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## EFFECT OF THE ADDITION OF INULIN ON THE QUALITY OF POULTRY BURGERS®

### Wpływ dodatku inuliny na jakość burgerów drobiowych®

*The article presents the results of research concerning the assessment of the effect of inulin on the quality of turkey meat burgers. The physical and sensory characteristics of products without additional and with addition inulin 2% and 5% were assessed after the poultry burgers had cooled down to room temperature. The addition of 2% and 5% inulin in the form of a powder to the recipe composition of poultry burgers contributed to the darkening of the products and the increased desirability of smell as well as a better structure and binding of turkey burgers. Poultry burgers containing 5% inulin were characterized by lower water holding capacity and higher cutting force, compared to burgers with 2% addition and a control product. The obtained research results indicate that both the addition of 2% and 5% can be used in the technology of turkey burger production, obtaining a tasty, good quality product.*

**Key words:** inulin, burgers, turkey meat, quality.

*W artykule przedstawiono prezentację wyników badań dotyczących oceny wpływu dodatku inuliny na jakość burgerów drobiowych o stałym składzie surowcowym. Cechy fizyczne i sensoryczne produktów bez dodatku i z dodatkiem 2% i 5% inuliny oceniano po wychłodzeniu burgerów do temperatury pokojowej. Wykazano, że dodatek 2% i 5% inuliny w postaci proszku do składu receptur burgerów drobiowych przyczynił się do przyciemnienia produktów i zwiększenia atrakcyjności zapachowej oraz lepszej struktury i konsystencji burgerów indyjskich. Burgery zawierające 5% inuliny charakteryzowały się mniejszą wodochłonnością i większą siłą cięcia w porównaniu z burgerami z dodatkiem 2% i produktem kontrolnym. Uzyskane wyniki badań wskazują, że zarówno dodatek 2%, jak i 5% można zastosować w technologii produkcji burgerów z indyka, uzyskując smaczny, dobrej jakości produkt.*

**Słowa kluczowe:** inulina, burgery, mięso indyjskie, jakość.

## INTRODUCTION

In the dynamic and fast pace of the development of consumerism, the interest and demand for convenient food has increased [3]. Due to the availability, ease and speed of preparation, convenience food made of poultry meat is very popular [1]. Poultry burgers are classified as more convenient fast food. It is a type of flat disc cutlets made of minced meat, subjected to heat treatment before consumption [12].

Consumers' nutritional awareness is growing, and with it their interest in meat products that not only meet the basic needs of the body, but also have a positive effect on its functioning. Inulin can be used as a fat replacer in meat products to reduce the fat content and develop healthier products [8, 10, 19, 21]. It can influence various characteristics of the products including physiochemical, textural and sensory attributes, although the reported effects were controversial [13]. Effect of inulin on mentioned properties depends on type of inulin, inulin concentration and structure and composition of meat and poultry products [7,22]. In addition, incorporation of inulin can enrich meat and poultry products in terms of dietary

fiber that have beneficial health effects [11,23]. However, more researches on diverse effects of inulin in different types of meat and poultry products formulations and process conditions are required.

The aim of this paper is to present the results of research on the assessment of the effect of inulin on the quality of turkey meat burgers.

## MATERIAL AND METHODS

The leg muscles of slaughter turkeys were used in the production of burgers. The choice of meat was made due to the high nutritional value of turkey meat and its high usefulness in the production of ground poultry products. The raw meat came from the same producer. The leg muscles were ground in a meat grinder (Zelmer, Poland) using a mesh with 3.0 mm. Two variants of burgers were produced, differing in the amount of inulin from chicory roots (TARGROCH Filipowice): 2% and 5%. The control group consisted of turkey burgers without the addition of inulin. Apart from the meat raw material, the stuffing consisted of water, the amount of which was 10% in

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relation to the weight of the meat raw material. The amount of the remaining ingredients (pepper 0.5% and salt 1%) was calculated in relation to the weight of the basic ingredients, i.e. meat and water.

The meat aces were mixed in a blender (Kenwood Major Titanium, USA). The meat masses was divided, 2% and 5% inulin were added and again mixed. Burgers (about 80 g) were formed from the prepared meat masses using a manual molding machine, giving them the shape of flat discs with a diameter of about 75 mm and a height of 7 mm. Processing of the burgers was carried out in a hot-air electric oven at 180°C up to reaching 75°C. Physical and sensory characteristics were assessed after the poultry burgers had cooled down to room temperature.

Weight loss(%) was calculated based on the weight difference before and after heat treatment. pH measurements were undertaken using a pH-meter fitted with a dagger electrode (HI 99163, Hanna Company). The water-holding capacity (WHC) was determined based on the volume of free water squeezed from sample using the Whatman no 2 filter papers Grau-Hamm method. All of the measurements were taken by one researcher. Analysis of the colour parameters on the surface of the burgers in CIE L\*a\*b\* space was performed with a CR-400 colorimeter (Konica Minolta, Japan) in accordance with the test methodology recommended by the device manufacturer D65 illuminant and a standard colorimetric observer with a field of view of 2° were used for colour measurements. For each test, a 3-fold measurement was performed. The brittleness was assessed by measuring the cutting force ( $F_{max}$ ) of 8×20×80 [mm] product samples, using the Zwick/Roell BT1-FR1. OTH.D14 resistance machine (Zwick CmbH& Co. KG. Ulm, Germany), using a Warner-Bratzler V-blade knife with a head speed of 100 mm·min<sup>-1</sup> and initial force of 0.2 N. The applied parameters of instrumental measurements were determined based on the preliminary tests results, each measurement was performed in triplicate and the obtained results were averaged. The sensory evaluation of burgers quality was performed according to the methodology of Baryłko-Pikielna and Matuszewska [2]. A 5-point rating on an ascending scale was used, including the following qualitative indices: intensity and desirability of taste and smell, juiciness, tenderness, bonding, texture, structure and overall desirability. The sensory evaluation was carried out by a 7-person evaluation team in duplicate. For the proper evaluation, the burgers samples were cooled to room temperature and cut into slices of rectangular parallelepiped shape (1cm x 1cm x 3cm). All samples to be assessed were placed in covered vessels, marked with numerical codes. The samples were randomly assessed. Each panelist assessed a sample in three replications. Between each sample testing, the assessors took a break for 30 s, and rinsed their mouths using mineral water. The test was carried out in a properly prepared a room free from foreign odours, in appropriate temperature and lighting, in conditions enabling independent assessment, ensuring comfort for the assessors, and eliminating all distracting factors.

Results obtained were statistically analysed with the analysis of variance ANOVA using the Statistica 13.3 software package (StatSoft, Inc. 2018). The arithmetic mean ( $\bar{x}$ ) and standard deviation (SD) were determined. The collected data were checked for normality with the Kolmogorov–Smirnov test with Lilliefors correction. To indicate the significance of

differences between means in groups, used the test Tukey's at a 95% confidence level ( $\alpha=0.05$ ). The results on the effect of inulin addition on the sensory characteristics of turkey burgers were verified with the use of non-parametric Kruskal-Wallis test. Differences were considered as significant if  $p<0.05$ .

## RESULTS AND DISCUSSION

The studies showed that the addition (2% and 5%) of inulin in the form of a powder had no significant effect ( $p>0.05$ ) on the efficiency of poultry burgers (Table 1). Also Ergönül et al. [6] did not show the effect of adding a 2.5% and 5% non-hydrated inulin preparation on the increase of thermal leakage of turkey meat balls. Florowski et al. [10] found that the use of inulin can reduce the fat content of the sausage without a significant increase in weight loss, and with increasing the addition of inulin, the yield of the product also decreases. Also Makala (2003) found a significant decrease in the yield of canned meat with the addition of inulin, which was related to the formation of a too delicate structure by inulin, which was not able to retain and bind water in the product. Cegiełka [4], examining chicken meat burgers with the addition of vegetable oils with 1% inulin content, showed a significant effect of recipe modification on burger performance. A decrease in product yield was observed, especially in the samples where the addition of meat raw material was lower in relation to the introduced mixture of vegetable oils. Méndez-Zamora et al. [17] obtained different results, where the addition of inulin to frankfurters increased the efficiency of the product.

Acidity is one of the basic parameters determining the quality of processed meat products. The conducted studies showed no effect ( $p>0.05$ ) of the applied inulin additives on the pH of the products (Table 1). In the studies carried out by Latoch [14], no significant difference in the acidity of turkey pates with the addition of inulin was also observed.

The addition of the inulin preparation significantly ( $p \leq 0.05$ ) differentiated the water retention capacity in poultry burgers. Both the addition of 2% and 5% of the inulin preparation reduced the water absorption of the obtained products. Estanech et al. [7] showed that the addition of inulin had a significant effect on the ability to retain water in a pate with the addition of inulin, which contributed to a greater binding of the consistency in the product. In turn, the research of Méndez-Zamora et al. [17] indicate that the addition of inulin to frankfurters increased water absorption in the product. Florowski et al. [10], introducing the addition of inulin to the model finely ground sausages, as a fat substitute received a product that was distinguished by a greater ability to maintain its own water compared to the product without the additive.

The colour of the cross-section of poultry burgers with the addition of 2% and 5% inulin was darker than in the control group, as evidenced by a significantly lower value of the L\* lightness parameter (Table 1). In the literature review [9,15], there are no clear results on the impact of inulin addition on the quality of meat products. Latoch et al. [14] showed the effect of inulin on the darkening of the colour of poultry pates with the addition of inulin. Zwolan et al. [23] obtained a lightening of the colour for products with the addition of inulin. In turn, Florowski et al. [10] showed that replacing fat with inulin in sausages did not change the colour parameters.

**Table 1. Effect of inulin addition on physical properties of turkey burgers****Tabela 1. Wpływ dodatku inuliny na cechy fizyczne burgerów z mięsa indyczego**

Parameter	Variant of burgers		
	Without additionals	Inulin 2%	Inulin 5%
Weight loss (%)	66,52±4,25	66,32±3,18	66,39±3,65
pH	6,08±0,02	6,06±0,01	6,05±0,15
WHC (%)	35,60 <sup>a</sup> ± 4,12	28,85 <sup>b</sup> ± 5,02	25,05 <sup>b</sup> ± 3,40
Shear force (N)	10,73 <sup>b</sup> ±2,10	11,92 <sup>b</sup> ±2,26	13,84 <sup>a</sup> ±3,12
<b>Colour:</b>			
L*, lightness	59,48 <sup>a</sup> ± 0,74	58,90 <sup>b</sup> ± 2,42	57,75 <sup>b</sup> ± 1,08
a*, redness	8,14 ± 1,34	8,64 ± 1,07	7,81 ± 0,96
b*, yellowness	12,83 ± 0,36	13,09 ± 0,76	13,31 ± 0,56

Explanations: ( $\bar{x} \pm s$ ) arithmetic mean±standard deviation, the mean values in rows with different letters differ significantly  $p \leq 0.05$

Objaśnienia: ( $\bar{x} \pm s$ ) średnia arytmetyczna ± odchylenie standardowe, wartości średnie oznaczone różnymi literami w wierszach różnią się statystycznie istotnie przy  $p \leq 0.05$

**Source:** The own study

**Źródło:** Badania własne

**Table 2. Effect of inulin addition on the sensory characteristics of turkey burgers****Tabela 2. Wpływ dodatku inuliny na cechy sensoryczne burgerów z mięsa indyczego**

Parameter	Variant of burgers		
	Without additionals	Inulin 2%	Inulin 5%
Odour intensity	4,80 ± 0,27	4,60 ± 0,42	4,80 ± 0,27
Flavour intensity	4,50 ± 0,35	4,50 ± 0,35	4,60± 0,41
Odour desirability	4,40 ± 0,55	4,60 ± 0,45	4,40± 0,55
Flavour desirability	4,00 <sup>b</sup> ± 0,27	4,50 <sup>b</sup> ± 0,35	4,80± 0,45
Juiciness	4,20 ± 0,27	4,40 ± 0,22	4,50 ± 0,35
Tenderness	4,80 <sup>a</sup> ± 0,35	4,30 <sup>b</sup> ± 0,35	3,80 <sup>b</sup> ± 0,27
Connection	3,80 <sup>b</sup> ± 0,55	4,70 <sup>a</sup> ± 0,22	4,60 <sup>a</sup> ± 0,54
Consistenc	4,40 ± 0,27	4,40± 0,22	4,60± 0,45
Structure	3,50 <sup>b</sup> ± 0,50	4,70 <sup>a</sup> ± 0,27	4,80 <sup>a</sup> ± 0,45
Surface color	4,80 ± 0,27	4,80 ± 0,27	4,80 ± 0,27
Color of the section	4,70 ± 0,27	4,80 ± 0,27	4,80 ± 0,27
Total desirability	4,40 ± 0,11	4,60 ± 0,20	4,70± 0,28

Explanations: ( $\bar{x} \pm s$ ) arithmetic mean±standard deviation, the mean values in rows with different letters differ significantly  $p \leq 0.05$

Objaśnienia: ( $\bar{x} \pm s$ ) średnia arytmetyczna ± odchylenie standardowe, wartości średnie oznaczone różnymi literami w wierszach różnią się statystycznie istotnie przy  $p \leq 0.05$

**Source:** The own study

**Źródło:** Badania własne

The brittleness parameter is one of the most important factors in the quality assessment of a meat product. The brittleness of the enriched product depends on many factors, such as temperature, time and the selected method of thermal treatment and the type and amount of additives used. The addition of dietary fibres to meat products does not always improve tenderness [20, 23]. The obtained test results indicate a significant ( $p \leq 0.05$ ) increase in the hardness of products with the addition of inulin (Table 1). Reduction of brittleness by the addition of inulin was shown by Menegas et al. [16]. The authors showed that the fermented poultry sausage was harder and less flexible compared to the control sample. Florowski et al. [10] observed a reduction in the brittleness of products in the study of fat substitution with inulin in sausages. Momchilova et al. [18] in the study of meat and vegetable pates showed that the addition of inulin gel caused a decrease in the hardness of meat products. Research by Cegiełka [4] showed no effect of the addition of 1% inulin on the hardness of burgers. The reason could be the use of a low dose of fibre or modification of the recipe composition.

The authors' own research showed that the addition of inulin to turkey burgers had an impact on the results of the sensory evaluation. The introduction of the addition of inulin in the amount of 2% and 5% significantly ( $p \leq 0.05$ ) impacted the increase of the desirable smell and better structure and binding of turkey burgers. Burgers with the addition of 5% inulin were characterized by greater hardness compared to burgers with 2% addition and no additives, which did not reduce the general desirability of the products. In the work of Janczar-Smuga and Gondek [13], the addition of 3% and 10% of inulin to poultry pates did not improve the taste and aroma of the product. However, an improvement in the consistency of the product was observed with the addition of inulin in an amount of 3% in relation to the product weight. In the studies by Cegiełka and Nadworska [5], where the addition of inulin to burgers was used, the smell of the product deteriorated with increasing doses of inulin. The taste of burgers was characterized by better parameters for burgers with the addition of 2% and 3% inulin. In the studies by Zwolan et al. [23], the addition of the inulin preparation to baked pates did not affect the taste and smell of the tested product. Momchilova et al. [18] showed that the higher concentration of inulin in the meat and vegetable pate was conducive to a lower sensory evaluation and that the addition of inulin contributed to the darkening of the colour of the pates.

## SUMMARY

The addition of 2% and 5% inulin in the form of a powder to the recipe composition of poultry burgers contributed to the darkening of colour the cross-section of the obtained products. Poultry burgers containing 5% inulin were characterized by lower water holding capacity and higher cutting force, compared to burgers with 2% addition and a control product.

The addition of 2% and 5% of inulin increased the desirability of smell as well as a better structure and binding of turkey burgers. Burgers with the addition of 5% inulin were characterized by higher hardness compared to burgers with 2% addition and no additives, which did not reduce the overall desirability of the products.

The obtained research results indicate that both the addition of 2% and 5% can be used in the technology of turkey burger production, obtaining a tasty, good quality product.

## PODSUMOWANIE

Dodatek 2% i 5% inuliny w postaci proszku do składu recepturowego burgerów z mięsa indyjskiego wpłynął na pociemnienie barwy przekroju otrzymanych produktów. Burgery drobiowe zawierające 5% inuliny charakteryzowały się mniejszą wodochłonnością i większą siłą cięcia w porównaniu z burgerami z dodatkiem 2% inuliny i produktem

kontrolnym. Dodatek 2% i 5% inuliny zwiększył atrakcyjność zapachu oraz wpłynął na lepszą strukturę i konsystencję burgerów indyjskich.

Burgery z dodatkiem 5% inuliny charakteryzowały się większą twardością w porównaniu do burgerów z dodatkiem 2% i bez dodatków, co nie obniżyło ogólnej pożądalności wyrobów.

Uzyskane wyniki badań wskazują, że dodatek 2% i 5% może być stosowany w technologii produkcji burgerów z mięsa indyjskiego uzyskując produkt smaczny, dobrej jakości.

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