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Method of Bill Trimming can Affect the Behaviour, Performance, and Welfare of Mule Duck

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Abstract:

In the poultry industry, debeaking is an efficient strategy to reduce feather pecking and cannibalism. For this study, researcher compared the behavioural, performance, and well-being effects of two debeaking consequences on Mule ducks. In this study, 15-day-old Mule ducks were separated into three groups named: control, scissor, and hot searing. The ducks were weighed every week. Scanning was used to evaluate ducks' behaviour, and feather condition was scored on a scale of 0 to 3. There were no significant variations in behavioural patterns like drinking and preening across the treatment groups ($P>0.05$). Feeding, sitting, sleeping, walking, pecking the environment and pecking other ducks were all significantly reduced in the hot searing group as compared to that of control and scissor groups. However, the group that was subjected to the hot searing experienced a significant increase in standing behaviour. Compared to the other groups, hot searing debeaking showed higher average daily, weekly, and ultimate weight gains (g). The type of debeaking had no effect on the ducks' average viability. By week four, control ducks had lower feather scores than the other two groups, and they continued to decline more quickly than the feathers of the trimmed ducks ($P<0.05$). Even though both techniques of trimming cause acute pain, it appears that using scissors is preferred as it leads to more weight gain in ducks and less beak-related behaviour in ducks, but it is still successful in reducing feather pecking damage.

INTRODUCTION

There is an increasing demand for meat and eggs around the globe. Ducks of various breeds are raised all over the world for their eggs and meat (Chen *et al*., 2021). According to the FAO, in 2017 there would be 1.15 billion ducks (Anas spp.) around the world, which is a lot more than in the past two decades. Mule ducks have the ability to adopt a broad range of natural and environmental states (Tai and Tai, 2001; Patil *et al*., 2021). This might be the reason for the duck industry's growing importance and reputation in numerous countries around the globe. In Africa, the 2nd leading poultry production is duck, after chicken (Bugiwati *et al*., 2021). Poultry meat is an important part of the diet and a high-quality protein, and its demand is increasing throughout the world (Ashraf *et al*., 2016).

The duck industry might help to fulfil the requirement for animal protein (Bugiwati *et al*., 2021). The main animal protein source in Egypt is both the egg and meat production of ducks (Yakout, 2004).

Throughout the world, the major problems associated with the poultry industry are feather pecking and cannibalism (Ali *et al*., 2020). Aggressive behaviour is shown amongst the birds when they are reared together in large numbers. Many reasons, including malnutrition, overcrowding, group size, excessive light, and even sickness, can lead to cannibalism or feather pecking outbreaks (Appleby *et al*., 2004). There is a wide range of poultry that engage in feather pecking, such as turkeys, chickens, ducks, and geese. The damaging behaviours that cause poultry welfare reductions are cannibalism and feather pecking. Pulling feathers out causes pain (Gentle, 2011). The mortality rate could be high in flocks due to cannibalism (Appleby *et al*., 2004). These behaviours result in financial losses for farmers. When compared to fully feathered birds, those with fewer feathers lose heat more quickly and increased feed consumption than in fully feathered birds. Bill trimming was called "debeaking" in the past. In this process, the upper beak alone or both the lower and upper beaks are removed by one quarter to one third (Sandilands *et al*., 2004; Gentle, 2011). The main objective of bill trimming is the reduction of pecking injuries (Pizzolante *et al*., 2007). Bill trimming can be done on many birds, such as hens, quail, ducks, geese, and turkeys (Gustafson *et al*., 2007; Pizzolante *et al*., 2007). Bill trimming reduces cannibalism behaviour (Petrolli *et al*., 2017). There are numerous controversies surrounding bill trimming due to the association of chronic and acute pain (Gustafson *et al*., 2007). Bill trimming causes pain near the bill's tip as a result of tissue and nerve damage. Chronic pain is caused by the regrowth of nerves and neuromas (Gustafson *et al.,* 2007). This causes a reduction in performing active behaviours such as drinking, eating, preening, etc. This problem can be avoided by finding a method of beak trimming that can prevent aggressive behaviour and result in the least amount of pain. Different techniques for beak trimming are used. The different techniques used in the past include infrared lasers, cautery blades, and hot cautery blades. A sharp instrument is used in both the cautery blade and the hot cautery blade to cut the tip of the bill (Gentle and McKeegan, 2007). Cutting could damage the neural tissue in all these techniques and result in stress.

Numerous research studies have been conducted on chicken beak trimming to determine its effect on behaviour and other physiological parameters, but very little data is available about duck beak trimming (Fijn *et al*., 2020). The morphology of the bill is amazingly different amongst bird species. During the development of the embryo, all the beaks are developed from similar tissues (Trainor, 2005; Petrolli *et al*., 2017). There are many similarities in the physiology, anatomy, and histology of the mature bills of different birds (Lucas, 1972). This shows that the behavioural variation and pain that occur in chickens due to bill trimming will be similar in ducks. According to a recent study on Muscovy ducks, bill trimming causes acute pain, but not chronic pain. All the behavioural changes were for a short period of time, and there was a small reduction in weight. This study focuses on Mule ducks as very little data is available about bill trimming in them specifically. The goal of this study was to investigate how two alternative

debeaking techniques affected Mule duck behaviour, performance, and welfare.

MATERIALS AND METHODS

This study was conducted at the Animal and Poultry Behaviour Management Department, Faculty of Veterinary Medicine, Assiut University in Egypt as part of a larger research project. The duration of this study was three months, from February 2021 to April 2021. The university's research and ethics committee approved this work. Sixty 15-day old Mule ducklings were bought from a local hatchery in El Waelday, T. Assiut, Egypt.

Experimental Design:

On the fifteenth day of age, the sixty Mule ducks were assigned based on body weight similarity to three experimental groups. Each treatment involved four replicates, with five birds in each replicate. The ducks were categorized into three groups, each containing 20 ducks. All the treatments were done two hours before the ducks were taken to the experimental pen. According to the type of bill trimming method, these three groups were referred to as the control, scissor, and hot searing groups, respectively. In the control group, the ducks were handled to make them feel like they were going through the same stress as the ducks in the other two treatment groups, but their beaks were left untrimmed. The second method was called "scissor," which means cutting the beaks with a scissor, and the third was "hot searing," which means temporarily pressing the cautery blade on the bill's tip. Ducks were assigned to one of three pens, each measuring 1 x 1 meter. A sand-thick layer and wheat straw were used as bedding materials. A uniform distribution of the litter at a depth of 4–8 cm was achieved. In order to avoid wet litter, the addition of straw, a new layer was added twice per week. A thin layer (3 cm) of sand was placed under the water. A clean and well-ventilated house was used for the rearing of ducks.

A round plastic feeder and two waterers were used to provide the ducks with food and water in each pen. To keep the facilities clean, management was done daily.

Behaviour observation:

Observations of the birds' behaviour were performed at the age of nine weeks, when they were observed twice daily between 9:00 and 11:00 and between 14:00 and 16:00. Data on duck behaviour was gathered over the course of three days. The pattern of behaviour was obtained by using a scanning observation system for behaviour from "3 to 9" weeks with digital infrared cameras, as in a previous study (Elshafaei *et al*., 2017). In order to keep the focus birds from interfering with their normal behaviour observations, they were kept one meter away from their pens. Observed behaviours are presented as a percentage of the overall data. On a check sheet, each group's data regarding specific duck behaviours was logged. The birds were counted as they ate, drank, sat, sleep, stood, walked, preened, pecked at the environment, and pecked other ducks (Table 1).

Performance of ducks:

Live body weight:

A leg band was used to identify the ducks, and they were weighed at the start of the trial and then weekly (3 "week to 9" weeks) to determine weight gain, daily weight gain, and final body weight. Viability (percentage) was calculated: "Viability (%)" = "The ducks are alive until the end of the experiment."

Feather Score:

Each duck was examined on three different bodily parts (wings, back, and tail or vent regions). A feather-scoring chicken system was adapted (Tauson *et al*., 1984), table 2. The overall feather score was calculated by adding up scores from three body parts (Table 2).

Table 1: Ethogram of the behaviours recorded in Mule ducks.

Behaviour	Definition
Sitting	Lying down, resting while still awake
Sleeping	Lying down, eyes closed
Standing	Standing still and not doing any of the activities listed below
Walking	Moving at any speed around the pen.
Feeding	Pecking at food
Drinking	Pecking at the drinker's water
Preening	Cleaning litter from one's own feathers
Pecking the environment	Pecking at the trash, the walls of the pen, and other objects
Pecking other birds	Non-aggressive pecking (like pecking at feathers or other litter on other birds' feathers, feather pulling and manipulation) and aggressive pecking (like pecking at other birds' heads, necks, or tails, which makes them flinch and/or make noise).

Table 2. Feather scoring system[1]

Feather Score	**Characteristic**
0	Feathers are intact, with no or little peeling or breakage.
0.25	One or two feathers lost, damaged, or cracked. No visible tissue injuries.
0.5	Three or four feathers are lost, damaged, or broken. Tissue injuries not apparent.
1	Some of the plumage lost, damaged, or cracked. Tissue injuries not apparent.
1.5	Some of the plumage lost due to slight skin and tissue damage.
2	Several feathers removed with some small skin or tissue damage.
2.5	Most or all of the feathers removed with some skin or tissue damage.
3.0	Loss of all feathers, and seriously injured.[1]

[1] Adaptation of (Tauson *et al.*, 1984)

Statistical Analysis:

The data was entered into SPSS version 23. One-way ANOVA was used to determine the significance of the data by considering a p-value of less than 0.05 as significant.

RESULTS AND DISCUSSION

The feeding behaviour of the control (3.85 ± 0.62) and scissor (4.05 ± 0.42) groups did not differ substantially (P>0.05). However, the hot searing trimmed ducks demonstrated significantly less feeding activity (3.65 ± 0.54; P<0.05) than the control and scissor trimmed duck groups (Table 3). None of the treatment

groups showed a statistically significant difference in drinking and preening behaviour (P > 0.05). In terms of drinking and preening, there were no significant changes noticed between the treated groups (P >0.05) (Table 3). Similarly, there was no notable change (P > 0.05) seen between the control and scissor groups for other behavioural patterns like sitting, sleeping, standing, walking, and pecking the environment. However, the hot searing group ducks displayed behavioural differences that were statistically significant (P<0.05) in these behavioural patterns compared to the other two groups (Table 3). The difference in pecking other ducks' behaviour across the three groups was statistically significant (P<0.05), with the control group having the most pecking (1.35%) (Table 3).

Table 3. Behavioral pattern (%) of Mule ducks in each beak-trim treatment group based on age (n = 20 in each group). The results are given as mean ± SD.

Behavioral pattern (%)	Treatments		
	Control	Scissor	Hot searing
Feeding	3.85 ± 0.62[a]	4.05 ± 0.42[a]	3.65 ± 0.54[b]
Drinking	5.95 ± 0.56[a]	5.84 ± 0.35[b]	5.76 ± 0.71[b]
Sitting	37.21± 2.57[a]	34.44± 2.57[a]	34.09 ± 3.34[a]
Sleeping	31.17 ± 3.87[a]	31.23 ± 3.57[a]	28.84 ± 1.68[b]
Standing	11.02 ± 2.53[a]	11.45 ± 1.61[a]	12.42 ± 0.78[b]
Walking	2.44 ± 0.83[a]	2.04 ± 0.17[a]	1.85 ± 0.14[b]
Preening	5.57 ± 0.24[a]	5.56 ± 0.32[a]	5.69 ± 0.45[b]
Pecking the environment	3.36 ± 0.62[a]	2.55 ± 0.54[b]	3.35 ± 0.45[a]
Pecking other ducks	1.35 ± 0.22[a]	0.89 ± 0.20[b]	1.05 ± 0.16[c]

Within a row with varied superscripts, [a,b, c] values significantly differ at p <0.05.

This study particularly focuses on Mule ducks as very little data is available about bill trimming in Mule ducks. Our results are in agreement with the earlier study that reported measurable impact of beak trimming on ingesting behaviour (Baker *et al*., 2022). These findings are also in line with finding of previous reported study (Gentle and McKeegan, 2007). In contrast to our findings, a previous study that reported a significant reduction in feeding and drinking occurred in trimmed bids as compared to birds that were not trimmed (Aerni *et al*., 2000). A previous study reported that beaks trimmed with scissors, hot blades, and hot searing cause a significant reduction in ingestion behaviour in the first week of trimming, while this behaviour no longer remains after one week (Gustafson *et al*., 2007).

Ducks' body weight in all groups was assessed on a weekly basis. The average beginning weight was not substantially different between the treated groups (P > 0.05). However, when compared with scissor-treated ducks (2004.42 g) and the control group (1864.28 g), the hot searing group had the lowest average weight gain (1724.75 g) (Table 4). No statistical difference in daily weight gain or final weight was found between the control and scissor groups (P>0.05), but the hot searing group ducks showed a statistically significant difference (P<0.05) in comparison to the other two groups (Table 4). These findings are consistent with

prior research that found low body weight in birds trimmed using a hot blade (Laganá *et al*., 2011). In contrast, another study found that cutting with a hot blade made birds heavier (Guesdon *et al.,* 2006).

The type of debeaking had no effect (p = 0.4360) on the birds' viability (Table 4). The extent of the impairment produced by bill-trimming is determined by the method utilized and the age at which it is done (Gustafson *et al*., 2007). Using appropriate debeaking techniques, along with adequate water and food, may have prevented bird mortality at this point of evaluation (Laganá *et al*., 2011). This result differs from a previous study (Vieira Filho *et al*., 2016) that showed an eight percent decline in the viability of the chicks in the 63rd week of their lives due to routine treatments of infrared radiation and hot blade.

Table 5 displays the feather scores of 9-week-old Mule ducks. Throughout the trial, scores increased significantly (P<0.05), and the maximum feather score (1.60) was observed in the control group, suggesting deteriorating feather condition.

Table 4. Treatment-related differences in Mule duck performance in the experimental period after debeaking.

Variables	Debeaking methods			CV %	P-value
	Control	Scissor	Hot searing		
Average initial weight (g)	389.74	393.21	370.35	9.6777	0.3181
Average weight gain (g)	1864.28^{a}	2004.42^{a}	1724.75^{b}	15.0641	0.0020
Average daily weight gain(g)	49.48^{a}	49.60^{a}	56.03^{b}	12.8178	0.0006
Average Final weight (g)	2283.25^{a}	2387.34^{a}	2096.25^{b}	6.8211	0.0030
Viability (%)	98.17	96.03	97.85	7.4266	0.4360

Within a row with varied superscripts, ^{a,b,c} values significantly differ at p <0.05.

Table 5. Treatment-related differences in Mule duck feather scores after debeaking in the experimental period.

Time since debeaking	Feather scores		
	Control	Scissor	Hot searing
Week 3	0.39 ± 0.03	0.29 ± 0.06	0.31 ± 0.05
Week 4	0.64 ± 0.02^{a}	0.33 ± 0.05^{b}	0.35 ± 0.07^{b}
Week 5	0.89 ± 0.07^{a}	0.34 ± 0.06^{b}	0.38 ± 0.04^{c}
Week 6	1.50 ± 0.10^{a}	0.40 ± 0.15^{b}	0.59 ± 0.09^{c}
Week 7	1.53 ± 0.06^{a}	0.59 ± 0.08^{b}	0.60 ± 0.08^{b}
Week 8	1.57 ± 0.07^{a}	0.48 ± 0.07^{b}	0.67 ± 0.13^{c}
Week 9	1.60 ± 0.06^{a}	0.44 ± 0.07^{b}	0.73 ± 0.14^{c}

Within a row with varied superscripts, ^{a,b,c} values significantly differ at p <0.05

This increase, however, differed significantly between treatment groups, with the feather condition deterioration in the control birds declining much more rapidly than that of scissor group ducks and hot searing ducks ($P<0.05$). By 5 weeks of age, scissors group birds' feather scores were significantly different from those of hot searing ducks, and these differences increased in significance as the trial went, apart from week 7, when there were no significant changes in feather scores between the two groups, suggesting decreasing feather condition. A study by Campbell et al. (2015) found that cutting the bird's bill didn't make a difference in the bird's eye score, cleanliness, or feather quality.

CONCLUSION

Ducks raised for meat and egg production face a wide range of welfare issues. While both trimming techniques induce acute discomfort, it appears that using scissors is preferable as it results in increased weight gain in ducks, no evidence of viability changes, and decreased beak-related behaviours (pecking the environment and pecking the other ducks), but it is still effective at minimizing feather pecking damage.

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CONFLICT OF INTEREST

Authors have no conflicts of interest to declare.

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