The effect of technological procedure of making burgers on their physico-chemical parameters and sensory properties

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Original scientific paper

SUMMARY

The aim of this study was to determine how different manufacturing technology (I addition of phosphates to the minced meat and fat materials at the beginning of mixing; II addition of phosphates at the end of mixing; III addition of phosphates half a minute before the addition of water and salt; IV sequential addition of phosphate and salt, mixing and re-grinding coarse ground mass) and different methods of thermal treatment (roasting in oven at air temperature 200 °C and on two-platted grill with temperature of plate 240 °C, till internal temperature (78 °C) was reached) effect on the texture and sensory properties of burgers. The physico-chemical (pH value, proximate chemical composition, phosphate content) and instrumental parameters of texture (Texture Profile Analysis) as well as sensory properties (descriptive analysis method) of burgers were determined. Technological procedure I resulted in a slightly firm, dry and gummy burger, with more expressed chewiness and resilience dominated by distinctive beefy aroma; procedure II resulted also in slightly too firm texture but almost optimal gumminess, other properties are similar. Sensory properties and texture parameters of burgers obtained with procedure III were comparable to procedure I. Burgers produced according to procedure IV resulted in tenderer, less adhesive and chewable texture than texture in burgers, manufactured according to other procedures. From the gastronomical point of view it is better to treat burgers on two-platted grill than to roast them in oven due to better preservation of form, juiciness and aroma.

Keywords: *beef burger, technological procedure, thermal treatment, texture parameters, sensory properties*

INTRODUCTION

Burgers are produced in different ways regard to type of meat utilized, form, shape, nutritional value and cost considerations, as well as religious reasons (Feiner, 2006; Soltanizadeh and Ghiasi-Esfahani, 2015; Abdel-Naeem and Mohamed, 2016). While some burgers consist of minced beef, salt and spices, others consist of minced meat and salt without any spices. Some 'pure-beef' burgers are made from beef meat only without salt, spices or added water (Feiner, 2006; Brewer, 2012). Other types of burger commonly contain, besides meat and fat, small amounts of added water as well as additives such as salt, phosphates (Long et al., 2011), spices, flavour enhancers, transglutaminases (Martínez et al., 2011) and other ingredients (Feiner, 2006; Forell et al., 2010; Akwetey and Knipe, 2012; Soltanizadeh and Ghiasi-Esfahani, 2015). The standard weight of a burger in the USA is 112 g. Beef burgers are usually made from fresh or formerly frozen beef, tempered on temperature between 10 and -4 °C. Moderately lean beef (70-75 % lean beef and 25-30 % fat) is used resulting in a fat content between 25 % and 30 % within the finished product. Feiner (2006) suggest several ways of producing burgers.

The aim of our study was to determine how four different procedures of manufacturing technology (I addition of phosphates at the beginning of mixing, II addition of phosphates at the end of mixing, III addition of phosphates half a minute before the addition of water and salt, IV re-grinding

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coarse ground mass) and different methods of thermal treatment effect on the texture and sensory properties of burgers.

MATERIAL AND METHODS

Material and experiment design

Beef burgers (after four different ways of producing) were made on the Chair of Meat Technology and Food Assessment, in five producing batches. Material used in experiment were beef topside, beef tallow, salt (purchased in local store), phosphate mixture named Aroma Univerzal K (Prava Aroma; dextrose : difosfate (E450) and triphosphate (E451) : sodium erythorbate (E 316) = 355 g : 300 g : 45 g) and water.

Beef burgers were made according to the recipe shown in Table 1; the procedure of the experiment is schematically presented in Table 2.

Table 1. *Ingredients (%) for production of beef burgers*

Ingredients	Content (%)
Beef	80
Bovine tallow	14
Salt	1.33
Phosphate mixture	0.65
Water	4

Table 2. *Scheme of the experiment*

Technological procedure	I	II	III	IV
Mincing (plate diameter)	3-6 mm	3-6 mm	3-6 mm	12 mm
Mixing	-	1 min	-	-
Phosphate mixture	-	-	+	+
Mixing	-	-	30 s	-
Salt	+	+	+	+
Water	+	+	+	+
Phosphate mixture	+	+	-	-
Mixing	+	+	+	1 min
Mincing (plate diameter)	-	-	-	3-4 mm
Formation	+	+	+	+

Time at which additives such as salt and phosphates are introduced to the minced meat and fat materials during mixing has an impact on the consistency and texture of the finished product. It is suggested that phosphate is added before salt, so simultaneous addition of additives is not optimal and represents positive control in our experiment. As mentioned the production of beef burgers was repeated five times following four different procedures:

I. Mincing semi-frozen beef and tallow through the 6 mm blade. The minced material with a temperature between -3 and -1 °C was then placed in a mixing device. Simultaneous addition of salt, water and phosphate to the meat mass followed by mixing till the mixed mass displays some degree of tackiness and shininess (90 s).

II. Mincing semi-frozen beef and tallow through the 6 mm blade. The minced material (-3 and -1 °C) was then mixed for 60 s; simultaneous addition of salt, water and phosphate to the meat mass followed by another mixing till the mixed mass displays some degree of tackiness and shininess (30 s).

III. Mincing semi-frozen beef and tallow through the 6 mm blade. The minced material (-3 and -1 °C) was placed in a mixing device together with phosphate, followed by mixing mass for 60 s and addition of salt and water to the mixed mass. Another mixing till the mixed mass displays some degree of tackiness and shininess (30 s) before forming was done.

IV. Mincing semi-frozen meat and fat through a 12 mm blade. The coarsely minced material was placed in the mixing device and phosphate was added. After mixing for around 30 s, salt and water were added and then mixed continuously for another minute. At this point the mixed mass displayed some degree of tackiness, with a temperature from -3 to -1 °C. Mass was minced once again through a 3–4 mm blade prior to forming.

The weight of a burger, formed with petri dishes, was approximately 120 g. In detail, for each experimental group 480 g meat mass was prepared, and from this mass four burgers were formed. Two of them were roasted in oven at air temperature 200 °C and other two at two-platted grill with temperature of plate 240 °C, till internal temperature of burgers (78 °C) was reached.

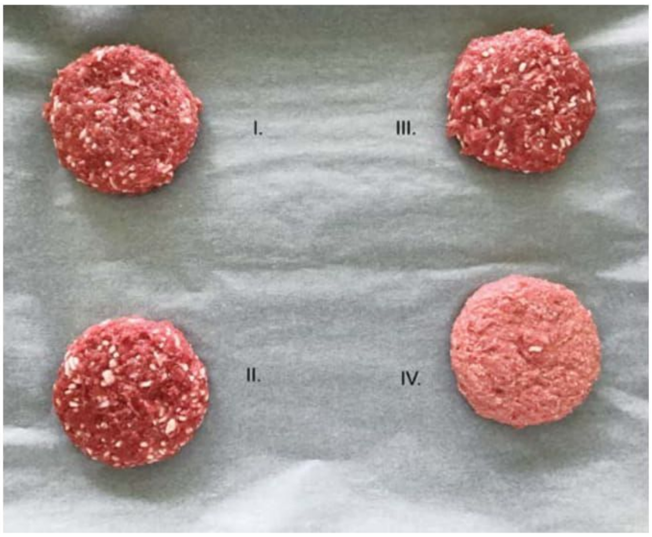

Figure 1. *Samples of beef burgers prepared according four technological procedures*

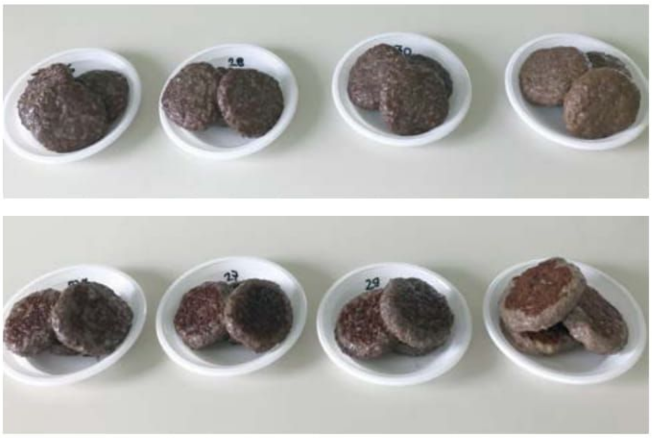

Figure 2. *Samples of beef burgers roasted in oven at temperature of 200 °C (above) and grilled on two-plated grill at temperature of plates 240 °C (below)*

METHODS

Determination of proximate chemical composition after thermal treatment: The moisture, protein and fat content in samples were determined by apparatus Food ScanTM Meat Analyser (FOSS, Dansk), specifically designed for meat and meat products. Apparatus on the base of the near-infrared (NIR) technique provides information on the content of water and macro nutrients in meat and meat products.

Determination of ash content: The ash content was determined according to the official procedure described in AOAC Official Method 920.153 Ash of Meat (AOAC, 1997).

Determination of phosphate content: The total phosphate content was determined spectrophotometrically, after drying the sample at a temperature of 650 °C and hydrolysis with HNO3 (Jamnik and Bertoncelj, 2009).

pH value measurement: pH was measured directly using a spear combined glass-gel electrode (type 03, Testo pH electrode) with thermometer (type T, Testo penetration temperature probe) connected to a pH meter (Testo 230, Testo). The pH meter was calibrated with pH 5 and pH 7 buffers and re-calibrated after every 20 readings. Calibration and reading was at 4 °C. Accuracy of reading was ±0.01 pH-unit. pH was measured in the middle of sample of each raw burger.

Measurement of mass loss during thermal treatment: The mass loss during thermal treatment was determined as the percentage of the leakage relative to the initial mass of the sample.

Instrumental texture analysis: Instrumental texture analysis were performed by the texture profile analysis (TPA), using a TA.XT plus Texture Analyser (Stable Micro Systems Ltd., Godalming, Surrey, UK) with a 50 kg load cell and a 50 mm diameter compression plate (P100). The roasted burger samples were conditioned at 4 ºC for 20 h. For TPA, the samples (diameter 45 mm, height 15 mm) were compressed twice to 50 % of their original height, at a crosshead speed of 5 mm/s and 5 s between 1st and 2nd compression cycle. The force vs. time curves were recorded and the following parameters were calculated: hardness, adhesiveness, cohesiveness, springiness, gumminess, chewiness and resilience (Morales et al., 2007). The hardness was expressed as the maximum force of the 1st compression; adhesiveness as the negative work between the two cycles; cohesiveness as the area of work during the second compression divided by the area of work during the first compression (the strength of the inner binders constituting the product); springiness as a ratio or percentage of a product's original height (how well a product physically springs back after it has been deformed during the first compression and has been allowed to wait for the target wait time between strokes); gumminess as a product of hardness × cohesiveness (N), chewiness as a product of gumminess × springiness (N), and resilience was expressed how well a product "fights to regain its original height" (Stable Micro Systems, 2000).

Sensory evaluation: Evaluation of sensory profile of burgers was carried out in defined, precisely prescribed, controlled and reproducible operating conditions. This includes: arrangement of laboratory, samples, accessories and organization of assessment (ISO 8589:2007). For the sensory evaluation, the burger samples were roasted in oven and on two-plated grill, wrapped in aluminium foil and then, when all experimental samples within production repetition were prepared, the centres were sliced warm into cube pieces of approximately 5 g for the panellists to evaluate. To evaluate the sensory qualities, a panel of six qualified and experienced panellists in the field of meat products was appointed (Gašperlin et al., 2014). The panel assessed the samples separately one by one in session composed of 8 samples. The same panel evaluated all samples; the trial consisted of five session (days). To neutralise the taste, the panel used the central dough of white bread. On the basis of preliminary tasting for the purpose of the evaluation, the panel decided in favour of, and applied, the analytical-descriptive test (Golob et al., 2005). The analysis was performed by scoring the sensory attributes on a structured scale from 1 to 7 points, where a higher score indicated greater expression of a given property. The exception here was for one of the texture attribute (gumminess), which was evaluated by scoring on a structured scale of 1 to 4 to 7 (1-4-7). Here, a score of 4 points was considered optimal, with scores of 4.5 or higher indicating greater expression of a property, and those of 3.5 or lower indicating insufficient expression of a property. These sensory profiles of the burger samples were assessed using 7 descriptors that were grouped into three blocks. The first block related to the visual attributes of the burgers and the cross-section of a slice: appearance and porousness. The second block related to the texture: juiciness, tenderness and gumminess. The third block related to the aroma attribute, characteristic of the aroma. The last sensory attribute was overall impression.

Data analysis: The data were analysed for normal distributions using the UNIVARIATE procedure (SAS/STAT). The differences according to the technological procedure (I-IV) and type of thermal treatment of the samples (roasting in oven and on two-platted grill) were analysed through a general linear model procedure and least squares mean tests (SAS/STAT), with a 0.05 level of significance. The experiment was done in five repetitions.

res (I, II and III), significantly ($P \leq 0.05$) the lowest content of protein, water and ash, and the highest content of fat. Consequently, due to the highest fat content, the energy value of the burgers produced according to procedure IV is significantly higher compared to other procedures.

Data on proximate chemical composition of burgers in this study are in good agreement with results of Angiolillo et al. (2015), who reported following contents for burgers made from minced beef, salt and oregano: moisture 63.32 g/100 g, fat 15.51 g/100 g, protein 19.32 g/100 g and ash 2.53 g/100 g.

pH value

On average, the pH value of the prepared meat mass for burger production was 6.14 ± 0.07, with values for individual procedures as follows: procedure I: 6.22, procedure II: 6.10, procedure III: 6.18, and procedure IV: 6.06; differences between groups are not significant. In the literature lower pH values for burgers was seen, 5.68, presumably do to fact, that phosphate was not added (Angiolillo et al., 2015).

Weight loss during thermal treatment

Figure 3 shows the mass loss during the different methods of thermal treatment of burgers depen-

Table 3. *Basic chemical composition of beef burgers regarding technological procedure and type of thermal treatment*

Parameter determined (g/100 g)	Technological procedure				Thermal treatment			Effect (P value)	
	I	II	III	IV	Oven	Grill	SEM	TP	TT
Protein	22.27^a	22.36^a	22.01^a	21.33^b	22.14	21.84	0.57	0.002	0.106
Fat	10.16^b	10.05^b	10.45^b	14.14^a	11.38	11.03	1.23	≤ 0.001	0.376
Moisture	67.14^a	66.94^a	67.01^a	65.17^b	66.54	66.59	1.07	≤ 0.001	0.869
Ash	2.73^a	2.79^a	2.71^a	2.51^b	2.66	2.71	0.08	≤ 0.001	0.060
Phosphate (g/kg)	0.26	0.26	0.26	0.25	0.26	0.26	0.02	0.255	0.057
$EV_{100\,g}$ (kJ)	716^b	716^b	724^b	832^a	751	742	49	≤ 0.001	0.572
$EV_{100\,g}$ (kcal)	171^b	171^b	173^b	200^a	180	178	12	≤ 0.001	0.576

TP – Technological procedure; TT – Thermal treatment; SEM, standard error of mean; P statistical probability; data with different superscript letters within individual effect and for each parameter differ significantly (P ≤ 0.05); $EV_{100\,g}$ (kJ) – Energy value

RESULTS AND DISCUSSION

Basic chemical composition

On average, the protein content in burgers was 22.03 ± 0.36 g/100 g, moisture 66.33 ± 1.43 g/100 g, fat 11.48 ± 2.35 g/100 g, ash 2.60 ± 0.16 g/100 g, and phosphate 2.68 ± 0.13 g/kg (not presented in tables) with significant differences in chemical parameters between technological procedures (with exception of phosphate content) and not-significant differences ($P > 0.05$) between types of thermal treatments (Table 3).

The burgers produced according to procedure IV contained, in comparison with other procedu-

ding on the technological procedure. Both the technological procedure and the method of thermal treatment statistically significantly ($P \leq 0.001$) affect the weight loss of burger samples. We can conclude that weight loss was significantly higher in grilled burgers compared to burgers roasted in the oven (12 % vs. 10 %). On average, the highest weight loss was seen in procedure II (14 %), the lowest in procedure IV (7 %). Our results on weight loss were quite lower than in literature due to different cooking appliances, temperatures and size of sample, probably also due to use of phosphate. For example, weight loss 20.2 to 36.1 % for grilled beef burger was reported, dependent on internal temperature during grilling (Sheard et al., 1998), reported weight loss for beef patty (20 g) cooked in a convection gas oven at 180 °C was 34 % (Chang et al., 2012), and weight loss of burgers made from minced beef, salt and oregano, roasted in oven to internal temperature of 71 °C was 33.5 % (Angiolillo et al., 2015). Some data on weight loss obtained on two-plated grill /appliances with double sided plate were not found in literature.

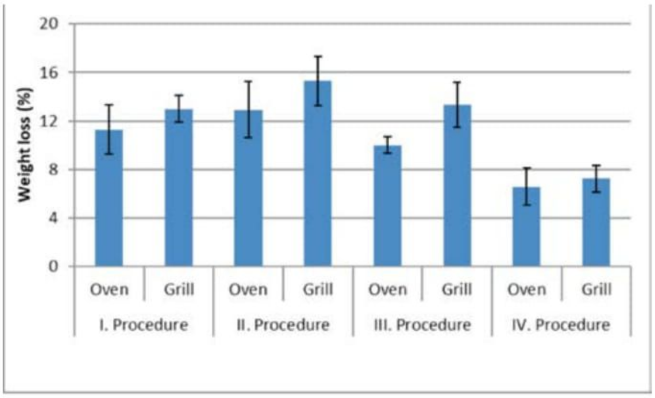

Figure 3. *Weight loss during the thermal treatment of burgers, regarding to technological procedure and the method of thermal treatment*

Instrumentally measured texture

The results of the texture measurements are given in Table 4 and show that the technological procedures of burger production significantly affected hardness, adhesiveness, gumminess and chewiness ($P \leq 0.001$). Just the opposite, different technological procedures do not affect texture parameters of burgers, such as springiness, cohesiveness and resilience ($P > 0.05$). The effect of thermal treatment method on hardness, gumminess and chewiness of burgers was significant ($P \leq 0.001$), but statistically not-significant ($P > 0.05$) on adhesiveness, springiness, cohesiveness and resilience.

The burgers produced according to procedure IV were significantly tenderer (318.40 N), less adhesive (-0.02 N.s) and less chewable (205.54 N) than burgers, manufactured by other procedures. Burgers produced according to procedure II were less gummy (4.1 N) and resilient (0.33) compared to other burgers.

Burgers, treated on grill, were harder, more chewable and less rubbery (gummy) compared to burgers that were heat-treated in the oven ($P \leq 0.001$).

Sensory properties

Table 5 shows the professional panel data for the sensory analysis of the beef burgers, regarding technological procedure and type of thermal treatment. The data shows that the technological procedures of burger production significantly affected appearance, porousness and gumminess ($P \leq 0.001$). The effect of thermal treatment method on sensory properties, such as appearance, juiciness, gumminess, aroma and overall impression was significant ($P \leq 0.001$).

The burgers produced according to procedure IV showed relatively optimal form with smooth surface and barely noted porousness on cross section than burgers, manufactured by other procedures. The texture was evaluated according to three characteristics, as juiciness, tenderness and gumminess, where burgers produced according to procedure II were almost optimal in gumminess compared to other burgers. On average, juiciness and tenderness were evaluated as slightly too dry (not juicy enough) (5.4-5.5 points), and a slightly too firm (5.3-5.5 points), regardless the technological procedure of burgers. In all experimental groups relatively characteristic aroma of the burgers (5.6-5.7 points) was dominated by distinctive beefy aroma and appropriate saltiness.

Table 4. *Texture parameters of beef burgers regarding technological procedure and type of thermal treatment*

Parameter determined (g/100 g)	Technological procedure				Thermal treatment			Effect (P value)	
	I	II	III	IV	Oven	Grill	SEM	TP	TT
Firmness (N)	423.52^a	387.54^a	417.53^a	318.40^b	337.97^b	435.48^a	81.76	≤ 0.001	≤ 0.001
Adhesiveness (N.s)	-0.03^c	-0.02^b	-0.02^b	-0.01^a	-0.02	-0.02	0.02	≤ 0.001	0.095
Springiness	0.88	0.82	0.87	0.88	0.85	0.83	0.16	0.119	0.575
Cohesiveness	0.72	0.67	0.72	0.70	0.71	0.70	0.13	0.341	0.697
Gumminess (N)	4.53^a	4.10^b	4.44^a	4.35^a	4.50^a	4.20^b	0.52	≤ 0.001	≤ 0.001
Chewiness (N)	270.54^a	242.26^a	260.88^a	205.54^b	217.48^b	272.14^a	53.33	≤ 0.001	≤ 0.001
Resilience	0.37^a	0.33^b	0.36^{ab}	0.37^a	0.35	0.37	0.07	0.054	0.269

TP – Technological procedure; TT – Thermal treatment; SEM, standard error of mean; P statistical probability; data with different superscript letters within individual effect and for each parameter differ significantly ($P \leq 0.05$).

Burgers, treated on grill, showed slightly better form, were less juicy, less gummy, with better aroma and consequently better in overall impression compared to burgers that have been thermal treated in the oven ($P \leq 0.05$). The last one became a bit inflated in the middle during roasting in the oven.

Feiner (2006) stated, that the point in time at which additives such as salt and phosphates are introduced to the minced meat and fat during mixing, has an impact on the consistency and texture of the finished product. If they are added at an early stage during mixing, their addition, in conjunction with mechanical energy introduced via mixing itself, produces elevated levels of activated protein, resulting in a firm-textured product. In our study in a slightly firm, dry and gummy texture, with more expressed chewiness and resilience dominated by distinctive beefy aroma burgers were produced according to procedure I (salt and phosphates were added to minced beef and tallow at the beginning of mixing) but differences compared to other procedures (II and III) were not significant (Table 4).

If additives are introduced at a later stage of mixing, less protein is activated and a loose-textured product is the result (Feiner, 2006). In our case it turned out that, procedure (II) burgers were slightly firm in texture but almost optimal in gumminess (sensory evaluated), other properties were similar.

It is quite common to add phosphates first and mix for around 30 s, before addition of salt and iced water (Feiner, 2006). Our hypothesis was, that this kind of burgers (procedure III) would have optimal quality (optimal texture). The sensory analysis of the texture showed that the burgers produced according to procedure III were slightly deviated from the optimum, they were less juicy, less soft and noticeable too rubbery; the instrumental analysis gave us additional information - they were relatively resilient and chewable, as well differed in gumminess from procedure II.

Next hypothesis was that burgers produced after re-grinding coarse minced beef with additives and salt (procedure IV) would result in loose-textured burgers. On average, these burgers differed from others in basic chemical composition, with exception of content of phosphate; they contained less moisture and probably also less activated protein. The instrumental analysis confirmed our prediction, burgers were tenderer, less adhesive and chewable than burgers, manufactured according to other procedures.

Consumers nowadays prefer beef burgers that are less gummy, not hard, less springy and cohesive, and easy to chew (Akwetey and Knipe, 2012). Thus, by choosing a certain technological procedure and the method of thermal treatment, we can formulate burgers of desired texture and sensory properties.

CONCLUSION

In our study different procedures of preparing (addition of phosphates at the beginning of mixing, addition of phosphates at the end of mixing, addition of phosphates half a minute before the addition of water and salt, and sequential addition of additives with re-grinding coarse ground mass at the end of mixing) on the texture and sensory properties of burgers were studied. The addition of phosphate and salt at an early stage during mixing resulted in a slightly firm, dry and gummy burger, with more expressed chewiness and resilience dominated by distinctive beefy aroma. Introducing additives at a later stage of mixing resulted also in slightly too firm texture but almost optimal gumminess, other properties were similar. Comparable sensory properties of burgers were obtained with procedure when addition of phosphates was half a minute before the addition of water and salt (III) as in proce-

Table 5. *Sensory attributes of beef burgers regarding technological procedure and type of thermal treatment evaluated by descriptive analysis with professional panel.*

Property	Technological procedure				Thermal treatment			Effect (P value)	
	I	II	III	IV	Oven	Grill	SEM	TP	TT
Appearance (1-7)	5.7^{a}	5.8^{a}	5.8^{a}	5.6^{b}	5.6^{B}	5.8^{A}	0.33	≤ 0.001	≤ 0.001
Porousness (1-7)	2.6^{b}	2.7^{ba}	2.8^{a}	2.0^{c}	2.5	2.5	0.37	≤ 0.001	1.000
Juiciness (1-7)	5.5	5.4	5.5	5.4	5.5^{A}	5.4^{B}	0.42	0.561	0.034
Tenderness (1-7)	5.4	5.3	5.4	5.4	5.4	5.3	0.48	0.264	0.051
Gumminess (1-4-7)	4.5^{a}	4.1^{b}	4.4^{a}	4.4^{a}	4.5^{A}	4.2^{B}	0.49	≤ 0.001	≤ 0.001
Aroma (1-7)	5.6	5.6	5.6	5.7	5.4^{B}	5.8^{A}	0.34	0.170	≤ 0.001
Overall impression (1-7)	5.6	5.5	5.5	5.6	5.4^{B}	5.7^{A}	0.35	0.243	≤ 0.001

TP – Technological procedure; TT – Thermal treatment; SEM, standard error of mean; P statistical probability; data with different superscript letters within individual effect and for each parameter differ significantly ($P \leq 0.05$).

dure I. Burgers produced after re-grinding coarse minced beef with additives and salt (IV) resulted in tenderer, less adhesive and chewable texture than in burgers, manufactured according to other procedures. From the gastronomical point of view it is better to treat burgers on two-platted grill than to roast in oven due to better preservation of form, juiciness and aroma.

**This article is part of a MSc. thesis named The effect of manufacturing technology of burgers on their physico-chemical parameters and sensory properties, issued by Gregor Sok.*

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Utjecaj tehnološkog postupka izrade hamburgera na njihova fizikalno-kemijska i senzorska svojstva

SAŽETAK

Cilj ovog istraživanja bio je utvrditi kako različite proizvodne tehnologije (I. dodavanje fosfata mljevenom mesu i masnom tkivu na početku miješanja, II. dodavanje fosfata na kraju miješanja, III. dodavanje fosfata pola minute prije dodavanja vode i soli, IV. sekvencijalno dodavanje fosfata i soli, miješanje i ponovno mljevenje grubo mljevenog mesa) i različite metode toplinske obrade (pečenje u pećnici pri temperaturi zraka od 200 °C i priprema na preklopnom roštilju s temperaturom ploča od 240 °C, do postizanja unutarnje temperature od 78 °C) utječu na teksturu i senzorska svojstva hamburgera. Određena su fizikalno-kemijska svojstva (pH vrijednost, kemijski sastav, sadržaj fosfata), instrumentalni parametri teksture (analiza profila teksture) i senzorska svojstva hamburgera (metoda deskriptivne analize). Tehnološki postupak I. rezultirao je tvrđim, suhim i gumenastim hamburgerom, s izraženom žilavošću i otpornošću te prevladavajućom i prepoznatljivom aromom govedine; postupak II. također je rezultirao malo pretvrdom teksturom, pri čemu je gumenost bila gotovo optimalna, a druga svojstva vrlo slična. Senzorska svojstva i parametri teksture hamburgera dobiveni postupkom III. bili su usporedivi s rezultatima postupka I. Hamburgeri proizvedeni prema postupku IV. rezultirali su mekšim mesom te manje ljepljivom i žilavom teksturom od tekstura hamburgera proizvedenih ostalim postupcima. Radi boljeg očuvanja oblika, sočnosti i arome, s gastronomskog je gledišta hamburgere bolje pripremati na preklopnom roštilju nego peći u pećnici.

Ključne riječi: goveđi hamburger, tehnološki postupak, toplinska obrada, parametri teksture, senzorska svojstva

Einfluss des technologischen Herstellungsverfahrens von Hamburgern auf ihre physikalisch-chemischen und sensorischen Eigenschaften

ZUSAMMENFASSUNG

Ziel dieser Arbeit war es festzustellen, wie unterschiedliche Herstellungstechnologien (I. Phosphatzugabe zum Hackfleisch und Fettgewebe am Beginn der Mischung, II. Phosphatzugabe am Ende der Mischung, III. Phosphatzugabe eine halbe Minute vor der Wasser- und Salzzugabe, IV. sequentielle Zugabe von Phosphaten und Salz, Vermischen und erneutes Hacken von grob gehacktem Fleisch) sowie diverse Methoden der thermischen Behandlung (Braten im Ofen bei einer Lufttemperatur von 200 °C und Zubereitung auf einem Klappgrill mit einer Plattentemperatur von 240 °C, bis zum Erreichen der inneren Temperatur von 78 °C) sich auf die Textur und die sensorischen Eigenschaften von Hamburgern auswirken. Bestimmt wurden die physikalisch-chemischen Eigenschaften (pH-Wert, chemische Zusammensetzung, Phosphat-Gehalt), die instrumentellen Texturparameter (Analyse des Texturprofils) und die sensorischen Eigenschaften von Hamburgern (Methode der deskriptiven Analyse). Beim I. Technologieverfahren war der Hamburger etwas fester, trockener und gummiartig, besonders zäh, mit einem dominanten, typischen Rindfleischaroma; das II. Verfahren ergab auch eine etwas zu harte Textur, wobei die Zähheit fast optimal war, während die anderen Eigenschaften sehr ähnlich waren. Die sensorischen Eigenschaften und Texturparameter des anhand des III. Verfahrens hergestellten Hamburgers waren mit den Ergebnissen des I. Verfahrens vergleichbar. Die nach dem IV. Herstellungsverfahren hergestellten Hamburger ergaben ein zarteres Fleisch, eine weniger klebrige und zähe Textur als bei den Hamburgern, die anhand der anderen Verfahren hergestellt wurden. Vom Aspekt der Formerhaltung, Saftigkeit und des Aromas ist es vom gastronomischen Aspekt her besser die Hamburger auf einem Klappgrill zuzubereiten anstatt sie im Ofen zuzubereiten.

Schlüsselwörter: Rinderhamburger, Technologieverfahren, thermische Behandlung, Texturparameter, sensorische Eigenschaften

Cómo el procedimiento tecnológico de elaboración de hamburguesas influye en sus propiedades fisicoquímicas y sensoriales

RESUMEN

El objetivo de este estudio fue determinar cómo las diferentes tecnologías de producción (I. adición de los fosfatos a la carne molida y tejido graso al principio de la mezcla, II. adición de fosfatos al final de la mezcla, III. adición de fosfatos medio minuto antes de la adición de agua y sal, IV. adición secuencial de fosfatos y sal, mezcla y nuevo molido de la carne gruesa) y diferentes métodos de tratamiento térmico (cocción a temperatura de aire de horno de 200°C y preparado en plancha eléctrica con temperatura de placas de 240°C hasta alcanzar la temperatura interna de 78°C) afectan a la textura y propiedades sensoriales de las hamburguesas. Se midieron las propiedades físicas y químicas (pH, composición química, contenido de fosfatos), parámetros de textura instrumentales (análisis de perfil de textura) y las propiedades sensoriales de la hamburguesa (análisis descriptivo). El procedimiento tecnológico I. ha resultado en hamburguesas más duras, secas y gomosas, con la elasticidad y resistencia marcadas y el sabor de carne vacuna reconocible; procedimiento II. también dio como resultado la textura un poco dura, con una gomosidad casi óptima y otras propiedades muy similares. Las propiedades sensoriales y los parámetros de textura de la hamburguesa obtenidos por el procedimiento III. fueron comparables a los resultados del procedimiento I. Las hamburgesas producidas de acuerdo con el procedimiento IV. resultaron en carne más suave y una textura menos pegajosa y elástica que la textura de las hamburguesas producidas por otros métodos. Para una mejor conservación de la forma, la jugosidad y el aroma, desde el punto de vista gastronómico, las hamburguesas están mejor preparadas en la plancha eléctrica que en en el horno.

Palabras claves: hamburguesa de carne vacuna, procedimiento tecnológico, tratamiento térmico, parámetros de textura, propiedades sensoriales

Incidenza del procedimento tecnologico di produzione degli hamburger sulle loro caratteristiche fisico-chimiche e sensoriali

RIASSUNTO

La presente ricerca aveva lo scopo di accertare in che modo differenti procedimenti tecnologici di produzione (1 - aggiunta di fosfati alla carne macinata e al grasso all'inizio della miscelazione; 2 - aggiunta di fosfati alla fine della miscelazione; 3 - aggiunta di fosfati mezzo minuto prima di aggiungere l'acqua e il sale; 4 – aggiunta sequenziale di fosfati e di sale, miscelazione e ulteriore macinazione della carne grossolanamente macinata) e differenti metodi di trattamento termico (cottura al forno a 200 °C e cottura in bistecchiera elettrica di contatto con piastra a 240 °C, sino a raggiungere la temperatura interna di 78 °C) possano incidere sulla texture (consistenza) e sulle caratteristiche sensoriali dell'hamburger. Si è proceduto all'accertamento delle caratteristiche fisico-chimiche (valore pH, composizione chimica, contenuto di fosfati), dei parametri strumentali di texture (analisi del profilo di texture) e delle caratteristiche sensoriali degli hamburger (metodo dell'analisi descrittiva). Il procedimento tecnologico n. 1 ha messo in luce un hamburger più duro, secco e gommoso, con una più marcata fibrosità (tigliosità) e resistenza ed un dominante e riconoscibile aroma di carne bovina; anche il procedimento n. 2 ha messo in luce un hamburger dalla consistenza un po' troppo dura, con una gommosità pressoché ottimale e le altre caratteristiche molto simili all'hamburger precedentemente esaminato. Le caratteristiche sensoriali e i parametri di texture dell'hamburger prodotto con il procedimento n. 3 erano paragonabili a quelli degli hamburger prodotti con il procedimento n. 1. Gli hamburger prodotti mediante il procedimento n. 4, invece, sono risultati più teneri, con una consistenza meno collosa e tigliosa rispetto a quella degli hamburger prodotti mediante gli altri procedimenti. Per preservare meglio la forma, la succosità e l'aroma del prodotto, dal punto di vista gastronomico è meglio cuocere gli hamburger sulla bistecchiera elettrica di contatto che al forno.

Parole chiave: *hamburger di manzo, procedimento tecnologico, trattamento termico, parametri di texture, caratteristiche sensoriali*

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b) Proceedings:

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