NSAIDs in Food Animals

– Animal Welfare for the Future –

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INTRODUCTION

Canadian Codes of Practice for each food animal species now require the use of products to control pain and inflammation for certain painful procedures.[1] In the future this will be expanded to all procedures and clinical conditions for all food animal species where pain and inflammation is associated. It is the role of the food animal practitioner to provide information and standard operating procedures (SOP's) to their clients to ensure the codes of practice are met and drug residues are addressed. Veterinarians must take the lead in insuring that both short term and long- term pain are addressed for the production animals under his/her care. This can now only be achieved by off label use of selected products as the registration process has not caught up to the animal welfare demands of the consumers and producers. Veterinarians need to be able to digest the current efficacy, safety and residue literature on the use of NSAID's and provide treatment protocols to their clients. This document is intended to provide information to assist the practitioner to make these decisions.

NSAID ACTION

Humans and animals have received nonsteroidal anti-inflammatory drugs (NSAID's) as natural products and commercial products for over 3,000 years. Only recently has it been shown that NSAID's reduce the formation of prostaglandins by inhibition of the enzyme cyclo-oxygenase (COX)[2]. Stimuli of various origins (surgical procedures, infectious agents, trauma, neoplasia) initiates a process involved in inflammation through the conversion of arachidonic acid into the prostaglandin precursor PGH2 by the enzyme cyclo-oxygenase. COX exists as two isoforms COX-1 and COX-2 and now all NSAID's are categorized according to their specificity to inhibit each of these isoforms.[3] Traditional NSAID's inhibit all COX but newer NSAIDs are designed for

selective inhibition of COX-2 (Table 1). COX-1 supports the production of physiologically relevant prostaglandins regulating the production of cytoprotective gastric mucus and controlling renal blood flow and platelet aggregation. Inhibition of COX-1 is responsible for potential side-effects of ulceration of the upper gastrointestinal tract and delayed blood clotting. COX-2 is responsible for the formation of pro-inflammatory prostanoids that are associated with pain, fever and swelling. Inhibition of only COX-2 provides an effective product without the serious gastrointestinal and renal side effects.[2]

NSAIDs provide analgesia through both central and peripheral mechanisms. NSAIDs like meloxicam produces analgesia largely via peripheral mechanisms[3]. The rapidity of its actions indicates a direct effect on sensitised nociceptors. This allow some NSAID to be used topically at the site of the pain. Diclofenac has been used topically in humans and topical meloxicam has been effectively used in horses and piglets by the author.

Some NSAIDs like flunixin and meloxicam have marked anti-endotoxic activity.[4] These NSAIDs inhibit the production of thromboxane B2, induced by intravenous *E. coli* endotoxin. This therapeutic effect has been used in calves and pigs for the treatment of diarrhea and *E. coli* mastitis in lactating cows.[5,6]

CONTRAINDICATIONS AND SIDE EFFECTS

NSAIDs should not be used in animals with gastrointestinal irritation, ulcers and hemorrhage. Animals should not have impaired hepatic, cardiac and/or renal function. Do not use with aminoglycoside antibiotics, anti-coagulants, steroidal agents or other NSAIDs. Do not use in dehydrated animals or severely debilitated animals.

Effects of NSAID's on Vaccination response

Although most vaccines rely upon the inflammatory response to an antigen/adjuvant, there are many publications demonstrating that NSAIDs do not have any adverse effects on vaccination regimens.[7]

Parturition and Retained Placentas: NSAIDs are potent inhibitors of prostaglandins and there fore should not be given to animals before parturition. There are concerns about retained placentas when giving NSAIDs post-partum. Meloxicam has been shown not to cause an increase in retained placentas.[8]

Pregnancy and Reproduction

NSAIDs have been shown to cross the placenta of pregnant animals and are detected in foetal tissue. In general, NSAIDs available for food animals in general are safe for use in pregnant animals at any stage of gestation. The reproductive effects on mares and stallions have not been evaluated but studies in laboratory animals and cattle have not shown any adverse effects. Veterinarians may want to consult with a company representative.

Table 1. NSAID PRODUCTS AVAILABLE FOR FOOD ANIMALS

Product Name	Active/Concentration	Route	COX 1 Inhibitor	COX 2 Inhibitor	Indications
Metacam 20 Rheumocam	meloxicam 20 mg/mL	SQ, IV	+/-	+	Pyrexia, Pain, Inflammation, Endotoxemia
Meloxicam Oral Suspension	Meloxicam 15/mg/mL	Oral	+/-	+	Pyrexia, Pain, Inflammation, Endotoxemia
Anafen Ketoprofen V	Ketoprofen 100 mg/mL	IM, IV	+	-	Pyrexia, Pain and Inflammation.
Banamine Flunazine Flunixin	Flunixin 50 mg/mL	IV	+	-	Pyrexia, Inflammation, endotoxemia
Banamine	Flunixin meglumine 50 mg/mL	Topical	+	-	Pyrexia, foot rot pain
Phenylbutazone Injection	Phenylbutazone 200 mg/mL	IV	+	-	Musculoskeletal – horses
Phenylbutazone Powder	Phenylbutazone 1g/15g	Oral	+	-	Musculoskeletal – horses

PHARMACOKINETICS/PHARMACODYNAMICS

NSAID's are administered by oral, intramuscular, subcutaneous, intravenous and even transcutaneously. In general, the volume of distribution is low for most NSAIDs in most species which is attributed to extreme binding to plasma protein.[10] NSAIDs are metabolized by hepatic oxidation and eliminated in the urine and feces. The plasma half- life of NSAIDs greatly differ among NSAID's and animal species (Table 2). They also can be different between neonatal/young animals and adults. (Table 2). This needs to be considered when animals are retreated. The long plasma half-life of some NSAIDs make them ideal for use in production animals where retreatments can be stressful on animals and costly to producers. The onset of action for most NSAIDs is rapid for most products, even oral products. This can be attributed to the low tissue concentration required and the rapid uptake following subcutaneous, intramuscular or oral administration

TABLE 2. ELIMINATION HALF LIFE OF NSAIDS

NSAID	Route	Elimination Half Life (Hours)						
		Cattle	Calves	Sheep	Goats	Piglets	Pigs	Horses
Ketoprofen	IV, IM	2.0	0.4	1.9	0.32	0.2	2	0.88
Flunixin	IV	3.1	6.8	2.4	3.6		5	1.6
	Topical	6.4						
Meloxicam	IV, SC	17.5	26	14.0	8	2.6	2.6	8.5
	Oral	28	40	15.4	10	4.3	6.8	10.2

Phenylbutazone	IV, Oral							4-8

ROUTES OF ADMINISTRATION AND DOSAGE

NSAIDs are administered by oral, intravenous, intramuscular, subcutaneous, intravenous and even transcutaneously (Table 1 and Table 3). Veterinarians and producers need to be aware that each product has restrictions on the route of administration and to read to label to ensure product is delivered as recommended. Inappropriate administration can result is adverse reactions and residue issues.

Injections

Ketoprofen and flunixin can be injected intramuscularly and intravenously to cattle and horses and is provided intramuscularly to pigs. Meloxicam is provided as an intravenous or subcutaneous injection to cattle. Sheep receive a subcutaneous injection while swine only receive the product intramuscularly. With subcutaneous and intramuscular injections moderate to severe swellings can occur. Injection site swelling can persist for over 28 days and can result in trimming at slaughter. It is the opinion of the author that intramuscular or subcutaneous injections of NSAIDs to horses should be avoided.

Oral

Oral meloxicam is delivered with a syringe or a dosing gun to the back of the mouth. Oral meloxicam is highly palatable. Studies were performed on horses and pigs where oral meloxicam was top dressed then fed to horses or sows/gilts. Treated animals consumed the feed more readily than control feed.

Topical

Topical flunixin was recently registered for cattle. This allows a stress free method for application. It also avoids the risk of needle contamination of meat. Lidocam was developed by Solvet for castration and tail docking of piglets. Topical delivery allows for both local anesthetic (lidocaine) and NSAID (meloxicam) to be delivered at high concentrations to the peripheral site where pain and inflammation occurs. It also avoids toxicity issues that can occur in neonates.

DOSAGE

Dosage of NSAIDs depends upon the NSAID, the duration of effect, the animal species, the indication of use and the age of the animal. **Table 3** provides the dose of NSAID products that have been used in Canada from label and from published/technical information. NSAID injections can be irritating and injection reaction can persist for over 28 days. In food animals, this can result in trimming of the injection site. Piglets have received a combination of injectable meloxicam and iron dextran. This should be avoided as the iron dextran inactivates the meloxicam. In addition, there is no data on local tissue damage and this combination could result in extensive trimming at slaughter.

TABLE 3. DOSAGE OF NSAIDS IN FOOD ANIMALS

Cattle				
NSAID	**Animal Type**	**Dose**	**Route**	**Comment**
Flunixin (injection)	Ruminant Cattle	2.2 mg/kg	IV	Can re-administer if non-responsive
Flunixin (Topical)	Ruminant Cattle	3.3 mg/kg	Topical	Can re-administer if non-responsive
Ketoprofen (injection)	Ruminant Cattle	3.3 mg/kg	IM, IV	Treat daily for up to 3 days
Meloxicam (Injection)	Ruminant Cattle	0.5 mg/kg	SQ, IV	Can repeat in 1-2 days
	Calves	0.5 mg/kg	SQ, IV	Can repeat in 1-2 days
Meloxicam (Oral)	Ruminant Cattle	1 mg/kg	Oral	Can repeat in 3 days
	Calves	1 mg/kg	Oral	Can repeat in 4-5 days
Sheep and Goats				
NSAID	**Animal Type**	**Dose**	**Route**	**Comment**
Flunixin (injection)	Sheep	2.2 mg/kg	IM, IV	May have injection site irritation with IM
	Goats	2.2 mg/kg	IM, IV	May have injection site irritation with IM
Ketoprofen (injection)	Sheep	3.3 mg/kg	IM, IV	May have injection site irritation with IM
	Goats	3.3 mg/kg	IM, IV	May have injection site irritation with IM injection
Meloxicam (Injection)	Sheep	1.0 mg/kg	SQ	Behind the ear, Can repeat in 24 hours
	Goats	1.0 mg/kg	SQ	Behind the ear, Can repeat in 24 hours
Meloxicam (Oral)	Sheep	1 mg/kg	Oral	Can repeat in 2 days
	Goats	1 mg/kg	Oral	Can repeat in 2 days
Pigs				
NSAID	**Animal Type**	**Dose**		**Comment**
Flunixin (injection)	Piglets	2.2 mg/kg	IM	Inject into the neck. Tissue damage for >28 days
Ketoprofen (injection)	Piglets	3 mg/kg	IM	May have tissue damage at injection site
Meloxicam (Injection)	Piglets	0.4 mg/ kg?	IM	Check with rep
	Weaners/Growers	0.4 mg/kg	IM	Can repeat in 24 hours
	Sows/Gilts	0.4 mg/kg	IM	Can repeat in 24 hours
Meloxicam (Oral)	Piglets	0.4 – 0.6 mg/kg	Oral	Piglets can readily clear
	Weaners/growers	0.4 mg/kg	Oral	Repeat daily for 3-5 days as atop dress or PO
	Sows/Gilts	0.4 mg/kg	Oral	Repeat daily for 3-5 days as atop dress or PO
Lidocam (Topical)	Piglets	1 mL/site	Topical	Tail base and scrotum
	Sows/Gilts	2-5 mL/site	Topical	Repeat daily as required
Horses				
NSAID	**Animal Type**	**Dose**		**Comment**
Flunixin (injection)	Mature	1.1 mg/kg	IV	Treat daily up to 5 days
Ketoprofen (injection)	Mature	2 mg/kg	IV	Treat daily up to 5 days
Meloxicam (Injection)	Mature	0.5 mg/kg	IV	Can repeat daily
Meloxicam (Oral)	Mature	0.6 mg/kg	Oral	Can repeat daily. Up to 45 days
	Foals	0.6 mg/kg	Oral	Can repeat twice a day. Up to 45 days

USE AND EFFICACY IN FOOD ANIMALS

Cattle

The largest amount of data on the use of NSAIDs has been provided for cattle (**Table 4**). Presently both beef and dairy cattle benefit from NSAIDs and where products have been registered for use for a variety of applications and there are a number of studies documenting the benefits.

Castration/dehorning/branding: Flunixin, ketoprofen and meloxicam all have been shown to reduce pain and inflammation in beef and dairy calves when administered before or at the time of castration/dehorning.[11,12,13,14] Dehorning is usually supplemented with lidocaine but the local anesthesia effect persists for only approximately 2 hours.[11,13] Oral meloxicam administration when calves are castrated/branded/vaccinated has been shown by Western Canadian beef producers to reduce stiffness, improve mothering and provided an additional 6-8 lbs in weaning weights.[14]

Diarrhea: The anti-endotoxin benefits of NSAID's has been used to treat calves with diarrhea. Regardless of etiology, calves with diarrhea often have increased coliform bacterial numbers in the small intestine. Small intestinal bacterial overgrowth is associated with altered function.[16] NSAID's should be considered as part of the initial treatment of calves with diarrhea and systemic illness.[17,18] No more than three NSAID treatments should be provided to avoid intestinal mucosal damage. It should also be combined with oral rehydration therapy.

Dystocia and downer cows: Mature beef and dairy cattle have also benefited from the use of NSAIDs. NSAIDs have been shown to be effective for controlling pain and inflammation associated with dystocias, downer cows, lameness and surgical procedures.[18,19,20]

Parturition in dairy cows: Recently oral meloxicam has been shown to increase milk production and reduce culling in dairy cattle when given at calving. It appears that treating cows at calving improves dry matter intake during the transition period which should reduce ketosis, hypocalcemia, mastitis and LDA.[20,22]

Undifferentiated respiratory disease: Ketoprofen, flunixin and meloxicam have been shown to reduce the morbidity and mortalities associated with undifferentiated respiratory disease in both dairy and feedlot calves.[23,24] It is believed that the benefits of NSAID use in long haul cattle is the reduction of stress. Solvet has been using oral meloxicam on veal calves when they are stressed associated with transportation, weaning and castrated/dehorned. This has resulted in a reduction in antibiotic treatments for respiratory disease.[15]

Mastitis: Ketoprofen, flunixin and meloxicam all have claims for the treatment of bovine mastitis. These NSAIDs act as anti-endotoxin and control pain and inflammation.[5]

TABLE 4. USE OF NSAIDS IN CATTLE

NSAID: F = Flunixin; K= ketoprofen; M = meloxicam; **Response:** B = behavioral; C = Clinical Disease; M = movement/musculoskeletal; F = Feeding G = Growth; L = Lactation; R = Reproduction

Procedure/Condition	NSAID's Used	Benefits	Procedure/Condition
Dehorning	F, K, M	B, M, G, F	Used with lidocaine
Castration	F, K, M	B, M, G, F	Both Surgical and Band castration
Branding	M	B, M, G, F	Movement improved, mothering, 6-8lbs weight gain
Vaccination	M	M, G, F	Reduces soreness at injection site
Dystocia	F, K, M	M, F	Reduces pain and inflammation
Normal Parturition	M	F, L, R	Reduced ketosis, mastitis, LDA; Increased milk production
Surgical	M	B, M, F, L	Reduces pain and inflammation
Lameness	F, K, M	B, M, F, G	Musculoskeletal, footrot
Downer	M	C, M	Reduces pain and inflammation
Respiratory Disease	F, K, M	C, G	Use to prevent and treat respiratory disease in feedlot cattle
Stress	F, K, M	C, G	Use with transportation, weaning and surgical procedure stress
Diarrhea	F, K, M	C	Use with oral electrolytes
Mastitis	F, K, M	C, M	Anti-toxin and pain benefits

Sheep and Goats

NSAIDs have been used in goats and sheep but there is little published literature. Extrapolation from the use in cattle has appeared to be useful. The duration of efficacy is not as long in sheep and goats so repeat treatments may be required. In Canada meloxicam is registered for controlling pain and inflammation in sheep. NSAIDs are an effective supplement to local or general anesthesia for controlling post-surgical pain associated with dehorning in goats and sheep. Vaccination is particularly hard on lambs and kids and meloxicam has been observed to improve nursing behavior and mobility following this procedure.[15]

TABLE 5 USE OF NSAIDS IN SHEEP AND GOATS

NSAID: F = Flunixin; K= ketoprofen; M = meloxicam; **Response:** B = behavioral; C = Clinical Disease; M = movement/musculoskeletal; F = Feeding G = Growth; L = Lactation; R = Reproduction

Procedure/Condition	NSAID's Used	Benefits	Comments
Dehorning	F, K, M	B, M, G, F	Used with lidocaine
Castration	F, K, M	B, M, G, F	Band and surgical. Use with lidocaine
Tail Docking	F, K, M	B, M, G, F	Observed with lambs with MOS
Vaccination	M	B, M, G, F	Lack of stiffness observed with MOS
Mastitis	F, K, M	C	Treats pain and swelling
Diarrhea	F, K, M	C	As with calves
Lameness	F, K, M	M	

PIGS

Castration and tail docking in piglets: Ketoprofen, flunixin and meloxicam are registered for use in pigs for inflammation, pyrexia and lameness. Canadian Codes of Practice require that both short term and long- term pain control are provided for castration of piglets. This will shortly be applied for tail docking. Currently there are no registered products for castration or tail docking in piglets but injectable and oral meloxicam are used.[25] Injectable meloxicam has been mixed with injectable iron but this should be avoided as it has been shown the meloxicam is inactivated in the combination. AVL/Solvet has recently developed a topical lidocaine (4%) /meloxicam (0.3%) which is called Lidocam. This combination when applied to the scrotum and tail base provides local anesthesia within 15 minutes and local analgesia for over 24 hours. Treated piglets have shown to have increased body weights after 14 days.[15] Lidocam has also been used in sows with crate sores and recently in cattle with open wounds (e.g. dehorning). Lidocam is effective in treating pain in open wounds within seconds.[15]

Post-farrowing pain and piglet performance: The pain caused by farrowing may substantially modify the normal behaviour of sows during and after parturition which affects production performance of sow and piglets. Meloxicam when provided post-farrowing has shown that the sows are more active, have increased DMI and water intake. Consequently, sows produce more milk, enabling a higher daily weight gain and lower piglet mortality in the first week.[26,27,28] Pain and stress are known causative factors in reduced milk production and mastitis.

Postparturient disease complexes: Postpartum Dysgalactia Syndrome (PPDS) and Mastitis Metritis-Agalactiae syndrome (MMA): Postparturient disorders (MMA or PPDS) are common (13%) and economically important. Although metritis often is a part of the syndrome, mastitis is the central symptom. PPDS is seen almost exclusively within the first 3 days after farrowing. NSAID's address three major issues: Endotoxemia, Inflammation caused by the pathogenic bacteria and stress caused by the illness, parturition and interventions. Post-Partum treatment of sows and gilts with meloxicam has reduced the incidence and severity of post-parturient disease complex.[29,30,31]

Lameness: Lameness is common and impacts performance and reproduction. Lameness is caused by injuries and by infections (e.g. Mycoplasma). Ketoprofen, flunixin and meloxicam have all shown beneficial effects in treating sows, boars and growers/weaners.[32] Oral meloxicam has been shown to be highly palatable in weaners, growers and guilts/sows. This provides the opportunity to top dress feed for post-partum sows and pens of weaners/growers with arthritis (e.g. Mycoplasma). NSAIDs have been used to treat arthritis in boars and gilts/sows and is given to downer pigs.

TABLE 6 USE OF NSAIDS IN PIGS

NSAID: F = Flunixin; K= ketoprofen; M = meloxicam; **Response:** B = behavioral; C = Clinical Disease; M = movement/musculoskeletal; F = Feeding G = Growth; L = Lactation; R = Reproduction

Procedure/Condition	NSAID's Used	Benefits	Comments
Castration	M, K, F	B, G	Do not mix with Iron dextran. Topical Lidocam provided short and long- term pain control.
Tail Docking	M, K, F	B, G	Do not mix with Iron dextran. Topical Lidocam provided short and long- term pain control.
Dystocia	M, K, F	B, L	Should treat daily for 3-5 days
Post Farrowing Pain and piglet performance	Oral Meloxicam	F, G, L, R	Feel better, Increase DM intake, Increase, feed time, Increased Piglet IgG, Increased weaning weights. Prevent MMA, PPDS. Should treat daily for 3-5 days
MMA/PPDS	M, F	B, C, L, F	Used to treat and prevent
Downer	M, K, F	C, M	Used to get pigs up
Crate Sores	M	C	Lidocam applied to wounds
Lameness	M, K, F	M	Used on growers (e.g. mycoplasma); sows and boars

HORSES

Horses are not traditionally thought as a food animal but a significant proportion are slaughtered in Canada. Horses have traditionally been treated with NSAIDs for musculoskeletal disease using phenylbutazone but these horses should never enter the food chain. Horses are held in feedlots for over 190 days before slaughter to ensure that there is no detectable residue in the meat. AVL is undergoing the registration of oral meloxicam with a meat withdrawal for horses and this is currently under review. Oral meloxicam has been shown in Alberta studies to be effective in controlling pain and inflammation in castrated horses.[33] Ketoprofen and Flunixin are approved for treatment of musculoskeletal disorders using intravenous or intramuscular injection however both oral and injectable meloxicam have been shown to be effective.[34] In the horse intramuscular injection with an NSAID should be avoided as significant swelling may occur.

TABLE 7 USE OF NSAIDS IN HORSES

NSAID: F = Flunixin; K= ketoprofen; M = meloxicam; **Response:** B = behavioral; C = Clinical Disease; M = movement/musculoskeletal; F = Feeding G = Growth; L = Lactation; R = Reproduction

Procedure/Condition	NSAID's Used	Benefit	Comments
Castration	M	B, M	Reduced swelling and decreased pain
Musculoskeletal	K, F, M	M	Controlled acute and chronic lameness
Colic	K, F, M	C	Response to colic. Used for E. coli toxemia

MILK AND TISSUE RESIDUES

Meloxicam, ketoprofen and flunixin can be used in some animals as tissue and milk as Maximum Residue Limits (MRL's) have been established. Minor species (goats, sheep, bison,

elk, horses) require the NSAID is below the detection limit. Phenylbutazone should never be given to any food animal that is intended for the food chain. To address this issue, AVL/Solvet is currently registering oral meloxicam for horses in Canada using European MRL's. Table 8 provides the withdrawal times based upon labels, cgFarad and research for different animal tissues and milk.

TABLE 8 WITHDRAWAL TIMES OF NSAID'S

Based upon registration, cgFarad and Research results. hrs = hours; d = days; NW = no withdrawal; NI = not intended for food horses; N/A = not available.

Animal	Cattle		Pigs	Sheep/Goats		Horse	Bison	Elk
	Meat	Milk	Meat	Meat	Milk	Meat		
Ketaprofen Injection	24 hrs	NW	7 d			NIA		
Flunixin Injection	6 d	36 hr	13 d			NIA		
Flunixin Topical	13 d							
Meloxicam Injection	20d	96 h	5d	11	NIA	NIA		
Meloxicam Oral	35d	96 h	5d	35d	144h	21 d	TBD	TBD
Lidocam			21d					

ENVIRONMENTAL CONSIDERATIONS

Environmental safety must be considered when pharmaceutical products are provided to large food animals. The use of NSAIDs in food animals is an example of the importance these safety considerations. The use of the NSAID, diclofenac, in food animals in Africa and India has resulted in a >95% reduction in the population of vultures.[35,36,37,38] Birds are very susceptible to renal toxicity of certain NSAIDs and a small meal from a treated animal that dies can be fatal to a scavenger bird.[37,38] The population decline and toxicity of the large vulture was relatively easy to monitor but we do not know the effects on other birds that feed on the carrion of dead animals. It has been shown that flunixin, ketoprofen and phenylbutazone have similar toxic properties to birds as diclofenac.[37,38] Surprisingly, meloxicam has been shown to be safe for birds and it is extensively used by zoo veterinarians for treatment of various conditions without toxic side effects. Veterinarians and producers using flunixin, ketoprofen and phenylbutazone should consider safe disposal methods of recently treated animals to protect adverse environmental effects. In Alberta and Canada birds like vultures, eagles, hawks, owls and ravens are frequently observed feeding on food animal carcasses.

CONCLUSIONS

NSAIDs now provide veterinarians and producers the tools to control pain and inflammation under a wide variety of clinical and management conditions. They can also be used as a adjunct for treatment of respiratory disease and diarrhea. Veterinarians and producers will certainly expand the applications of NSAIDs as they become more widely used in food animals.

DISCLAIMERS

In October 2015 Meloxicam Oral Suspension was approved for sale in Canada by Solvet/Alberta Veterinary Laboratories as a New Drug. Dr. Merle Olson, the presenter and author of the paper is the founder of Alberta Veterinary Laboratories/Solvet. The author has made all attempts to make is paper non-biased and present a fair and accurate assessment of all NSAID products available in Canada. It is the desire of AVL/Solvet that all food animals are provided a safe and effective product when they experience pain and inflammation.

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