Extralabel drug use in small ruminants

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In the present FARAD Digest, common medications used to treat small ruminants in the United States and FARAD-recommended WDIs following ELDU in small ruminants will be reviewed. For this digest, we use the term small ruminants to refer only to sheep and goats. In the United States, sheep and goats are considered minor species by the FDA and are therefore exempt from many of the rules used to regulate drug use in the major species (horses, cats, dogs, cattle, swine, turkeys, and chickens). From 2007 to 2012, the overall number of sheep and goats in production in the United States declined by 7.8% and 16.5%, respectively; however, the number of dairy goats increased by 23.5%.[1] Despite a decrease in the overall number of sheep and goats in production, FARAD has had a steady increase in the number of requests for information regarding WDIs following ELDU in small ruminants since 2007. The purpose of this digest is to update a previous FARAD Digest[2] concerning small ruminants and provide veterinarians with summary information regarding ELDU in small ruminants.

FDA-Approved Drugs for Sheep and Goats

In the United States, there are fewer FDA-approved drugs for minor species (such as sheep and goats) than for the major species. Currently, there are 70 and 25 FDA-approved drugs for domesticated and nondomesticated sheep and goats, respectively.[3]

ABBREVIATIONS

CPG	Compliance Policy Guide
ELDU	Extralabel drug use
FARAD	Food Animal Residue Avoidance and Depletion Program
IMM	Intramammary
VFD	Veterinary feed directive
WDI	Withdrawal interval
WDT	Withdrawal time

Information regarding FDA-approved drug dosages, WDTs for milk and meat following administration of an FDA-approved drug at the approved dosage, and established tolerance (ie, the drug or chemical concentration that the FDA deems safe for human consumption) for drug residues in meat and milk intended for human consumption can be accessed from the FDA Animal Drugs[3] and FARAD VetGRAM[4] websites. It is important to note that, when a drug is administered to a food animal species for which it is not approved, tolerances have not been established for acceptable residues of that drug or its metabolites in meat and milk obtained from treated animals, and detection of any drug residue in the meat or milk of treated animals marketed for human consumption is considered a violation and subject to regulatory action (ie, there is a zero tolerance for residues of that drug or its metabolites in meat and milk).

ELDU of medicated feeds for sheep and goats

The FDA prohibits extralabel use of medicated feeds in major species but not in minor species. The guidelines for extralabel use of medicated feeds in minor species are outlined in CPG 615.115.[5] That CPG does not establish legally enforceable responsibilities but does provide FDA field inspectors guidance regarding when to take regulatory action against veterinarians or producers following discovery of extralabel use of medicated feeds in food-producing animals. Extralabel use of medicated feeds in minor species must meet all stipulations for ELDU set forth by the AMDUCA[6] in addition to the guidelines outlined in CPG 615.115.[5]

In minor species, extralabel use of medicated feeds is limited to products approved by the FDA for administration in or on animal feed. A medicated feed is administered in an extralabel manner

when it is used for a minor species or for an indication not listed on the product label or when the FDA-approved WDT is extended. Medicated feeds can be administered only to minor species similar to those for which it is approved. In the case of sheep and goats, medicated feeds administered in an extralabel manner must be approved for use in other mammalian species. Extralabel use of a medicated feed in a minor species requires a written recommendation by a licensed veterinarian within the confines of a valid veterinarian-client-patient relationship and is limited to confined or farmed species for therapeutic purposes or when the health of the animals is threatened. Also, extralabel use of a medicated feed cannot be advertised by veterinarians, producers, or feed distributors.

When recommending extralabel use of an over-the-counter medicated feed, veterinarians need to provide the client with a written recommendation dated within 6 months of actual use of the product that includes the indication (diagnosis), drug, dose, duration of treatment, and WDI. The veterinarian should maintain a copy of the written recommendation and make it available to the FDA upon request. When recommending extralabel use of a VFD-medicated feed, veterinarians need to provide the client with a written recommendation dated within 6 months of actual use of the product that includes the indication, drug, dose, duration of treatment, and WDI. The veterinarian should maintain a copy of the written recommendation for a minimum of 2 years and make it available to the FDA upon request. The veterinarian must also complete a VFD form, and in the special instructions section include the species for which the medicated feed is intended, an appropriate WDI for extralabel use, and the following statement: "This VFD is being issued in accordance with CPG 615.115."[5]

Number of sheep and goat–related queries to FARAD

During the period from 2004 through 2017, FARAD received 23,688 queries for WDI recommendations following ELDU in various food animal species, and the percentages for each of those species were summarized **(Figure 1)**. The annual percentage of queries related to sheep and goats increased from 13% in 2004 to 25% in 2017. For both sheep and goats, queries to FARAD were most frequently prompted by ELDU of antimicrobials, anthelmintics, and other therapeutic drugs **(Figure 2)**. The 10 most common active ingredients for which WDIs were requested for sheep and goats in 2017 were summarized **(Table 1)**.

FARAD-recommended WDIs for drugs commonly used in an extralabel manner in sheep and goats

Several FARAD Digests have provided standardized WDIs for various drugs following ELDU in small ruminants.[2,7–9] Those WDIs, along with WDIs from this digest, were derived by FARAD on the basis of data that were available at the time **(Table 2)**. Also, FARAD-recommended WDIs often differ substantially from the WDTs for FDA-approved drugs following administration in accordance with the label directions. When species-specific pharmacokinetic data are unavailable for a particular drug, FARAD will not provide a standardized WDI but will provide as much information as possible with a cautionary statement that the recommendation is based on limited or extrapolated data. Veterinarians are encouraged to contact FARAD for WDIs, even for products for which FARAD has traditionally not been able to recommend WDIs, because new data may have become available in the intervening period.

Amprolium—To our knowledge, amprolium is not approved for use in sheep or goats in the United States or any other country. However, it is frequently used in small ruminants for the treatment of coccidiosis, despite the fact that scientific studies regarding the incidence or duration of amprolium residues in the meat or milk of treated sheep and goats are lacking. Owing to the lack of data for small ruminants, FARAD encourages veterinarians to submit a WDI request because new data may become available in the future that necessitates updated recommendations.

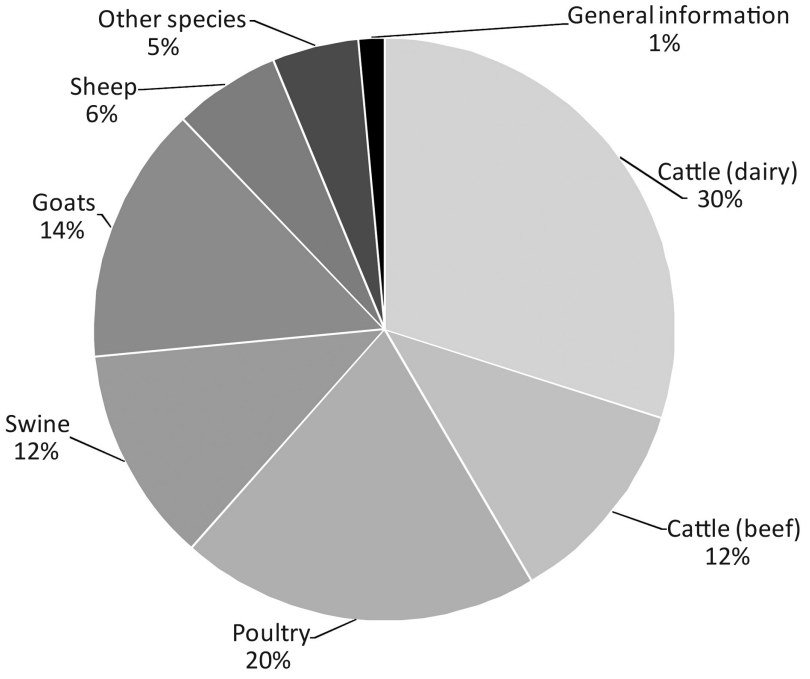

Figure 1—Pie chart that depicts the percentage of queries (n = 23,688) submitted to FARAD between January 1, 2004, and December 31, 2017, by species.

Ceftiofur—Ceftiofur is a third-generation cephalosporin. Currently, there are 3 FDA-approved ceftiofur formulations (ceftiofur sodium, ceftiofur crystalline-free acid, and ceftiofur hydrochloride) available for use in veterinary species in the United States. The FDA strictly prohibits ELDU of cephalosporins in all major food-producing species (cattle, swine, chickens, and turkeys), but minor species such as sheep and goats are excluded from that prohibition.[52] The AMDUCA requires that a drug containing the desired active ingredient and approved for use by the FDA in the species of interest must be used first unless the veterinarian judges the approved drug to be clinically ineffective[6] or unavailable. Ceftiofur sodium is approved for IM administration in sheep and goats and has a 0-day WDT for both meat and milk when used in accordance with the FDA-approved label. Therefore, FARAD recommends that ceftiofur sodium be used for sheep and goats whenever possible to comply with AMDUCA.

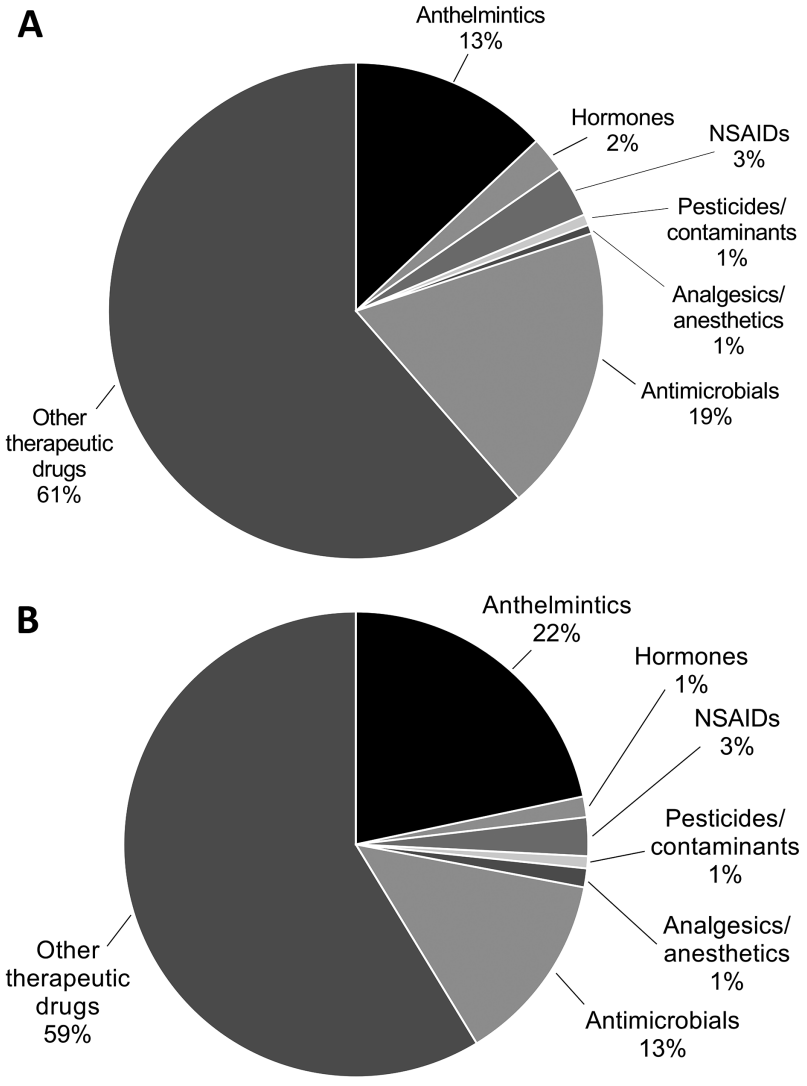

Figure 2—Pie charts that depict the percentage of WDI queries submitted to FARAD between January 1, 2004, and December 31, 2017, on the basis of specific drug classes and contaminants in sheep (A; n = 1,398 total queries) and goats (B; 3,359).

Ceftiofur crystalline-free acid is an extended-release formulation that is approved by the FDA for use in cattle. The FDA-approved WDTs (meat, 13 days; milk, 0 hours) for cattle are based on the drug being administered SC in the base of an ear in accordance with the label directions. Ears are discarded at slaughter as are any drug residues that may be present in the ear tissues. When ceftiofur crystalline-free acid is administered SC at a location other than the base of an ear, it can diffuse into the underlying muscle, thereby increasing the risk for violative tissue drug residues. The pharmacokinetics of ceftiofur crystalline-free acid in sheep and goats have been described in multiple studies,[53–55] but those studies did not include any data re-garding depletion of tissue drug residues. Consequently, veterinarians should submit a request to FARAD for a recommended WDI whenever ceftiofur crystalline-free acid is administered to sheep and goats.

Scientific pharmacokinetic and tissue drug residue data for ceftiofur hydrochloride in small ruminants are sparse. The ceftiofur concentration in milk and serum following IMM administration of ceftiofur hydrochloride to healthy goats was evaluated in 1 study.[56] However, because the goats of that study were healthy, veterinarians should contact FARAD for a WDI

Table 1—The 10 drugs for which FARAD most frequently received WDI requests for sheep and goats in 2017.

Drug	No. of WDI requests for sheep	No. of WDI requests for goats
Flunixin meglumine	29	49
Tulathromycin	26	42
Florfenicol	24	42
Oxytetracycline	17	31
Penicillin G procaine	15	23
Ceftiofur hydrochloride	14	17
Ceftiofur crystalline-free acid	13	19
Meloxicam	11	27
Amprolium	9	16
Fenbendazole	8	26

Table 2—Current FARAD recommendations for meat and milk WDIs for drugs commonly administered to sheep and goats in an extralabel manner.

			Sheep		Goat		
Drug	**Dose or dosage**	**Route**	**Meat WDI (d)**	**Milk WDI (h)**	**Meat WDI (d)**	**Milk WDI (h)**	**Reference No.**
Acepromazine	< 0.13 mg/kg	IV	7	48	7	48	8
	< 0.44 mg/kg	IM	7	48	7	48	8
Aspirin	All usual doses		1	24	1	24	9, 10
Fenbendazole	5 mg/kg, once	PO	28	—	6 (WDT)	120	11–14
Florfenicol	40 mg/kg, once	SC	42	—	70*	624* plus test	15
	20 mg/kg, q 48 h, twice	IM	60*	168* plus test	60*	168* plus test	16
Flunixin meglumine	2.2 mg/kg, once	IM	15*	96*	15*	96*	a
	2.2 mg/kg, once	IV	10*	72*	10*	72*	a
Ivermectin	0.2 mg/kg	PO	—	—	11	144	17–19
	0.2–0.4 mg/kg	PO	—	—	14	216	19–21
	0.2 mg/kg	SC	—	—	35	960	22, 23
	0.5 mg/kg	Topical	—	—	—	168	19
Ketamine	< 2 mg/kg	IV	3	48	3	48	8, 24, 25
Ketoprofen	3.3 mg/kg, q 24 h X 3 doses	IV, IM	7	24	7	24	9, 26–30
Lidocaine with epinephrine	Local infiltration	Epidural	1	24	1	24	2, 8, 31–33
Meloxicam	1 mg/kg, once	PO	15*	—	15*	—	a
Moxidectin	0.2 mg/kg	PO	—	—	14	—	17, 34–36
	0.5 mg/kg	PO	—	—	23	—	7
Long-acting oxytetracycline	20 mg/kg, once	SC	35*	144* plus test	35*	144* plus test	37, 38
Thiopental	< 5 mg/kg	IV	1	24	1	24	8, 39–42
Tulathromycin	2.5 mg/kg, once	SC	—	—	34	1,080* plus test	43–46
Xylazine	0.016–0.1 mg/kg	IV	5	72	5	72	8, 47, 48
	0.05–0.3 mg/kg	IM	10	120	10	120	8, 47, 49, 50
Yohimbine	< 0.3 mg/kg	IM	7	72	7	72	8, 51

"Plus test" indicates that FARAD recommends testing the milk from treated animals to ensure it is free of residues of the parent drug and drug metabolites before it is marketed for human consumption.

*Recommendation based on limited data; veterinarians are encouraged to submit a WDI request to FARAD each time this drug is used in an extralabel manner in the event that new data become available.

— = Insufficient data currently available for FARAD to recommend a WDI.

To convert mg/kg to mg/lb, divide by 2.2.

recommendation when ceftiofur hydrochloride is administered to small ruminants. Also, owing to the lack of data regarding drug residue depletion in milk, it is advised that the milk of small ruminants treated with ceftiofur in an extralabel manner be tested for residues of the drug before it is marketed for human consumption.

Fenbendazole—In the United States, fenbendazole is approved for the removal and control of stomach worms (*Haemonchus contortus* and *Teladorsagia circumcincta*) in nonlactating goats at a dose of 5 mg/kg (2.3 mg/lb), PO, with retreatment after 4 to 6 weeks, if necessary. The FDA-approved WDT for meat is 6 days following administration in accordance with the label directions, but a WDT for milk has not been established. Fenbendazole is approved for use in lactating goats at a dose of 5 mg/kg, PO, with a withdrawal period of 24 hours and 35 days in Australia and New Zealand, respectively, for milk.[57,58] Milk residues following PO administration of fenbendazole at a single dose of 5 mg/kg to goats have been evaluated in 2 studies.[11,12] However, because fenbendazole is not approved by the FDA for use in lactating goats, the detection of fenbendazole residues in milk marketed for human consumption is considered a violation. On the basis of the collective data available, FARAD currently recommends a 5-day WDI for milk from goats treated with a single dose of fenbendazole (5 mg/kg, PO).

Fenbendazole is not currently approved by the FDA for use in sheep in the United States. It is approved for use in sheep in Australia, Ireland, New Zealand, and the United Kingdom at a dose of 5 mg/kg, PO, with withdrawal periods for meat that vary from 10 to 28 days.[57-60] Fenbendazole residues deplete the slowest in the liver, which is the target tissue for goats and cattle in the United States. Liver tissue concentrations of fenbendazole in sheep following administration of a single dose of the drug (5 mg/kg, PO) have been evaluated in 3 studies.[11,13,14] On the basis of the results of those studies[11,13,14] and foreign approvals, FARAD currently recommends a 29-day meat WDI for sheep administered a single dose of fenbendazole (5 mg/kg, PO).

Florfenicol—Florfenicol is not approved by the FDA for use in sheep or goats in the United States. Nevertheless, FARAD commonly receives WDI requests following ELDU of florfenicol in small ruminants. Sheep and goats are frequently administered florfenicol consistent with the label dosages for cattle (ie, 20 mg/kg [9.1 mg/lb], IM, q 48 h twice or 40 mg/kg [18.2 mg/lb], SC, once). A few studies[61-66]

have evaluated the use of florfenicol in goats, but none include information regarding depletion of tissue drug residues. Currently, FARAD recommends a 60-day meat and 7-day milk WDI for goats administered 2 IM doses of florfenicol (20 mg/kg) separated by a 48-hour interval and a 70-day meat and 26-day milk WDI for goats administered a single SC dose of florfenicol (40 mg/kg); FARAD also recommends that the milk from all treated goats be tested and free of florfenicol and metabolite residues before it is marketed for human consumption. This is especially important after SC administration because results of a study[67] in cattle suggest that florfenicol residues remain detectable in milk for a prolonged period.

In the United Kingdom, florfenicol is approved by the European Medicines Agency for use in sheep at a dose of 20 mg/kg, IM, every 24 hours for 3 doses, with the volume per injection site not to exceed 4 mL and a meat withdrawal period of 39 days.[59] Currently, FARAD recommends a 60-day meat and 7-day milk WDI for sheep administered 2 IM doses of florfenicol (20 mg/kg) separated by a 48-hour interval; FARAD also recommends that milk of treated sheep be tested and free of florfenicol residues before it is marketed for human consumption. Given the limited number of published studies[61,68–70] involving IM administration of florfenicol to sheep and the lack of data regarding depletion of tissue drug residues, veterinarians are encouraged to contact FARAD for a WDI recommendation whenever florfenicol is administered by the IM route to sheep. Results of 1 study[15] indicate that the half-life of florfenicol in sheep is 10.3 days in liver, the target tissue for cattle, following SC administration of the drug. On the basis of calculations performed by means of the FDA tolerance limit method,[71] FARAD currently recommends a 42-day meat WDI for sheep administered a single SC dose of florfenicol (40 mg/kg).

Flunixin meglumine—For sheep and goats, requests for WDIs following ELDU of flunixin meglumine are the most common queries received by FARAD. Although multiple studies[72–76] have assessed the use of flunixin meglumine in sheep and goats, none have evaluated depletion of tissue drug residues. Because flunixin meglumine is not approved by the FDA for use in sheep and goats, the detection of flunixin meglumine residues in any sheep or goat product marketed for human consumption is considered a violation. The FDA considers NSAIDs, including flunixin meglumine, drugs of high regulatory concern, and food animal tissues and products (eg, milk) are commonly screened for NSAID residues. Currently, FARAD recommends a 15-day meat and 96-hour milk WDI for sheep and goats following IM administration of a single dose of flunixin meglumine up to 2.2 mg/kg (1.0 mg/lb) and a 10-day meat and 72-hour milk WDI for sheep and goats following IV administration of a single dose of flunixin meglumine (2.2 mg/kg). Because those recommendations are based on the limited data currently available and NSAIDs are drugs of high regulatory concern, veterinarians are encouraged to contact FARAD for WDI recommendations following ELDU of flunixin meglumine in small ruminants in the event that new information becomes available.

Combined florfenicol–flunixin meglumine formulation—A combined florfenicol–flunixin meglumine formulation is approved by the FDA for use in cattle but not small ruminants. It is labeled for SC administration and has a 38-day meat WDT; it is not approved for use in dairy cattle > 20 months old regardless of lactation status. Because the product is not approved for use in sheep and goats, the detection of drug residues in sheep and goat products marketed for human consumption is considered a violation. Moreover, because the product is labeled for SC administration, residues are likely to persist for a prolonged period at the site of administration. The FDA-approved WDT for cattle was dictated by the florfenicol component of the formulation. Veterinarians should contact FARAD for WDI recommendations when this formulation is administered to small ruminants.

Meloxicam—In the United States, meloxicam is not approved by the FDA for use in any food-producing species. In Canada, New Zealand, and Australia, meloxicam is approved for use in nonlactating sheep at a single dose of 1 mg/kg (0.45 mg/lb), SC, in the neck behind the ear, with an 11-day meat withdrawal period.[57,58,77] Because meloxicam is not approved for use in small ruminants in the United States, the detection of meloxicam residues in any sheep or goat product marketed for human consumption is considered a violation. Meloxicam is frequently administered orally to sheep and goats. The pharmacokinetics of meloxicam following oral administration to sheep[78] and goats[79–81] has been evaluated in only a limited number of studies. Currently, FARAD recommends a 15-day meat WDI following PO administration of a single dose of meloxicam (1 mg/kg) to small ruminants. Owing to the limited data available and the fact that NSAIDs are of high regulatory concern, veterinarians should contact FARAD for WDI recommendations whenever meloxicam is administered to small ruminants.

Oxytetracycline—Currently, there are no FDA-approved oxytetracycline products for parenteral use in sheep or goats. In 2017, the most frequent request FARAD received regarding oxytetracycline in both sheep and goats was for WDI recommendations following SC administration of long-acting formulations. Subcutaneous administration of oxytetracycline to sheep[38] and goats[37] has been evaluated in 2 studies. Currently, FARAD recommends a 35-day meat and at least a 6-day milk WDI for small ruminants following SC administration of a single dose of oxytetracycline (20 mg/kg). Intravenous and IM administration of oxytetracycline to sheep and goats is discussed further in a previous FARAD Digest.[82]

Penicillin G procaine—In the United States, multiple penicillin G procaine products are approved for IM administration to various food-producing species. Some of those products are available over the counter, whereas others are available only by prescription. In California, Senate Bill 27[83] prohibits the over-the-counter sale of medically important antimicrobials, and penicillin G procaine can be obtained only by a prescription from a veterinarian issued within the confines of a valid veterinarian-client-patient relationship. Penicillin G procaine products approved by the FDA for use in sheep have meat WDTs that vary from 8 to 9 days; milk WDTs have not been established for sheep. However, for most penicillin G procaine products, the label dose is generally considered ineffective, and the drug is often administered at doses 3 to 6 times the label dose, which is ELDU and necessitates the observation of extended WDIs. There are no penicillin G procaine products approved by the FDA for use in goats; thus, there is a zero tolerance for penicillin residues in goat products marketed for human consumption, and extended meat and milk WDIs are generally necessary. Owing to variation in dosing of penicillin G procaine in small ruminants in general, and the lack of pharmacokinetic data for goats in particular, veterinarians should contact FARAD for WDI recommendations following ELDU of penicillin G procaine in small ruminants. It is also advised that treated animals be screened for penicillin residues before milk or meat from those animals is marketed for human consumption.[84–88] Milk and urine samples from treated animals can be screened for penicillin residues at most veterinary diagnostic laboratories, and in-house (or on-farm) commercial test kits for screening milk[b] and urine[c] for β-lactams are available. In fact, the kit[b] used to screen milk for β-lactams has been validated for use in individual goats.[86] When administering penicillin G procaine to small ruminants, it is important that the vial or bottle be agitated well to ensure the contents are evenly suspended so that the correct dose is loaded into the syringe, that the drug be administered by the IM route, and that the volume injected per injection site is limited to that recommended on the label to minimize the risk for violative residues.

Tulathromycin—Results of multiple studies[42–45] indicate that the pharmacokinetics of tulathromycin following SC administration to goats is similar to the pharmacokinetics of tulathromycin for cattle. Currently, FARAD recommends a 34-day meat WDI for goats following SC administration of a single dose of tulathromycin (2.5 mg/kg [1.1 mg/lb]). Like all macrolides, tulathromycin persists for an extended period in the milk of treated animals.[89,90] For the lactating goats of 1 study,[89] tulathromycin residues were still detectable in milk 45 days after administration of a single dose of the drug (2.5 mg/kg, SC). Therefore, administration of tulathromycin to lactating animals is not recommended. Additionally, because tulathromycin is not approved for use in goats, it is important to remember that the detection of tulathromycin residues in goat products marketed for human consumption is considered a violation.

In the United Kingdom, tulathromycin is approved for use in sheep at a dose of 2.5 mg/kg, IM, once.[59] On the basis of WDI requests submitted to FARAD, it appears that sheep and goats are frequently administered the cattle dosage (2.5 mg/kg, SC, once) of tulathromycin. To our knowledge, only 1 study[91] has been published in which SC administration of tulathromycin was evaluated in sheep, and depletion of tissue drug residues was not assessed in that study. Because of the lack of published data regarding administration of tulathromycin to sheep, veterinarians should contact FARAD for WDI recommendations following ELDU of tulathromycin in sheep.

IMM drug formulations—Mastitis causes both physical and chemical alterations in the mammary glands and milk composition, and those changes can affect the distribution and elimination of drugs administered by the IMM route.[92] For IMM drug formulations, administration of the FDA-approved dose for cattle (ie, 1 tube/mammary gland) to sheep and goats results in a much higher dose on a milligram-per-kilogram basis than that achieved for cattle. Because of the size discrepancy between small ruminants and cattle, FARAD hypothesizes that milk residues of IMM-administered drugs may be prolonged in small ruminants relative to cattle, but to our knowledge, data to validate or refute that hypothesis are not currently available. Results of 1 study[93] indicate that, following IMM infusion of cefuroxime, cephalexin, or cloxacillin, drug elimination from milk was quicker in high-producing goats than in low-producing goats. A similar phenomenon has been described for lactating cattle.[94,95] In another study,[96] the duration of detectable milk drug residues varied greatly and was much longer than that for cattle when lactating dairy goats were administered a commercially available IMM antimicrobial in accordance with the label directions for dairy cattle. The investigators of that study[96] attributed differences in the duration of detectable milk drug residues between goats and cattle to factors such as differences in body size, milk volume, and extent of flushing within the mammary gland. Results of other studies[97–99] also indicate that stage of lactation and milk production contribute to drug elimination differences between small ruminants and cattle following IMM drug administration. However, results of another study[100] indicate that the milk discard time for goats was similar to that for cattle following IMM infusion of the cattle dose for each of 4 IMM antimicrobial formulations. Results of other studies[101,102] suggest that dairy sheep and goats receiving the cattle dose (1 tube/mammary gland) of a dry cow treatment immediately after the last milking before the dry period (ie, period before parturition during which female dairy animals [sheep, goats, and cows] are not milked) were at low risk for drug residues in milk following parturition, likely owing to the fact that the dry period of dairy sheep and goats is often longer than that for dairy cows. However, extrapolation of data from bovine studies in regard to IMM administration of

drugs in small ruminants may not be appropriate owing to interspecies differences and differences in the mastitis status of individual animals.[103,104]

Although the gross composition of caprine milk is similar to that of bovine milk, there are some differences that may affect the absorption, distribution, and elimination of drugs following IMM infusion. The composition of the casein and whey protein fractions of caprine milk differs from that of bovine milk, and caprine milk has a higher proportion of free fatty acids and smaller fat globules than bovine milk.[105] Additionally, milk is secreted by an apocrine process in goats and a merocrine process in cows; consequently, milk of healthy goats has a higher somatic cell count than the milk of healthy cows.[106] All of those factors can affect the pharmacokinetics of drugs following IMM infusion. Veterinarians are encouraged to contact FARAD for recommended WDIs following ELDU of IMM drug formulations in small ruminants.

Summary

The purpose of this FARAD Digest was to provide US veterinarians guidance regarding ELDU in small ruminants. The lack of FDA-approved drugs for sheep and goats frequently necessitates ELDU in those species. When the FDA approves a drug for use in a particular species, it establishes a tolerance for that drug in the various tissues or products (eg, milk or eggs) of that species that might be consumed by people. When a drug not labeled for use in a small ruminant is administered in an extralabel manner, there is a zero tolerance for residues of the parent drug or its metabolites in the edible tissues or products of treated animals, and detection of the parent drug or metabolites in any product marketed for human consumption is considered a violation and subject to regulatory action. Given the lack of tolerance and pharmacokinetic and tissue depletion data for many drugs administered in an extralabel manner to small ruminants, extended meat and milk WDIs are generally required to ensure that drug residues are undetectable. Veterinarians need to be cognizant of the requirements for legal ELDU in food-animal species to safeguard the human food supply while continuing to promote the health and welfare of small ruminants.

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Footnotes

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c. MeatSafe β-Lactam Test, Silver Lake Research Corp, Monrovia, Calif.

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