temperatures(Aksu, 2007, 2009; Kayaardi et al., 2005; Sağır and Turhan, 2013).

Animal fats including kidney fat, internal fats and sheep tail fat are one of the main ingredients of *kavurma*, thus they have high influence on general characteristics and sensorial properties of products(Aksu, 2009; Şişik Oğraş et al., 2018). However, poultry meat has gained popularity recently by consumers since its high biological value, religious beliefs and lower price compared to red meat. Chicken abdominal fat is one of the mainby-products that are removed from chicken meat during chicken carcass portioning. It comprises about 2.5% of chicken carcass and commonly used as biofuel to generate energy or rendered and used as animal feed or in soap production (Centenaro et al., 2008; Santos et al. 2020). It has been well-determined that chicken abdominal fat is rich in mono (44.0 g/100 g) and polyunsaturated fatty acids (25.7 g/100 g), thus it has potential to improve fatty acid profile of meat products (Arnaud et al., 2004).

In previous studies chicken abdominal fat was used as fat sources in emulsified chicken patties (Santos et al., 2020) and chicken sausage (Lima et al., 2020). However, there is no research has been performed regarding production of chicken *kavurma* and utilization of chicken abdominal fat as beef fat replacer in chicken *kavurma*. Therefore, the aims of this study were; i) production of chicken *kavurma* andii) to investigate effects of using chicken abdominal fat as beef fat replacer on some quality characteristics, and oxidative stability during 3-month storage of chicken *kavurma*.

MATERIAL AND METHODS

Material

In the current study, chicken meat, beef fat and chicken abdominal fat (41.67 g/100 g MUFA, 30.42 g/100 g PUFA),and salt were used in *kavurma* production. Chicken meat and chicken abdominal fat were obtained fromGedikPiliçCompany (Uşak, Turkey), beef fat was obtained from local butcher. Salt was purchased from Yeni AktuzCompany (Bornova, İzmir). 2-thiobarbituric acid, chloroform, methanol, potassium iodide and trichloro acetic acid were purchased from Merck (Germany).

Design and Production of Kavurma

Five different formulations were prepared to observe the effects of BF replacement with CAF: control group (C; 100% BF), P1 (87.5% BF+12.5% CAF), P2 (75% BF+25% CAF), P3 (62.5% BF+37.5% CAF) and P4 (50% BF+50% CAF). 84% chicken meat, 15% total fat and 1% salt were used for *kavurma* production.

All chicken *kavurma* trials were produced in GedikPiliçR&D Center (Uşak, Turkey). The chicken meat, beef or chicken abdominal fat (2 x 2 cm pieces) and salt wereadded to cauldron. All the ingredients were stirred for homogenous cooking during production. Cooking process was continued until internal temperature reached 74-78°C. After cooking, *kavurma* samples were filled into fibrouse casings. All the samples were cooled, sliced and vacuum packaged then kept under refrigerated (4 °C) conditions for up to 3 months. Analyzes were performed after 0, 30, 60 and 90 days of storage.

Methods

Proximate composition

Moisture, fat, protein and ash contents of the samples were determined according to (AOAC, 2005).

pH

pH values of samples were measured from homogenate (10 g of sample homogenized in 100 mL distilled water) by using a pH-meter (Hanna Instruments Inc., USA).

Lipid oxidation

Peroxide value (POV) of samples was determined

by using method described by Koniecko, (1979). Sample (5 g) was weighted and homogenized with 30 mL chloroform, then filtered to flask. Filtrate was treated with 30 mL glacial acetic acid and 2 mL saturated potassium iodide solution. Then, flask was stirred and kept in the dark for 5 minutes. 100 mL distilled water and 1% starch solution were added to flask and titrated with 0.1 N sodium thiosulfate solution. Results were expressed as meqO_2/kg fat.

The TBARS value of samples were measured by using Witte et al. (1970) method. 20 grams of sample was weighted and homogenized with 50 mL 20% TCA solution for 2 minutes, then 50 mL cold distilled water added and mixed for another 2 minutes. Sample was filtered through Whatman No:1 filter paper into a 100 mL flask. Cold TCA:distilled water was used to complete volume of flask. 5 mL filtrate and 5 mL TBA solution mixed in test tube and tube was incubated at

Table1. Analysis of variance on the effect of fat combination and storage time on physico-chemical parameters, lipid oxidation and sensorial properties of chicken kavurma samples (F-values of independent variables and interactions)

	Source of variances		
Parameter	A	B	A x B
pH	696,385*	49,260*	26,442*
Lipid oxidation			
Peroxide value	70,582*	21,392*	11,933*
TBARS	490,323*	115,888*	26,205*
Color			
L*	19,147*	5,073*	0,516NS
a*	21,977*	20,797*	3,304*
b*	54,102*	16,010*	0,815NS
Sensorial properties			
Appearance	16,529*	2,826*	2,101*
Texture	8,281*	3,888*	1,070NS
Taste	17,889*	11,806*	0,667NS
Overall acceptability	12,621*	4,724*	1,188NS

A: treatments. B: Storage time.
*P < 0.05
NS: not significant P>0.05

Table 2. Lipid oxidation of chicken kavurma samples

Sample	day	30. day	60. day	90. day
Peroxide Value (meqO_2/kg fat)				
C	33.43±1.64^{a,X}	6.93±1.43^{a,Z}	13.65±1.98^{a,Y}	9.13±1.09^{b,Z}
P1	16.10±4.73^{b,X}	7.29±0.93^{a,Y}	9.67±1.22^{b,Y}	11.22±0.30^{a,Y}
P2	15.75±4.09^{b,X}	7.58±2.71^{a,Y}	10.57±0.21^{b,Y}	7.82±1.73^{b,Y}
P3	12.69±3.63^{b,X}	6.78±1.57^{a,Y}	8.73±1.37^{b,XY}	7.60±0.85^{b,Y}
P4	11.57±3.68^{b,X}	7.80±1.00^{a,XY}	4.88±0.42^{c,Y}	9.33±1.01^{ab,X}
TBARS value (mgMA/kg)				
C	0.43±0.02^{a,Z}	1.50±0.09^{a,X}	0.84±0.13^{a,Y}	0.80±0.08^{a,Y}
P1	0.27±0.03^{b,Z}	1.50±0.11^{a,X}	0.45±0.05^{bc,Y}	0.39±0.06^{c,YZ}
P2	0.25±0.03^{b,Z}	0.76±0.04^{c,X}	0.54±0.03^{b,Y}	0.31±0.04^{c,Z}
P3	0.24±0.04^{b,Z}	0.91±0.04^{b,X}	0.42±0.07^{bc,Y}	0.32±0.01^{c,Z}
P4	0.28±0.02^{b,W}	0.74±0.06^{c,X}	0.38±0.04^{c,Z}	0.50±0.02^{b,Y}

All values are means ± SD of three replicates.
Means within the same column with different superscripts (a-d) are different
Means within the same row with different superscripts (X-Z) are different

80°C for 35 minutes in water bath. The absorbance of sample was measured at 532 nm and results were expressed as mg malonaldehyde/kg sample.

Color

Color parameters of samples were measured by using a digital colorimeter (Chromameter CR400, Minolta, Japan) to obtain the color coordinates lightness (CIE L*), redness (CIE a*) and yellowness (CIE b*).

Instrumental Texture Profile Analysis (TPA)

Meat samples were prepared by cutting meat pieces to 2cm length uniformly. Samples wereheld at room temperature before analysis. TPA test were performed using a Brookfield CT3-4500 Texture Analyzer (Brookfield Engineering Laboratories, Inc., USA) to determine hardness, springiness, cohesiveness, gumminess and chewiness. Test conditions were: 4500 *g* load cell, TA25/1000 probe, 1,50 mm/s pretest speed, 1,00 mm/s and 25% compression.

Sensory properties

Sensory evaluation of samples was carried out by 10 panel members who were either graduate students or staff atUşak University, Food Engineering Department. Panelists were trained according to Kavurma Standard of Turkish Standard Institute (Anon, 2002). Appearance, texture, aroma-taste and overall acceptability were evaluated by using hedonic scale (1: very bad to 9: very good). *Kavurma* samples were sliced around 2 cm thick and presented to panelists after warmed up for 2 minutes in randomized order. Water and bread were provided to panelists.

Statistical analysis

Statistical analysis of data was performed using SPSS package program (IBM, version 21.0, USA). One way ANOVA was used to compare differences in chemical composition and texture of samples. For other analysis, two factors 1) five treatments and 2) storage time were chosen for two-factorial analysis in a completely randomized design. Differences among the means of samples were compared using Duncan's Multiple Range test. A significance level of $P<0.05$ was used for evaluations.

RESULTS AND DISCUSSION

Proximate Composition

Moisture, protein and fat contents of samples were ranged between 44.35%-44.70%, 24.96%-25.51%, and 29.04%-29.94%, respectively. Changes in fat composition did not affect the proximate composition of samples since all samples were produced through thesame formulation ($P>0.05$). For this reason, similar moisture, protein, and fat contents were found in all samples, as expected. According to Turkish Legislation maximum moisture and fat contents of *kavurma* is 45% and 30%, respectively (Anon, 2019). Thus, all samples were found within the standards.

pH

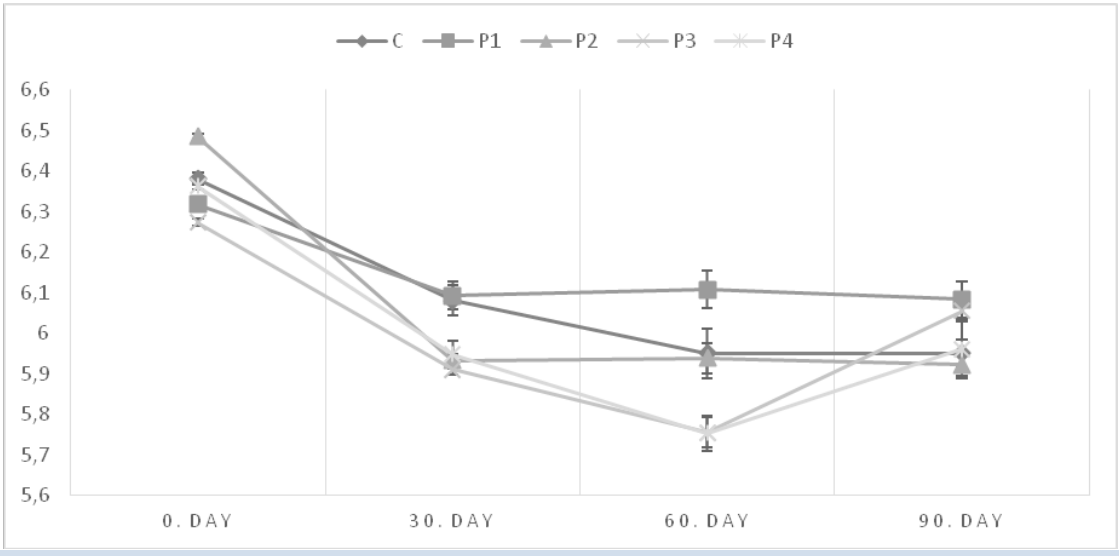

Fig. 1. pH results of chicken kavurma samples

Table 3. Color parameters of chicken kavurma samples

Sample	day	30. day	60. day	90. day
L*				
C	77.91±1.85^{ab,X}	72.47±0.76^{b,Y}	75.08±2.14^{a,Y}	73.86±1.53^{a,Y}
P1	79.59±0.95^{a,X}	75.98±1.69^{a,Y}	76.45±3.12^{a,Y}	74.94±1.49^{a,Y}
P2	76.36±2.25^{b,X}	72.63±1.51^{b,Y}	74.26±1.55^{a,XY}	74.12±0.49^{a,XY}
P3	77.46±1.99^{ab,X}	73.22±2.17^{b,Y}	75.46±2.49^{a,XY}	74.30±1.71^{a,XY}
P4	76.24±0.22^{b,X}	73.52±1.03^{b,Y}	73.76±1.41^{a,Y}	73.59±2.37^{a,Y}
a*				
C	3.39±0.03^{a,X}	0.96±0.76^{d,YZ}	0.34±0.18^{c,Z}	1.25±0.44^{b,Y}
P1	3.57±0.27^{a,X}	1.57±0.27^{cd,Y}	0.95±0.55^{bc,Z}	1.34±0.32^{b,YZ}
P2	3.31±0.06^{a,X}	2.55±0.34^{bc,XY}	1.96±0.84^{ab,Y}	3.06±0.92^{a,X}
P3	3.38±0.15^{a,XY}	3.71±1.05^{a,X}	2.51±0.70^{a,Y}	2.64±0.18^{a,Y}
P4	3.37±0.20^{a,X}	3.22±0.75^{ab,X}	2.92±1.38^{a,X}	3.27±1.26^{a,X}
b*				
C	13.78±0.43^{a,Y}	13.84±1.21^{a,Y}	16.65±1.06^{a,X}	16.37±0.74^{a,X}
P1	12.83±0.56^{ab,Y}	13.75±1.35^{a,Y}	16.42±1.87^{a,X}	15.62±0.32^{a,X}
P2	12.38±1.01^{b,Z}	13.78±1.07^{a,Y}	15.66±0.29^{a,X}	15.23±0.57^{a,X}
P3	11.33±0.62^{c,Y}	11.92±1.12^{a,Y}	15.09±1.11^{ab,X}	15.42±0.70^{a,X}
P4	11.04±0.53^{c,Z}	12.23±1.42^{a,YZ}	13.61±0.74^{b,XY}	13.96±1.21^{b,X}

All values are means ± SD of three replicates.
Means within the same column with different superscripts (a-d) are different
Means within the same row with different superscripts (X-Z) are different

Table 4. Textural properties of chicken kavurma samples

Sample	Hardness (N)	Springiness (mm)	Cohesiveness	Gumminess (N)	Chewiness (Nxmm)
C	2203,75±184,25^{a}	2,65±0,04^{a}	0,51±0,03^{a}	1128,50±164,10^{a}	29,26±3,82^{a}
P1	660,50±198,50^{b}	2,58±0,02^{a}	0,50±0,05^{a}	321,05±62,25^{b}	7,99±1,63^{b}
P2	357,75±19,75^{c}	2,59±0,04^{a}	0,50±0,06^{a}	181,10±31,90^{bc}	4,60±0,87^{bc}
P3	254,33±33,23^{c}	2,31±0,46^{a}	0,52±0,10^{a}	133,33±42,15^{c}	3,13±1,62^{c}
P4	159,50±26,50^{c}	1,75±0,17^{b}	0,34±0,08^{b}	51,75±3,05^{c}	0,89±0,14^{c}

All values are means ± SD of three replicates.
Means within the same factor and the same column with different superscripts (a-d) are different

pH of *kavurma* samples aregiven in Fig. 1. Use of CAF and storage time have significant effects on pH of samples (Table 2., P<0.05). According to Turkish Kavurma Standard, pH of *kavurma* should be between 4.5 to 6.4, so all the samples were found within standards (Anon, 2002). pH differences were recorded at the beginning of storage; the highest pH was found in P2 and the lowest pH was recorded in P3 sample (P<0.05). Thus, differences between samples at the beginning might not be result of fat replacement, but differences in raw material. Storage period significantly decreased the pH of samples due to microbial growth (P<0.05). Considering the sour taste of samples at the end of storage, this result might be result of proliferation of lactic acid bacteria. Similar effects of storage time on pH of *kavurma*was also reported by other authors (Aksu, 2007; Sağır and Turhan, 2013). During storage, the largest pH drops were observed in P3 and P4 samples on 60th day compared to beginning. However, significant pH increment was also observed in these samples after 60th day (P<0.05). This pH increment might be result of microbial breakdown of proteins and production of free amino acids(-Karabagias et al., 2011; Lorenzo et al., 2014).

Lipid Oxidation

Peroxide value (POV) is the measurement of lipid hydroperoxides formed during oxidation. Lipid oxidation parameters of samples were significantly affected by the beef fat replacement and storage period

(Table 2). As seen on Table 2, CAF addition significantly decreases the POV in modified *kavurma* samples (P<0.05). POV of C was found 33.43 meqO_2/kg while modified samples were ranged between 11.57 to 16.10 meqO_2/kgat the beginning of storage.

Hydroperoxides are highly reactive and unstable products, thus fluctuation of POV during storage-couldbe observed(Amaral et al., 2018).As expected, significant decrements on30th and 90th day and increment on 60th day were observed in C and P4 samples (P<0.05). However, P1, P2, and P3 samples were more stable than C and P4, and POV of these samples were found to be similar during storage (P>0.05). At the end of storage, significantly lower POV than 0th day were observed in all samples, except P4 sample (P<0.05). During storage, the highest POV of modified samples was observed in P1 sample at the end of storage (11.22 meqO_2/kg fat), yet this result was found lower than the maximum POV limit of *kavurma*which is 20 meqO_2/kg fataccording to Kavurma Standard (Anon, 2002). Wu et al. (2016) stated that, peroxide value of chicken oil was significantly increased during 14 day accelerated storage (65°C) study, however lower POV were found on samples with use of antioxidants during storage.Lima et al. (2020)showed that use of chicken abdominal fat in chicken sausages resulted lower POV compared to use of chicken skin as fat source during 135-day storage. According to Yetim et al. (2006), POV of beef *kavurma* were found between 3.21 and 7.10 meqO_2/kg fat, and increased during storage. In a similar study, POV of beef *kavurma* formulated with beef fat was found 5.19 meqO_2/kg fat; antioxidant addition to formulation resulted significantly lower POV in samples. During 180 day of storage POV of samples increment and decrement were observed, due to instability of hydroperoxides (Sağır and Turhan, 2013).

Primary oxidation products (hydroperoxides) can decompose under different conditions, thus peroxide value might be not enough to reflect oxidation states (Çoban et al., 2016). TBARS value is the measurement of the malonaldehydes, secondary lipid oxidation products, formed by oxidation of fatty acids(Shoaib et al., 2016). In the present study (Table 2), TBARS of samples were affected by formulation and storage time (P<0.05). BF replacement by CAF significantly decreased TBARS value and significant differences were observed between C and modified samples on 0th day (P<0.05). With respect to increasing storage time, TBARS value was increased and peak value of all samples were found on 30th day(P<0.05). This result might be result of decomposition of primary oxidation products (hyrdoperoxides) to secondary oxidation products (aldehydes) since significant decrease were observed in POV on 30th day of storage. After 30th day, significantly lower TBARS values were found on 60th and 90th days (P<0.05).Reduction of TBARS values after 30th day of storage could be because of decomposition of aldehydes to minor components or oxidative reaction of aldehydes with protein fractions. Guyon et al. (2016)mentioned that, combination of aldehydes with other compounds could result loss of aldehydes during storage and their interactions with protein cause protein damage.

Kayaardı et al. (2005) stated that, TBARS value of beef *kavurma* significantly increased during 90-day storage, and found nearly 1.80 mgMA/kg. Authors also added that, antioxidant addition to the formulation resulted significantly lower TBARS values. In a previous study, higher TBARS values were observed in chicken sausages formulated with chicken abdominal fat, and found around 6 mgMA/kg on 90th day of frozen storage at -18°C since CAF has high amount of unsaturated fatty acids in its composition (Lima et al., 2020). Similar trends were expected in our study. However, replacing BF with CAF resulted lower TBARS values during storage (P<0.05). Thus, this could be attributed to the antioxidative ingredients in the chicken fed, sinceaccording specifications, chicken fed was enriched with vitamin E (80 mg/ton), selenium (300 mg/ton) and BHA-BHT combination (150 g/ton in fed oil). Niu et al. (2018) found that, dietary vitamin E addition to poultry fed can decrease the lipid oxidation parameters, and during storage lower TBARS results were found in samples with vitamin E added fed. During storage, the maximum TBARS value of modified samples was found in P1 sample (1.50 mgMA/kg) in the 30th day. This value was found lower than the maximum TBARS limit for our method (2.0 mgMA/kg) to detect rancid taste in products(Naveena et al., 2014). Similar result were observed in previous studies and authors mentioned that use of chicken abdominal fat does not increase oxidative stress of lipids (Santos et al. 2020; de Carli et al., 2018).

Color

Color is an important parameter to effect consumer decision on products. Color parameters of samples (L*, a*, b*) are given in Table 3.Color parameters of samples were affected with treatment and storage

period (P<0.05). However, treatment x storage time interaction (Table 1) had significant effect on only a* values(P<0.05). At the beginning of storage, modified samples had similar L* and a* values to those obtained from C; yet b* values of P2, P3, and P4 samples were found to be lower than these of C. P2 sample had the highest L* values on 30th day of storage, and all samples had similar L* values for the rest of the storage. Similar trend was observed in a* value; a* values of samples were found similar at the beginning of storage; however significant reduction was observed during storage (P<0.05).Similar to our findings, Shoaib et al. (2016) stated that due to cold storage, changes in pigments can decrease redness of samples. Contradictory, b* values of samples were significantly increased during storage and the highest values were found on 90th day of storage (P<0.05). Similar result were reported by Ferreira et al. (2016) and Al-Hijazeen & Al-Rawashdeh (2019), where higher b* and lower L*, a* values were found at the end of chilled storage in chicken meat and chicken patties.

Texture profile analysis

Fat modification strategies have important influence on textural properties of meat and meat products;thus, it is very important to monitor textural changes in modified products. Textural parameters of chicken *kavurma* samples are given in Table 4. Significant differences were recorded in all of the textural parameters(P<0.05). Hardness, gumminess and chewiness of modified samples were found to be significantly lower than C sample (P<0.05), however only P4 sample showed lower springiness and cohesiveness than all other samples (P<0.05). The results showed that fat source used in *kavurma* production have important influence on hardness and hardness derived parameters. At room temperature, chicken abdominal fat is liquid-semi liquid, for this reason it can be used to improve consistency of products such as creams, cakes and chips (Chiu and Gioielli, 2002). Similar to our findings, Lima et al. (2020) stated that use of chicken abdominal fat could decrease hardness, chewiness and gumminess of chicken sausages. Santos et al. (2020) found that use of chicken skin in

Table 5. Sensory scores of chickenkavurma samples

Sample	day	30. day	60. day	90. day
Appearance				
C	6.00±0.47^{b,X}	6.00±0.67^{ab,X}	6.10±0.57^{ab,X}	5.70±0.82^{a,X}
P1	7.20±0.79^{a,X}	6.70±0.82^{ab,X}	6.40±0.84^{a,X}	5.20±1.14^{a,Y}
P2	7.40±0.97^{a,X}	6.80±0.63^{ab,XY}	6.40±1.17^{a,Y}	5.40±1.17^{a,Z}
P3	6.70±0.95^{ab,X}	5.80±1.14^{b,XY}	5.20±1.33^{b,Y}	6.00±0.82^{a,XY}
P4	7.20±0.92^{a,X}	6.20±1.40^{a,XY}	6.00±1.40^{ab,Y}	5.60±0.70^{a,Y}
Texture				
C	6.80±0.63^{ab,X}	6.30±0.67^{a,X}	6.40±0.97^{a,X}	6.40±0.52^{a,X}
P1	6.90±0.99^{ab,X}	6.20±0.79^{a,XY}	6.30±0.82^{a,XY}	5.90±0.57^{ab,Y}
P2	6.30±0.48^{b,XY}	6.00±0.82^{a,XY}	6.50±0.71^{a,X}	5.70±0.82^{b,Y}
P3	6.70±0.95^{ab,X}	6.00±1.33^{a,XY}	5.30±1.57^{b,Y}	5.70±0.82^{b,XY}
P4	7.20±0.79^{a,X}	6.70±0.82^{a,XY}	6.50±0.85^{a,XY}	6.00±0.67^{ab,Y}
Taste				
C	7.10±0.57^{a,X}	6.50±0.85^{a,XY}	6.20±0.92^{ab,XY}	6.00±1.33^{a,Y}
P1	7.50±0.97^{a,X}	6.60±0.97^{a,XY}	6.80±1.03^{a,XY}	6.30±0.82^{a,Y}
P2	6.90±0.88^{ab,X}	6.30±0.95^{a,XY}	6.20±0.79^{ab,XY}	5.60±0.52^{ab,Y}
P3	6.30±0.82^{b,X}	6.10±0.99^{a,X}	5.10±0.57^{c,Y}	5.10±0.74^{b,Y}
P4	6.30±0.67^{b,X}	6.20±0.63^{a,X}	5.80±0.79^{bc,X}	5.10±0.74^{b,Y}
Overall acceptability				
C	6.30±0.67^{a,X}	6.30±0.67^{a,X}	6.30±0.82^{a,X}	6.10±0.74^{ab,X}
P1	7.10±0.88^{a,X}	6.50±0.53^{a,XY}	6.50±0.71^{a,XY}	6.20±0.79^{a,Y}
P2	6.70±0.48^{a,X}	6.40±0.52^{a,X}	6.50±0.71^{a,X}	5.80±0.79^{abc,Y}
P3	6.60±0.97^{a,X}	6.00±0.82^{a,XY}	5.40±0.67^{a,Y}	5.50±0.53^{bc,Y}
P4	6.80±0.92^{a,X}	6.40±0.70^{a,X}	6.20±0.79^{a,X}	5.40±0.52^{c,Y}

All values are means ± SD of three replicates.
Means within the same column with different superscripts (a-d) are different
Means within the same row with different superscripts (X-Z) are different

chicken patties resulted twice the hardness, chewiness and gumminess values observed in patties formulated with chicken abdominal fat.

Sensory properties

Sensory property scores of *kavurma*samples including appearance, texture, taste and overall acceptability are given inTable 5.It was found that, use of CAF and storage time has significant impact on sensory properties of *kavurma* samples(Table 2).Appearance scores of C samples were found to be the lowest and replacing BF with CAF more than 25% resulted lower taste scores compared to C ($P<0.05$). However, overall acceptability of *kavurma* samples were found to be similar at the beginning of storage. Sensory evaluation scores showed expected decrease for all groups with duration of storage ($P<0.05$), yet C and P1 samples were found to be more stable than P2, P3, and P4 samples during storage in terms of taste and overall acceptability.Appearance scores of all modified samples were found lower compared to beginning of storage ($P<0.05$). The probable reason for lower scores could be result of decrement in L* values of samples due to oxidative changes during store. CAF is more liquid than BF, and during storage higher purge loss were observed in modified samples (data not shown). Thus, loss of moisture and fat in modified samples might result lower texture scores especially 90^{th} day.At the end of storage P3 and P4 samples got the lowest taste scores ($P<0.05$). These samples also had higher pH values on 90^{th} day compared 60^{th} day. This trend might be result of increment of microbial load and decomposition of proteins. Overall acceptability scores of both control and modified samples decreased and all modified samples had significantly lower scores at the end of storage. Negative effect of storage time on sensory quality of chicken meat were mentioned in previous studies (Ferreira et al., 2016; Sivarajan et al., 2017). Santos et al. (2020) stated that, the lowest overall acceptability scores were observed at the end of storage of chicken patties formulated with chicken abdominal fat, probably result of deterioration of the aroma.

CONCLUSION

The use of CAF as BF replacer in chicken *kavurma* has significant influence on quality characteristics and oxidative stability. Using CAF as BF replacer more than 25% resulted higher pH drop during storage and caused sour taste.Use of CAF decreased the lipid oxidation results of samples. Because of oxidative changes during cold storage, L* and a* values of samples decrease while b* values increase. Addition of CAF resulted softer products as well as decreased chewiness and gumminess values. With respect to CAF ratio increment, taste and overall acceptability scores of *kavurma* significantly decreased at the end of storage. As conclusion, replacement ratio is an important factor for oxidative stability, shelf life and consumer acceptance of chicken *kavurma*.

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CONFLICT OF INTEREST

None declared by the authors.

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