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The Effect of Thawing Process with Microwaves on the Changes of Physical Qualities of Pig Meat PWL Breed

Wpływ procesu rozmrażania z wykorzystaniem mikrofal na zmianę cech fizycznych mięsa świń rasy wbp

It is widely known that to maintain human creative power at the proper level and human life in general, continuous energetic and material regeneration of his organism is demanded. Taking up food serves this purpose (5). However, we should not forget that food is of full value only if it is processed and prepared in a right way. Thawing is one of such processes as it is the last operation performed on frozen food before its consumption. The ultimate quality of frozen food is conditioned by a thawing method to a great extent, hence it should be made carefully not to cause excessive drip or unfavourable changes in food flavour and consistence (1). The present work aims at demonstrating the influence of microwaves on the thawing meat, its physical qualities in particular.

MATERIAL AND METHODS

The examinations were made on 9 pigs LWP breed. After slaughter the meat samples of 0.5 kg from loin, neck, ham and shoulder blade were collected to determine *pH*, colour and meat water absorbability. Colour and water absorbability was established with standard methods. Estimation of meat *pH* was achieved by device STAR CPU. The above indices were established in both, raw meat and after thawing. The samples studied were thawed in microwave Moulinex under the waves 150 and 350 W over 10 and 25 min.

RESULTS AND DISCUSSION

Power and time of microwave operation had a significant influence on *pH* changes in the samples examined. It was observed that growth of microwave power and the operation time went together with *pH* value increase (Tab. 1 and 2). The lower *pH* values of the samples studied correlated to higher indices of colour brightness and water absorbability, whereas the higher *pH* values of meat corresponded to lower colour brightness and watery indices (Tab. 3 and 4), (Tab. 5 and 6). Microwave operation also exerts a significant effect on meat water absorbability; together with the growth of its power and operation time water absorbabiilty was reduced considerably (Tab. 5 and 6).

Table 1. Effect of meat thawing with microwaves (150 W) on *pH* value (x) in the basic cuts of pig LWP breed

Kind of cuts	Raw meat	After thawing	
		10 min	25 min
Ham	5.50	5.60	5.63
Loin	5.56	5.65	5.66
Neck	5.66	5,80	5.94
Shoulder	5.60	5.80	5.86

Table 2. Effect of meat thawing with microwaves (350 W) on *pH* value (x) in the basic cuts of pig LWP breed

Kind of cuts	Raw meat	After thawing	
		10 min	25 min
Ham	5.46	5.45	5.55
Loin	5.41	5.46	5.48
Neck	6.10	6.18	6.37
Shoulder	6.5	6.53	6.57

Table. 3. Effect of meat thawing with microwaves (150 W) on its colour (%) in the basic cuts of pig LWP breed

Kind of colour		Shoulder			Neck			Ham			Loin		
		PZ	10 min	25 min	PZ	10 min	25 min	PZ	10 min	25 min	PZ	10 min	25min
W	$\bar{x}$	20.49 ^{A}	22.04 ^{B}	22.16 ^{C}	20.10 ^{A}	33.04 ^{C}	19.08 ^{C}	25.23 ^{A}	29.06 ^{B}	18.00 ^{C}	26.42 ^{A}	36.26 ^{B}	24.88
	SD	0.21	0.19	0.18	0.22	0.19	0.20	0.22	0.26	0.24	0.31	0.17	0.35
R	$\bar{x}$	41.18 ^{A}	38.14 ^{B}	35.93 ^{C}	37.06 ^{A}	33.77 ^{B}	35.92 ^{C}	43.23 ^{A}	44.30 ^{B}	37.87 ^{C}	43.36 ^{A}	54.00 ^{B}	41.42 ^{C}
	SD	0.39	0.27	0.24	0.26	0.61	0.24	0.30	0.23	0.42	0.23	0.42	0.41
G	$\bar{x}$	16.21 ^{A}	18.36 ^{B}	17.11 ^{C}	17.64 ^{A}	18.12 ^{B}	13.11 ^{C}	14.41 ^{A}	30.83 ^{B}	15.88 ^{C}	14.40 ^{A}	29.12 ^{B}	18.81 ^{C}
	SD	0.19	0.21	0.13	0.24	0.26	0.28	0.22	0.48	0.39	0.22	0.35	0.59
B	$\bar{x}$	15.06 ^{A}	17.12 ^{B}	16.14 ^{C}	16.68 ^{A}	17.12 ^{B}	12.60 ^{C}	13.64 ^{A}	29.42 ^{B}	14.54 ^{C}	16.20 ^{A}	28.06 ^{B}	18.19 ^{C}
	SD	0.18	0.27	0.22	0.23	0.26	0.24	0.17	0.38	0.34	0.16	0.34	0.59

$^{A, B, C}$ Mean values in the same rows with big letters differ significantly $P \leq 0.01$

Table 4. Effect of meat thawing with microwaves (350 W) on its colour (%) in the basic cuts of pig LWP breed

Kind of colour		Shoulder			Neck			Ham			Loin		
		raw meat	10 min	25 min	raw meat	10 min	25 min	raw meat	10 min	25 min	raw meat	10 min	25min
W	$\bar{x}$	19.00 ^{A}	21.24 ^{B}	22.73 ^{C}	25.08 ^{A}	30.92 ^{B}	23.98 ^{C}	19.40 ^{A}	25.86 ^{B}	27.13 ^{C}	28.82 ^{A}	41.54 ^{B}	33.91 ^{C}
	SD	0.24	0.52	0.41	0.62	0.41	0.31	0.37	0.29	0.30	0.30	0.73	0.38
R	$\bar{x}$	33.27 ^{A}	31.38 ^{B}	36.66 ^{C}	47.76 ^{Aa}	44.01 ^{B}	48.14 ^{Ba}	49.20 ^{A}	35.64 ^{B}	37.27 ^{C}	49.60 ^{A}	57.98 ^{B}	53.02 ^{C}
	SD	0.30	0.31	0.47	0.39	0.41	0.34	0.55	0.46	0.42	0.26	0.40	0.42
G	$\bar{x}$	17.03 ^{A}	20.28 ^{B}	20.86 ^{C}	23.36 ^{A}	18.48 ^{B}	17.43 ^{C}	24.06 ^{Aa}	23.53 ^{bA}	25.60 ^{B}	24.12 ^{A}	38.80 ^{B}	25.67 ^{C}
	SD	0.51	0.26	0.45	0.32	0.37	0.38	0.46	0.47	0.40	0.45	0.45	0.50
B	$\bar{x}$	15.49 ^{A}	21.00 ^{B}	21.01 ^{C}	21.91 ^{B}	17.04 ^{A}	16.80 ^{C}	22.92 ^{A}	24.97 ^{B}	26.16 ^{C}	23.08 ^{A}	38.09 ^{B}	24.56 ^{C}
	SD	0.26	0.61	0.74	0.48	0.55	0.38	0.32	0.44	0.54	0.40	0.45	0.39

$^{A, B, C}$ Mean values in the same rows with big letters differ significantly $P \leq 0.01$

$^{a, b}$ Mean values in the same rows with little letters differ significantly $P \leq 0.05$

Table 5. Effect of meat thawing with microwaves (150 W) on its water absorbability (%) in the basic cuts of pig LWP breed

Kind of cuts	Raw meat		After thawing			
			10 min		25 min	
	$\bar{x}$	*SD*	$\bar{x}$	*SD*	$\bar{x}$	*SD*
Ham	22,82 ^{A}	0,61	15,58 ^{B}	0,48	9,79 ^{C}	0,47
Loin	16,63 ^{A}	0,51	14,94 ^{B}	0,14	9,14 ^{C}	0,28
Neck	19,16 ^{A}	0,50	15,23 ^{B}	0,66	10,24 ^{C}	0,83
Shoulder	26,34 ^{A}	0,49	16,92 ^{B}	0,54	14,73 ^{C}	0,39

$^{A, B, C}$ Mean values in the same rows with big letters differ significantly $P \leq 0.01$

Table 6. Effect of meat thawing with microwaves (350 W) on its water absorbability (%) in the basic cuts of pig LWP breed

Kind of cuts	Raw meat		After thawing			
			10 min		25 min	
	$\bar{x}$	*SD*	$\bar{x}$	*SD*	$\bar{x}$	*SD*
Ham	24,70 ^{A}	0,82	18,22 ^{B}	0,27	16,83 ^{C}	0,32
Loin	13,41 ^{A}	0,26	11,20 ^{B}	0,22	5,59 ^{C}	0,63
Neck	18,93 ^{A}	1,16	8,53 ^{B}	1,12	4,97 ^{C}	0,41
Shoulder	38,11 ^{A}	2,56	24,92 ^{B}	0,91	9,49 ^{C}	0,85

$^{A, B, C}$ Mean values in the same rows with big letters differ significantly $P \leq 0.01$

Meat colour and *pH* are considered to be some of the major criteria for meat quality evaluation as they are crucial for consumer`s preference of a product. Colour brightness is of special importance. Bright meat is usually more watery and hence less useful for processing (2). Among many qualities characterising meat quality the most reliable information is provided by its *pH*, which affects the value of other physical properties in a decisive way (4). A muscle of a living animal shows *pH* of about 7.2 (10). Różyczka (7) proved clear correlation between *pH* and W,R,G,B value (% reemission) and water absorbability. Identical relations were recorded in the samples examined in the present study. Power and time of microwave operation had a significant influence on *pH* changes in the samples examined. It was observed that growth of microwave power and the

operation time went together with *pH* value increase (Tab. 1 and 2). The lower *pH* values of the samples studied correlated to higher indices of colour brightness and water absorbability, whereas the higher *pH* values of meat corresponded to lower colour brightness and watery indices (Tab. 3 and 4), (Tab. 5 and 6). Higher *pH* meat values prove that glycogenolysis and glycolysis processes slowed down. Such conclusions were drawn by Lechowski et al. (3).

After slaughter, glycolysis resulting from the muscular tissue enzymes causes depletion of adenosine-5-triphosphate (ATP) store and *pH* in a muscle declines. Then glycogen breaks down to form lactic acid reducing *pH* value (6). Decrease of *pH* and high temperature conduce to myoprotein denaturation (9). Owing to protein denaturation there occurs endogenic water release which is maintained in meat in such great quantity practically by proteins. Due to hydrophilic properties of proteins meat shows great water absorbability, i.e. an ability to absorb and keep water by muscular tissue. Water absorbability is of great importance for meat processing as it is vital for juiciness and rheological properties of a product as well as for the weight loss due to thermal treatment (8). Microwave operation also exerts a significant effect on meat water absorbability; together with the growth of its power and operation time water absorbability got reduced considerably (Tab. 5 and 6).

CONLUSIONS

On the basis of the examinations and their results the following conclusions can be drawn:

1. Owing to meat thawing with microwave operation the changes in meat colour are observed.
2. Microwave operation also decreases water maintenance capacity in meat.
3. Microwaves induce change of meat *pH* as well.

Values of the changes depend on power and time of microwaves used.

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STRESZCZENIE

Od sposobu rozmrażania zależy w dużym stopniu ostateczna jakość mrożonki, dlatego powinno być ono wykonywane starannie, aby nie powodować nadmiernego wycieku, niekorzystnych zmian zapachu i konsystencji. Praca miała na celu przybliżenie wpływu, jaki mają mikrofale na rozmrażane mięso, a dokładnie na jego cechy fizyczne. Badania wykonano na 9 sztukach świń rasy wbp. Po uboju pobrane zostały próbki mięsa o masie 0,5 kg, pochodzące z polędwicy, karkówki, szynki oraz łopatki, w celu oznaczenia *pH*, barwy i wodochłonności badanego mięsa. Wartości te oznaczano zarówno w mięsie surowym przed zamrożeniem, jak i po rozmrożeniu. Badane próby rozmrażano w kuchni mikrofalowej firmy Moulinex, poddając je działaniu fal o mocy 150 i 350 W przez okres 10 i 25 minut. W badaniach stwierdzono, że zarówno moc, jak i czas oddziaływania mikrofal na próby mięsa miały istotny wpływ na zmiany *pH*. Wraz ze wzrostem mocy mikrofal i czasu oddziaływania na badane próby zauważono wzrost wartości *pH*. Niższym wartościom *pH* badanych prób odpowiadały wyższe wskaźniki jasności barwy oraz wodochłonności, wyższym natomiast wartościom *pH* mięsa odpowiadały niższe wskaźniki jasności barwy oraz wodochłonności. Oddziaływanie mikrofal wywiera także istotny wpływ na wodochłonność mięsa, wraz ze wzrostem mocy i czasu ich działania wodochłonność ulega znacznemu obniżeniu.