

## COMPLICATIONS OF HORN OVERGROWTH IN SHEEP AND GOATS WITH SPECIAL REFERENCE TO THEIR CLINICAL BEHAVIOR AND SURGICAL MANAGEMENT

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### ABSTRACT

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Background: Uneven growth of the horns is frequently seen in male sheep and goat of both sexes due to ecological, managerial or genetic reasons. The aim of the study: To describe the surgical complications, clinical behavior and surgical management of the horn overgrowth in sheep and goats. Methods: The study was carried out on 16 animals (8 rams and 8 goats) suffering from trauma in the head or the neck region due to unilateral or bilateral horn overgrowth. The cases were recorded during clinical examination of 94 native rams and 155 native goats of both sexes. Clinical behavior was based on an ethogram designated for rams and adult goats, and the suitable surgical intervention was performed. Main results: Wounds in different parts of the head and neck were recorded in 8.5% of examined rams and 5.2% of examined goats. Wounds occurred due to pressure necrosis from the inner surface of the horn or due to penetration from the horn end. Severity of the wounds was variable depending on the causative trauma. An ethogram analysis revealed increased circling and head tilting in cases of unilateral overgrown horns, while cases with bilateral overgrown horns suffered from reduced locomotor activity without an obvious effect on the gait. Results of gait analysis indicated disrupted feet alignment or increased overlapping distance for the hind and forefeet in cases of unilateral but not in case of bilateral overgrowths of the horns. Conclusion: The study suggested that, good managerial practices such as disbudding or dehorning of the overgrowths avoid the detrimental effect of horn overgrowth on the animal welfare.

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**Keywords:** *Clinical behavior, Dehorning, Goat, Horn overgrowth, Sheep.*

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### INTRODUCTION

In the wild, horns serve as weapons for defense against predators and for offence in fight between males for breeding access to females. The same issues apply to domestic ruminants under housed conditions; horned animals represent a threat to pen mates (Al-Sobayil, 2007 and Davis *et al.*, 2011). Horn growth is often indicative of population characteristics and habitat quality. Horn growth can be affected by numerous intrinsic factors such as earlier horn growth by the same individual, reproduction and genetic variability. The horn is divided into base, body, and apex (Lundrigan, 1996 and Cote *et al.*, 1998). In both sheep and goats the frontal sinus excavates the horn core at the base but does not reach so far toward the tip as in cattle (Dyce *et al.*, 2010). In goats, the horned animals require more feeding trough space

(Loretz *et al.*, 2004). Therefore dehorning or disbudding is an important husbandry practice.

Dehorning or disbudding in sheep and goats is the process of removing or stopping the growth of the horns. The practice of removing the horns is undertaken to improve animal welfare and for operator safety during handling. There is an increased risk of injury, hide damage and bruising in horned animal compared to polled one, particularly during handling, housing, and transport (Williams, 1990). Overgrowth of the horn sometimes carries the inner surface of the horn close to the skin of the face, which may cause traumatic injuries on the animals (Bamaiyi and Turaki, 2012) and also the overgrown horn may lead to pain resulted from pressure on the soft tissue of the head and neck as well as they may obscure vision (Sayed, 1988). Uneven growth of the horns is

frequently seen in male sheep and goat of both sexes due to many reasons; genetically, ecologically and managerial (Grubb, 2005).

The aim of the present study is to describe the complications of the unilateral and bilateral horn overgrowths in sheep and goats with special reference to their clinical behavior and surgical management.

## **MATERIALS and METHODS**

**Animals:** The present study was carried out on a total number of 16 native breeds of sheep and goats (8 rams, 4 does and 4 bucks) suffering from horn overgrowth complications at the head and neck regions. These cases were recorded during clinical examination of total 94 rams and 155 goats (91 does and 64 bucks) during the clinical field trips, and in small farms of private sector plus those reared inside Sohag University Veterinary Teaching Hospital for teaching and research purposes. All animals were 2.5-5 years old. Each case was fully reported concerning causes, sites and severity of the soft tissue trauma in the head and neck region, clinical behavior, gait analysis and the possible surgical management.

**Clinical behavior:** an ethogram was customized in terms of clinical signs (circling, head tilting, head or horn rubbing and head dropping) for the cases suffering from complications of horn overgrowth. Behavioral sheet was used for video recording within a period of 5 min. examination, according to the focal sample technique (Mitlöchner *et al.*, 2001). Within the small private sector farms, sheep and goat were examined in the flock according to the clinical examination manual (Lovatt, 2010) to check the difference from the rest of the group during foot print test for the following signs; bright/alert/dull/apathetic/anxious/restless/ excitable/ and manic.

**Gait analysis using foot print test:** Foot print test was adapted to analyze the locomotion and gait analysis in small ruminants according to Fiore *et al.* (2004) with some modifications. In brief, to obtain foot prints, the hind-and forefeet of the animal were dipped in a bucket filled of water while the feet were being soiled. The animals were then allowed to walk along a 150×600 cm runway corridor with tiles floor, video recorded and the locomotion was measured as the time (seconds) spent to finish the course. Four animals for each group (unilateral overgrown horn, bilateral overgrown horn and the control is overgrown horn without complications) subjected to the course. The foot print patterns were analyzed for 4 step parameters (all measured in centimeters). (1) A stride length was measured as the average distance of forward movement between each stride. (2) Hind-base width and (3) front-base width were measured as the average distance between left and right hind foot prints and left and right front foot prints, respectively.

These values were determined by measuring the perpendicular distance of a given step to a line connecting its opposite preceding steps. (4) Distance from left or right front foot print/hind foot print overlap was used to measure uniformity of step alternation. When the center of the hind foot print fell on top of the center of the preceding front foot print, a value of zero was recorded. For each step parameter, three values were measured from each run, excluding foot prints made at the beginning and end of the run where the animal was initiating and finishing movement, respectively. The mean value of each set of three values was used in subsequent analysis.

**Surgical Management:** The overgrown horns were cut off at the apex, mid-horn or close to the base of the horn depending on the causative part of the trauma. The horns were cut with Gigli wire saw. Sedation with xylazine Hcl 2% (xyla-ject®) 1 I M. injection in a dose of 0.05mg/Kg B.W in goat and 0.2 mg/Kg B.W in sheep was satisfactory for cutting off the tip of the overgrown horns. Sedation in addition to cornual nerve block by Lidocaine Hcl 2% (Debocaine®) 2 for the cornual branches of the lacrimal and infratrochlear nerves (Hall *et al.*, 2001) were required for cutting at mid-horn or close to the base of the horn. Bandages were applied for animals subjected to cutting of the body or close to the base of the horn for one week post-operatively. Wounds in the skin and muscle of the head and neck were surgically dressed. Eye affections were treated with local antibiotics and anti-inflammatory. Systemic broad spectrum antibiotics were prescribed for all cases.

### *Statistical analysis:*

Statistical analysis of data was performed by GraphPad Prism 5 software (GraphPad Software Inc. 2015. www.graphpad.com/). One-way ANOVA was used for multiple comparisons between groups in foot print test followed by Tukey's *post-hoc* test. The values were considered significant only when *p* value is below 0.05 level.

## **RESULTS**

### *Horn overgrowth complications in sheep and goat:*

Complications of the horn overgrowth in sheep and goats were reported in 16 cases. Causes and percent (%) of these complications were illustrated in Table (1). Clinical examination of the head and neck of sheep and goats revealed presence of 8 out of 94 examined rams (8.5%) and 8 out of 155 examined goats (5.2%) suffered from wound in different parts of the head and neck regions due to unilateral or bilateral horn overgrowth (Table 1). All cases were adult animals (2.5-5 years old). Horns pursue a helical course that carries them first caudally, then successively ventrally, rostrally and dorsally. Soft tissue trauma occurred from pressure necrosis from

the inner surface of the horn base, body and apex, or due to penetration from the pointed end of the horn or sharp broad end of previously cut horn. The severity of the wounds was variable depending on the causative trauma. Wounds occurred due to penetration of the pointed or sharp end of the horn were deeper and more painful than that caused by pressure from the inner surface of the horn. Wounds in the skin and muscle of the cheek (Fig. 1A) and the neck (Fig. 1 B&C) were not serious and all cases recovered after surgical dressing and administration of systemic broad spectrum antibiotics. Wounds in the lateral canthus of the eye developed various degree of keratitis and deformities in the upper and lower eyelids (Fig. 1D&E) which required further ophthalmic treatment. Figure 1 (F) showed cut off the apex of overgrown horn causing traumatic pressure on the neck.

*The effect of horn overgrowths on behaviors of rams and adult goats of both sexes:*

To investigate the animal behavior in cases of stress induced by painful traumatic injuries, an ethogram was customized to include the clinical signs (circling, head tilting, head or horn rubbing and head dropping) for the cases suffering from wounds due to horn overgrowth. Clinical signs recorded for the rams and adult goat of both sexes indicated the increased circling and head tilting in cases of unilateral overgrown horns (Table 2A&B). Clinical

examination of the animal within the flocks examined in private small scale producers, rams and goat with unilateral complicated overgrown horns were positive for signs of (anxious; restless and excitable), those of bilateral complicated horn growth were positive for these signs; dullness and apathetic, whereas, those without complications were bright and alert and negative for other signs (Table 3A&B).

*The effect of horn overgrowths on gait analysis of rams and adult goats of both sexes:*

In foot print test cases with bilateral overgrown horns were suffered from reduced locomotor activity, as indicated by increased time spent to finish the run course, without an obvious effect on the gait, although the effect was not significant different between unilateral and bilateral completed cases, but complicated cases consumed a significant longer time in the running course for foot print than control group (Table 4 A&B). Results of gait analysis indicated disrupted uniformity of step alternation or increased overlapping distance for the hind and forefeet in cases of unilateral overgrowth of the horns in both sheep and goats (Fig. 2 and Table 4A&B). On other hand, no such effects of horn overgrowths were observed on astride length, fore feet base width and hind feet base width (Fig. 2 and Table 4 A&B). Together these results indicated that sheep and goats with unilateral horn overgrowth showed more altered behaviors than those suffered from bilateral overgrown horns.

**Table 1:** Illustrates types, causes and percent (%) of complications of horn overgrowths in rams and goats.

Complications	Causative part	Sheep No (%)	Goat No (%)	Total of sheep and goat (No)
Wound in the skin and muscles of the cheek	Penetrating pointed end of the horn	2 (25%)	2 (25%)	4
	Inner surface of the body and/or apex of the horn	1 (12.5%)	3 (37.5%)	4
Wound in the skin and muscles of the neck	Sharp broad end of a previously cut horn	1 (12.5%)	1 (12.5%)	2
	Inner surface of the base of the horn	2 (25%)	1 (12.5%)	3
Keratitis and wound in the lateral canthus of the eye	Inner surface of the body and/or apex of the horn	2 (25%)	1 (12.5%)	3
Total		8/94 (8.5%)	8/155 (5.2%)	16

**Table (2)** Effect of unilateral or bilateral overgrowth of horns on an ethogram in adult goat of both sexes and rams**A) Ram**

Requency of behavior/ 5min	Control	Uinlateral overgrown horn	Binlateral overgrown horn	Statistics
Circling	nd	3.25 ± 1.50	nd	
Head Tilting	nd	4.75 ± 1.75	nd	
Head/horn	nd	3.38 ± 1.29 (a)	0.50 ± 0.62 (b)	$F(2, 11) = 37.24, p < 0.01$
Head dropping	nd	1.62 ± 1.37 (a)	4.00 ± 1.50 (b)	$F(2, 11) = 28.25, p < 0.01$

**B) Adult goat**

Requency of behavior/ 5min	Control	Uinlateral overgrown horn	Binlateral overgrown horn	Statistics
Circling	nd	4.38 ± 1.29	nd	
Head Tilting	nd	3.25 ± 0.88	nd	
Head/horn	nd	4.87 ± 1.29 (a)	1.87 ± 0.75 (b)	$F(2, 11) = 26.34, p < 0.05$
Head dropping	nd	1.62 ± 1.37 (a)	3.75 ± 1.25 (b)	$F(2, 11) = 23.22, p < 0.05$

Abbreviations: nd; not detected. Statistics;  $F$  value, degree of fredoms between groups and total. Data represent average of values for means ± SD. Values with different letters are significant when  $p < 0.5$ .

**Table (3)** Effect of unilateral or bilateral overgrowth of horns on gait and locomotor activity of adult goat of both sexes and rams**A) Adult goat**

Foot print distance (cm)	Control	Uinlateral overgrown horn	Binlateral overgrown horn	Statistics
Astride length	59.25 ± 1.26	57.25 ± 1.29	59.25 ± 1.26	$F(2, 11) = 5.10, p = 0.11$
Forebase width	11.75 ± 1.50	11.75 ± 1.25	11.75 ± 1.50	$F(2, 11) = 3.10, p = 0.10$
Hindbase width	18.00 ± 1.50	18.50 ± 1.30	18.00 ± 1.50	$F(2, 11) = 1.00, p = 0.78$
Fore/hind feet overlap distance	3.00 ± 0.82 (a)	8.50 ± 0.58 (b)	4.00 ± 1.50 (a)	$F(2, 11) = 47.40, p < 0.001$
Time consumed in course (s)	23.0 ± 1.82 (a)	31.0 ± 4.82 (b)	35.0 ± 3.22 (b)	$F(2, 11) = 47.40, p < 0.01$

**B) Rams**

Foot print distance (cm)	Control	Uinlateral overgrown horn	Binlateral overgrown horn	Statistics
Astride length	62.25 ± 1.89	59.25 ± 0.96	61.75 ± 1.26	$F(2, 11) = 2.50, p = 0.13$
Forebase width	17.00 ± 1.41	15.25 ± 1.50	15.75 ± 1.50	$F(2, 11) = 1.17, p = 0.35$
Hindbase width	21.75 ± 0.96	21.75 ± 1.50	21.74 ± 1.50	$F(2, 11) = 0.25, p = 0.77$
Fore/hind feet overlap distance	5.09 ± 0.82 (a)	11.00 ± 0.58 (b)	5.25 ± 1.50 (a)	$F(2, 11) = 79.80, p < 0.001$
Time consumed in course (s)	21.0 ± 1.72 (a)	29.0 ± 3.23 (b)	31.0 ± 2.42 (b)	$F(2, 11) = 47.40, p < 0.01$

Abbreviations: ND; not detected. Data represent average of values for means ± SD. Statistics;  $F$  value, degree of fredoms between groups and total. Values with different letters are significant when  $p < 0.5$ .

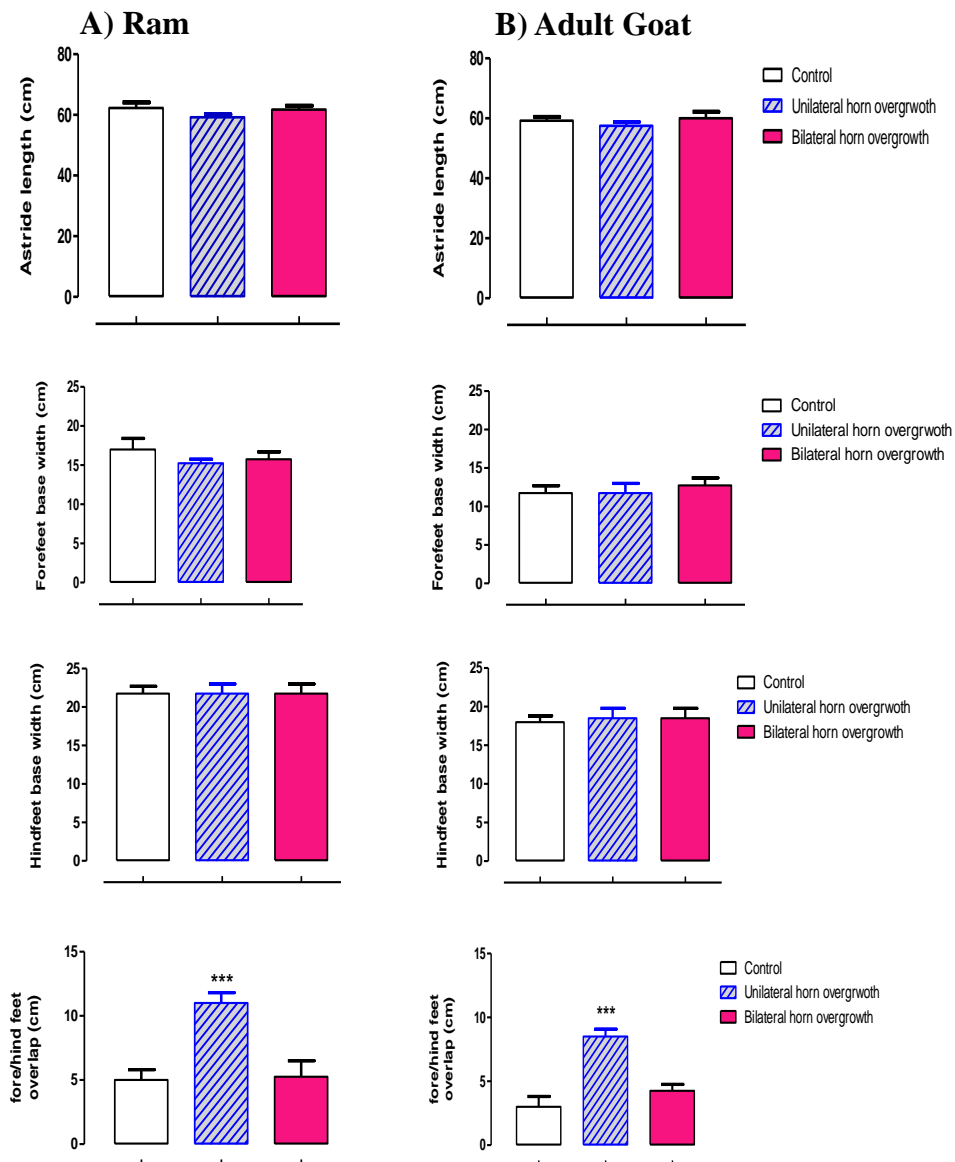
**Table 4:** Effect of unilateral or bilateral overgrowth of horns on clinical behavior of adult goat of both sexes and rams

<b>A) Adult goat</b>			
<i>State of animal</i>	<b>Control (n =4)</b>	<b>Unilateral overgrown horn (n =4)</b>	<b>Bilateral overgrown horn (n =4)</b>
<b>Bright</b>	+	-	-
<b>Alert</b>	+	-	-
<b>Dull</b>	-	+	+
<b>Apathic</b>	-	+	+
<b>Anxious</b>	-	+	+
<b>Restless</b>	-	+	+
<b>Excitable</b>	-	+	+
<b>Manic</b>	-	+	+
<b>B) Rams</b>			
<i>State of animal</i>	<b>Control (n =4)</b>	<b>Unilateral overgrown horn (n =4)</b>	<b>Bilateral overgrown horn (n =4)</b>
<b>Bright</b>	+	-	-
<b>Alert</b>	+	-	-
<b>Dull</b>	-	-	+
<b>Apathic</b>	-	-	+
<b>Anxious</b>	-	+	-
<b>Restless</b>	-	+	-
<b>Excitable</b>	-	+	-
<b>Manic</b>	-	-	-

Data represent the presence (+) or absence of behavior (-)



**Figure 1: Complications of horn overgrowths in goats and rams.** Overgrown horn caused wound on the cheek of a doe (A). Sharp broad end of previously cut horn induced injury in the neck of a buck (B). Overgrown horn caused a wound in the neck (C) or caused keratitis and wound in the lateral canthus in of a ram (D). Overgrown horn caused keratitis and wound in the lateral canthus of the eye in a ram (postoperative view) (E). Cut off the apex of overgrown horn causing traumatic pressure on the neck (F).



**Figure 2: The effect of horn overgrowths on gait of rams and adult goats of both sexes.** Gait analysis was performed by foot print test in control, unilateral horn overgrowth and bilateral horn overgrowth in rams (Panel A) and adult goats of both sexes (Panel B). One-way ANOVA followed by Tukey’s post hoc test analysis (GraphPad Prism 5 software, 2015. www.graphpad.com/) indicated no significant effect of horn overgrowths on a stride length; fore feet base width and hind feet base width ( $p > 0.5$ ). On other hand, unilateral overgrowth of the horn significantly disrupted the alignment of the feet in terms of increased overlap distance between the hind feet and forefeet in the rams ( $F_{(2, 11)} = 29.55, p < 0.001$ ) and the adult goats ( $F_{(2, 11)} = 72.75, p < 0.001$ ). Data were presented as means  $\pm$  SD. An asterisk indicates that  $p < 0.05$ .

## DISCUSSION

The horns of sheep and goats grow continuously throughout life, following their first appearance after birth. Size and shape are strongly characteristic for breed and are influenced by the age and gender. Horn growth is decreasing with advancing age (Cote, *et al.*, 1998). Overgrown horns naturally get twisted, coiled, or unevenly grown in such a way as to inflict traumatic injury on the animal itself (Grubb, 2005 and Bamaiyi and Turaki, 2012). The present study

indicated that increased length and thickness of the helical shaped horn led to traumatic injuries from the inner surface of the horn or from its penetrating end. Complications resulted from overgrown horn in the present study include; unilateral and bilateral wounds in the skin and muscles of the cheek and neck and eye affections such as keratitis and wound in the lateral canthus of the eye. Detrimental effects on animal behaviors were recorded due to unilateral or bilateral complications of the horn overgrowth in terms of disrupted feet alignment, circling and head tilting, and low general health state.

About 8.5% of examined rams were suffered from horn overgrowth complications. However, 5.2% of examined goats were suffered from these complications. Horns of sheep have a triangular section, but horns of goats have an oval section (Dyce *et al.*, 2010) that make sheep are more liable to cause compressions or wounds from overgrown horns than goats. The present study emphasized that, the horns grow much more rapidly than most owners realize and so their overgrowth may cause traumatic injuries to the animal itself. Dehorning of adult animal is recommended to decrease risk of traumatic injuries in the flock (Hull, 1995; Hague and Hopper, 1997 and Al-Sobayil, 2007). Therefore, routine clinical examination should be performed in small ruminant farm to notice any early overgrowth, so that treatment can be induced promptly to save the animal and the flock (Lovatt, 2010).

The welfare of animals, emphasized the basic health and functioning of animals, especially freedom from disease and injury, pain, distress and the ability of animals to carry out natural behavior and have natural elements in their environment (Frazer, 2008). Data presented in Table 2 (A&B) indicated that complications of horn overgrowth adversely affected the animal behavior. Animals showed circling, head tilting and rubbing in case of unilateral complications. While in case of bilateral complications showed increased head dropping. Also, in Table 3 (A&B) we observed that cases with unilateral and bilateral horn complications showed 2 divergent patterns of clinical behaviors; hence, rams and goat with bilateral complicated horn growth were positive for signs of reduced activity such as dullness and apathetic, those with bilateral complications were anxious, restless and excitable while, those without complications were positive for signs of increased activity such as brightness and alertness (Table 3 A&B). These behavioral signs were previously reviewed by Lovatt (2010). Moreover, data of gait analysis in foot print test revealed non-significant differences between both cases of complications except in disrupted foot alignment in terms of significant increased overlap distance in unilateral complications (Fig.2 and Table 4 A&B).

The present study concluded that overgrown horns not only induce injury to other animals during fighting but also cause some traumatic affection to animal itself. The overgrown horns may cause traumatic injuries to head, neck and eye leading to poor animal welfare. Disbudding of the newly born animal and dehorning in adult one may minimize the risk of traumatic injuries in the farm.

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**مضاعفات فرط نمو القرن في الأغنام والماعز مع إشارة خاصة إلى السلوكيات الإكلينيكية  
المصاحبة والعلاج الجراحي**

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**الخلفية البحثية:** النمو الغير المتكافئ للقرون في ذكور الأغنام وفي ذكور وإناث الماعز يتم ملاحظته بكثرة وهذا الإختلاف قد يعزى لأسباب عديدة وراثية وبيئية ورعاية. الهدف من هذه الدراسة: هو وصف المضاعفات الجراحية والسلوكيات الإكلينيكية المصاحبة والعلاج الجراحي لفرط نمو القرن في الأغنام والماعز. وقد أجريت هذه الدراسة على عدد ١٦ حيوان (٨ من الكباش و٨ من الماعز) الذين يعانون من جروح في منطقة الرأس أو الرقبة بسبب فرط نمو القرن. طرق البحث: تم تسجيل هذه الحالات خلال الفحص الإكلينيكي لاجمالي عدد ٩٤ كبش وعدد ١٥٥ من الماعز من كلا الجنسين من السلالات المحلية. وقد تم فى كل حالة دراسة أسباب الحالة وأماكن وشدة جروح الأنسجة؛ السلوكيات الإكلينيكية المصاحبة على أساس الإثوجرام المعد للكباش والماعز البالغين من كلا الجنسين وإجراء التدخل الجراحي المناسب. أهم النتائج: ظهور جروح في أجزاء مختلفة من الرأس والرقبة في ٨.٥% من الكباش و٥.٢% من الماعز التي تم فحصها. وكانت الجروح بسبب الضغط من السطح الداخلى للقرن أو بسبب اختراق من نهاية القرن. وكانت شدة الجروح متغيرة تبعا للأسباب. كما أشارت دراسة السلوك الإكلينيكي والإثوجرام الى زيادة في الدوران وزيادة إمالة الرأس في حالات فرط نمو القرن فى جانب واحد، بينما لوحظ في حالات فرط نمو القرن لكلا الجانبين إنخفاض النشاط الحركي دون تأثير واضح على المشى. و أشارت نتائج تحليل المشية عن طريق إختبار بصمة القدم إلى الإخلال بمحاذاة الأقدام أو بمعنى آخر زيادة المسافة بين تطابق الأقدام الخلفية مع الأمامية في حالات فرط نمو القرن فى جانب الواحد. الإستنتاج: توضح هذه الدراسة إلى أن طرق الرعاية الجيدة مثل عملية وقف نمو القرون أو القطع المنتظم للنمو المفرط للقرن يجنب تلك الحيوانات من التعرض للإصابات والجروح التي لها ضرر بالغ على حالة الإراحة لتلك لحيوانات.