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Prevalence and risk factors associated to the incorrect application of the anabolic implant in intensive cattle feedlots in Sinaloa, México

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ABSTRACT

Objective: To determine the prevalence and the risk factors associated to the incorrect application of the anabolic implant in intensive cattle feedlots.

Design/Methodology/Approach: An observational study was conducted in which 888 cattle ears were evaluated from five livestock feedlots. The criteria of the condition of the anabolic implant were: correct and incorrect (encapsulated, abscessed, in cartilage, poorly placed, bunched, partial and missing.). The results were evaluated through the chi-squared test and logistic regression, the alpha level established was 0.05.

Results: A prevalence of 64.30% incorrectly applied anabolic implants was observed. At least 50% of the cattle from the feedlots evaluated presented failures in the application of the implant. Encapsulated and poorly implants represented 91.6% (51.4 and 40.2%, respectively) of the total incorrect conditions. The risk of a bovine presenting an incorrect condition increased 1.8 times more when the feedlot has more than 4000 cattle ($P<0.001$) and 4.2 times more when they are females ($P<0.001$); the season of the year was not a risk factor ($P>0.17$).

Study Limitation/Implications: The incorrect application of anabolic implants derives in failures that complicate their absorption and integration into the organism, which is why more studies are suggested to determine the economic impact that this can cause.

Findings/Conclusions: The prevalence of the failures in anabolic implants is high, and, therefore, the productive and economic benefits that favor the application of this productive technology are not being obtained, in addition to there being determinant risk factors.

Keywords: Cattle, growth promoters, anabolic implant, condition.

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INTRODUCTION

Anabolic steroids are substances that increase the retention of nutrients from food by the animal's organism; in particular, they increase the retention of protein and non-protein nitrogen, and its later transformation into protein, specifically in the skeletal muscle of ruminants (Palermo, 1998). The use of anabolic implants as growth promoters is a routine practice in the intensive production of beef, and it has been estimated that a higher proportion than 95% of cattle in confinement in northwestern Mexico are implanted (Cáñez *et al.*, 1985). This practice has the purpose of improving the productive yield and food efficiency, thus reducing the production costs; concerning this, it has been informed that in comparison to non-implanted livestock, the daily weight gain increases (5-18%) and the dietary efficiency improves (5-10%) (Duckett *et al.*, 1996; Mader, 1998). The anabolic implant must be placed in the posterior part of the ear, via subcutaneous in the middle third, between the two longitudinal cartilaginous ribs (Mader, 1998). However, an incorrect application of the implant can cause different conditions (encapsulated, abscessed, in cartilage, poorly placed, bunched, partial and missing), which has been called "failure of the anabolic implant" (Barajas *et al.*, 2010; Berry *et al.*, 2000; Folmer *et al.*, 2009), causing double loss, first the investment in the implant and second the loss of productive benefits (Barajas *et al.*, 2010). In this regard, failures have been reported in the absorption of the implant from 2.65% (Folmer *et al.*, 2009) to 95.5% (Zollers *et al.*, 2002), which is reflected in an estimated economic loss of $15.1 USD to $22.50 USD per animal (Anderson and Botts, 2002; Barajas *et al.*, 2010), as a reflection of the loss of calculated productive yield in 0.077 kg day^{-1} of reduction in weight gain of the carcass (Mader, 1998). Therefore, it becomes necessary to perform studies to evaluate the technique of anabolic implants in confined beef cattle. Because of this, the purpose of this research was to determine the prevalence and the risk factors associated to the incorrect application of the anabolic implant in intensive feedlot cattle.

MATERIALS AND METHODS

Location of the study area and generalities of the sampling

The research was conducted in two Federal Inspection Type Meat Processors; this type of establishments are regulated by the norms NOM-194-SSA1-2004 corresponding to Products and Services, which indicate the sanitary specifications in the establishments devoted to the sacrifice and skinning of animals for supply, storage, transport and retail.

Sanitary specifications of products and the norm NOM-033-SAG/ZOO-2014 indicate the method to slaughter domestic and wild animals, located in the municipality of Culiacán, Sinaloa, Mexico (24° 2' 4.92" N to 25° 16' 33.6" N) (INEGI, 2020). To determine the condition of the anabolic implant of cattle when finalizing the fattening, n=888 ears were inspected. The cattle evaluated came from five production units, three of which had more than N=4000 bovines and were considered as large feedlots, and two with inventory of less than N=4000 bovines which were considered as small feedlots. Four fattening production units are located in the municipality of Culiacán and one in the municipality of Guasave, Sinaloa. Twenty-three (23) cattle feedlots were inspected, where the origin and sex of the bovines were identified. In the period when the evaluations were performed, the season

was determined according to the monthly average temperature, winter (<29 °C) and summer (≥29 °C), obtained from the meteorological station of the Center for Research in Feed and Development (*Centro de Investigación en Alimentación y Desarrollo*, CIAD, 2019) located approximately 4.2 km from the meat processors.

Evaluation of the condition of the anabolic implant

When starting the inspection of the implant's condition, the ear implanted was removed from each bovine, and later dissected with a scalpel blade number 23; the criteria of the condition of the anabolic implant were classified as: 1-correct, 2-incorrect (encapsulated, abscessed, in cartilage, poorly placed, bunched, partial and missing), capturing at the end a photograph of each inspection as evidence. The criterion to assign the condition of the anabolic implant was: correct when the anabolic implant is degraded and liberated into the blood stream; encapsulated when there was a fibrous capsule that covered the anabolic implant and it was found without degradation; abscessed when there was purulent content; in cartilage when it was incrusted in the ear's cartilage; poorly when it was positioned outside the middle third, close to another anabolic implant, identification earrings, orifices or notches; bunched when it was bound together in the same site; partial when there were less pellets than those that there ought to be, even if they were in degradation process or not; and missing when it was not applied or lost (Barajas *et al.*, 2010; Berry *et al.*, 2000; Folmer *et al.*, 2009).

Statistical analysis

All the ears that presented at least one inadequate condition of the anabolic implant and were identified as incorrect were included. The prevalence was calculated as number of incorrect implants/number of ears evaluated × 100. A graph was made to understand the order of presentation of failures in the implant. The association between the time of the year, sex of the animal, and size of the feedlot with the condition of the implant was analyzed with the Chi-squared test. To estimate the odds ratio, a logistic regression analysis was conducted with the LOGISTIC procedure from SAS (SAS, 2002), for the sex variable the procedure used was univariate analysis for 474 observations, while for the feedlot size and time of the year it was multivariate analysis, where there were 888 observations. The alpha level established was 0.05.

RESULTS AND DISCUSSION

Prevalence of the conditions of the anabolic implants

A prevalence of 64.30% (IC 95% 61.01-67.59) of incorrect anabolic implants was observed. Folmer *et al.* (2009) observed failures of 2.65% when sanitary measures were applied at the time of placing the implant; likewise, Anderson & Botts (2002) observed 5.75% in the fault of the implant when contaminating the site at the time of placing the implant and using an implant with an antibiotic pellet (Tylosin tartrate), and therefore the high prevalence in our study can be attributed to the implantation technique. Our findings differ from what was reported by Berry *et al.* (2000) and Barajas *et al.* (2010), from 20 to

32.98%, respectively, although it is lower than that reported by Zollers *et al.* (2002) of 94.1% fault of the implant.

Table 1 shows the prevalence of the fault of the anabolic implant in each feedlot, which presented prevalence higher than 50% of incorrect anabolic implants.

When determining the prevalence of the criteria of the condition of incorrect anabolic implant (n=369), the conditions encapsulated and poorly represented 91.6% (51.4 and 40.2%) respectively (Figure 1).

During the implantation, bacteria present in the site (auricle) are inevitably introduced under the skin, an inflammation process begins on day one in the surrounding area and the organism seeks to inhibit this infection; the anabolic implant is considered a foreign body and on day seven it is encapsulated as the organism attempts to isolate it to minimize its impact; by day fourteen a capsule of fibrous connective tissue forms, which will be degraded by macrophages and the absorption of the anabolic implant in the blood stream will begin, the thickness of the capsule will depend on the amount of bacteria present in the implantation site (Loughin, 2004); this causes for the implant not to degrade, which is why sanitary measures have been established to decrease the pathogenic load (Lancaster, 2009). Likewise, in a poorly placed implant (close to the base of the ear), the irrigation is lower and this affects absorption (Goodall, 1955). Parrott *et al.* (1985) indicate that the percentage of losses is reduced from 29 to 14% when applying it in the middle zone, since

Table 1. Prevalence of the anabolic implant condition in Feedlots cattle.

	Condition of the anabolic implant		Total
	Incorrect	Correct	
Feedlot 1	106 (84.80 %)	19 (15.20 %)	125
Feedlot 2	235 (58.89 %)	164 (41.10 %)	399
Feedlot 3	99 (97.05 %)	3 (2.94 %)	102
Feedlot 4	105 (49.52 %)	107 (50.47 %)	212
Feedlot 5	26 (52 %)	24 (48 %)	50
Total	571	317	888

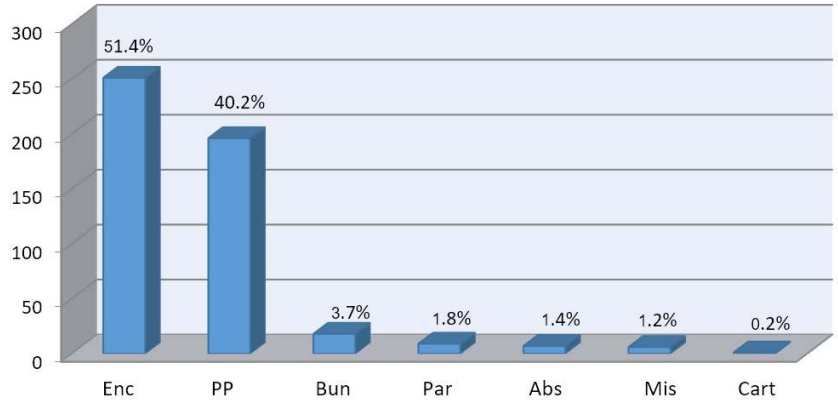

Figure 1. Incorrect conditions of the anabolic implants n=369: Enc=Encapsulated, PP=Poorly placed, Bun=Bunched, Par=Partial, Abs=Abscessed, Mis=Missing, Cart=In cartilage.

the skin is less relaxed and firmer which ensures that the anabolic implant is not displaced to the incision zone and lost, and close to other implants, earrings or blood vessels, where irrigation can be interrupted; however, the formation of new blood vessels and capillaries towards surrounding tissues (angiogenesis) takes place (Lancaster, 2009); thus, it is possible that absorption is favored.

In cattle with the incorrect condition of the implant, 151 ears (40.92%) presented one failures condition and 147 ears (39.83%) presented 2 conditions (Table 2).

Risk factors

When determining association between size of the feedlot, time of the year, and sex with the incorrect condition of the anabolic implants, the three factors were associated ($P \leq 0.05$) (Table 3).

When the size of the feedlot and the time of the year were included in the logistic regression model, only the size of the feedlot was determined to be a risk factor ($P < 0.05$). Likewise, the sex was also estimated as a risk factor (Table 4).

The risk for a bovine to present an incorrect condition of the anabolic implant when the size of the feedlot was larger than n=4000 cattle is 1.8 times higher ($P < 0.05$). This result

Table 2. Prevalence of the number of incorrect conditions per ear inspected.

Number of incorrect conditions	Number of ears	%
1	151	40.92
2	147	39.83
3	13	3.52
4	1	0.27

Table 3. Association of size of the feedlot, sex, and time of the year with the condition of the anabolic implant.

		Condition of the anabolic implant		Total	P[3]
		Correct[1]	Incorrect[2]		
Feedlot size	Small[4]	43 (4.84 %)	132 (14.86 %)	175 (19.71 %)	<0.0006
	Large[5]	274 (30.86 %)	439 (49.44 %)	713 (80.29 %)	
	Total	317 (35.70 %)	571 (64.30 %)	888 (100 %)	
Sex[6]	Female	59 (12.45 %)	215 (45.36 %)	274 (57.81 %)	<0.0001
	Male	108 (22.78 %)	92 (19.41 %)	200 (42.19 %)	
	Total	167 (35.23 %)	307 (64.77 %)	474 (100 %)	
Time of the year	Winter[7]	126 (14.19 %)	266 (29.95 %)	392 (44.14 %)	<0.0493
	Summer[8]	191 (21.51 %)	305 (34.35 %)	496 (55.86 %)	
	Total	317 (35.70 %)	571 (64.30 %)	888 (100 %)	

[1,2] Correct=the anabolic implant was absorbed, Incorrect=the anabolic implant was not absorbed.
[3] Probability values of the chi-square statistic.
[4,5] Small=<4000 animals, Large=≥4000 animals.
[6] n=474.
[7,8] Winter=<29 °C, Summer=≥29 °C.

Table 4. Risk factors associated to the condition of the anabolic implant.

Risk factor		Estimator	Standard error	OR[1]	CI[2] 95 %	P[3]
	Intercept	0.7958	0.0960			<0.0001
Time of the year	Winter			1		
	Summer	0.0984	0.0725	1.217	0.0916-1.618	0.1747
Feedlot size	<4000			1		
	≥4000	0.3028	0.0973	1.832	1.251-2.683	<0.0019
	Intercept	0.5664	0.1021			<0.0001
Sex	Male			1		
	Female	0.7267	0.1021	4.278	2.866-6.384	<0.0001

Odds Ratio[1], Confidence interval[2] 95 %, Statistical association[3] (P≤0.05).

is attributed to the human factor that is related to the management of the animals, so that with more animals in the inventory of a livestock farm there is more work and workers can be tired and reduce the efficiency of implantation, which is why it is recommended that there be a substitute worker available.

Authors like Elanco (2017) and Brsci *et al.* (2018) indicated that when decreasing the number of animals in charge of a worker, the deficiencies in the operative management of the feedlot are reduced in up to 3.5%. Likewise, the analysis showed that the females had 4.2 more risk of presenting incorrect anabolic implants (P<0.05). These results agree with those found by Anderson and Botts (2002), who reported that the females presented 3% more probability of implantation failures compared to the males and this is possibly a reflection of the temperament that depends on the sex, which could modify their behavior.

CONCLUSIONS

The prevalence of incorrect anabolic implants was 64.30%, and the conditions with highest frequency were encapsulated and poorly placed. An association between the time of the year, the inventory and the sex with the incorrect condition of anabolic implants was identified. The risk of an animal presenting such a condition increases 1.8 times when the inventory of the livestock feedlot is large and 4.2 times when they are females; therefore, it is important to consider the economic losses that this could generate and to direct more attention to the implantation technique.

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REFERENCES

Anderson, P. T., & Botts, R. L. (2002). Evaluation of the Ability of Implants Containing a Pellet of Tylosin Tartrate (Component® with Tylan®) to Prevent Implant Site Abscesses Under Field Conditions. *The Professional Animal Scientist*, 18(3), 262–267. Doi: 10.15232/S1080-7446(15)31531-X

Barajas, R., Cervantes, B. J., Romo, J. A., Juárez, F., & Aguirre, J. (2010). Influencia de la falla del implante hormonal en la respuesta productive de toretes en ceba. *Zootecnia Tropical*, 28(2), 193–200.

Berry, B. A., Perino, L. J., Galyean, M. L., Montgomery, T. H., & Bachman, S. (2000). Association of Implanting Abnormalities with Growth Performance of Feedlot Steers. *The Professional Animal Scientist*, 16(2), 128–133. Doi: 10.15232/S1080-7446(15)31675-2

Brsci, M., Knierim, M. K., Contiero, B., Gottardo, F., & Winchkler, C. (2018). Risk factors associated with beef cattle losses on itensive fatening farms in Austria, Germany and Italy. *The Veterinary Journal*, 239, 48–53. Doi: 10.1016/j.tvjl.2018.08.002

Cáñez, H., Gómez, R., Cajal, C., & Zambrano, R. (1985, December). Evaluación de diferentes agentes anabólicos para novillos de engorda en condiciones experimentales. Patronato Del Centro de Investigaciones Pecuarias Del Estado de Sonora, A.C. Disponible en:https://www.patrocipes.org.mx/publicaciones/nutricion/N85008.html

CIAD. (2019). Centro de investigación en alimentos y desarrollo. Estación Meteorológica. Disponible en: http://red.globalmet.mx/campo_experimental/NOAA/NOAA-2019.txt

Duckett, S. K., Wagner, D. G., Owens, F. N., Dolezal, H. G., & Gill, D. R. (1996). Effects of Estrogenic and Androgenic Implants on Performance, Carcass Traits, and Meat Tenderness in Feedlot Steers: A Review. *The Professional Animal Scientist*, 12(4), 205–214. Doi: 10.15232/S1080-7446(15)32526-2

ELANCO. (2017). Critical control points. Zero Defect Implanting*. Disponible en: https://assets-us-01.kc-usercontent.com/2de3931d-61f2-00a3-6635-b7b29fac0245/df1749c4-2e76-4b0b-aaa6-25b000c88a1e/SBBUNON01207_1__-__ZDI_Critical_Control_Points.pdf

Folmer, J. D., Farran, T. B., Erickson, G. E., Klopfenstein, T. J., Reinhardt, C. D., Dicke, B. D., Drouillard, J. S., Streeter, M. N., & Vasconcelos, J. T. (2009). Evaluation of Revalor-IH and Revalor-IS as Initial Implants Compared with Traditional Initial Implants for Finishing Heifers and Steers. *The Professional Animal Scientist*, 25(5), 580–585. Doi: 10.15232/S1080-7446(15)30760-9

Goodall, A. M. (1955). Arterio-venous anastomoses in the skin of the head and ears of the calf. *Journal of Anatomy*, 89(1), 100–105. Disponible en: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1244729/pdf/janat00459-0120.pdf

INEGI. (2020). Instituto de estadística y geografía. Áreas Geográficas. Disponible en: https://www.inegi.org.mx/app/buscador/default.html?q=culiacan+sinaloa#tabMCcollapse-Indicadores

Mader, T. L. (1998). Feedlot medicine and management. Implants. Veterinary Clinics of North America. *Food Animal Practice*, 14(2), 279–290. Doi: 10.1016/s0749-0720(15)30254-1

NOM-033-SAG/ZOO-2014. (2014). Método para dar muerte a los animales domésticos y silvestres. Disponible en: https://www.dof.gob.mx/nota_detalle.php?codigo=5405210&fecha=26/08/2015

NOM-194-SSA1-2004. (2004). Productos y servicios. Especificacions sanitarias en los establecimientos dedicados al sacrificio y faenado de animales para abasto, almacenamiento, transporte y expendio. Disponible en: http://dof.gob.mx/nota_detalle.php?codigo=5283380&fecha=26/12/2012

Palermo, J. (1998). Anabolic hormones and animal productión. *Educación Continuada Do CRMV-SP*, 1(1), 10–15. Doi: 10.36440/recmvz.v1i1.3390

Parrott, J. C., Bason, R. P., Carroll, N. G., Elliston, N. G., Ferguson, T. H., Gorham, P. E., Grueter, H. P., McAskill, J. . W., & Wagner, J. . F. (1985). Factors affecting retention of estradiol-17βsilicone rubber implants in ears of steers. *Journal of Animal Science*, 61(4), 807–813.

SAS. (2002). SAS® Procedure Guide Versión 9.0. SAS Institute Inc. Cary, NC, US. 1643p.

Zollers, W. G., Cook, D. L., Janes, T. H., & Barton, W. E. (2002). Effects of a Tylosin Tartrate Pellet Added to Cattle Growth Implants on the Incidence of Implant Site Abscesses. *The Professional Animal Scientist*, 18(3), 258–261. Doi: 10.15232/S1080-7446(15)31530-8.