EFFECTS OF SEASON, GENDER AND PORTION ON THE YIELD, PH, COLOUR AND PROXIMATE CHARACTERISTICS OF EGYPTIAN GOOSE MEAT

G. Geldenhuys[1,2], L. C. Hoffman[2] and N. Muller[1]

[1] Department of Food Science, Stellenbosch University, Private Bag X1, Matieland (Stellenbosch) 7602, South Africa

[2] Department of Animal Science, Stellenbosch University, Private Bag X1, Matieland (Stellenbosch) 7602, South Africa

Abstract – The carcass yield, physical characteristics and proximate composition of Egyptian geese (*Alopochen aegyptiacus*), a southern African gamebird species, has been studied. Gender affected (P≤0.05) the carcass yield with the male fowl having higher values. The data does not indicate that the pH and colour were affected by gender; however, the meat from the female fowl had a higher intramuscular fat (IMF) content. The IMF content of the fowl hunted in July was higher (P≤0.05) due to the effect of the breeding season. The physical parameters also differed (P≤0.05) as a result of season. The physical characteristics and the proximate composition between the breast, thigh and drumstick portions varied considerably. This may be connected to a difference in the fibre composition of the muscles. Overall, this study revealed that in order to ensure a consistent eating quality the harvesting periods of Egyptian geese should be considered.

Key Words – Carcass yield, Gamebirds, Nutritional value

• INTRODUCTION

The gamebird industry and wingshooting in South Africa is becoming increasingly popular and the Egyptian goose (*Alopochen aegyptiacus*) is considered to be one of the leading gamebird species hunted [1]. Crop farmers in the Western Cape, South Africa also consider Egyptian geese to be very serious agricultural pests, which have a negative impact on the agricultural economy of this region [2]. The geese forage on grains during the harvesting period which results in enormous financial losses. In attempting to reduce the damage they cause, wingshooting of the geese are recommended. For this reason, utilisation of the meat is vital; however, with the current absence of available scientific literature, it is essential to investigate the meat quality of this waterfowl species as well as influential factors such as season and gender. Information regarding the carcass yield, physical characteristics and proximate composition of Egyptian geese will give insight into the nutritional value, as well as the economic potential of the meat from this species.

• MATERIALS AND METHODS

Harvesting

Egyptian geese were harvested on the University of Stellenbosch's experimental farm, Mariendahl (ethical clearance: 10NP_HOF01), by the use of double barreled shotguns. A total of 36 geese (14 females and 22 males) were harvested during the month of July (winter) 2010. This was followed by a total of 33 geese (13 females and 20 males) harvested during November (summer) 2010. The geese were collected in the field and refrigerated (4°C) for approximately 12 h before further processing.

Slaughtering and deboning

The slaughtering procedures were carried out manually. Firstly, the head was removed between the C1 and C2 vertebrae. Both of the feet were removed at the ankle joint and the tip of each wing from the wrist region. The skin containing the feathers was removed from the body. The geese were eviscerated by means of an incision in the abdominal muscles. The dressed carcasses were hung over-night (±24 h) in a refrigerated area (4°C), where after the neck was removed at the base between the neck and body and the carcasses were halved by means of a portioning machine. The left sides of the carcasses were used for this study. Portioning of the halved left sides of the carcasses into the breast, thigh and drumstick followed. A cut was made at the knee joint to remove the drumstick from the thigh; another cut was made at the junction between the thigh and the post-dorsal region of the carcass in order to remove the thigh, at the hip joint, from the backbone. The *M. pectoralis* and *M. supracoracoideus* was removed from the breast region of the carcass by cutting through the shoulder joint and around the *M. pectoralis* on the lateral side to detach the breast from the carcass. The three portions were then deboned. Subsequently, the physical measurements were completed and each portion was packaged separately and stored (-18°C) for the proximate analyses.

Carcass yield

The "live" weights of each of the geese (July and November) were recorded before the slaughtering process commenced. After slaughtering and hanging of the dressed carcasses for ± 24 h, the weights of the individual carcasses (neck removed) were recorded. The dressing percentage of each individual goose was determined by calculating the dressed carcass weight as a percentage of the live weight.

Physical measurements

The pH_u of the breast, thigh and drumstick of each of the individual geese were recorded. The pH was measured by means of a Crison pH25 portable pH meter (Lasec, SA) calibrated with the standard buffers (pH 4.0 and 7.0) provided by the manufacturer. The colour measurements were taken 48 h post mortem, at three randomly selected positions on each of the three respective portions from July and November, according to the method described by Honikel [3]. A Colour guide 45˚/0˚ colorimeter (BYK-Gardner, USA) was used to establish the L*, a* and b* values. The hue angle (h_{ab}) (°) and chroma value (C^*) was calculated by the use of the a* and b* values.

Proximate analysis

The analyses were performed on a homogenized meat sample from the breast, thigh and drumstick portions respectively, of each of the geese (July and November). The moisture content (%) was determined according to the Association of Official Analytical Chemist's Standard Techniques (AOAC) method 934.01 [4] and the ash content (%) of the moisture free sample was determined by the official AOAC method 942.05 [4]. The chloroform/methanol (1:2 v/v) extraction method stipulated by Lee *et al.* [5] was used to determine the total lipid (%) (IMF). To establish the total crude protein content (%) the Dumas combustion method 992.15 [4] was applied. All proximate analyses are controlled by a National inter-laboratory scheme (Agricultural Laboratory Association of South Africa) where blind samples are analysed on a bi-monthly basis in order to control and ensure the accuracy and repeatability of the procedures used.

Statistical analysis

For the carcass yield data the main effects of season and gender were tested as well as the interaction between the two. The experiment thus consisted of 4 treatments (2 seasons x 2

genders) with approximately 36 replicates for each season and gender. The analysis of the physical and proximate data required the use of a split-plot design. Each of the carcasses was considered as one experimental unit and every carcass was further divided into the three different portions (breast, thigh and drumstick). Portion was therefore a sub-plot factor. All of the data were subjected to an analysis of variance (ANOVA) and the t-Least Significant Differences (LSD) were calculated at a 5% significance level. Differences between the variables were accepted as being significant at $P \leq 0.05$. SAS™ statistical software (Version 9.2, USA) was used for the ANOVA.

- RESULTS AND DISCUSSION

Even though it was expected that the carcass yield of Egyptian geese would be influenced by both season and gender; the latter alone significantly affected the live and carcass weights of Egyptian geese (Table 1).

Table 1 The mean values[1] (±SD) for the carcass yield of Egyptian geese as affected by gender[2]

	Female	Male
Live weight (kg)	$2165.7^{b} \pm 226.8$	$2614.0^{a} \pm 376.1$
Dressed carcass weight (kg)	$1145.0^{b} \pm 102.2$	$1413.3^{a} \pm 226.6$
Dressing (%)	53.1 ± 3.4	54.1 ± 4.3

[1]Means in rows, with different superscripts, are significantly different at $P \leq 0.05$. [2]Abbreviations: Standard deviation (SD).

It is evident from Table 1 that the male geese had higher ($P \leq 0.05$) live and dressed carcass weights. Similar results have not only been found in ungulate game species [6] but in wild gamebirds such as pheasants [7] and bobwhite quails [8] as well.

Gender was not a significant factor regarding the colour and pH of the muscles. Considering the hue angle and chroma values (Table 2), the November meat had a much more vivid, red colour as opposed to the July meat which was situated more towards the yellow area on the colour spectrum. Fat colour is correlated to the carotenoid content of forage and animals that feed on grass based diets, such as Egyptian geese in July, generally have higher levels of this compound present in their fat. This results in a more yellow and less white coloured meat. Studies have also shown that the IMF colour of grass-fed beef become whiter when the feed intake becomes more grain based [9]. This is consistent with the data (Table 2) which indicates that the meat from the geese hunted in November was lighter ($P \leq 0.05$) due to the grain based diet of this period. The lighter colour (high L*) of the thigh portion may be related to the higher ($P \leq 0.05$) intramuscular fat content (Table 3). Fat is lighter in colour compared to muscle [10] and contributes to a higher L* value. The lighter colour can also be linked to the composition of the muscle fiber types. Waterfowl species use the leg muscles for several activities and it therefore consists of a combination of type I (red), type IIb (red) and type IIa (white) fibers [11]. However, the higher IMF (Table 3) does in-fact suggest that the thigh consisted of a greater proportion of type I, oxidative fibers as muscles predominantly containing these fibers store fat rather than glycogen for energy metabolism [12]. The higher pH of the thigh and drumstick portions indicates that Egyptian geese walk more than they fly. Especially since the pH of the drumstick is also higher ($P \leq 0.05$) than the breast.

The proximate composition (Table 3) was significantly influenced by season, gender and portion. It appears as though the breeding period was responsible for the increased ($P \leq 0.05$) IMF content of the meat harvested in July. The peak breeding period of Egyptian geese is between August and October in the Western Cape of South Africa.

Table 2 The mean[1] values (±SD) for the physical characteristics of Egyptian geese as affected by season, gender and portion[2]

	L*	Hue	Chroma	pH
		Season		
Jul	$30.06^{b} \pm 2.93$	$32.06^{a} \pm 3.06$	$17.62^{b} \pm 2.22$	$5.84^{b} \pm 0.17$
Nov	$31.79^{a} \pm 3.00$	$28.65^{b} \pm 3.93$	$21.23^{a} \pm 2.71$	$5.99^{a} \pm 0.11$
		Portion		
B	$28.61^{c} \pm 2.37$	$29.87^{b} \pm 3.66$	$19.18^{b} \pm 3.2$	$5.85^{b} \pm 0.17$
T	$32.57^{a} \pm 2.85$	$31.32^{a} \pm 3.75$	$20.24^{a} \pm 2.78$	$5.95^{a} \pm 0.13$
D	$31.48^{b} \pm 2.55$	$30.11^{b} \pm 4.14$	$18.61^{b} \pm 2.99$	$5.93^{a} \pm 0.16$

[1]Means in columns, within main effect, with different superscripts are significantly different at P≤0.05.
[2]Abbreviations: Breast (B), thigh (T), drumstick (D), standard deviation (SD).

The body fat of female wildfowl is highly influenced by the breeding period and in the days preceding egg-laying these levels are very high as the geese have been preparing their body for the strain it will endure during this brood period [13]. This is verified by the fact that the female geese had an overall higher (P≤0.05) IMF of 4.7% compared to the males.

Table 3 The mean percentages (±SD) for the proximate composition of Egyptian geese as affected by season, gender and portion

	Moisture	Protein	Fat	Ash
		Season		
Jul	$72.9^{a} \pm 2.02$	$20.2^{b} \pm 1.49$	$4.6^{a} \pm 1.13$	$1.1^{a} \pm 0.12$
Nov	$72.3^{a} \pm 1.98$	$20.8^{a} \pm 1.74$	$4.1^{b} \pm 1.11$	$1.2^{a} \pm 0.13$
		Gender		
F	$72.0^{b} \pm 2.06$	$20.3^{a} \pm 1.73$	$4.7^{a} \pm 1.11$	$1.2^{a} \pm 0.13$
M	$73.0^{a} \pm 1.89$	$20.5^{a} \pm 1.58$	$4.2^{b} \pm 1.13$	$1.2^{a} \pm 0.13$
		Portion		
B	$72.6^{b} \pm 1.31$	$20.8^{a} \pm 1.39$	$4.4^{a} \pm 1.27$	$1.2^{a} \pm 0.13$
T	$72.1^{c} \pm 2.77$	$19.4^{b} \pm 1.39$	$4.6^{a} \pm 0.96$	$1.1^{c} \pm 0.10$
D	$73.2^{a} \pm 1.51$	$21.1^{a} \pm 1.65$	$4.0^{b} \pm 1.09$	$1.2^{b} \pm 0.10$

[1]Means in columns, within main effect, with different superscripts are significantly different at P≤0.05.
[2]Abbreviations: Female (F), male (M), breast (B), Thigh (T), drumstick (D), standard deviation (SD).

The negative relationship that exists between the fat and moisture content of muscle is also found within the gender and portion effects of this study. There is a higher (P≤0.05) IMF in the thigh and breast portions of Egyptian geese. The breast muscle of Anseriformes is used during flying, which requires fast, sustained muscle contraction, and therefore consists mainly of type IIa fibres [14]. These oxidative muscles have a higher IMF content [12]. Similarly, the thigh which is comprised of a combination of the three main fibre types, are also used for postural activity which indicates that type I, fibres are present. Anatomically the thigh portion may also have more physical capacity in order to accommodate intramuscular fat deposition. The ash content was not affected by season and gender but did in fact differ (P≤0.05) between portions with the breast muscle having the highest amount of ash. The mineral concentration varies considerably between different muscles. The variable ash contents of the different portions may therefore be linked to the inherent muscle effect.

- CONCLUSION

Several factors which are important to consider regarding the commercial utilisation of

Egyptian goose meat were revealed. Gender affects the carcass characteristics and IMF content of the meat which may have economical and nutritional implications. There are also differences in the quality of the meat from the geese hunted during the summer and winter periods in South Africa relating to the IMF content, colour and pH. It is questionable whether the physical differences will be recognized by the average consumer. Even so, the data indicates that in order to ensure a consistent eating quality the harvesting periods should be considered.

ACKNOWLEDGEMENTS

This work is based on the research supported by the South African Research Chairs Initiative of the Department of Science and Technology and National Research Foundation of South Africa. Any opinion, finding and conclusion or recommendation expressed in this material is that of the author(s) and the NRF does not accept any liability in this regard.

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