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The Effects of Grape Seed Powder and Extract on Quality of Fermented Turkish Sausage

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Abstract:

In this study, the effects of seed powder and extracts of two different grape varieties (Razakı and Black Gemre) on the maturation stage quality properties of Fermented Turkish sausage was investigated. Thiobarbituric acid (TBA), pH and color change characteristics of Fermented Turkish sausage have been investigated. TBA was influenced by grape seed extract on the 12th day of maturation in comparison to the control. The lowest value for different days of fermentation was obtained from 2000 ppm dosage of Black Gemre grape extract. In fermented Turkish sausage, pH were not significantly affected by supplemental grape seed powders and extracts. Color change in sausages with grape seed powder and extract was (L) slight bright, (a) slight reddish and (b) slight yellow. It has been concluded that grape seed powder and extract may be suitable for use as an antioxidant agent to prevent degradation of sausage by oxidation.

Keywords **— Grape seed powder and extract, Lipid oxidation, Fermented Turkish sausage**

I. INTRODUCTION

The main changes (microbial, chemical and sensory) affecting the quality and durability of sausage, which is one of the important meat products of the food sector, occur during the maturation process of sausages [1].Not paying attention to technological and hygienic conditions during the maturation stage of the sausages causes the lack of standard structure and appearance of sausage, standard odor, color and aroma as a result of lipid oxidation. These negativities in sausages affects human health negatively.

Grapeseed contains significant levels of minerals andvitamins. Inparticular, it is an important source of calcium, potassium, sodium, andiron. Moreover, it is an important source of A, B1, B2, C vitaminsandniacin[2, 3]. Grapeseed, in general, contains 40 70% fibre, 16% oil, 11% protein and 7% phenolic compounds[3]. Fiber, fat, proteins and phenolic compounds can affect physical, technological and sensory properties of themeatproducts.However, phenolic compounds affect oxidativest ability of meat products as an İmportant source of antioxidants. The effects of antioxidants in grapesmay protect against cardio vascular diseaseandcancer[4, 5]. The aim of this study was to determine the effect of grape seed powder and extract on the oxidative stability and quality properties of Fermented Turkish sausages.

II. MATERIALS AND METHODS

A. *Materials*

The day after slaughter, three-year-oldsbeef, beef subcutaneousfat and sheep'stailfat were obtainedfrom Biçici sausageltd.,Sti., in Afyonkarahisar (Turkey). Spices used in sausage making was obtained from Soylu spicesltd., Sti., in Afyonkarahisar (Turkey). Razakı and Siyah Gemregrapescultivars was obtained from localpuclic market in Isparta (Turkey). Inthestudy, different concentrations of grapeseed powder and extract obtained from Razakı and Black Gemrevarieties were added to sausage during the fermentation process.

B. *Preparation of Grape Seed Powder And Grape Extract*

Grape seeds obtained from bunches of grape varieties Mature Razakı and Black Gemre were washed and cleaned, then dried in the shade. Dried grape seeds were triturated in a laboratory-type mill to obtain powder. The resulting grape seed powder was extracted with petroleum ether at 60 ° C for 6 hours in a Soxhelet extraction apparatus, and then the oil was separated. The remaining oil-free powder was again extruded in a Soxhelet extraction apparatus for 8 hours at 60 ° C with a solution of acetone: water: acetic acid (90: 9.5: 0.5) [6]. The extracts were passed through Whatman 1 filter paper and completely freed from solvent in a rotary evaporator, then freeze-dried in a lyophilizer.

C. *Susage Production*

The meats are first made into the meat cubes in hygienic conditions and spices are added on them. Raw materials and additives used in sausage production are given in Table 1. The mixture was then passed through a mincemeat machine with frozen fat. The dough passed through the mincing machine was allowed to mature at 4 ° C for 8 hours. Then, grape seed, grape seed extract and bacterium were added into the sausage dough and mixed at a speed of 10-12 rpm for 1 hour and then filled into natural sheaths. Sausages stuffed in natural sheaths are attached to hanging carts by cotton threads. Samples of sausages were taken for microbiological and other analyzes at this stage. The sausages that were filled and put in carts were kept in equilibrium rooms (70-75 % relative humidity at 10-15 ° C) for 12 hours. Sausages kept in balancing rooms have been subjected to a certain period of submergence. The sausage samples were subjected to drying and maturation for 12 days in the incubation chamber. Sausage samples remaining in the incubation chamber were stored at 25 ° C and 90 % relative humidity for the first 2 days, 22 ° C and 80 % relative humidity for 3-4 days, 20 ° C and 70% relative humidity for 5-7 days, 18 ° C and 65% relative humidity for 8-10 days, it was maintained at 18 ° C and 60% relative humidity until the 12th day of maturation. During maturation, the air flow in the environment was set at 0.5 m / s and kept constant. Sausage production was done twice in the same quantity and conditions.

TABLE 1
RAV MATERİALS AND ADDİTİVES USED İN FERMENTED TURKİSH SAUSAGE

Materials	K	N	RT1/ SGT1	RT2/ SGT2	RT3/ SGT3	RT4/ SGT4	RE1/ SGE1	RE2/ SGE2	RE3/ SGE3	RE4/ SGE4
Meat cubes (kg)	5	5	5	5	5	5	5	5	5	5
Tail fat (g)	500	500	500	500	500	500	500	500	500	500
Salt (g)	5	5	5	5	5	5	5	5	5	5
Garlic (g)	75	75	75	75	75	75	75	75	75	75
Chili pepper (g)	35	35	35	35	35	35	35	35	35	35
Red pepper (g)	20	20	20	20	20	20	20	20	20	20
Black pepper (g)	35	35	35	35	35	35	35	35	35	35
Cumin	35	35	35	35	35	35	35	35	35	35
Pimento (g)	10	10	10	10	10	10	10	10	10	10
Grape seed powder (ppm)			250	500	1000	2000	250	500	1000	2000
Grape seed extract (ppm)			250	500	1000	2000	250	500	1000	2000
NaNO2 (g)		0.5								

RT1/SGT1: Razakı grape seed powder 250 ppm, RT2/SGT2: Razakı grape seed powder 500 ppm, RT3/SGT3: Razakı grape seed powder 1000 ppm, RT4/SGT4: Razakı grape seed powder 2000 ppm, RE1/SGE1: SiyahGemre grape seed extract 250 ppm, RE2/SGE2: SiyahGemre grape seed extract 500 ppm, RE3/SGE3: SiyahGemre grape seed extract 1000 ppm, RE4/SGE4: SiyahGemre grape seed extract 2000 ppm

TBA values, pH values and coloranalyzes were determined on days 0, 3, 6, 9 and 12 of the production phase. These analyzes were carried out with 2 repetitions and in 3 parallel measurements.

D. *Determination of TBA values*

TBA (mg malonaldehyde/kg sausage) was determined according to the distillation method as outlined by Tarladgis *et al*. [7]. 10 g of the sample was homogenized with 97.5 ml of distilled water at 50 ° C and taken into the Kjeldahl flask. 2.5 ml of a 4 N HCl solution (1: 2 37% HCl: pure H2O) was added to a volume of 100 ml. 50 ml of distillate was precisely collected by steam distillation. 5 ml of destillate was added and 5 ml of 0.02 M TBA (prepared with 90% glacial acetic acid) was added

and reactivated for 35 minutes in a boiling water bath. The absorbance values of the cooled samples were read at a wavelength of 538 nm on a UV spectrophotometer (UV-1601, Schimadzu, Japan). The absorbance values were multiplied by factor 7,8 to calculate mg of malonaldehyde in kg [7, 8].

The lipid oxidation inhibition rates (%) of the antioxidant samples used in the study were calculated with the following equation.

$$\% \text{ Antioxidant effect: } \frac{\text{Control TBA - antioxidant containing sample TBA}}{\text{Control TBA}} \times 100$$

E. Determination Of The pH Values

Ten grams of sausage was homogenized in 100 mL distilled water and the pH was measured using a pH meter (HANNA type), [9].

F. Determination OfColor Specification

L (brightness), a (redness) and b (yellowness) values of sliced samples of Fermented Turkish sausage were determined with 5 different readings by changing the position of Minolta brand (CR-A70, Japan) color measuring device by placing it between two petri dishes of sliced samples [10].

G. Statistical Analyzes

The data obtained were evaluated in the SAS statistical program [11]. Variance analysis was used in the General Linear Modeling implementation, and the Tukey test was used when the differences between the groups were determined [12].

III. RESULT AND DISCUSSION

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A. TBA Values

The TBA values according to the implementations during the production stages of the sausages are shown in Table 2.

It has been determined that the TBA value generally increases during the maturation period. On the 12th day of maturation, the lowest TBA value was found in 0.62 malonaldehyde / kg SGE4. All implementations have been determined to significantly reduce the TBA value compared to the control. Findings about the inhibitory properties of grape seed against sausage lipid oxidation were parallel with Brannan et al. [13], Carpenter et al. [14], Bañón et al. [15], Rojas et al. [16] and Sáyago-Ayerdi et al. [17] studies.

We argue that the use of Grape seed extract (GSE) against lipid oxidation, which causes undesirable flavor and odor in meat products, oxidation of carcinogenic substances and polyunsaturated fatty acids as result of malondialdehyde formation, and which affects the safety of food in a negative way, would be beneficial.In terms of prevention of lipid oxidation in sausage, there was no difference in terms of grape varieties and grape seed powder and extract. Both types and additives were observed to be effective in preventing lipid oxidation.

TABLE 2
CHANGES in TBA VALUES of SAUSAGES DURİNG FERMENTATİON (MG (MALONALDEHYDE / KG)

	Maturation time (days)				
Sample	**1 d**	**3 d**	**6 d**	**9 d**	**12 d**
N	0.58^{a*E**}	0.70^{aD}	0.91^{aC}	1.14^{aA}	1.02^{aB}
K	$0,58^{aE}$	$0,74^{aD}$	$1,26^{Ac}$	$1,35^{aB}$	$1,50^{aA}$
RT1	$0,49^{bD}$	$0,55^{bC}$	$0,58^{bB}$	$0,63^{bcA}$	$0,58^{bB}$
RT2	$0,48^{bcC}$	$0,56^{bB}$	$0,57^{bcB}$	$0,64^{bcA}$	$0,55^{bB}$
RT3	$0,44^{cdB}$	$0,48^{cB}$	$0,58^{bA}$	$0,61^{bcA}$	$0,56^{bA}$
RT4	$0,43^{deC}$	$0,45^{cdeC}$	$0,53^{bcdB}$	$0,60^{bcA}$	$0,55^{bB}$
RE1	$0,40^{defD}$	$0,48^{cdC}$	$0,57^{bcAB}$	$0,62^{bcA}$	$0,57^{bB}$
RE2	$0,39^{efgC}$	$0,43^{deC}$	$0,55^{bcdB}$	$0,61^{bcA}$	$0,56^{bB}$
RE3	$0,41^{deB}$	$0,45^{cdeB}$	$0,56^{bcdA}$	$0,59^{bcA}$	$0,56^{bA}$
RE4	$0,42^{deC}$	$0,45^{cdeC}$	$0,55^{bcdB}$	$0,59^{bcA}$	$0,57^{bAB}$
SGT1	$0,42^{deE}$	$0,48^{cdD}$	$0,52^{cdC}$	$0,65^{bA}$	$0,58^{bB}$
SGT2	$0,41^{defE}$	$0,46^{cdeD}$	$0,53^{bcdC}$	$0,65^{bcA}$	$0,58^{bB}$
SGT3	$0,44^{cdC}$	$0,46^{cdeC}$	$0,54^{bcdB}$	$0,64^{bcA}$	$0,57^{bB}$
SGT4	$0,39^{efgC}$	$0,43^{eC}$	$0,52^{cdB}$	$0,61^{bcA}$	$0,56^{bB}$
SGE1	$0,41^{defB}$	$0,45^{cdeB}$	$0,56^{bcdA}$	$0,59^{bcA}$	$0,57^{bA}$
SGE2	$0,41^{defC}$	$0,43^{eC}$	$0,55^{bcdB}$	$0,61^{bcA}$	$0,57^{bAB}$
SGE3	$0,37^{fgC}$	$0,43^{eB}$	$0,54^{bcdA}$	$0,58^{cA}$	$0,57^{bA}$
SGE4	$0,35^{gD}$	$0,42^{eC}$	$0,51^{dB}$	$0,59^{bcA}$	$0,56^{bAB}$

* The difference between the averages with the same lowercase letters in the vertical column is not statistically significant (p> 0,05)

** The difference between the averages with the same uppercase letters on the horizontal line is not statistically significant (p>0,05)

pH Values

The effects of grape seed powder and grape seed extract of ripening period on the pH values of Fermented Turkish sausages were found to be significant (p>0.05). But, As shown in Table 3. pH values decreased during the ripening period.

TABLE 3
PH VALUES OF SAUSAGES DURİNG RİPENİNG PERİOD

	Maturation time (days)				
Sample	**1 d**	**3 d**	**6 d**	**9 d**	**12 d**
N	5.81 ^{a*A**}	5.07^{aA}	4.79^{aA}	4.83^{aA}	4.89^{aA}
K	5.85^{aA}	5.11^{aB}	4.74^{aC}	4.83^{aBC}	4.94^{aBC}
RT1	5.83^{aA}	5.12^{aB}	4.82^{aB}	4.85^{aB}	4.97^{aB}
RT2	5.83^{aA}	5.12^{aB}	4.86^{aB}	4.82^{aB}	4.94^{aB}
RT3	5.82^{aA}	5.11^{aB}	4.86^{aC}	4.81^{aC}	4.92^{aBC}
RT4	5.81^{aA}	5.14^{aB}	4.86^{aC}	4.81^{aC}	4.92^{aBC}
RE1	5.83^{aA}	5.09^{aB}	4.81^{aB}	4.83^{aB}	4.94^{aB}
RE2	5.80^{aA}	5.09^{aB}	4.80^{aB}	4.87^{aB}	4.92^{aB}
RE3	5.82^{aA}	5.10^{aB}	4.83^{aB}	4.84^{aB}	4.94^{aB}
RE4	5.83^{aA}	5.12^{aB}	4.82^{aB}	4.83^{aB}	4.92^{aB}
SGT1	5.84^{aA}	5.12^{aA}	4.82^{aA}	4.80^{aA}	4.97^{aA}
SGT2	5.80^{aA}	5.10^{aA}	4.80^{aA}	4.82^{aA}	4.96^{aA}
SGT3	5.81^{aAB}	5.12^{aA}	4.83^{aB}	4.82^{aAB}	4.95^{aB}
SGT4	5.81^{aA}	5.11^{aA}	4.87^{aA}	4.81^{aA}	4.93^{aA}
SGE1	5.82^{aA}	5.09^{aA}	4.83^{aA}	4.82^{aA}	4.94^{aA}
SGE2	5.83^{aA}	5.08^{aA}	4.88^{aA}	4.85^{aA}	4.94^{aA}
SGE3	5.82^{aA}	5.09^{aA}	4.89^{aA}	4.83^{aA}	4.92^{aA}
SGE4	5.82^{aA}	5,09^{aA}	4.85^{aA}	4.84^{aA}	4.94^{aA}

* The difference between the averages with the same lowercase letters in the vertical column is not statistically significant (p>0,05)
* The difference between the averages with the same uppercase letters on the horizontal line is not statistically significant (p>0,05)

B. Color Values

The values of CIE L (brightness), a (redness) andb (yellowness) values were determined on the 1st, 3rd, 6th, 9th and 12th day of sausages obtained by adding grape seed powder and extract.

L Values

The change inL values in the production stages of the sausages is shown in Table 4. During the fermentation process, it was observed that the difference between the L values of the implementations was significant (p> 0.05).
It has been determined that the L value is partially reduced in some implementations during the maturation period compared to the implementations made on different days. There was no difference in terms of L values of sausages for grape varieties and grape seed powder and extract. Studies on L value of GSE showed different results. Brannan [13], reported that the value of L was increased in a study of the effect of GSE on chicken breast, Sáyago-Ayerdi et al. [17] found that GSE led to a decrease in the brightness in a research on the color values of cooked and raw chicken hamburgers. The findings obtained in these studies are different compared to our studies. This is thought to be due to the fact that the studied material and the maturation process conditions are different. Many studies have shown that GSE has no effect on the L value, and it is similar to the findings we have obtained in our study. [14].

TABLE 4
L VALUES OF FERMENTED TURKİSH SAUSAGES DURİNG RİPENİNG PERİOD

	Maturation time (days)				
Sample	**1 d**	**3 d**	**6 d**	**9 d**	**12 d**
N	42,26 ^{a*C**}	45,78^{aB}	46,38^{aAB}	47,74^{aAB}	48,34^{aA}
K	41,01^{aA}	42,34^{abA}	41,09^{abA}	41,35^{bA}	41,28^{bA}
RT1	41,37^{aA}	40,30^{abA}	39,36^{bA}	39,25^{bA}	41,43^{bA}
RT2	41,61^{aA}	42,78^{abA}	41,84^{abA}	42,63^{abA}	39,70^{bA}
RT3	41,15^{aA}	39,69^{bAB}	43,06^{abA}	41,98^{bA}	41,10^{bA}
RT4	41,07^{aA}	40,95^{abA}	39,59^{bA}	40,30^{bA}	40,51^{bA}
RE1	40,02^{aA}	39,60^{abA}	39,87^{bA}	40,63^{bA}	42,10^{bA}
RE2	40,89^{aA}	40,28^{abA}	41,56^{abA}	41,96^{bA}	40,87^{bA}
RE3	41,78^{aA}	40,23^{abAB}	39,90^{bAB}	37,39^{bB}	40,53^{bAB}
RE4	41,78^{aA}	40,31^{abA}	40,57^{abA}	39,44^{bA}	40,33^{bA}
SGT1	42,33^{aA}	40,07^{abA}	42,73^{abA}	40,76^{bA}	41,75^{bA}
SGT2	40,92^{aA}	38,91^{bA}	42,83^{abA}	42,07^{bA}	39,84^{bA}
SGT3	39,47^{aA}	42,22^{abA}	41,13^{abA}	40,32^{bA}	39,94^{bA}
SGT4	42,21^{aA}	43,12^{abA}	42,69^{abA}	40,70^{bA}	39,55^{bA}
SGE1	42,80^{aA}	39,96^{abA}	37,97^{bA}	38,98^{bA}	38,27^{bA}
SGE2	40,14^{aA}	41,83^{abA}	42,43^{abA}	40,91^{bA}	40,83^{bA}
SGE3	41,53^{aA}	41,23^{abA}	43,25^{abA}	41,82^{bA}	42,53^{bA}
SGE4	42,18^{aA}	41,66^{abA}	42,20^{abA}	40,54^{bA}	39,24^{bA}

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* The difference between the averages with the same uppercase letters on the horizontal line is not statistically significant (p> 0,05)

A Values

The change in a values in the production stages of the sausages is shown in Table 5.A values were found to decrease in measurements on different days throughout the maturation period. In the measurements, implementations except K, RT2 and RE4 were observed to be statistically significant.
Brannan [13] measured a value by applying GSE to chicken breast, Mc Carthy et al. [18] to pork meatball. The results showed that GSE causes darker redness.

These findings are different from the findings of our study. The reason for this is thought to be due to the material used during the research and the maturation period.Sáyago-Ayerdi et al. [17] reported that GSE caused a reduction in redness of color values in cooked and raw chicken hamburgers which is similar to our results.

TABLE 5
A VALUES OF FERMENTED TURKİSH SAUSAGES DURİNG THE FERMANTATİON STAGE

	Maturation time (days)				
Sample	**1 d**	**3 d**	**6 d**	**9 d**	**12 d**
N	11,36 ^{b*C**}	13,52 ^{bBC}	14,28 ^{efAB}	15,73 ^{abcdAB}	15,91 ^{cdeA}
K	19,88^{aA}	22,91^{aA}	18,54^{abcdeA}	17,07^{abcdA}	18,28^{abcdA}
RT1	21,00^{aA}	22,23^{aA}	15,12^{cdefB}	18,21^{abcAB}	18,85^{abcAB}
RT2	19,17^{aA}	20,74^{aA}	18,82^{abcdeA}	18,58^{abcA}	19,08^{abcA}
RT3	19,16^{aB}	26,05^{aA}	19,62^{abcB}	18,48^{abcB}	17,58^{abcdB}
RT4	20,44^{aAB}	20,79^{aA}	16,89^{bcdeAB}	16,44^{abcdB}	17,31^{bcdAB}
RE1	17,65^{aB}	23,25^{aA}	17,87^{abcdeB}	16,83^{abcdB}	17,03^{bcdB}
RE2	20,12^{aAB}	23,40^{aA}	18,24^{abcdeB}	17,11^{abcdB}	16,03^{cdeB}
RE3	19,50^{aB}	24,38^{aA}	21,67^{aAB}	14,80^{cdeC}	14,33^{defC}
RE4	18,96^{aA}	21,49^{aA}	19,00^{abcdA}	18,78^{abcA}	19,01^{abcA}
SGT1	19,37^{aB}	23,37^{aA}	20,03^{abB}	20,08^{aB}	21,68^{aAB}
SGT2	19,04^{aBC}	23,69^{aA}	17,56^{abcdeC}	20,18^{aC}	21,51^{aB}
SGT3	21,39^{aA}	21,23^{aA}	16,32^{bcdefB}	19,52^{abAB}	20,84^{aA}
SGT4	18,60^{aA}	21,67^{aA}	14,66^{defB}	12,83^{deB}	12,58^{efB}
SGE1	17,62^{aB}	24,02^{aA}	12,05^{fC}	11,12^{eC}	11,67^{fC}
SGE2	19,50^{aA}	22,98^{aA}	21,67^{aA}	14,81^{cdeB}	14,33^{defB}
SGE3	20,86^{aB}	22,50^{aA}	18,27^{abcdeC}	15,62^{bcdD}	12,44^{efCD}
SGE4	19,05^{aAB}	21,19^{aA}	19,35^{abcdA}	15,40^{bcdeC}	12,23^{efD}

* The difference between the averages with the same lowercase letters in the vertical column is not statistically significant (p> 0,05)
** The difference between the averages with the same uppercase letters on the horizontal line is not statistically significant (p> 0,05)

B Values

The B values of the applications are shown in Table 6. During the fermentation process of the implementations, the difference between the b values was found to be non-significant (p> 0.05). It has been found that b value decreased in some implementations during measurements on different days throughout the maturation period. These are N, SGT1, SGT4, and SGE2 implementations.

Mc Carthy et al. [18] and [16] had different results than ours and found that b value did not change pork meatballs. It is believed that the different material and the conditions of maturation process can explain different results. Sáyago-Ayerdi et al. [17] found that GSE led to a reduction of b value in cooked and raw chicken burgers which was in line with our results.

TABLE 6
B VALUES of FERMENTED TURKİSH SAUSAGES DURİNG THE FERMENTATİON STAGE

	Maturation time (days)				
Sample	**1 d**	**3 d**	**6 d**	**9 d**	**12 d**
N	18,24 ^{a*A**}	16,18^{bAB}	15,62^{bAB}	14,42^{bB}	14,03^{bB}
K	23,19^{aA}	20,79^{abA}	20,15^{abA}	19,71^{aA}	19,69^{aA}
RT1	21,61^{aA}	22,30^{aA}	20,99^{aA}	21,46^{aA}	20,10^{aA}
RT2	22,00^{aA}	20,78^{abA}	20,53^{abA}	20,49^{aA}	19,50^{aA}
RT3	21,22^{aA}	22,98^{aA}	19,65^{abA}	20,07^{aA}	20,82^{aA}
RT4	22,51^{aA}	21,65^{abA}	20,19^{abA}	19,61^{aA}	20,08^{aA}
RE1	20,18^{aA}	21,15^{abA}	20,19^{abA}	20,18^{aA}	20,17^{aA}
RE2	20,88^{aA}	23,17^{aA}	20,02^{abA}	20,02^{aA}	20,41^{aA}
RE3	23,87^{aA}	23,17^{aA}	20,23^{abA}	19,35^{aA}	19,53 ^{Aa}
RE4	22,46^{aA}	20,73^{abA}	20,63^{aA}	19,56^{aA}	20,21 ^{Aa}
SGT1	23,87^{aA}	19,61^{abB}	19,94^{abB}	19,92^{aB}	20,39^{aAB}
SGT2	21,54^{aA}	20,11^{abA}	20,02^{abA}	19,56^{aA}	19,70 ^{Aa}
SGT3	21,98^{aA}	20,27^{abA}	20,22^{abA}	19,86^{aA}	19,89 ^{Aa}
SGT4	22,58^{aA}	19,14^{abB}	19,41^{abB}	19,99^{aAB}	20,51^{Aab}
SGE1	21,50^{aA}	23,03^{aA}	20,43^{abA}	20,21^{aA}	19,57^{aA}
SGE2	20,99^{aAB}	24,14^{aA}	20,44^{abB}	19,76^{aB}	19,82^{aB}
SGE3	22,84^{aA}	20,03^{abA}	20,57^{aA}	20,34^{aA}	20,02^{aA}
SGE4	22,97^{aA}	21,56^{abA}	20,36^{abA}	20,09^{aA}	19,78^{aA}

*The difference between the averages with the same lowercase letters in the vertical column is not statistically significant (p>0,05)
** The difference between the averages with the same uppercase letters on the horizontal line is not statistically significant (p>0,05)

IV. CONCLUSIONS

We argue that the use of grape seed powder and extact due to their antioxidant activity against lipid oxidation, which causes undesirable flavor and odor in meat products, oxidation of carcinogenic substances and polyunsaturated fatty acids as result of malondialdehyde formation, and which affects the safety of food in a negative way, would be beneficial. The addition of grape seed powder and

extract did not affect pH values of Fermented Turkish sausage. The results suggested that grape seed powder and extract may have a potential application as a natural additive in dry fermented sausages.

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