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KONSUMENCKA I SENSORYCZNA CHARAKTERYSTYKA NISKOTŁUSZCZOWYCH I WYSOKOTŁUSZCZOWYCH MARGARYN I TŁUSZCZÓW MIESZANYCH

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W dwóch kolejnych latach (1995 i 1996) przeprowadzono badania pożądalności konsumenckiej (z udziałem 104 i 101 konsumentów, kobiet w wieku 19–64 lat) oraz badania jakości sensorycznej (metodą profilową) wybranych (niskotłuszczowych i wysokotłuszczowych) margaryn i tłuszczów mieszanych reprezentujących obecne na polskim rynku tłuszeze do smarowania pieczywa. Wyniki badań konsumenckich analizowano pod kątem ich zależności od czynników demograficznych, współzależności z ocenami ankietowymi tych samych tłuszczów na podstawie ich nazwy, a także badano rozkład preferencji konsumentów na mapach preferencyjnych. Nałożenie na mapy preferencyjne wyników analizy profilowej pozwoliło dodatkowo na określenie wyróżników sensorycznych badanych margaryn decydujących o ich wysokiej ocenie konsumenckiej. Przeprowadzone badania nie wykazały istotnych różnic w preferencjach konsumenckich dla badanych wysokotłuszczowych (70–80%) i niskotłuszczowych (45–60%) margaryn i tłuszczów mieszanych. W obydwu grupach tłuszczów były produkty oceniane zarówno wyżej jak i niżej pod względem pożądalności konsumenckiej. Głównymi cechami decydującymi o zróżnicowaniu jakości konsumenckiej badanych tłuszczów były: zapach i smak "maślany" (nota pozytywna) oraz zapach i smak "margarynowy" i "olejowy" (noty negatywne). Stosunek tych not wyraźnie wpływał na pożądalność konsumencką ocenianych margaryn i tłuszczów mieszanych.

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EFFECT OF SILAGES ON THE YIELD AND QUALITY OF MEAT FROM TWO LINES OF GOOSE

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Key words: chemical composition of goose meat, functional properties of goose meat, goose feeding

White Italian WD-1 and Biłgorajskie geese fed different silages were studied. Compared with White Italian geese, the breast and thigh muscles' percentages were higher by 1.63% and 0.47%, respectively, in Biłgorajskie geese, independently on silage. The chemical composition and functional properties of these muscles also showed their high quality. Irrespective of goose line, better percentage of leg muscles and significantly greater amounts of crude protein in breast and thigh muscles were found in geese fed the grass or red-clover silage.

INTRODUCTION

The composition and physicochemical properties of meat determine its nutritive and dietetic values. The edible parts of goose carcass have less protein, and more dry matter and fat compared with gallinaceous fowls [Michalik, 1994].

According to Niewiarowicz [1971], and Puchajda and Faruga [1980], the meat of geese being slaughtered at 14 week of age is of the highest nutritive and dietetic values. For these characteristics, the breast muscles are of greater value than the thigh muscles. Puchajda and Faruga [1980] reported that the composition and physicochemical properties of breast muscles are influenced by the line of goose. Despite higher nutritive value of breast muscles than thigh muscles, the latter are of greater technological suitability [Bielińska *et al.*, 1984a]. The muscle composition is not dependent on goose sex and body weight [Rosiński & Bieliński, 1990].

The study by Bielińska *et al.* [1984a] showed that a reduced consumption of

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nutritive fodder influenced the interstitial and intracellular fat deposits of breast muscles. The breast muscle contents of dry matter and protein were, however, not affected by a reduced intake of the fodder. The study by Faruga and Puchajda [1993] showed that feeding silages to geese does not influence the chemical composition of breast and thigh muscles, whereas it influences the content of expressible moisture, colour and pH of the breast muscles.

In Poland, the production of goose meat is based on two long term-selected White Italian lines (WD-1 and WD-3). These lines have great body weight, fast growth rate [Rosiński & Bieliński, 1990; Rosiński *et al.*, 1996], and high content of storage fat in the carcass and fat in the meat [Puchajda, 1991]. Besides White Italian geese, 16 groups of geese are maintained as a genetic reserve, including Biłgorajskie geese, which can be used for future selection of novel lines suitable for fattening. The Biłgorajskie geese have high survival rate, small body weight and adiposis, and good muscle development [Puchajda, 1991].

The objective of this work was to determine the effect of silages on the amount and quality of meat from two genetic lines of geese.

MATERIAL AND METHODS

The Biłgorajske geese (75 males and 75 females) and White Italian WD-1 geese (75 males and 75 females) fed different silages were used. The geese of each genetic line were allocated into three dietary groups with 25 males and 25 females of Biłgorajskie geese and 25 males and 25 females of White Italian geese in each group. To 3 week of age, the birds were fed *ad libitum* a rich mix (19.9% crude protein and 12.54 MJ metabolizable energy). From 4 week of age, the food ration contained a silage in the amount being gradually increased. From 14 week of age, feeding barley grains was started with the silage and rich mix being withdrawing from the food ration, and from 15 week of age geese were fed *ad libitum* barley during the following 3 weeks.

Geese in group 1 were fed prewilted-grass silage on week 4 and 5, and fresh-grass silage on week 6 to 14. Geese in group 2 were fed fresh-red clover (95%) and wheat meal (5%) silage followed by feeding only fresh-red clover silage. Geese in group 3 were fed the silage of steamed potato (87%), double improved rapeseed meal (5%), faba bean meal (4%), and dried alfalfa (4%) during a 10 week period from week 4 to 14. The crude protein contents of silages for group 1 were 7.02% from week 4 to 5 and 4.94% from week 6 to 14. The respective values of metabolizable energy were 2.72 and 1.87 MJ/kg. In group 2, the crude protein contents of silages were 4.16% from week 4 to 5 and 3.86% from week 6 to 14, and silage metabolizable energies were 1.91 and 1.31 MJ/kg, respectively. In group 3, the silage contained 5.27% crude protein and 3.51 MJ/kg metabolizable energy.

All birds were weighed on developing fully matured second feathers and 6 males and 6 females of Biłgorajskie geese, and 6 males and 6 females of White Italian geese were then selected from each group using a systematic sampling system. Slaughter and rough analysis at slaughter were made according to the methods reported previously [Puchajda, 1991]. The breast and thigh muscles from each goose were sampled to determine some functional properties and chemical composition. The latter was analysed by classical methods and the former included the analysis of (1) expressible moisture, determined by a Grau and Hamm method as modified by Pohja and Niinivaara [1957], (2) colour, characterised on a basis of colour brightness according to a Kortz *et al.* [1968] method, and (3) pH, measured after 48 h from slaughter using a Radiometer pH-meter with a glass electrode. The results obtained were analysed statistically using two-factor orthogonal variance analysis and Duncan's test.

RESULTS AND DISCUSSION

The percentage of leg muscles was statistically greater and that of abdominal fat pad was statistically smaller in the carcasses of geese from groups 1 and 2 as compared with group 3 (Table 1). Significantly more breast and leg muscles had Biłgorajskie geese than White Italian geese. In the study by Bielińska *et al.* [1984a,b], geese of small body weight also had well-developed muscles and small adipose. By comparing the carcasses of Biłgorajskie and White Italian geese, highly significantly lower content of skin with subcutaneous fat along with slightly greater content of fat pad was found in Biłgorajskie geese. When studying Biłgorajskie and White Italian geese, Puchajda [1991] found that the body weight and slaughter yield was very close in both these geese, and significant differences were found only for the content of fat pad. In the present study, significantly greater amount of fat pad was found in geese from group 3 fed the silage with a high proportion of steamed potatoes (87%). For this trait, the diet by line interaction was observed, which proves that Biłgorajskie and White Italian geese responded dif-

TABLE 1. Percentage analysis of geese at slaughter.

Trait	Dietary group* (A)			Goose origin (B)		Interaction**
	1	2	3	Biłgorajskie	White Italian	A × B
Dressed carcass	100	100	100	100	100	
Breast muscles	16.12 (7.89)	16.28 (8.14)	16.82 (8.69)	17.22^{A} (7.86)	15.59^{B} (4.91)	–
Leg muscles	17.60^{A} (4.73)	17.43^{A} (6.12)	16.61^{B} (5.45)	17.45^{a} (4.77)	16.98^{b} (6.76)	–
Breast and leg muscles	33.74 (5.02)	33.75 (4.71)	33.43 (6.37)	34.68^{A} (4.94)	32.31^{B} (3.67)	–
Skin with subcutaneous fat	22.91 (15.92)	24.31 (11.95)	23.25 (16.95)	21.22^{A} (12.08)	25.76^{B} (10.99)	–
Suet fat	5.63^{a} (24.91)	5.96^{b} (16.00)	6.66^{b} (16.49)	6.27 (23.28)	5.90 (15.74)	+

The results are means at the variation coefficients (%) given in parentheses. The means within the same row without the same superscript are significantly different: $P \leq 0.05$ (a,b), $P \leq 0.01$ (A<B); * 1 – Prewilted-grass silage on week 4 and 5 fresh-grass silage on week 6 to 14, 2 – Fresh red clover (95%) and wheat meal (5%) silage and fresh-red clover silage, 3 – Steamed potato (87%), rapeseed meal (5%), faba bean meal (4%) and dried alfalfa (4%) silage from week 4 to 14; ** (–) absent, (+) present.

TABLE 2. Chemical composition (%) of breast muscles.

Component	Dietary group* (A)			Goose origin (B)		Interaction** A × B
	1	2	3	Bilgorajskie	White Italian	
Dry matter	27.35^{A} (3.40)	27.29^{A} (2.59)	26.63^{B} (2.20)	27.34^{A} (2.94)	26.84^{B} (2.80)	–
Crude protein	23.39^{A} (2.91)	23.36^{A} (2.90)	22.85^{B} (2.47)	23.38^{a} (2.51)	23.02^{b} (3.16)	–
Crude fat	2.61^{AB} (26.95)	2.92^{A} (24.88)	2.36^{B} (20.43)	2.73 (27.00)	2.54 (24.04)	–
Crude ash	1.32 (7.21)	1.28 (8.49)	1.32 (4.54)	1.30 (6.71)	1.31 (7.48)	–

The results are means at the variation coefficients (%) given in parentheses. The means within the same row without the same superscript are significantly different: P≤0.05 (a,b), P≤0.01 (A<B); * see Table 1 for description; ** (–) absent.

TABLE 3. Chemical composition (%) of thigh muscles.

Component	Dietary group* (A)			Goose origin (B)		Interaction** A × B
	1	2	3	Bilgorajskie	White Italian	
Dry matter	29.63 (5.59)	29.00 (4.77)	30.43 (10.68)	29.47 (8.51)	29.90 (6.96)	–
Crude protein	20.14^{A} (3.67)	19.98^{A} (5.52)	19.21^{B} (5.59)	20.16^{A} (5.01)	19.39^{B} (5.00)	–
Crude fat	8.51 (24.53)	7.84 (23.93)	8.94 (34.22)	8.00 (31.49)	8.86 (25.29)	–
Crude ash	1.06 (13.30)	1.10 (5.93)	1.03 (13.16)	1.08 (10.33)	1.04 (12.14)	–

The results are means at the variation coefficients (%) given in parentheses. The means within the same row without the same superscript are significantly different: P≤0.05 (a,b), P≤0.01 (A<B); * see Table 1 for description; ** (–) absent.

ferently to diet. In group 1, higher content of fat pad had White Italian geese than Bilgorajskie geese, whereas in the other two groups (group 2 and 3), higher content of fat pad was found in Bilgorajskie geese.

The breast muscles analysed depending on the feeding programme and goose line, differed with the chemical composition (Table 2). The highest contents of dry matter and crude protein in breast muscles were found in groups 1 and 2, and the lowest in group 3. These muscles also differed with the fat content. The study by Faruga and Puchajda [1993] did not show, however, the differences in the chemical composition of breast and thigh muscles in geese fed multicomponent silages. By comparing the chemical composition of breast muscles of Bilgorajskie and White Italian geese, greater contents of dry matter and crude protein were found in Bilgorajskie geese. Other study [Puchajda & Faruga, 1980] also showed a greater content of crude protein and lower content of crude fat in breast muscles of Bilgorajskie geese than of other lines.

For thigh muscles, the statistically significant differences were found only for crude protein content (Table 3). Greater contents of crude protein were found in groups 1 and 2 than in group 3 and they were also greater for Bilgorajskie geese than for White Italian geese.

The breast and thigh muscles of geese from groups 1 and 2 had lower amount of expressible moisture, darker colour, and higher pH value than geese from group 3 (Table 4). Faruga and Puchajda [1993] reported that the breast muscles of geese fed corn silage had greater amount of expressible moisture and lower pH value compared with geese fed green fodder. In the present study, the effect of goose line

TABLE 4. Characteristics of some functional propertiers of breast and thigh muscles.

Trait	Dietary group* (A)			Goose origin (B)		Interaction** A × B
	1	2	3	Bilgorajskie	White Italian	
Breast muscles						
Expressible moisture, cm^2	3.11^{B} (60.71)	3.09^{B} (69.66)	4.97^{A} (24.82)	2.99^{B} (62.77)	4.46^{A} (41.06)	++
Colour brightness, %	9.04^{B} (15.80)	9.62^{b} (21.62)	10.71^{Aa} (17.08)	8.92^{B} (15.95)	10.67^{A} (18.21)	–
pH 48	6.18^{Aa} (2.93)	6.10^{Ab} (3.29)	5.90^{B} (2.06)	6.14^{A} (3.49)	5.98^{B} (2.76)	++
Thigh muscles						
Expressible moisture, cm^2	4.01^{B} (52.22)	3.89^{B} (46.57)	5.34^{A} (22.05)	3.74^{B} (40.82)	5.00^{A} (37.19)	++
Colour brightness, %	16.92 (20.40)	17.12 (15.90)	15.62 (13.58)	15.02^{B} (12.47)	18.08^{A} (15.88)	+
pH 48	6.53^{A} (4.08)	6.49^{A} (4.04)	6.33^{B} (2.35)	6.54^{A} (3.53)	6.35^{B} (3.52)	++

The results are means at the variation coefficients (%) given in parentheses. The means within the same row without the same superscript are significantly different: P≤0.05 (a,b), P≤0.01 (A<B); * see Table 1 for description; ** (–) absent, (+) present at P≤0.05, (++) present at P≤0.01.

TABLE 5. Characteristics of functional properties of breast and thigh muscles.

	Bilgorajskie goose			White Italian goose		
	Dietary group*					
	1	2	3	1	2	3
Breast muscles						
Expressible moisture, cm^2	1.75 (93.74)	2.31 (110.29)	4.89 (18.19)	4.47 (40.28)	3.86 (150.68)	5.05 (45.10)
Colour brightness, %	8.33 (20.36)	8.50 (11.76)	9.92 (21.01)	9.75 (15.15)	10.75 (49.26)	11.50 (30.83)
pH 48	6.30 (0.27)	6.23 (0.21)	5.89 (0.14)	6.06 (0.28)	5.97 (0.58)	5.91 (0.38)
Thigh muscles						
Expressible moisture, cm^2	2.76 (34.90)	3.00 (13.94)	5.46 (21.43)	5.26 (91.43)	4.77 (98.82)	5.22 (32.54)
Colour brightness, %	14.50 (20.69)	15.67 (23.60)	14.92 (24.94)	19.33 (47.34)	18.58 (38.61)	16.33 (28.20)
pH 48	6.67 (0.49)	6.67 (0.14)	6.28 (0.26)	6.38 (1.08)	6.31 (0.96)	6.37 (0.40)

The results are means at the variation coefficients (%) given in parentheses; * See Table 1 for description.

on the analysed functional properties of muscles was also observed (Table 4). The breast [illegible]nigh muscles of Bilgorajskie geese had highly significantly lower amo[illegible]xpressible moisture, darker colour and higher pH value. The physico-

chemical analysis of breast and thigh muscles made by Puchajda [1991] for Biłgorajskie and White Italian geese showed statistically significant differences only in the pH of breast muscles. The data in Table 4 proves that diet by line interaction influenced the functional properties of breast muscles, except for colour brightness.

The data in Table 5 for particular dietary groups of Biłgorajskie and White Italian geese shows different tendencies for the analysed traits. The smallest amount of expressible moisture in breast and thigh muscles was found in Biłgorajskie geese fed the grass silage (group 1) and in White Italian geese fed the red-clover silage (group 2). The thigh muscles were the brightest in Biłgorajskie geese fed the grass silage (group 1) and in White Italian geese fed the silage, in which one of the component was steamed potatoes (group 3).

CONCLUSIONS

The Biłgorajskie and White Italian geese fed grass silage (group 1) and red-clover silage (group 2) had better development of leg muscles and smaller amount of skin with subcutaneous fat than geese fed the steamed-potato silage. The breast and thigh muscles of these geese also had greater amount of crude protein, smaller amount of expressible moisture and higher pH value, with the Biłgorajskie geese from groups 1 and 2 having higher muscle percentages and lower amounts of skin with subcutaneous fat than White Italian geese.

The breast muscles of Biłgorajskie geese from three groups analysed contained a greater amount of crude protein and smaller amount of expressible moisture than the White Italian goose muscles. The Biłgorajskie goose muscles were darker and had higher pH value.

The Biłgorajskie geese can be used in the production of carcasses of small weight (2.5 to 3.0 kg), small adiposis and good musculature.

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UDZIAŁ I JAKOŚĆ MIĘSA W ZALEŻNOŚCI OD ŻYWIENIA I POCHODZENIA GĘSI

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Badania przeprowadzono na gęsiach biłgorajskich i białych włoskich rodu WD-1 żywionych od 4 do 14 tygodnia różnymi kiszonkami. Gęsi z grupy 1 otrzymywały w 4 i 5 tygodniu kiszonkę z traw podsuszonych, a od 6 do 14 tygodnia z traw świeżych, z grupy 2 kiszonkę z koniczyny czerwonej świeżej (95%) i śruty pszennej (5%), oraz kiszonkę z koniczyny czerwonej świeżej, natomiast gęsi z grupy 3 – kiszonkę sporządzoną z ziemniaków parowanych (87%), poekstrakcyjnej śruty rzepakowej 00 (5%), śruty bobikowej (4%) i suszu z lucerny (4%). Gęsi z grupy 1 i 2, charakteryzowały się większą zawartością mięśni nóg i mniejszą zawartością tłuszczu sadełkowego niż gęsi z grupy 3 (tab. 1). Mięśnie piersiowe gęsi z grupy 1 i 2 odznaczały się także większą zawartością suchej masy, białka ogółem i tłuszczu surowego (tab. 2) oraz mniejszą zawartością wody wolnej, jaśniejszą barwą i wyższym pH niż mięśnie piersiowe gęsi z grupy 3 (tab. 4). Mięśnie udowe gęsi z grupy 1 i 2 charakteryzowały się mniejszą ilością wody wolnej, większą zawartością białka ogółem i wyższym pH niż mięśnie gęsi z grupy 3 (tab. 2 i 4). Udział mięśni piersiowych i nóg w tuszkach gęsi biłgorajskich był wyższy niż u gęsi białych włoskich (tab. 1). Mięśnie piersiowe i udowe gęsi biłgorajskich charakteryzowały się większą zawartością białka ogółem oraz mniejszą ilością wody wolnej, ciemniejszą barwą i wyższym pH niż mięśnie gęsi białych włoskich (tab. 2, 3 i 4). Korzystniejszy udział mięśni nóg w tuszce i istotnie większą zawartość białka ogółem w mięśniach piersiowych i udowych stwierdzono, niezależnie od pochodzenia, w grupach gęsi żywionych kiszonką sporządzoną z traw (grupa 1) i koniczyny czerwonej (grupa 2).