The Effects of Orange Fiber on Some Qualitative Properties of Sucuk, Traditional Turkish Dry-Fermented Sausage

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Introduction

- There is a great interest on production of functional food products in the world.
- Among these products, functional meat products have a special importance.
- As these foods can be derived from traditional foods, they can also be produced by using new technologies.
- Use of plant products in production of functional meat products (dietary fiber, phytochemicals, etc.) is common.

Introduction

- Dietary fiber usage is particularly common because of its technological and physiological properties, such as fat substitution and positive health effects
- The aim of this study is to determine the effects of different orange fiber and fat levels on the physical, chemical, microbiological and sensorial properties of sucuk during ripening.

Materials and Methods

- **Production of Orange Fiber**
- by a method offered by Fernandez-Gines *et al.* (2003). The obtained fiber was cooked and dried.
- **Sausage Formulation and Processing**
- Three different sheep tail fat levels

1. 90% lean meat + 10% tail fat,
2. 85% lean meat + 15% tail fat,
3. 80% lean meat + 20% tail fat

Materials and Methods

- **Sausage Formulation and Processing**
- 25 g/kg NaCl
- 10 g/kg garlic
- 4 g/kg saccarose
- 7 g/kg red pepper
- 5 g/kg black pepper
- 9 g/kg cumin
- 2,5 g/kg pimento
- 0,15 g/kg $NaNO_2$ (Kaban and Kaya 2009)

Materials and Methods

- **Sausage Formulation and Processing**
- Amount of orange fiber was calculated over the total mixture and added to batters in different levels (0, 2 and 4%).
- *Lactobacillus plantarum* GM77 *Staphylococcus xylosus* GM92 (Kaban and Kaya, 2008) (LAB appx:10^7 cfu/g, *S. xylosus* appx:10^6 cfu/g)
- Sucuk samples were fermented and dried in an automatic climate unit

Materials and Methods

- **Sausage Formulation and Processing**
- First day 22°C,
- Second and third days 20°C
- For the following days 18°C.
- In the first three days relative humidity (RH) was 90±2% and on the other days the RH was decreased to 82±2% by degrees.
- Air stream was used in two different velocities (0,5 m/s - 1 m/s).

Materials and Methods

- **Sampling Procedure**
- Sampling was performed by randomly selecting 2 samples of each sausage group after 0, 1, 3, 5, 7 and 10 days for microbiological, physical and chemical analyses. Sensorial analysis was performed on the ripened sucuk samples.

Materials and Methods

- **Microbiological Analysis**

a) Lactic acid bacteria
b) *Staphylococcus/Micrococcus*
c) *Enterobacteriaceae*

- **Physical and Chemical Analysis**

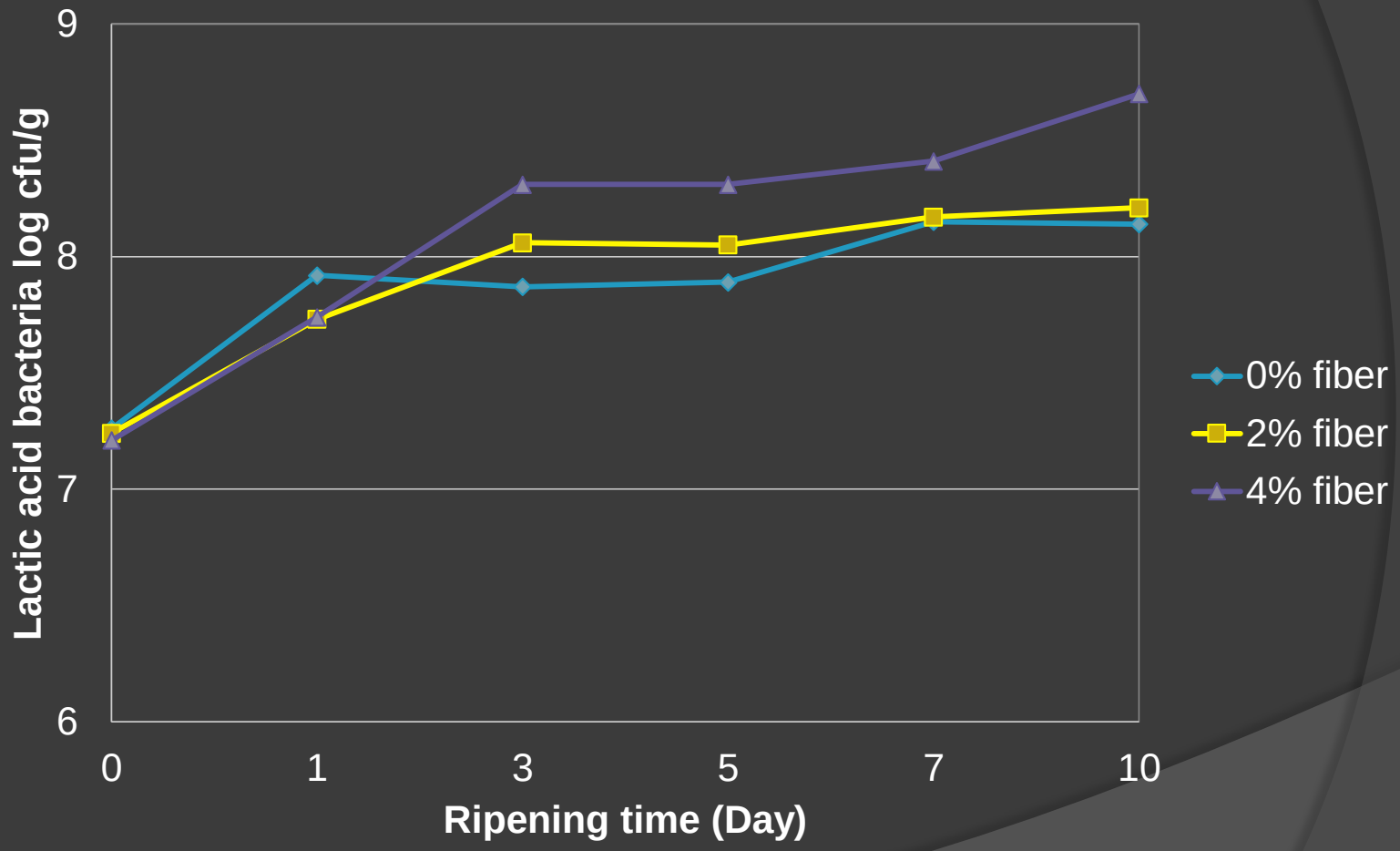
a) pH and Water Activity
b) Residual Nitrite and Thiobarbituric Acid Reactive Substances (TBARS)
c) Color Analysis
d) Cooking Loss

- **Sensory Evaluation**
- **Statistical Analysis**

Results and Discussion

	Lactic Acid Bacteria (log cfu/g)	Micrococci/Staphylococci (log cfu/g)
Orange Fiber (O)		
0%	7,87±0,34b	6,54±0,24^{a}
2%	7,91±0,39b	6,47±0,23^{ab}
4%	8,11±0,53a	6,39±0,27^{b}
Significance	**	*
Ripening Period (R)		
0	7,23±0,97d	6,65±0,19^{a}
1	7,80±0,20c	6,43±0,24^{b}
3	8,08±0,28b	6,33±0,21^{b}
5	8,08±0,24b	6,31±0,24^{b}
7	8,24±0,17a	6,43±0,23^{b}
10	8,35±0,35a	6,65±0,17^{a}
Significance	**	**
Fat (F)		
10%	7,983±0,44a	6,454±0,24a
15%	7,978±0,44a	6,509±0,25a
20%	7,94±0,45a	6,451±0,27a
Significance	NS	NS
OxR	**	NS

Figure 1. The interaction of Ripening time and Fiber level on LAB counts (P<0,01)



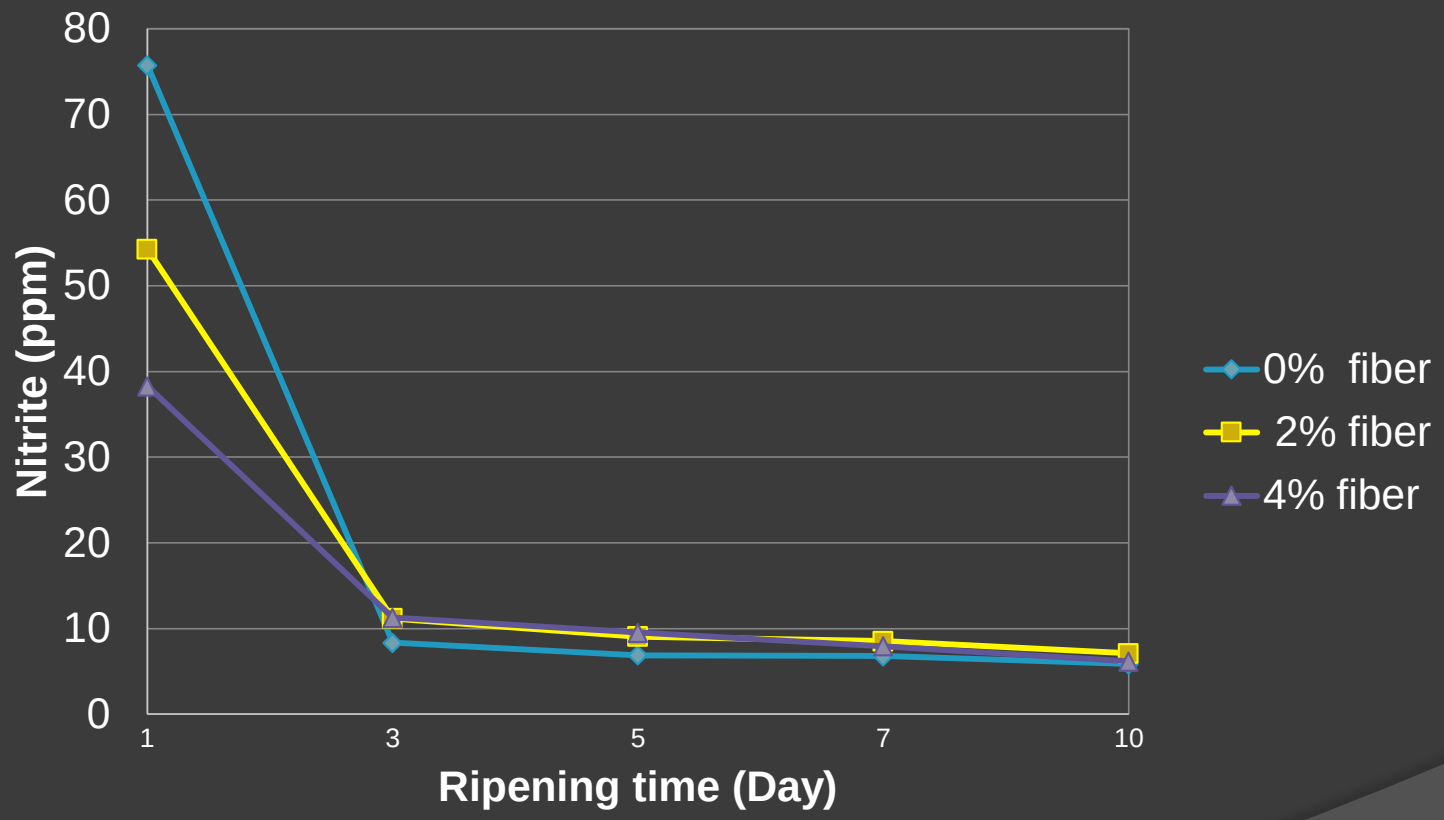
Results and Discussion

- *Enterobacteriaceae* count was 10^2 cfu/g in Experiment I and decreased under detectable level ($<10^2$ cfu/g) in the first three days of ripening. In Experiment II, *Enterobacteriaceae* count was under detectable level in all samples.

	pH	aw
Orange Fiber (O)		
0%	4,96±0,53a	0,921±0,032a
2%	4,83±0,52b	0,923±0,029a
4%	4,71±0,49c	0,924±0,028a
Significance	**	NS
Ripening Period (R)		
0	5,63±0,12a	0,952±0,001a
1	5,37±0,12b	0,950±0,002a
3	4,44±0,12e	0,935±0,006b
5	4,49±0,09d	0,915±0,015c
7	4,50±0,10d	0,905±0,020d
10	4,56±0,11c	0,875±0,012e
Significance	**	**
Fat (F)		
10%	4,83±0,49a	0,923±0,03a
15%	4,84±0,49a	0,921±0,03a
20%	4,84±0,51a	0,923±0,03a
Significance	NS	NS

	Residual Nitrite (ppm)	TBARS µmol/gr
Orange Fiber (O)		
0%	20,73±28a	8,95±1,42c
2%	18,03±18b	12,03±2,6b
4%	14,64±12c	14,50±5,1a
Significance	**	**
Ripening Period (R)		
0		10,09±2,96b
1	56,11±16a	11,18±3,11b
3	10,26±1,66b	10,57±2,45b
5	8,49±1,32ab	11,81±4,59ab
7	7,76±1,08c	12,92±3,54ab
10	6,37±1,22c	14,38±5,84a
Significance	**	*
Fat (F)		
10%	17,07±19,68a	12,16±4,8a
15%	18,087±22a	11,79±3,84a
20%	18,25±21,05a	11,54±3,67a
Significance	NS	NS
OxR	**	NS

Figure 2. The interaction of fiber level and ripening time on residual nitrite levels of samples (P<0,01).

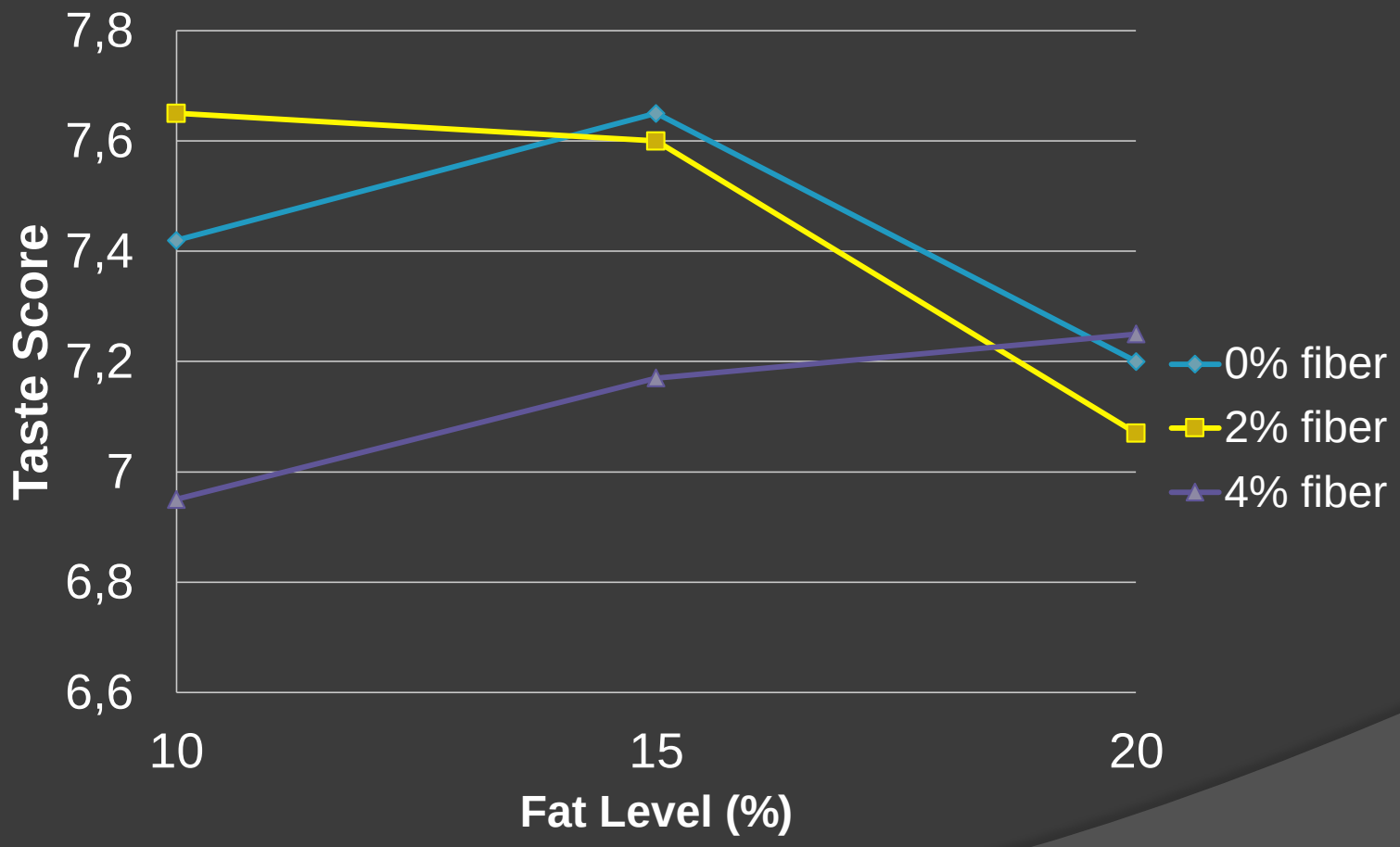


	L*	a*	b*
Orange Fiber (O)			
0%	42,28±2,8c	17,11±2,77a	11,69±3,1c
2%	45,26±2,4b	17,55±2,86a	13,33±2,6b
4%	47,28±2,5a	17,17±3,16a	14,78±3,1a
Significance	**	NS	**
Ripening Period (R)			
0	44,43±2,4c	11,34±1,6c	18,01±2,8a
1	42,59±3,7d	17,86±1b	13,84±1,7b
3	47,01±2,8a	18,56±0,8ab	12,80±1,9bc
5	46,03±2,6ab	18,85±1,2a	11,89±2,4c
7	45,33±3cb	18,59±0,9ab	11,76±2,3c
10	44,25±3,3c	18,45±1,2ab	11,32±2,6c
Significance	**	**	**
Fat (F)			
10%	43,42±1,75c	17,57±3,14a	12,84±3,12b
15%	44,87±3,01b	17,12±2,86a	12,94±3,11ab
20%	46,53±3,18a	17,14±2,78a	14,037±3,4a
Significance	**	NS	NS

	Cooking loss	Colour	Texture
Orange Fiber (O)			
0%	16,41±3,4a	7,78±0,24a	6,93±0,31b
2%	14,48±3a	7,18±0,43a	7,27±0,12a
4%	11,59±2,9b	6,39±0,56b	6,96±0,29b
Significance	**	**	*
Fat (F)			
10%	11,19±2,34c	7,23±0,89a	6,98±0,33a
15%	14,01±2,48b	7,21±0,6a	7,19±0,17a
20%	17,28±3,14a	6,92±0,71a	6,98±0,32a
Significance	**	NS	NS

	Odour	Taste	General acceptability
Orange Fiber (O)			
0%	7,47±0,43a	7,42±0,26a	7,45±0,3a
2%	7,22±0,22a	7,44±0,29a	7,5±0,24a
4%	7,02±0,28a	7,12±0,18b	7,11±0,2b
Significance	NS	**	*
Fat (F)			
10%	7,17±0,54a	7,34±0,35ab	7,4±0,41a
15%	7,32±0,23a	7,47±0,26a	7,42±0,27a
20%	7,23±0,27a	7,17±0,11b	7,25±0,17a
Significance	NS	*	NS
OxF	NS	*	NS

Figure 3. The interaction of fat and fiber level on taste scores of samples (P<0,01).



Conclusions

- Production of sucuk with functional properties is possible by using orange fiber.
- This study also gives an opportunity to evaluate by-products of orange fruit production.