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APPLICATION OF CHIA SEED COPRODUCT IN DRY-CURED SAUSAGES: EFFECT UPON ITS PHYSICOCHEMICAL PROPERTIES

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INTRODUCTION

less salt

less nitrite

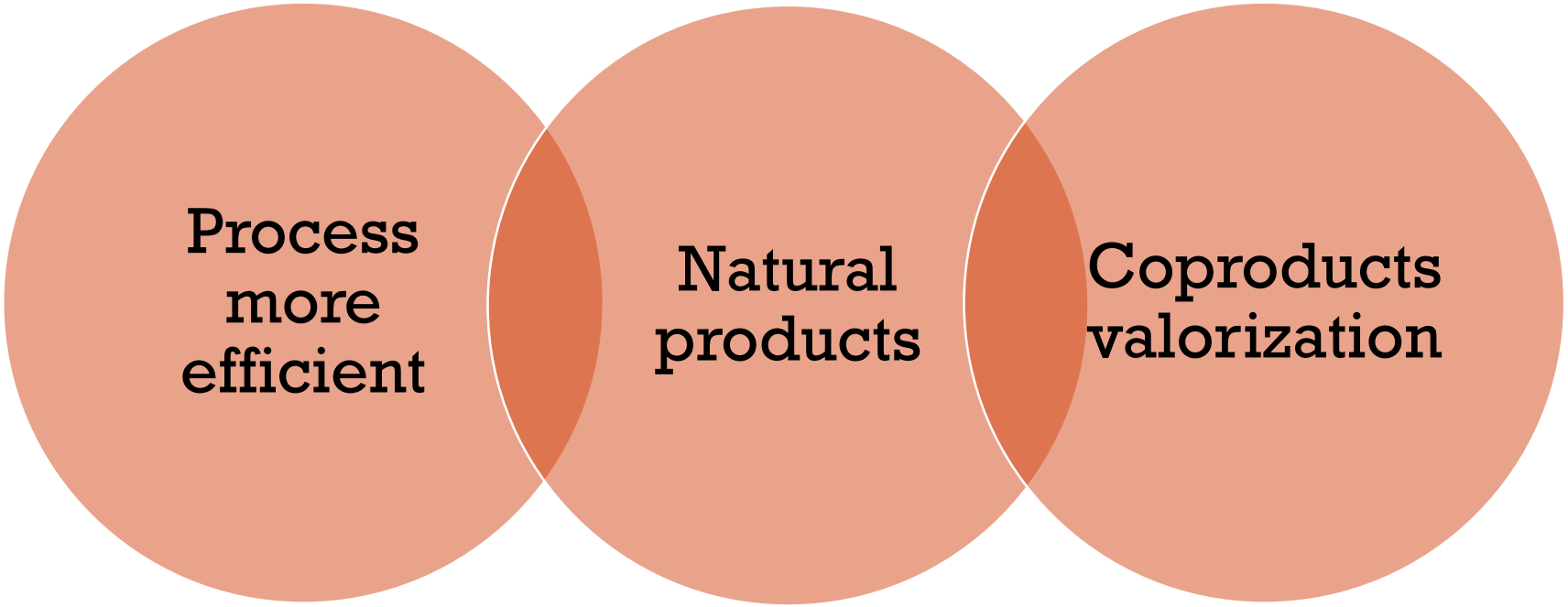
less saturated fats

more dietary fiber

HEALTHIER MEAT PRODUCTS

INTRODUCTION

INCREASING SUSTAINABILITY IN THE MEAT INDUSTRY



INTRODUCTION

OIL EXTRACTION

COPRODUCT

DEFATTED FLOUR

MUCILAGE EXTRACTION

CHIA SEED WITHOUT MUCILAGE

MATERIALS AND METHODS

CONTROL

+ WHOLE CHIA SEEDS (WCS)

- 1.5%
- 3%
- 4.5%

+ CHIA SEEDS WITHOUT MUCILAGE (WSWM)

- 1.5%
- 3%
- 4.5%

Dry-curing process: 15 ± 1 ◦C and 75 ± 2% relative humidity during 3 days

MATERIALS AND METHODS

Moisture content

Water activity

pH

Lipid oxidation

Residual nitrite level

Colour properties

During dry-curing process

Day 1 > Day 2 > Day 3

RESULTS

Table 1. Mean and standard deviation of CIELAB colour parameters (L*: lightness; a*: red/green co-ordinate (+/-); b*: yellow/blue co-ordinate (+/-)) of dry-cured sausages added with different concentrations (0, 1.5, 3.0 and 4.5%) of chia whole seed (CWS) and chia seed without mucilage (CSWM) during a traditional dry-curing elaboration process (0, 1, 2 ,3 days).

			CSWM			WCS		
	days	CONTROL	1.5%	3%	4.5%	1.5 %	3 %	4.5%
L*	0	44.07 ± 0.23Aa	44.49±1.27 Aa	43.42±0.27Aa	41.29±0.76 Aa	50.24± 0.13Aa	48.04±1.06Aa	46.28 ± 1.41Aa
	1	54.43 ± 3.82Aa	51.33±2.79 Aa	48.04±3.45Aa	46.62±2.26Aa	47.46± 4.00 Aa	47.20±1.75Aa	46.92 ± 3.00Aa
	2	48.93 ± 3.41Aa	47.46±4.00Aa	46.22±2.20Aa	44.89±4.55Aa	46.32±5.67Aa	45.25±2.85Aa	45.82 ± 4.17Aa
	3	45.39 ± 2.61Aa	48.67±2.87Aa	46.61±6.97Aa	43.88±2.96Aa	46.18±5.56Aa	45.48±2.53Aa	45.84 ± 5.17Aa
a*	0	3.50 ± 0.07Aa	1.61 ± 0.22Aa	2.08 ± 0.37 Aa	2.21 ± 0.12 Aa	3.64 ± 0.07 Aa	2.35 ± 0.46 Aa	1.75 ± 0.22 Aa
	1	4.62 ± 1.75Aa	4.49 ± 1.05 Aa	4.91 ± 1.55 Aa	4.50 ± 0.95 Aa	4.46 ± 1.49 Aa	4.75 ± 1.04 Aa	3.59 ± 0.58 Aa
	2	4.27 ± 1.08Aa	4.46 ± 1.49Aa	3.36 ± 1.13 Aa	3.10 ± 1.55 Aa	3.99 ± 1.61 Aa	3.77 ± 0.78 Aa	3.05 ± 1.28 Aa
	3	5.50 ± 0.72Aa	3.27 ± 1.35b	3.02 ± 1.66b	3.32 ± 0.87b	3.96 ± 1.45b	3.09 ± 1.43b	3.26 ± 1.37b
b*	0	6.50 ± 0.23Cab	6.11 ± 0.43Cb	5.65 ± 0.82Cbc	5.66 ± 0.14Dc	6.59 ± 0.08Ba	6.88 ± 0.20Ba	5.59 ± 0.48Bc
	1	10.04 ± 1.30Aa	9.22 ± 0.52Aab	9.08 ± 1.31Aab	8.05 ± 1.52Abc	7.02±2.64ABbcd	7.76 ± 1.02Acd	7.41 ± 1.52Acd
	2	8.02 ± 1.84ABa	7.02±2.64ABab	6.16 ± 1.14Bb	7.23±1.70ABab	6.71±1.67ABabc	6.71±1.72ABabc	6.0 ± 1.30ABabc
	3	8.05 ± 1.36ABa	7.84±1.18ABab	5.79±1.75ABbc	6.51±1.52ABCbc	5.44±1.81ABCbc	6.56±2.40ABab	4.41 ± 0.92Ccd

[a-f] Similar values in the same row indicates not significant differences (P>0.05)

[A-D] Similar values in the same column indicates not significant differences (P>0.05)

RESULTS

Table 1. Residual nitrite level (RNL) and lipid oxidation (TBA values) of dry-cured sausages added with different concentrations (0, 1.5, 3.0 and 4.5%) of chia whole seed (CWS) and chia seed without mucilage (CSWM) during a traditional dry-curing elaboration process (0, 1, 2 ,3 days).

			CSWM			WCS		
	days	CONTROL	1.5%	3%	4.5%	1.5 %	3 %	4.5%
	0	99.05 ± 1.53Aa	79.17 ± 0.32Ac	82.08 ± 1.13Ab	65.93 ± 1.54Ad	79.04 ± 0.82Ac	80.19 ± 0.4Ac	79.76 ± 0.97Ac
RNL	1	86.47 ± 1.08Ba	62.32 ± 0.70Bc	63.45 ± 1.76Bc	65.23 ± 0.36Ab	66.15 ± 0.54Bb	62.88 ± 0.08Bc	62.29 ± 0.82Bc
(mg/kg)	2	71.49 ± 0.78Ca	57.39 ± 1.65Cd	41.81 ± 0.21Ce	50.03 ± 0.07Bd	53.66 ± 0.67Cc	53.45 ± 0.62Cc	58.47 ± 0.88Cb
	3	31.59 ± 0.15Da	7.14 ± 0.42Dd	3.00 ± 0.05Df	5.25 ± 0.54Ce	14.85 ± 0.36Db	13.17 ± 0.47Dc	13.84 ± 0.01Dbc
	0	0.16 ± 0.08Aa	0.19 ± 0.02Aab	0.13 ± 0.10Aa	0.17 ± 0.02Aa	0.20 ± 0.09Ab	0.20 ± 0.09Ab	0.19 ± 0.02Ab
TBA	1	0.27 ± 0.06Ba	0.29 ± 0.12Bb	0.35 ± 0.03Babc	0.39 ± 0.06Bc	0.25 ± 0.06Aab	0.36 ± 0.13Bc	0.37 ± 0.11Bc
(mgMA/kg)	2	0.54 ± 0.16Cab	0.58 ± 0.03Ca	0.67 ± 0.14Cb	0.61 ± 0.05Cb	0.55 ± 0.03Ba	0.51 ± 0.26BCab	0.48 ± 0.10BCa
	3	0.79 ± 0.04Db	0.90 ± 0.07Da	0.84 ± 0.01Da	0.78 ± 0.16Dab	0.63 ± 0.06Cc	0.66 ± 0.11Cc	0.69 ± 0.08Dc

[a-f] Similar values in the same row indicates not significant differences (P>0.05)

[A-D] Similar values in the same column indicates not significant differences (P>0.05)

RESULTS

Table 1. Mean and standard deviation of pH, water activity and moisture content of dry-cured sausages added with different concentrations (0, 1.5, 3.0 and 4.5%) of chia whole seed (CWS) and chia seed without mucilage (CSWM) during a traditional dry-curing elaboration process (0, 1, 2 ,3 days).

			CSWM			WCS		
	days	CONTROL	1.5%	3%	4.5%	1.5 %	3 %	4.5%
	0	5.78 ± 0.02Aa	5.74 ± 0.02Ab	5.68 ± 0.01Ac	5.63 ± 0.01Ad	5.63 ± 0.02Ad	5.64 ± 0.03Ad	5.63 ± 0.02Ad
pH	1	5.76 ± 0.02Aa	5.73 ± 0.01Aab	5.64 ± 0.02Ac	5.64 ± 0.02Ac	5.61 ± 0.03ABc	5.62 ± 0.02Ac	5.63 ± 0.02Ac
	2	5.61 ± 0.03Ba	5.50 ± 0.01Bb	5.52 ± 0.02Bb	5.55 ± 0.03Bbc	5.59 ± 0.02Acd	5.61 ± 0.01Ad	5.61 ± 0.01Ad
	3	5.58 ± 0.03Bb	5.42 ± 0.03Cc	5.42 ± 0.02Cc	5.44 ± 0.02Cc	5.58 ± 0.03Ab	5.99 ± 0.04Aa	5.60 ± 0.04Ab
	0	0.989 ± 0.004Aa	0.984 ± 0.010Aab	0.985 ± 0.002Aa	0.979 ± 0.001Ab	0.969 ± 0.001Ac	0.968 ± 0.023Ac	0.965 ± 0.003Acd
Aw	1	0.974 ± 0.003Ba	0.948 ± 0.002Bb	0.942 ± 0.002Bc	0.940 ± 0.001Bc	0.941 ± 0.001Bc	0.939 ± 0.002Bcd	0.935 ± 0.001Be
	2	0.939 ± 0.004Ca	0.942 ± 0.001Ca	0.939 ± 0.001Ca	0.937 ± 0.002BCa	0.923 ± 0.002Cc	0.932 ± 0.002Cb	0.932 ± 0.001Cb
	3	0.931 ± 0.002Db	0.938 ± 0.003Da	0.933 ± 0.003Db	0.929 ± 0.003Dbc	0.92 ± 0.003CDc	0.927 ± 0.002Dd	0.926 ± 0.002Dd
	0	64.28 ± 0.65Aa	63.23 ± 1.29Aa	64.02 ±0.56Aa	66.22 ± 3.92Aa	64.67 ± 1.11Aa	64.40 ± 0.62Aa	64.54 ± 0.33Aa
Moist.	1	60.09 ± 1.62Ba	59.28 ± 0.43Ba	59.89 ± 1.53Ba	62.72 ± 0.48ABb	61.14 ± 1.40Ba	60.45 ± 1.28Ba	60.07 ± 0.38Ba
$gH_2O/100g$	2	54.77 ± 0.69Ca	54.75 ± 1.16Ca	56.92 ± 1.59Ca	52.75 ± 1.03Cb	56.57 ± 0.39Ca	57.84 ± 5.89BCa	53.42 ± 0.83Cb
	3	42.48 ± 2.18Da	41.12 ± 0.67Da	35.15 ± 1.65Db	40.14 ± 1.71Da	34.29 ± 2.95Db	35.12 ± 1.59Db	33.13 ± 1.45Db

$^{a\text{-}f}$ Similar values in the same row indicates not significant differences (P>0.05)

$^{A\text{-}D}$ Similar values in the same column indicates not significant differences (P>0.05)

CONCLUSIONS

This work opens a very interesting door to further studies in which chia seeds (as whole chia seed and as its coproduct obtained after mucilage extraction) can be applied in conventional formulations and broadening the knowledge of the interesting technological advantages, that chia could bring to this type of meat products to make them healthier and more attractive to the consumer. The results suggest that whole chia seed (WCS) at any of the concentrations (1.5, 3.0 and 4.5%) under study, is a very good option for dry-cured sausages elaboration process.

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