

THE EFFECT OF ADDING DEGREASED FLAXSEEDS ON THE QUALITY OF PORK SAUSAGES

Tomasz Florowski, Anna Florowska*, Daria Wodzyńska, Marta Chmiel, Lech Adamczak, Dorota Pietrzak
Department of Food Technology and Assessment, Institute of Food Sciences, Warsaw University of Life Sciences-SGGW,
159c Nowoursynowska Street, 02-787 Warsaw, Poland;
Correspondence*: anna_florowska@sggw.edu.pl

INTRODUCTION & AIM

Flax seeds are a nutritionally valuable and widely used raw material for oil production [1]. The residue after pressing the oil are degreased flax seeds (DFS). This by-product is a source of many nutritionally valuable ingredients [2], such as protein, fiber, mucous substances and lignans, which makes it a potentially attractive raw material for use in the production of various types of functional food [3].

The aim of the study was to assess the effect of adding this nutritionally valuable raw material on the quality of homogenized pork sausages.

METHOD

Five variants of homogenized sausages were produced, which differed in the amount of degreased flax seeds added, i.e. 0, 2%, 4%, 6% and 8% (Basic batter recipe: pork meat 54%, pork jowl 23%, water 23%, curing mixture 1.6% of the batter mass, spice mixture 0.37% of the batter mass).

The quality of sausages was determined based on i.e. cooking losses (smoking and steaming to a temperature of 72°C), reheating losses (95°C, 10 min.), measurements of water activity, pH, colour parameters (L^* , a^* , b^*), texture parameters (shear and compression forces), basic chemical composition (water, protein and fat content; NIR method), and sensory evaluation of the product (meat and flax seed odor and taste, elasticity, juiciness, overall desirability; 0-10 points). Statistical analysis: one-way analysis of variance, Tukey test, $\alpha = 0.05$.

RESULTS & DISCUSSION

It was found that the addition of degreased flax seeds (DFS) in the amount of 2% to the batter had no effect on most of the analyzed quality parameters of homogenized sausages (i.e. cooking and reheating loss, water activity, pH [Tab. 1], L^* and a^* color parameters [Tab. 2], water, protein and fat content [Tab. 3], shear force [Fig. 1] and compression force [Fig. 2], elasticity and meat taste [Tab. 4]). However, such a 2% DFS addition resulted in an increase in the share of yellow colour (increased b^* parameter) [Tab. 2], reduction of the intensity of the meat odor and the appearance of the odor and taste of flax seeds in the product [Tab. 4], as well as a slight deterioration in its overall desirability [Fig. 3]. The higher the DFS addition, the more pronounced its adverse effect on the product quality, especially its sensory quality. With the increased addition of DFS to the batter of homogenized sausages, an increase in the intensity of the flax seed odor and taste was observed, while the perception of the meat odor and taste decreased. A decrease in the scores awarded for the elasticity and juiciness of the product, as well as its overall desirability, was also noted [Tab. 4, Fig. 3]. A large addition of DFS to the batter also caused a significant reduction in the shear force of sausages (with an addition of 8%) [Fig. 1], a reduction in the brightness of their color (with an addition of 4-8%), a reduction in the share of red color (with an addition of 4-8%) [Tab. 2], and an increase in the pH value (with an addition of 8%) [Tab. 1]. At the same time, the addition of even the largest amount of DFS (e.g. 8%) to the batter had no significant effect on such quality features of sausages as cooking and reheating loss, water activity [Tab. 1] and protein content [Tab. 3].

Table 1. The effect of DFS addition on the cooking loss and mass loss during reheating, water activity and pH of pork sausages

Variant	Cooking Loss [%]	Reheating loss [%]	Water Activity	pH
0% DFS	9.0 ^a ± 2.0	1.60 ^a ± 0.65	0.958 ^a ± 0.004	6.05 ^a ± 0.05
2% DFS	9.0 ^a ± 2.0	1.45 ^a ± 0.51	0.962 ^a ± 0.005	6.09 ^{ab} ± 0.03
4% DFS	8.0 ^a ± 1.0	1.91 ^a ± 0.62	0.962 ^a ± 0.002	6.10 ^{ab} ± 0.01
6% DFS	8.0 ^a ± 1.0	2.02 ^a ± 0.91	0.964 ^a ± 0.003	6.11 ^{ab} ± 0.03
8% DFS	8.0 ^a ± 1.0	2.27 ^a ± 0.64	0.963 ^a ± 0.005	6.12 ^b ± 0.02

Means in columns with different letter symbols differ significantly ($p < 0.05$)

Table 2. The effect of DFS addition on the color parameters of pork sausages

Variant	L^*	a^*	b^*
0% DFS	66.41 ^c ± 0.65	13.18 ^b ± 0.46	8.48 ^a ± 0.43
2% DFS	65.41 ^{bc} ± 0.98	12.36 ^{ab} ± 0.53	9.58 ^b ± 0.40
4% DFS	64.49 ^{ab} ± 0.66	11.93 ^a ± 0.59	10.96 ^c ± 0.79
6% DFS	63.80 ^a ± 0.80	11.74 ^a ± 0.44	11.68 ^c ± 0.55
8% DFS	63.30 ^a ± 0.84	11.67 ^a ± 0.58	11.98 ^c ± 0.54

Means in columns with different letter symbols differ significantly ($p < 0.05$)

Table 3. The effect of DFS addition on the water, protein and fat content of pork sausages

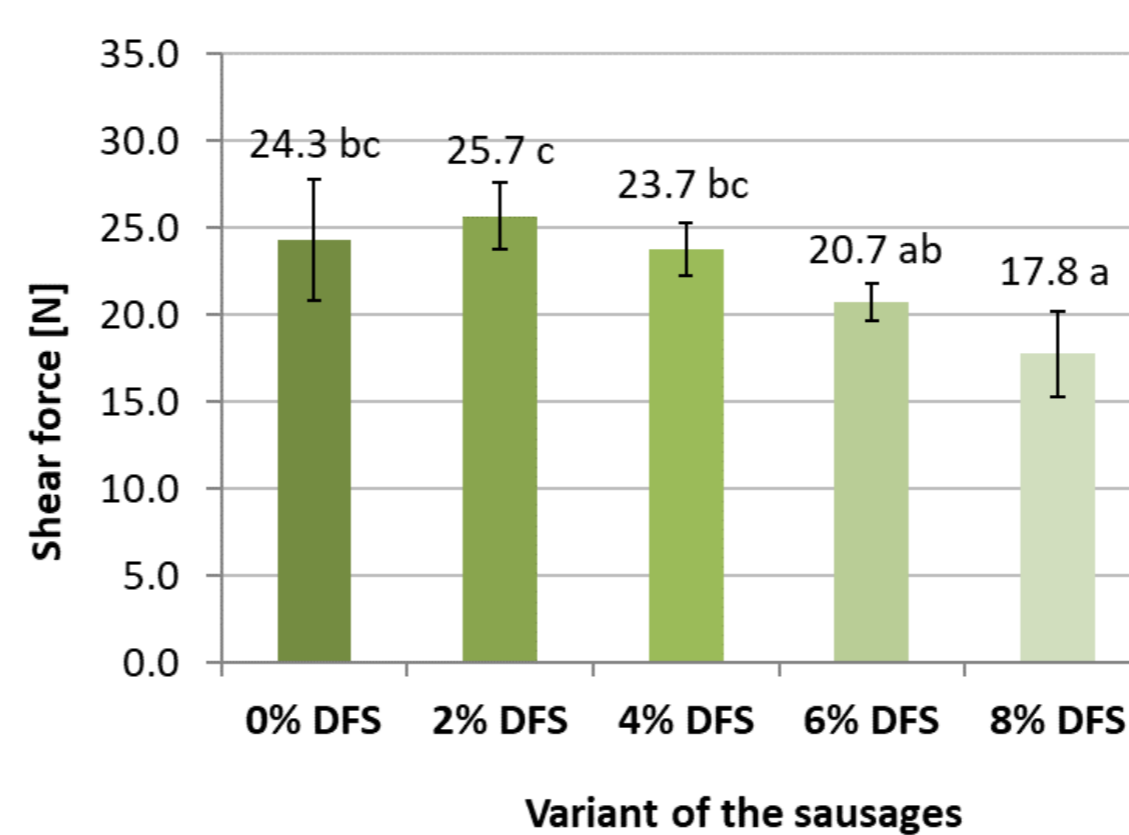
Variant	Water [g / 100 g]	Protein [g / 100 g]	Fat [g / 100 g]
0% DFS	58.17 ^a ± 1.45	15.44 ^a ± 1.15	23.21 ^c ± 0.79
2% DFS	59.24 ^{ab} ± 1.55	15.00 ^a ± 0.72	22.49 ^c ± 0.57
4% DFS	60.71 ^{bc} ± 1.05	15.11 ^a ± 0.71	20.84 ^b ± 0.72
6% DFS	59.58 ^{abc} ± 1.44	14.86 ^a ± 0.94	22.33 ^c ± 0.45
8% DFS	62.00 ^c ± 0.92	15.94 ^a ± 0.56	18.16 ^a ± 0.53

Means in columns with different letter symbols differ significantly ($p < 0.05$)

Table 4. The effect of DFS addition on the sensory quality characteristics of pork sausages

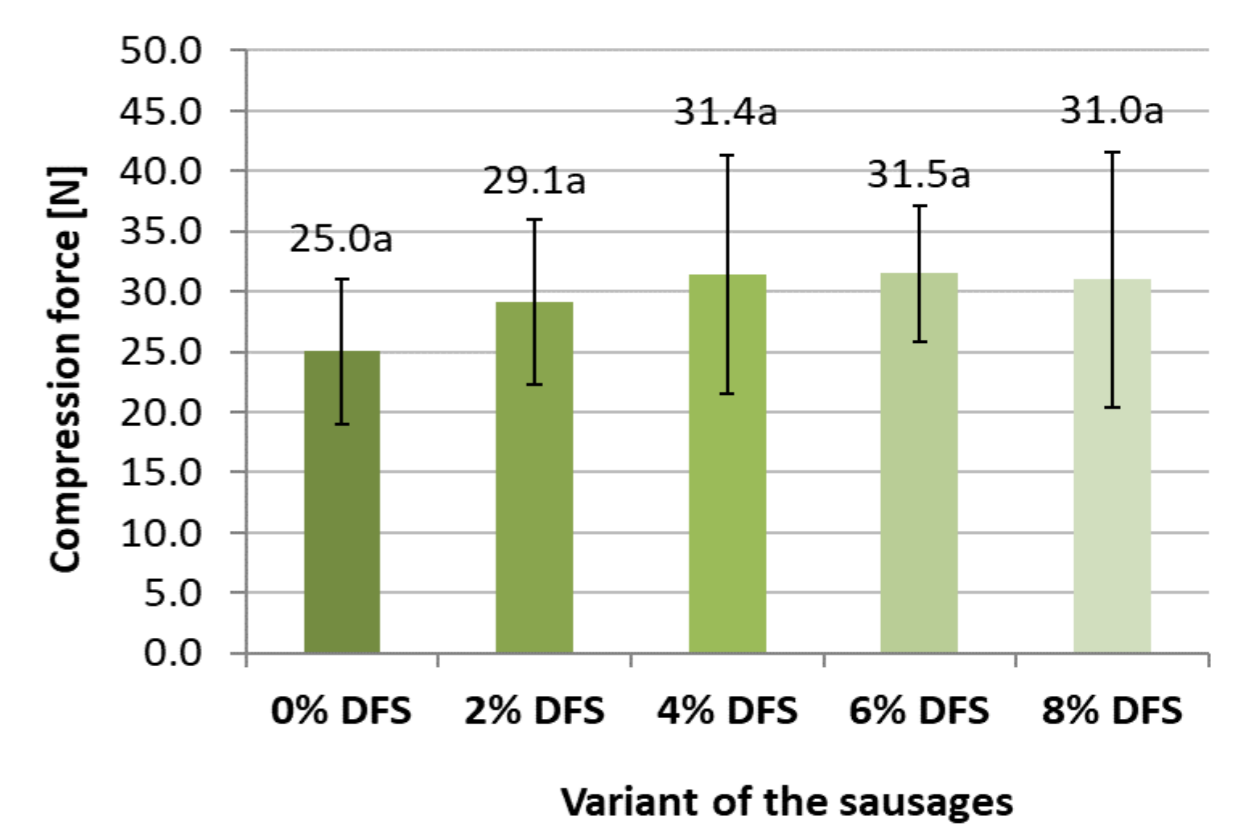
Variant	Meat odor	Flax seeds odor	Meat taste	Flax seeds taste	Elasticity	Juiciness
0% DFS	8.7 ^d ± 0.6	0.0 ^a ± 0.0	9.2 ^d ± 0.3	0.0 ^a ± 0.0	7.3 ^d ± 1.2	8.0 ^e ± 0.6
2% DFS	6.9 ^c ± 0.5	2.4 ^b ± 0.8	8.3 ^{cd} ± 0.3	2.6 ^b ± 0.4	6.3 ^{cd} ± 0.5	6.9 ^d ± 0.6
4% DFS	5.1 ^b ± 0.7	3.9 ^c ± 0.4	7.0 ^{bc} ± 0.6	4.3 ^c ± 0.3	5.2 ^{bc} ± 0.2	5.5 ^c ± 0.5
6% DFS	3.9 ^a ± 0.4	5.8 ^d ± 1.1	5.7 ^b ± 1.1	7.6 ^d ± 1.0	3.9 ^{ab} ± 0.5	3.7 ^a ± 0.3
8% DFS	3.2 ^a ± 0.8	7.5 ^e ± 1.0	4.4 ^a ± 0.9	8.7 ^e ± 0.8	3.0 ^a ± 0.9	2.6 ^a ± 0.6

Means in columns with different letter symbols differ significantly ($p < 0.05$)



Means with different letter symbols differ significantly ($p < 0.05$)

Figure 1. The effect of DFS addition on the shear force of pork sausages



Means with different letter symbols differ significantly ($p < 0.05$)

Figure 2. The effect of DFS addition on the compression force of pork sausages

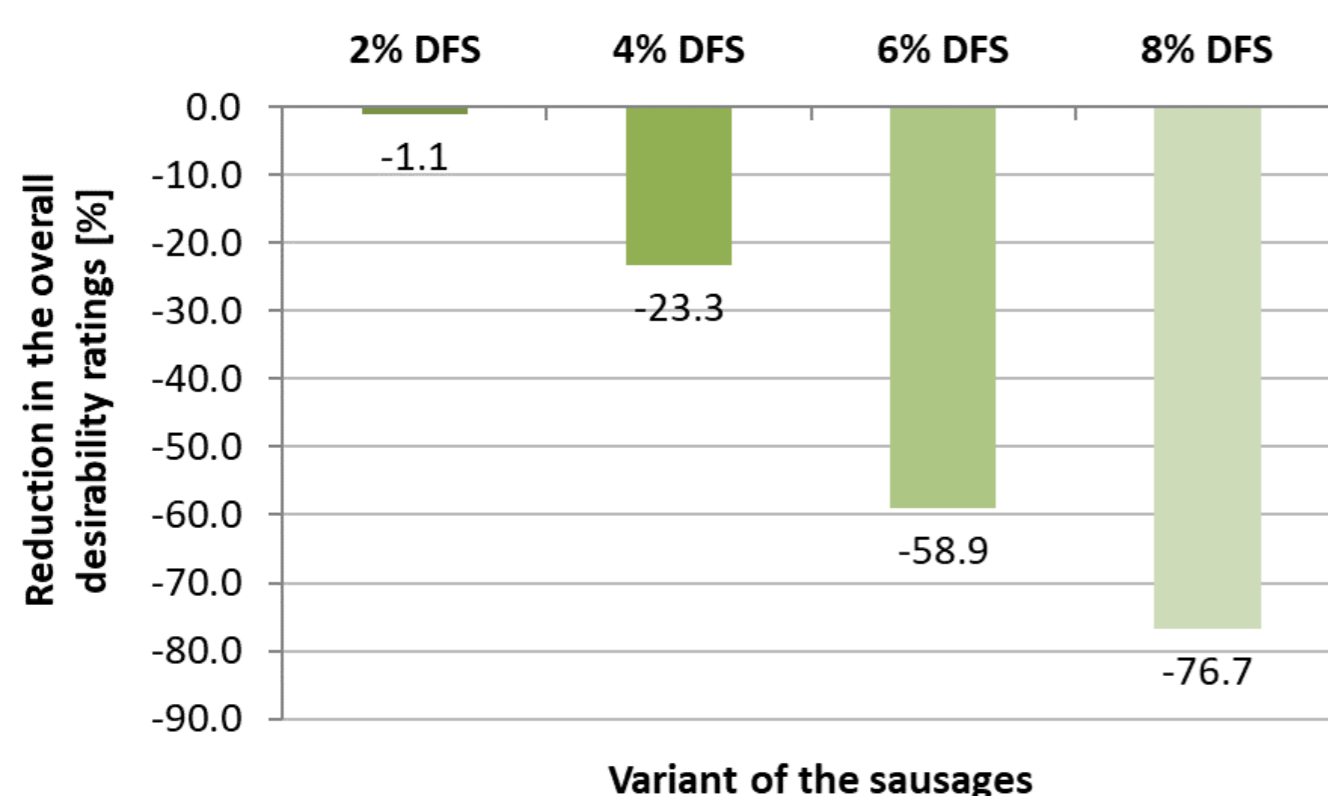


Figure 3. The effect of DFS addition on the reduction in the overall desirability ratings of pork sausages

CONCLUSION

The effect of adding degreased flax seeds (DFS) on the quality of pork sausages depends on the amount of seeds introduced to the batter. The greater the amount of DFS in the stuffing, the more pronounced, unfavorable effect on the quality of homogenized sausages, especially on sensory quality, color, and shear force. The obtained results indicate that the production of good quality homogenized pork sausage enriched with degreased flax seeds is possible, but the addition of this nutritionally valuable ingredient to the stuffing must be small and cannot exceed 2%.

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