The effect of toe trimming on behavior, mobility, toe length and other indicators of welfare in tom turkeys

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ABSTRACT Society is increasingly concerned about the welfare of animals kept for food production, for this reason, invasive procedures such as toe trimming in turkeys must be studied to assess the corresponding welfare implications and to ensure such procedures are acceptable for continued use. To this end, research was conducted to evaluate the welfare effects of toe trimming on toms raised to 140 d. The study used 306 Hybrid Converter toms, half of which were toe trimmed using a Microwave Claw Processor (MCP) which group are denoted T, and half of which were sham treated but not trimmed, which group are denoted NT. Turkey behavior was observed on d 1, 3, 5, and 133. Toe cross sections were taken every second day for 14 d after treatment and were used to histologically examine the healing process. Toe length, gait score, and bird stance were assessed on d 55, 84, 119, and 139. For the first 5 d after treatment, T birds demonstrated less active behaviors such as feeding, standing, walking and running ($P \leq 0.05$), indicative of pain with the effect diminishing with age. At d 133, T turkeys stood more and walked less than NT birds ($P \leq 0.05$). Gait score and bird stance were not affected by treatment. Trimmed toes were on average 91.9% of the length of NT toes and toe length was more variable ($P \leq 0.05$) as a result of the trimming process. Histological examination indicated T toes had complete epithelium closure over the healthy tissue by d 8 and were fully healed by d 14. Although bird mobility and stance were unaffected by treatment, turkey behavior both early and late in the production cycle were suggestive of pain and balance effects; both indicators of reduced welfare as a result of toe trimming.

Key words: Microwave Claw Processor, bacterial infection, toe clipping, gait

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INTRODUCTION

Interest in the intensification of livestock production systems, increased disposable income, as well as an increasingly urban population with reduced contact to agriculture, has heightened consumer concern for animal welfare and encouraged animal industries and governments to establish policies or legislation for the production of food animals (Napolitano et al., 2010). In Canada, both government and industry are working to develop codes of practice to establish guidelines on acceptable animal production. These codes are not legislated but can be used to judge the acceptability of poultry production methods. The Turkey Farmers of Canada develop recommendations based on these codes which can be enforced through auditing programs run by the board. The current codes state that surgical alterations, including toe trimming, "should be avoided except when it is necessary to prevent either self-inflicted injury or injuries to others in later stages" (Canadian Agri-food Research Council, 2003). Due to changes in the industry since the majority of prior studies were completed, it is important to re-examine toe trimming to assess its effect on bird welfare and to determine if it is still an acceptable practice in respect of the above code.

Toe trimming is a procedure used regularly within the turkey industry and is undertaken to remove or reduce the claws of the three forward facing toes on each foot, preventing the birds from scratching one another. Trimming is primarily done using a MCP, an automated system in which the tips of the toes to be trimmed are exposed to microwaves, killing the tissue and causing it to fall off in one to three weeks (Gorans, 1993). Previous studies on toe trimming of turkeys have focused on production effects rather than the procedure's impact on bird welfare. Carcass scratching has been a focus of many of the prior studies, and although discussed in economic terms, attention should also be paid to animal welfare issues associated to the pain and stress caused by the procedure. Several studies found have decreased carcass scratching when birds were toe trimmed, suggesting a benefit in long term welfare (Owings et al., 1972; McEwen and Barbut, 1992).

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Fournier et al. (2012) examined the welfare implications of trimming turkey hens with the MCP. While behavior suggested short term pain due to the procedure, the reduction in scratches observed at processing was significant, and mobility and other long term behavior criteria were unaffected. As a result, trimming was suggested to be beneficial to hen welfare.

No research has been published on the impact of MCP treatment on the welfare of tom turkeys. The larger weight of toms as compared to hens at marketing may reduce bird mobility and subsequently scratching. Furthermore, toe shortening in heavy toms may have a more noticeable impact on balance or posture compared to hens due to increased body weight and breast muscling. Finally, toms may differ inherently in behaviors associated with scratching. A previous article has already discussed the impacts of MCP treatment on production, which found no impact on carcass scratching or mortality (Fournier et al., 2014). Thus the objective of the current study is to determine the impact of MCP toe trimming on bird welfare as assessed by examining the behavior, mobility, toe healing, toe lengths, and posture of tom turkeys kept to 140 d of age.

MATERIALS AND METHODS

The standards set by the Canadian Council of Animal Care (1993) were followed and approval for all procedures was received from the University of Saskatchewan's Animal Care Committee.

Birds, Housing, and Care

Hybrid Converter tom poults were obtained from a commercial hatchery with 153 birds treated (T) using the MCP with exposure set at 1.26 sec and toe length at 59% trim (61% of guide light is blocked by the inserted toe length), and 153 poults sham treated (NT). The poults were randomly assigned to 3 × 3 m floor pens within a common barn (nine pens per treatment; 17 poults per pen giving an estimated stocking density of 34kg/m^2). Toms in each pen were given ad libitum water from one bell drinker (45.7cm diameter) and commercial feed from two tube feeders (38.1cm diameter up to 89 d, at which point the diameter was increased to 40.6cm). Feed was provided in a six-step dietary program meeting or exceeding recommended nutrient specifications (Hybrid Turkeys, 2011 - "*Nutritional Guidelines*"). Poults were given 23 h of light at 22 lux intensity from placement to 9 d of age. Day length was then reduced to 18 h and light intensity to 10 lux. Due to aggression, light intensity was further reduced to 3 lux on d 27, 2 lux on d 33 and 0.7 lux on d 98. Barn temperature was set at 30°C until d 13, after which it was decreased (by 0.4°C/d) to 22°C by d 35, 21°C by d 42, 19°C by d 49, and 17°C by d 91. A heat lamp (175 watt), supplemental drinkers and feeders, and a cardboard ring were included in each pen for the first 9 d. Small or weak poults from both treatments were replaced on d 1 (n = 12). An additional 42 birds (28 T and 14 NT) were kept in two spare pens for tissue collection.

Data Collection

Behavior was assessed using instantaneous scan sampling (Altmann, 1974) throughout the trial. On d 1, 3, and 5 after treatment, scan sampling was conducted for 10 min for each of the 18 pens with one observation per min. Scanning began half an hour after the morning walkthrough and feeding in order to avoid disruption. Sampling was performed by a single observer seated beside the pen, with recording beginning after 5 min of acclimatization. One behavior was recorded per poult per scan.

Behavior was also examined at d 133 of age. Birds were observed over a 24 h period, using a ceiling mounted infrared camera (TVR Digital Video Recorder version 2.20, American Dynamics, Boca Raton, FL) in each of the trial pens. All 18 pens were recorded over the same 24 h. Videos were then reviewed (VLC media player 2.0.1, VideoLAN, Paris, France) using the scan sampling technique, with observations made every 30 min from each pen. Every observed behavior was recorded at each of the sampling periods, and observed behaviors are described in Table 1.

Bird mobility was assessed on d 55, 84, 119, and 139 using the gait scoring method of Nestor et al. (1985). Birds were categorized on a scale from 0 to 4. A 0 score was assigned when there was no defect in the gait, a score of 1 was assigned when there was an evident defect in the gait which however did not hinder the bird, a score of 2 was assigned when the bird sat within 15 s, a score of 3 was assigned where the bird had to be be forced to move, and a score of 4 was assigned when the bird was unable to walk. Five toms were randomly selected from every pen on d 55 and wing banded for identification. At each age, these birds were individually weighed, gait scored, and the length of digits II, III, and IV on both feet were measured from the metatarsal-phalangeal joint to the distal edge of the toe (not including the claw) using digital callipers. The five toms were photographed from a side-profile in a natural stance to determine if the toe trimming had affected the center of balance of the birds. From this photo, the angle of the breast in relation to the horizontal plane was measured. This measurement was performed by drawing a horizontal line through the point where the breast meets the leg, and a further line from that point following the line of the breast (Figure 1). If a selected bird died during the trial another bird from the pen was randomly selected to replace it. Bird replacement occurred on five occasions during the trial.

Four T poults and two NT poults sampled from the spare pens were euthanized every other day, beginning on d 0 and ending on d 14, for histological

Table 1. Description of observed behaviors.

Behavior	Description
Resting	Legs are bent beneath the bird and the body is resting on the ground. Head on the ground or resting against the chest. Very little movement, the bird appears to be sleeping.
Sitting	The feet are curled beneath the bird and the body is resting on the ground. The head is up and the bird appears alert.
Standing	Both feet are in place on the floor and the legs are erect. None of the other described behaviors are being performed.
Walking	In the process of taking a step in any direction, while not engaged in other described behaviors.
Run	Moving quickly across the pen, with no hesitation between steps.
At feeder	The bird is pecking at the feed and appears to be eating.
At drinker	The bird is focused on the water, either with beak in the water or pausing in between dips into the water.
Strutting	Back and tail feathers are erect, snood is extended and wings are dropped.
Preening	Use of the beak to clean and condition feathers.
Litter pecking	Pecking or sorting through the litter.
Stretching	A leg or wing is extended fully out with constant force for several seconds with the apparent purpose of stretching the muscles.
Head shaking	The head is moved side to side rapidly.
Object pecking	Pecking at inanimate objects within the pen, other than the litter.
Feather pecking	Pecking at the feathers of another bird, whether aggressive or not.

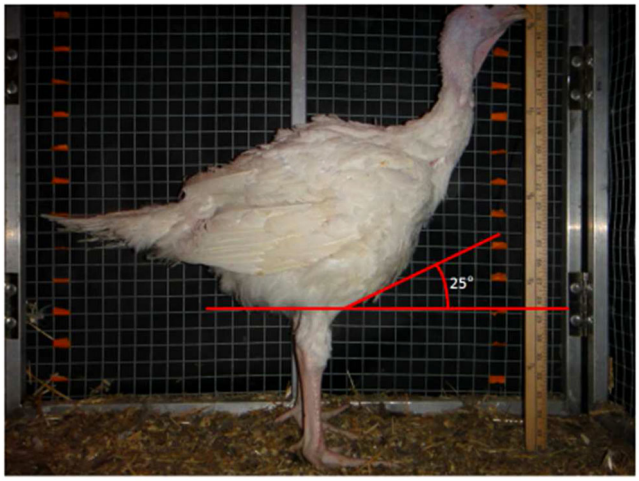

Figure 1. Technique used to evaluate bird stance. The angle between the 2 lines is measured.

examination of the toes. The right foot was removed from each poult and stored in 10% neutral buffered formalin. Digits II through IV were later removed from the foot, sectioned at 5 μm, stained with haematoxylin and eosin, and subsequently used to study toe healing. After the trial, because of observations of histopathology, X-rays were performed on the feet of two 18 wk turkeys, visually demonstrating differing severity in response to the procedure .

Statistical Analysis

The data were analyzed according to a randomized design with a one-way ANOVA using the mixed model (Proc Mixed) in Statistical Analysis System 9.2 (2002). Repeated measurement analysis was employed in order to evaluate the effects of treatment and time on stance and gait. Correlations between gait score and toe length (analyzed by digit) were determined using Proc Corr on each collection day. For toe length, the coefficient of variation was first calculated by treatment, then analyzed as a one-way ANOVA. When analyzed on an individual toe basis, the percentage of length lost was calculated based on an average length for each digit in the NT birds. The time budgeted for any given behavior was calculated as the number of birds observed in the behavior per pen over the total number per pen by 100. All data were checked for normality using Proc Univariate, with abnormally distributed data (behavior) being log +1 transformed. Where $P \leq 0.05$, treatment differences were considered significant.

RESULTS AND DISCUSSION

Toe Length and Variability

Toe lengths were measured throughout the trial to assess both the severity and consistency of the toe trimming procedure (Table 2). At d 140, the mean toe length of the three trimmed toes was 63.6 mm, compared to a mean length of 69.3 mm in the NT toms, resulting in a trimmed toe being on average 91.9% the length of an intact toe. Table 2 shows that toe length variability was affected by both trimming treatment and bird age, increasing with both variables. These results are similar to those reported by Fournier et al. (2012), who found increased toe length variability for T hens at wk 12, but not wk 7, and that T toes were 9.7% shorter, on average. Minor differences between these studies could be due to gender effects, or differences in the trimming procedure such as debris build up in the MCP, age of the magnetron generating the microwaves, chosen settings regarding treatment time and percentage trim (length trimmed) or operator variances (Nova-Tech Engineering, Inc., 2011). This analysis showed digit II (inside anterior toe) was trimmed more severely and more uniformly than the other two digits ($P = 0.01$). Digit II was on average 9.8% (SE = 0.78) shorter in T birds, compared to 6.5% (SE = 1.02) and 6.3% (SE = 0.99) for digits III and IV, respectively. Toe shortening for the right and left foot were

Table 2. Mean toe length and variation of digits II III, and IV (n = 9; mean of three toes from five birds per pen with 9 pens per treatment).

Age	Toe length (mm)				Coefficient of variation (%)			
(d)	T	NT	SEM	*P*-Value	T	NT	SEM[1]	*P*-Value
55	57.9[a]	63.0[b]	0.677	<0.0001	21.8[a]	19.4[b]	0.003	<0.0001
84	62.7[a]	67.8[b]	0.655	<0.0001	22.2[a]	20.5[b]	0.002	<0.0001
119	62.8[a]	67.8[b]	0.671	<0.0001	25.6[a]	23.6[b]	0.003	<0.0001
139	63.6[a]	69.3[b]	0.786	<0.0001	25.4[a]	22.9[b]	0.003	<0.0001

[a,b]Treatment means with different letters are significantly different ($P \leq 0.05$).

[1]SEM – pooled standard error of the mean.

Table 3. Behaviors of toe trimmed and not trimmed poults at 1 d of age as a percentage of time spent performing notable behaviors[1] during observation (n = 9). Log +1 transformed data are in brackets.

Behavior	Trimmed	Not Trimmed	SEM[2]	*P*-Value
Resting	81.4[a] [4.4]	56.5[b] [4.0]	4.33 [0.08]	0.01
Sitting	10.8 [2.4]	8.5 [2.2]	0.88 [0.09]	0.14
Walking	1.4[b] [0.8]	7.3[a] [1.9]	1.06 [0.19]	0.001
Standing	1.8[b] [0.9]	10.4[a] [2.3]	1.45 [0.21]	<0.0001
Running	0.1 [0.1]	0.2 [0.2]	0.06 [0.05]	0.62
At feeder	0.4[b] [0.3]	10.4[a] [2.2]	1.89 [0.27]	<0.0001
At drinker	0.6 [0.4]	1.8 [0.9]	0.36 [0.14]	0.08
Stretching	0.4 [0.3]	0.5 [0.3]	0.12 [0.08]	0.58
Litter peck	0.1 [0.1]	0.0 [0.0]	0.03 [0.03]	0.33
Head shake	0.5 [0.3]	0.1 [0.1]	0.12 [0.08]	0.20
Object peck	1.0 [0.6]	2.5 [1.1]	0.38 [0.13]	0.06
Feather peck	0.2 [0.3]	0.1 [0.1]	0.08 [0.06]	0.27

[a,b]Treatment means with different letters within an age are significantly different based on analysis of the transformed data ($P \leq 0.05$).

[1]Behaviors showing ≤ 0.2% expression throughout the three observation days were omitted.

[2]SEM – pooled standard error of the mean.

Table 4. Behaviors of toe trimmed and not trimmed poults at 3 d of age as a percentage of time spent performing notable behaviors[1] during observation (n = 9). Log+1 transformed data are in brackets.

Behavior	Trimmed	Not Trimmed	SEM[2]	*P*-Value
Resting	53.5 [4.0]	48.3 [3.9]	3.28 [0.06]	0.46
Sitting	17.6[a] [2.9]	9.1[b] [2.2]	1.57 [0.12]	0.005
Walking	4.8[b] [1.6]	8.9[a] [2.3]	0.87 [0.15]	0.02
Standing	11.1 [2.4]	12.7 [2.6]	1.08 [0.09]	0.51
Running	0.2 [0.2]	0.2 [0.1]	0.08 [0.06]	0.90
At feeder	5.5 [1.5]	9.2 [2.2]	1.16 [0.20]	0.07
At drinker	1.1 [0.7]	2.9 [1.2]	0.45 [0.15]	0.09
Stretching	0.7 [0.4]	0.9 [0.6]	0.14 [0.09]	0.40
Litter peck	0.2 [0.2]	0.1 [0.1]	0.07 [0.05]	0.60
Head shake	0.0 [0.0]	0.1 [0.1]	0.05 [0.04]	0.15
Object peck	2.7 [1.1]	4.2 [1.5]	0.61 [0.17]	0.21
Feather peck	0.7 [0.5]	0.9 [0.6]	0.14 [0.08]	0.59

[a,b]Treatment means with different letters within an age are significantly different based on analysis of the transformed data ($P < 0.05$).

[1]Behaviors showing ≤ 0.2% expression throughout the three observation days were omitted.

[2]SEM – pooled standard error of the mean.

not statistically different (6.9 and 8.2%, respectively, $P = 0.25$).

Behavior and Gait Score

The effects of toe trimming on poult behavior at d 1, 3 and 5 are shown in Tables 3, 4, and 5. The findings from d 1 show that T poults spent more time resting (81.4 vs. 56.5% of their time) and less time at the feeder (0.4% vs. 10.4%), standing (1.8% vs. 10.4%), and walking (1.4% vs. 7.3%) compared to NT poults. On d 3, the T poults spent less time walking (4.8 vs. 8.9%) and more time sitting (17.6 vs. 9.1%) than the NT birds. On d 5, T poults spent less of their time running (0.1 vs. 0.7%) and at the feeder (4.7 vs. 16.5%) when compared with birds from the NT group.

Behavior is often used as an indication of pain and welfare in poultry species (Rutherford, 2002; Buchwalder and Huber-Eicher, 2005; Hocking et al., 2005). For all three observation days, the T birds demonstrated less mobility than those of the NT group, but the degree of response appeared to reduce with age. Trimmed poults spent more time resting and sitting and less time running, walking, and feeding. This decrease in mobility suggests toe treatment caused pain in the poults in the short term. Other meat-purpose species have been shown to be highly motivated to feed, which behaviour is likely to be similar in turkeys (Bokkers et al., 2004). Fournier et al. (2012) found similar results in a trial testing MCP toe treatment in hen turkeys. One difference in the latter trial was that the decreased mobility associated with trimming was only seen on d 3, with no differences noted on d 1 or 5. While Owings et al. (1972) did not specifically include behavioral assessments, they also noted the T poults (treated using surgical scissors) were less active over the first 3 d after trimming, which the authors suggested was likely due to pain caused by the procedure.

The comparison of tom behavior on d 133 summarized over the 24 h observation period is shown in Table 6. Trimmed birds spent more time standing but less time walking compared to NT toms. The average time spent standing was 27.1% for T toms vs. 24.1% for NT toms. Toms in the NT treatment group spent 5.6% of their time walking compared to 4.6% for T toms. These results are somewhat contradictory as both standing and walking are active behaviors (Schwean-Lardner et al., 2012) so that the difference between the treatment groups are unlikely to be attributed to pain.

Table 5. Behaviors of toe trimmed and not trimmed poults at 5 d of age as a percentage of time spent performing notable behaviors[1] during observation (n = 9). Log+1 transformed data are in brackets.

Behavior	Trimmed	Not Trimmed	SEM[2]	*P*-Value
Resting	55.7 [3.9]	32.9 [3.3]	6.12 [0.18]	0.08
Sitting	9.8 [2.3]	8.1 [2.1]	1.01 [0.12]	0.39
Walking	7.3 [1.8]	14.5 [2.5]	2.37 [0.20]	0.08
Standing	11.9 [2.2]	12.3 [2.5]	1.70 [0.18]	0.44
Running	0.1[b] [0.1]	0.7[a] [0.5]	0.11 [0.08]	0.002
At feeder	4.7[b] [1.1]	16.5[a] [2.7]	2.28 [0.29]	0.002
At drinker	1.3 [0.7]	2.6 [1.1]	0.45 [0.15]	0.22
Stretching	0.9 [0.5]	0.3 [0.2]	0.15 [0.09]	0.11
Litter Peck	0.4 [0.3]	0.1 [0.1]	0.11 [0.07]	0.15
Head shake	0.1 [0.1]	0.3 [0.2]	0.09 [0.06]	0.11
Object peck	5.6 [1.6]	8.5 [2.0]	1.26 [0.19]	0.29
Feather peck	0.3 [0.2]	0.7 [0.5]	0.13 [0.08]	0.12

[a,b]Treatment means with different letters within an age are significantly different based on analysis of the transformed data ($P < 0.05$).

[1]Behaviors showing ≤ 0.2% expression throughout the three observation days were omitted.

[2]SEM – pooled standard error of the mean.

Table 6. Effect of toe trimming on time budgets (% of time) summarized over 24 h of observation for toms at d 133 of age for notable behaviors[1] (n = 9). Log+1 transformed data are in brackets.

Behavior	Trimmed	Not Trimmed	SEM[2]	*P*-Value
Resting	30.4 [3.4]	30.7 [3.5]	1.21 [0.02]	0.78
At feeder	3.7 [1.6]	3.3 [1.4]	0.19 [0.04]	0.23
At drinker	1.8 [1.0]	1.8 [1.0]	0.14 [0.09]	0.73
Standing	27.1[a] [3.3]	24.1[b] [3.2]	0.72 [0.03]	0.03
Sitting	23.5 [3.2]	26.0 [3.3]	0.61 [0.03]	0.07
Walking	4.6[b] [1.7]	5.6[a] [1.9]	0.24 [0.04]	0.03
Strutting	2.4 [1.2]	1.9 [1.1]	0.23 [0.07]	0.28
Preening	4.0 [1.6]	3.9 [1.6]	0.21 [0.04]	0.62
Litter pecking	1.2 [0.8]	1.3 [0.8]	0.11 [0.04]	0.73
Feather pecking	0.3 [0.3]	0.5 [0.4]	0.06 [0.04]	0.15

[a,b]Treatment means with different letters are significantly different based on analysis of the transformed data ($P < 0.05$).

[1]Behaviors with occurrences < 0.20% were omitted.

[2]SEM – pooled standard error of the mean.

If pain was associated with this behavioral difference, it would be expected that T birds would spend more time sitting or resting as was observed during the first week after treatment. Instability is a more probable cause; while the birds are able to walk, they may choose to walk less because of reduced balance.

In a study by Fournier et al. (2012), behavior of T and NT hens was examined at 13 wk of age. They found no differences in behavior, contradicting the tom data obtained at an older age in the current study. The behavioral differences between the two trials may relate to bird gender and/or bird size, as the 19 wk toms were heavier than the 13 wk hens (Fournier et al., 2012; Fournier et al., 2014). Fournier et al. (2014) found feed intake decreased over wk 18 to 20 in T toms, consistent with the reduced walking observed in the current study. This reduction in feed consumption plus the altered behavior reported in the present study are suggestive of reduced mobility in older toms.

Gait score was not impacted by toe trimming at any age (Table 7), but otherwise worsened with age. While the age effect showed that the mobility of turkeys decreased with age, it is noteworthy that the values were all low. These results suggest T turkeys were not experiencing pain at older ages, in agreement with the conclusions drawn from the d 133 behavior. Fournier et al. (2012) examined the gait of T and NT hens at 7 wk of age and found no differences, which is in agreement with the present research.

It is possible that the gait scoring method used was not sensitive to changes in bird movement that might be associated with instability, as suggested by the behavioral observations. A study investigating the importance of toes in the human gait found humans actively use their toes, from root to tip, while walking, and if toes (especially the largest two) are not able to be utilized, the subjects tend to use their upper body to compensate (Takemura et al., 2003). While the gait scoring system used in the current research looked for unnatural leg motion, it did not address upper body movement in the birds. Additionally, the method used by Nestor et al. (1985) puts emphasis on the amount of time taken for a bird to sit. As the behavior analysis indicated no difference in time spent sitting, a method focusing on leg and body movement as scale markers may have been more useful.

Posture Assessment

In addition to stability while walking, toes also play a key role in balance during standing for human subjects (Takemura et al., 2003; Menz et al., 2005; Chou et al., 2009). Because of this, it is possible that a decrease in toe length may cause turkeys to adjust their posture in order to alter their center of gravity. In this study, posture was assessed by measuring the angle of the breast from a line parallel with the horizontal surface on which

Table 7. Effect of age and toe treatment on average gait score and the angle (°) of the breast from horizontal (n = 9).

Variable	Treatment Means			Period Means					
	Trimmed	Non-Trimmed	*P*-Value	55d	82d	119d	139d	*P*-Value	SEM[2]
Gait score	0.22	0.26	0.58	0.09[c]	0.18[b,c]	0.27[a,b]	0.42[a]	<0.0001	0.029
Breast angle	13.1	13.3	0.92	20.6[a]	20.5[a]	9.8[b]	1.9[c]	<0.0001	0.733

[a–c]Treatment means with different letters are significantly different ($P < 0.05$).

[1]SEM – pooled standard error of the mean.

the bird was standing (Table 7). Toe trimming did not affect the posture or stance of the turkeys. Age however had a large effect, which decreased with bird age, especially after 12 wk. These results indicate that the difference in toe length does not require the birds to re-adjust their center of gravity. However, more severe trimming than was performed in this research may be of concern, as the digital flexor plays a significant role in a digit's ability to stabilize the body (Winter et al., 2003). If the toe is trimmed excessively and the tendon attachment to the distal two phalanges is compromised, then toe functionality may decrease, resulting in reduced stability (George and Berger, 1966; Urbaniak et al., 1985). The age effect observed with respect to posture is probably due to the proportional muscle mass of the breast increasing as the toms mature.

Healing Process

Tissue sections from toes collected approximately 10 h post-treatment (d 0) are shown in Figure 2A and B. At this point, infiltration of heterophils, edema, hemorrhage, and necrosis of the epidermis and deeper tissues were evident. On d 4, the epithelium can be seen migrating to surround the healing tissue (Figure 2C) and by d 8 after treatment the regenerated epithelium

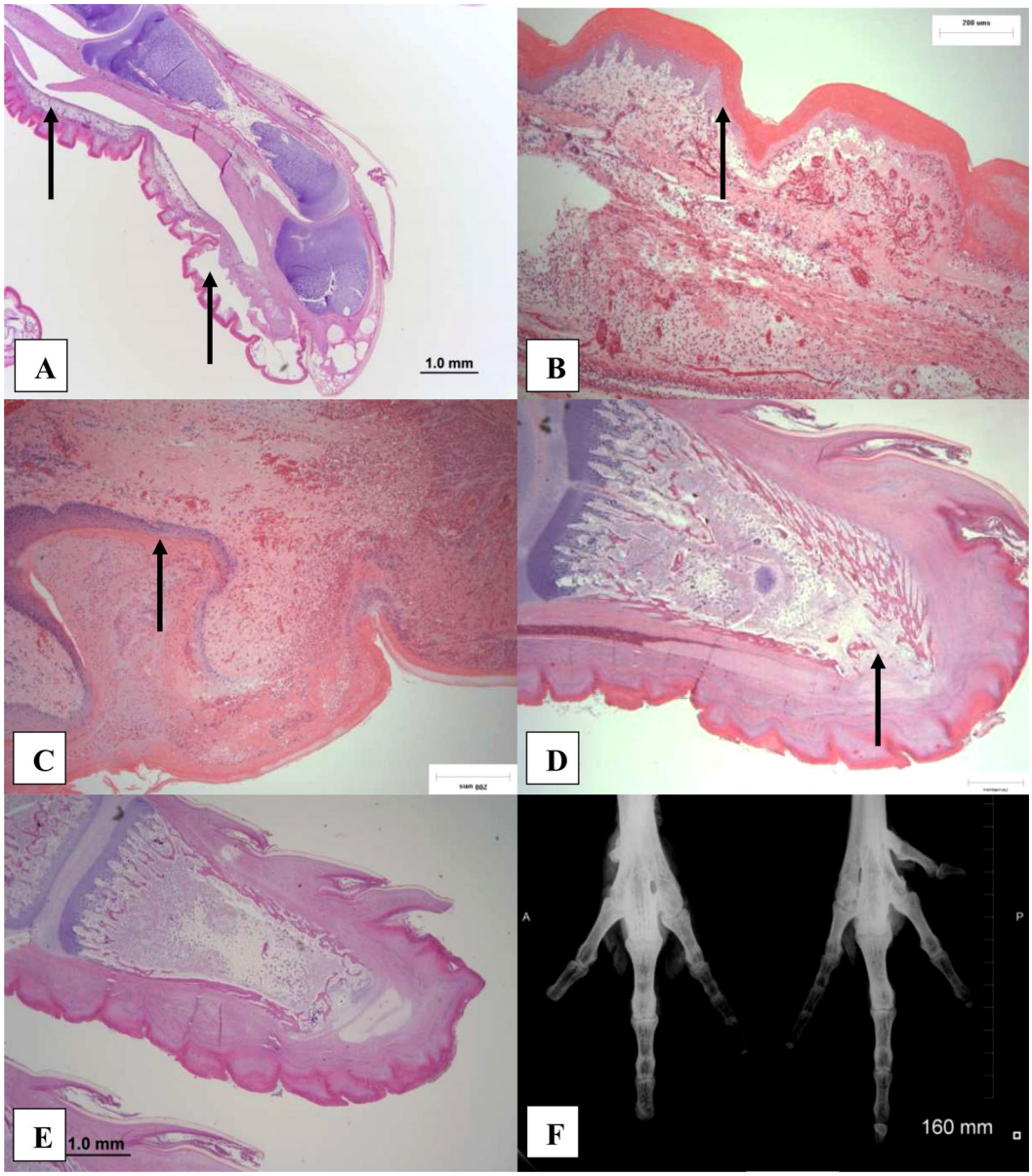

Figure 2. H & E stained histopathological sections and an X-ray of MCP treated toes documenting the healing process. A & B) MCP treated toe on d 0 showing acute inflammation with infiltration of inflammatory cells, predominantly heterophils with edema, hemorrhage, and necrosis. Necrotic and edematous epidermis (A - arrows); clear demarcation of the normal and necrotic epidermis (B - arrow) due to MCP treatment. C) MCP treated toe on d 4 demonstrating regeneration of the epithelium (arrow). D) By d 14, soft tissues within the trimmed area were completely healed with regeneration and remodeling of the bone (arrow). E) Areas of cartilage in the region of the terminal phalanx suggesting regeneration and possible claw formation. F) X-ray of a foot from two 18 wk toms, both treated with MCP. The left foot demonstrates a more severe MCP treatment with no distal phalanx and the right foot with a regenerating distal phalanx.

completely covered the underlying healing soft tissues. In the latter birds, some necrotic tissue had yet to be sloughed. While tissue formation was not complete on d 8, having an enclosed epidermis would provide a physical barrier to the outside environment. By d 14, which was the final sampling day, all necrotic tissue had been sloughed, and evidence of regeneration and remodeling of the bone was observed within the healing soft tissues (Figure 2D). Indications of cartilage regeneration in the region of the distal phalanx on d 14 resulted in speculation that the phalanx and the claw it supports may form again, even after sloughing is complete (Figure 2E). X-rays taken of the feet of two 18-week-old toe trimmed toms (varied in trimming severity) showed that the distal phalanx is present in some toes, along with a claw, supporting the concept of regeneration (Figure 2F). If claws are only partially regenerated, they may not result in scratching behavior, although the full toe length would give maximum stability. The occurrence of regeneration is likely correlated with the severity of trimming, although further research would be required before any conclusions about regeneration can be drawn.

One of the advantages of a MCP over the hot blade for trimming toes is believed to be a reduced risk of infection (Gorans, 1993). However, a case study by Alfonso and Barnes (2006) found that *Staphylococcus aureus* may have gained entry through toes which had been treated using a MCP. In the current study, signs of bacterial infection in the trimmed toes were found in 3 of the 40 histology slides. The bacteria were found in toes collected on the day of trimming, suggesting that the infection occurred at the hatchery or during transport. This observation demonstrates that even though the toe had not been sloughed, the treatment can damage the toes to a point where the skin is more susceptible to bacterial penetration due to necrosis. It also emphasizes the need to maintain hygienic conditions for treated turkey poults.

When considering the overall effects of toe trimming on tom welfare, it is also important to look at carcass scratching, which may cause pain and fear to the birds. Previous work has demonstrated no reduction in carcass scratching as a result of the T treatment at 20 wk (Fournier et al., 2014), indicating no benefit in this respect to counter the discomfort observed in the days following the procedure.

CONCLUSIONS

Reduced activity of T poults on d 1, 3, and 5 indicate that MCP toe trimming causes short term pain in poults. In addition to the increase in resting and sitting, T poults spent less time feeding, which is a strong indicator of pain. While there were also differences in behavior at d 133, which may indicate reduced mobility, the lack of significant differences in the gait score and early growth rate indicate an alternative mechanism to chronic pain accounts for this effect. Nevertheless, the d 133 behavioral data are indicative of reduced welfare.

While there may be minimal long term welfare impacts of toe trimming, it has been demonstrated that toe trimming of poults does cause pain and, as such, is a welfare concern for the industry. As no positive impacts were found in the toms as a result of toe trimming, this procedure should not be a recommended practice for the heavy tom industry based on the results of this research. However, while scratching was not found to be worse at 20 wk in NT birds (Fournier et al., 2014), there may still be a high occurrence of scratching earlier in production when the birds are lighter, detracting from bird well-being. When toe trimming was studied in 15 wk hens, pens left with intact toes saw high scratching, likely differing from the toms due to size and mobility (Fournier et al., 2012). The level of scratching at younger ages should be studied before a conclusion is drawn on the impact of this procedure on tom turkeys.

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