

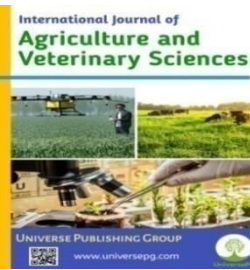


Publisher homepage: www.universepg.com, ISSN: 2663-7529 (Online) & 2663-7510 (Print)

<https://doi.org/10.34104/ijavs.022.086093>

International Journal of Agriculture and Veterinary Sciences

Journal homepage: www.universepg.com/journal/ijavs



Meloxicam is the Primary Choice of Analgesic for Dogs and Cats; A Cross-Sectional Clinical Study in Bangladesh

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ABSTRACT

A cross-sectional clinical survey was conducted on 262 veterinarian participants practicing in the Bangladesh with the aim of the current practice of pain management in dogs and cats. The veterinarians were interviewed physically or in online communication with a structured questionnaire. Demographic data of the veterinarians revealed that majority of them are young males and freshly graduated who use their academic knowledge during practice. Findings of the study also demonstrated that meloxicam is the primary choice of pain management in dogs 66.79% and cats 52.67%. Ketoprofen is the second most choice in both orthopedic and muscular injuries. Among the steroids and opioids categories, dexamethasone and tramadol are recorded respectively as first choice. Dexamethasone is the primary choice where pain is the worst. Usual duration of analgesic therapy recorded is less than three-days. In most cases, veterinarians suggest H2 blockers in association with meloxicam and ketoprofen to reduce adverse effects. Side effects following analgesic therapy observed are vomiting and diarrhea. The current study reviewed the present scenario of analgesics use in dogs and cats in Bangladesh. Further studies are required involving more participants, detailed information on cases, and response to analgesic therapy.

Keywords: Dog, Cat, Analgesics, Cross-sectional, Pain management, and Veterinarian.

INTRODUCTION:

Analgesics include NSAIDs (non-steroidal anti-inflammatory drugs), opioids, local anesthetics (LA), and centrally acting non-opioids, are used to relieve pain in animals. Meloxicam, ketoprofen, flunixin, metamizole, aspirin, and paracetamol are conventional NSAIDs prescribed for pain management following surgery or trauma. Availability, relatively long duration of action, and low-cost made the NSAIDs accessible for the veterinarians. However, vomiting, diarrhea, gastro-intestinal tract-ulcers, and hepatorenal toxicity limit their use in pets (Bostrom *et al.*, 2006). For example, paracetamol is not recommended at any dose in cats and dogs and can be fatal due to hepatotoxicity and methemoglobin formation (David,

2016; Roy, 2001; Walton *et al.*, 2017). Lidocaine and procaine are applied locally despite sometimes causing dizziness, headaches, blurred vision, and muscle twitching (David, 2016). Opioids include morphine, meperidine, butorphanol, tramadol, and others and are the most effective analgesics to relieve systemic pain in many species, although CNS effects like sedation, euphoria and excitement also occur (Newhouse, 1986). Dexamethasone, prednisolone, triamcinolone are commonly used steroids suggested in cases of severe and acute pain. Stomach ulcers, prolonged healing of wounds, suppression of thyroid hormone and immune suppression are typical side effects of long-term steroid medications (Donovan, 2017; Hunter, 2018; Morassi *et al.*, 2018).

Although side effects of analgesics are unavoidable, their effectiveness in managing pain is undeniable. However, appropriate selection of particular analgesics could mitigate adverse effects, considering types of tissue damage, animal species, severity of pain, dosage, and length of use (Mathews, 2000; Pascoe, 2000). The attitudes of veterinarians towards post-operative analgesic therapy in dogs and cats have been studied in Canada (Dohoo *et al.*, 1998; Dohoo & Dohoo, 1996), the United States (Hansen & Hardie, 1993; Hellyer *et al.*, 1999; Wagner & Hellyer, 2000), the United Kingdom (Capner *et al.*, 1999), Finland (Raekallio *et al.*, 2003), France (Hugonnard *et al.*, 2004), and Australia (Watson *et al.*, 1996). However, most of the studies reported that the usage of analgesics was mainly during perioperative periods, and there is a lower tendency of analgesic use in non-surgical cases (Capner *et al.*, 1999; Hansen & Hardie, 1993; Hellyer *et al.*, 1999; Hugonnard *et al.*, 2004; Pascoe, 2000; Raekallio *et al.*, 2003; Wagner & Hellyer, 2000; Gammada *et al.*, 2022; Watson *et al.*, 1996).

The veterinarian's understanding of the severity of pain perceived and their concerns about the risk of adverse reactions of analgesics is one of the key factors given for limited usage (Dohoo & Dohoo, 1996). In Bangladesh, there are an increasing trend of household pet dogs and cats for companionship and security purpose. It is now common for owners to bring injured animals to local veterinary clinics and surgical procedures including ovariohysterectomy and castration are increasingly being requested. Post-operative pain management is essential but challenging. However, there are limited reports on the types of analgesics recommended by veterinarians in Bangladesh. Therefore, the present study was designed to investigate the current practice of analgesics and their uses, doses, side-effects in dogs and cats in Bangladesh.

MATERIALS AND METHODS:

Veterinarians practicing on companion animals in Bangladesh were invited to participate in the current study. The key questions during interviewing the participants were focused on analgesic therapy in small animals after surgery and injury.

Setting

The survey was conducted between January and April 2019. The participants were mostly based in Chattogram, the South - eastern region of Bangladesh. UniversePG | www.universepg.com

des. However, participants from throughout the country were recruited under the study.

Participants

A total of 262 registered veterinarians who had a minimum Bachelor degree on Veterinary Science were interviewed.

Data measurement

The data of the current study was from the registered or record book maintained in the veterinary clinics. Other data was collected from the participants' practical experiences directly provided by them.

Bias

Only a few veterinarians who practice in a hospital or clinic have records of pain medication. Others have responded to the interview from their routine practice and memory. Therefore, the chances of bias cannot be ignored.

Quantitative variables

Information on analgesic therapy was collected using a formulated questionnaire. Maximum questions were close ended for the veterinarian's convenience with a few open-ended questions. The questionnaire solicited data in two key areas: (i) information about the veterinarians themselves and their practice and (ii) information about their use of analgesics. Other information collected included: veterinary school attended, year of graduation which was used to determine the type of analgesic used and the individuals' source of knowledge on analgesic use. Data was collected about their use of nine NSAIDs including flunixin, meloxicam, ketoprofen, metamizole, salicylic acid, aspirin, paracetamol, ibuprofen, and diclofenac sodium; two steroids dexamethasone and prednisolone; and three opioids butorphanol, meperidine, and tramadol. An open option was used to record the use of any other analgesics. Furthermore, veterinarians were questioned which analgesic they use frequently, types of cases (medical, surgical) and types of tissue injuries treated (skeletal, muscular, or soft tissues).

Participants were invited to score severity of pain on a scale of '0' for 'no pain' to '10' for 'worst pain'. This has been used to assess analgesic choice in different perceived pain levels. Histamine-2 (H2) blockers are frequently used to prevent NSAID-induced mucosal damage (Tuskey & Peura, 2013). Data on H2 blockers was also recorded in this study. Post-medication side effects were recorded to identify the safest analgesic for pain management. All the

data mentioned above were collected by the investigators completing the structured questionnaire during a physical interview or telephone call.

Statistical methods

Confirmation of normal distribution of data sets was established using D'Agostino & Pearson normality test in Graph Pad Prism 8 statistical software. The data sets from different groups that passed D'Agostino & Pearson normality test was compared and tested using one-way ANOVA or t-test. Non-parametric Kruskal-Wallis tests and Mann-Whitney tests were performed to compare data that weren't normally distributed. Specific test used are written in the figure legends. A p value of ≤ 0.05 was considered significant.

RESULTS:

Demographic data of the participants

Total 262 licensed veterinarians were interviewed across the country via face-to-face, telephone or email interview. The respondents had different opinions on analgesic therapy. This study found that young male veterinarians aged less than 40 years (Table 1) in Bangladesh still dominate the pet practice landscape. The majority of respondents received their undergraduate veterinary science qualifications from Chattogram University of Veterinary and Animal Sciences (CVASU), however, some reported the Bangladesh Agricultural University (BAU) and other universities. Most veterinarians reported that textbooks, drug literature and the internet were their key sources of up-to-date information.

Table 1: Demographic data of veterinarian participants.

Parameters		Distributions (%)
Gender	Male	71
	Female	29
Age (years)	< 40	69
	> 40	31
Years since graduation	< 10	60
	> 10	40
School of education	CVASU	61
	BAU	22
	HSTU	9
	SAU	8
Source of knowledge	Text books	70
	Drug literature	19
	Internet	11

CVASU: Chattogram Veterinary and Animal Sciences University, BAU: Bangladesh Agricultural University, HSTU: Hajee Mohammad Danesh Science & Technology University, SAU: Sylhet Agricultural University.

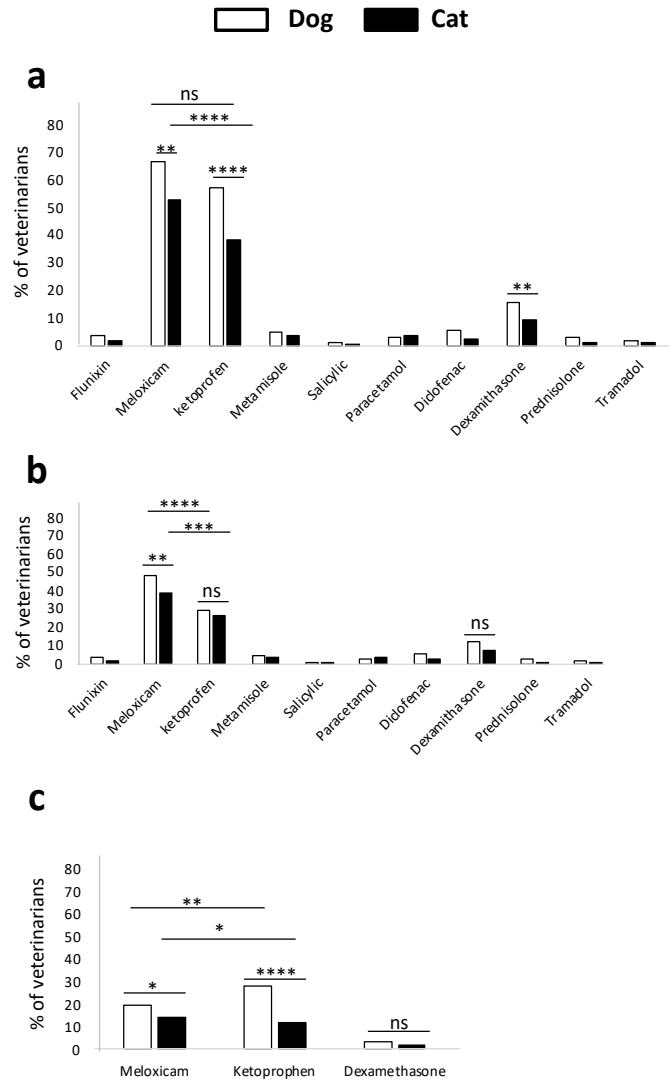


Fig. 1: Overall analgesic therapy in dogs and cats.

Meloxicam is the most prescribed analgesic, followed by ketoprofen and dexamethasone, whereas flunixin, salicylic acid, and tramadol are the least used (a). The situation remains unchanged in medicinal (b) and surgical (c) cases. Statistical analysis by Mann Whitney test except dexamethasone (c) which was analysed by unpaired t test. $p^* < 0.05$, $** < 0.01$, $*** < 0.001$, $**** < 0.0001$, ns: not significant.

Use of analgesics

The cumulative analgesic therapy was analyzed (Fig. 1a). Meloxicam was found as the most frequently suggested analgesic followed by ketoprofen. Meloxicam, ketoprofen, and dexamethasone were more commonly used in dogs compared to cats. Overall, these three medications most commonly suggested in both medical (Fig. 1b) and surgical (Fig. 1c) cases. The least commonly used pain relief medications were flunixin, metamizole, salicylic acid, paracetamol, diclofenac sodium, prednisolone, and tramadol.

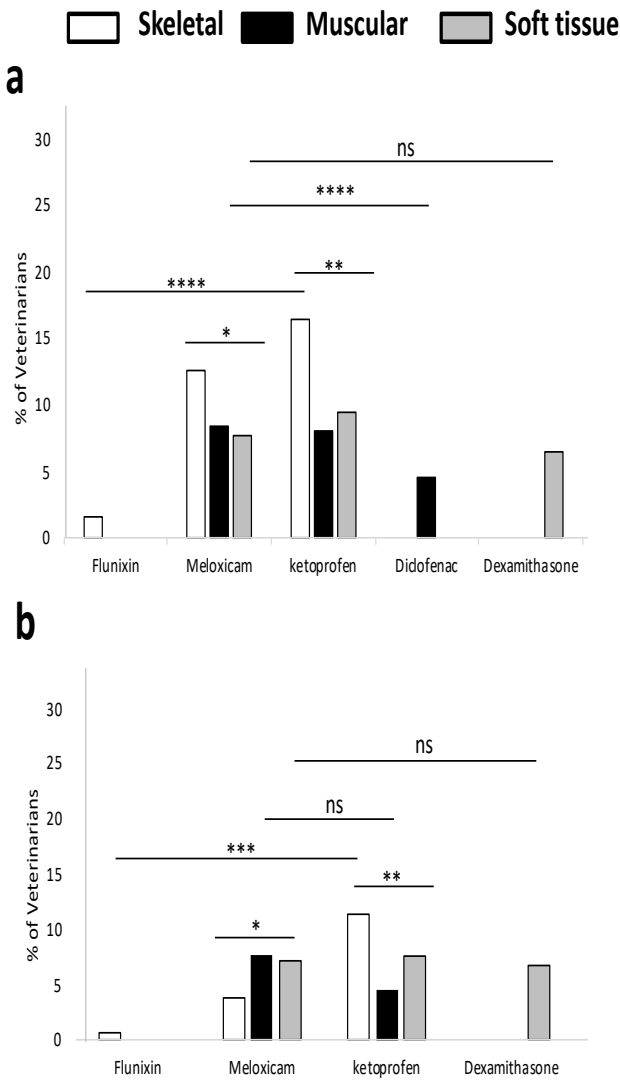


Fig. 2: Analgesic therapy in different tissue injuries. Different analgesics used in skeletal, muscular, and soft tissue injuries are presented in dogs (a) and cats (b). In dogs, ketoprofen was used in most of the skeletal tissue injuries, followed by meloxicam (a). Both the drugs were used approximately equally for muscular and soft tissue injuries. However, in cats, meloxicam was used in most of the muscular and ketoprofen was used for skeletal tissue injuries (b). Statistical analysis by Kruskal-Wallis test except muscular (b) which was analysed by Mann Whitney test. $p < 0.05$, $** < 0.01$, $*** < 0.001$, $**** < 0.0001$, ns: not significant.

Analgesic uses against different degrees of pain

Ketoprofen was the only analgesic used for pain relief irrespective of the severity according to our current study. Dexamethasone was suggested when the pain was acute and severe (Fig. 3a). Moderate pain symptoms were treated with ketoprofen followed by meloxicam. Some veterinarians suggested ketoprofen even when there were no pain symptoms.

Side-effects of analgesics

Vomiting was commonly observed side-effect following analgesic medication (Fig. 3b). Vomiting and diarrhea were the major side-effects reported following meloxicam and ketoprofen medication. Other side-effects recorded were in appetite to anorexia, indigestion and bloating.

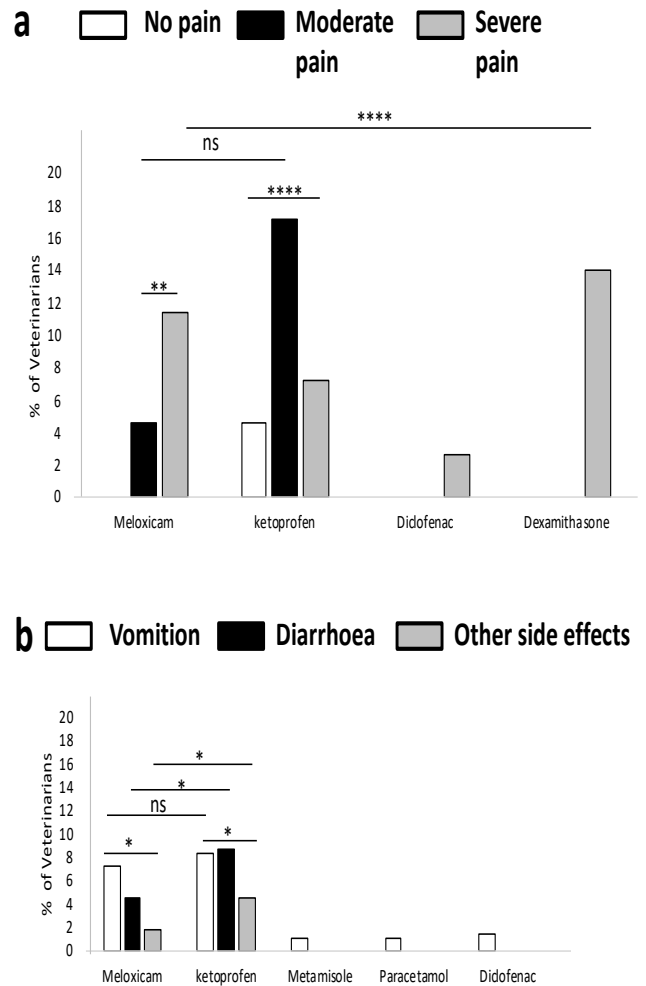


Fig. 3: Observed side-effects following administration of analgesics. Dexamethasone was commonly suggested during severe pain, followed by meloxicam (a). However, the cases with moderate pain were treated with mostly ketoprofen. Vomiting and diarrhoea were the most frequently observed side effects during meloxicam and ketoprofen medication (b). Moreover, vomiting was noticed during metamizole, paracetamol, and diclofenac sodium medication. Statistical analysis by Kruskal-Wallis test (Ketoprofen a, Meloxicam and Ketoprofen b), Mann Whitney test (Meloxicam a, Vomition of Meloxicam and Ketoprofen b) and unpaired t test (Diarrhoea of Meloxicam and Ketoprofen, and Others). $p < 0.05$, $** < 0.01$, $**** < 0.0001$, ns: not significant.

Duration of analgesic therapy

In dogs (Fig. 4a) and cats (Fig. 4b), a three-day schedule with ketoprofen, meloxicam, and dexamethasone was followed by most veterinarians. Three or >3-days of treatment were prescribed for the less frequently used analgesics: paracetamol, prednisolone and tramadol. Flunixin and diclofenac used for variable durations.

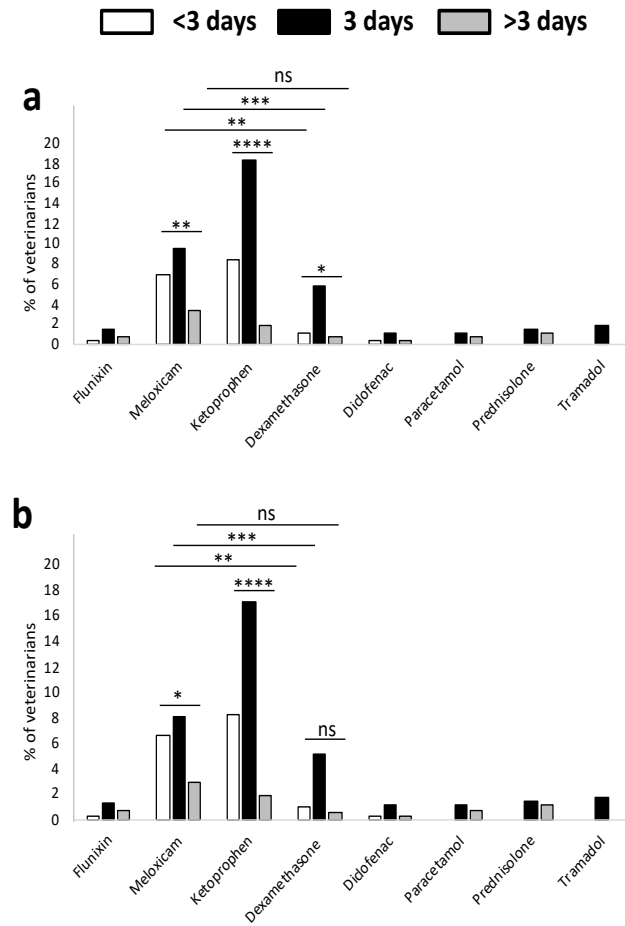


Fig. 4: Duration of analgesics used. In dogs, a schedule of three days was suggested with meloxicam, ketoprofen, & dexamethasone (a). The scenario was similar in cats (b). However, paracetamol, prednisolone, & tramadol suggested for ≥3-days. Statistical analysis by Kruskal-Wallis test except >3 days of b which was analysed by ANOVA. p* < 0.05, ** < 0.01, *** < 0.001, **** < 0.0001, ns: not significant.

Analgesic used in association with H2 blockers

Histamine (H) 2 blockers are used to minimize side-effects of analgesics. The present analysis revealed that many veterinarians used H2 blockers, along with meloxicam, ketoprofen, flunixin, diclofenac sodium, and tramadol (Fig. 5). The veterinarians were not used to prescribe H2 blockers when prescribed metamizole, salicylic acid, paracetamol, and dexamethasone.

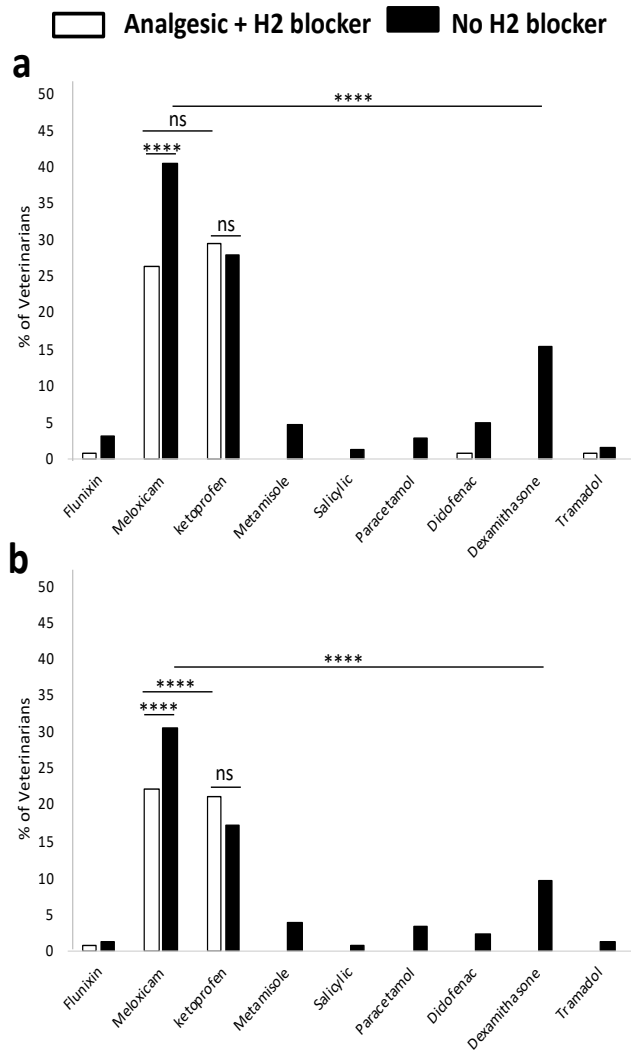


Fig. 5: Analgesic and H2 blocker therapy. H2 blockers were used in dogs (a), and cats (b) in association with analgesics are presented. Most cases were treated with meloxicam without H2 blockers, whereas approximately 50% of the veterinarians used it during ketoprofen (a). The veterinarians were not used to suggest it during medication with metamizole, salicylic acid, paracetamol and dexamethasone (a, b). Statistical analysis by Mann Whitney test except H2 blocker used or not used in Meloxicam, Ketoprofen and Dexamethasone of a and b which were analysed by Kruskal-Wallis [test. p**** < 0.0001, ns: not significant.

DISCUSSION:

Analgesics are used to combat pain when it is severe and unbearable. Analgesics also prescribed during perioperative periods. Different analgesics have specific actions on different tissues and the length of pain relief needed. Although not all analgesics are free from side-effects, they are frequently prescribed in pet dogs and cats as pain relief. However, it is worth knowing the analgesics are used for specific

cases of tissue injuries for effective pain management by minimizing the side effects. The present study aimed to investigate the current analgesics used in pet dogs and cats for pain management by registered veterinarians in Bangladesh. It was observed that young male veterinarians with <10 year experience dominate small animal practice. This differs significantly from developed countries like Canada (Hewson *et al.*, 2006). Older and experienced veterinarians were practicing on farm animals or poultry. Most veterinarians interviewed had graduated from Chattogram Veterinary and Animal Sciences University, followed by Bangladesh Agricultural University. This result might be biased however, as the present study was based in the Chattogram region. The study also revealed that maximum veterinarians use their academic knowledge during prescribing analgesics rather than drug information leaflets and the internet. Inappropriate drug literature provided by manufacturers and insufficient internet facilities may explain this preference. The study results revealed that meloxicam and ketoprofen were the first and subsequent choices among NSAIDs, followed by dexamethasone as steroid and tramadol as opioids. The drugs were used mostly in medical cases, however, meloxicam, ketoprofen, and dexamethasone were also used in surgical cases, which were like the trends in France and Brazil (Lorena *et al.*, 2014).

The least prescribed analgesics were flunixin, metamizole, Salicylic acid, and prednisolone. In South Africa, most commonly used analgesics are flunixin meglumine followed by phenylbutazone with the least common are aspirin, pethidine, ibuprofen, xylazine, and meloxicam (Hugonnard *et al.*, 2004; Joubert, 2001). Although paracetamol and diclofenac sodium are not routinely used in dogs and cats as they are toxic and cause serious illness, a few veterinarians suggest these drugs in different medical conditions. Lack of awareness or ignorance about paracetamol poisoning in dogs and cats may explain this practice. In the present study, meloxicam and ketoprofen were most prescribed analgesics for skeletal, muscular, and soft tissue injuries. This is partially consistent with Brazilian and Colombian veterinarians who mostly prescribe tramadol among opioids and meloxicam among NSAIDs (Morales-Vallecilla *et al.*, 2019). Several other studies in different countries reported similar trends of analgesic therapy in different orthopedic and soft tissue sur-

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geries (Deneuche *et al.*, 2004; Hewson *et al.*, 2006; Hugonnard *et al.*, 2004; Lafuente *et al.*, 2005; Leece *et al.*, 2005). However, the situation is different in North American and European surveys, where butorphanol and/or buprenorphine appear to be the most popular opioid (Capner *et al.*, 1999). Difference in drugs might be due the availability and response to treatment perceived by the veterinary practitioners. The present study also revealed that majority of the veterinarians prescribes dexamethasone when pain is most severe. Supporting to this result, Hermeto *et al.* (2017) reported that epidural dexamethasone injection with lignocaine considerably prolongs postoperative analgesia after ovariohysterectomy in dogs. Dexamethasone has anti-inflammatory effects in acute cases of tissue damage. Most analgesics were used for three days, observed in the current survey.

Luna *et al.* (2007) reported that meloxicam has the minimum gut effects in long-term use than flunixin and ketoprofen. Alves *et al.* (2018) also reported effective management of chronic back pain in dogs using dexamethasone up to four months. However Joubert, (2001) recommended a single application of analgesics to minimize side effects. In another study, Varrassi *et al.* (2017) suggested tramadol in managing more severe pain in different tissue injuries. Selection of analgesics and prescription for short- or long-term usage might be dependent on the species, physiological condition and types of tissues involved. However, long term effect of longer duration analgesic therapy needs to be investigated. Histamine (H)-2 blockers are used to prevent adverse effects of NSAIDs and treatment of peptic ulcer disease and its complications (Lukas, 2018; Savarino *et al.*, 2018; Scally *et al.*, 2018). Our survey indicates that none of the veterinarians used this drug when prescribing metamizole, Salicylic acid, paracetamol, diclofenac sodium, and tramadol. This contrasts with Hunt *et al.* (2015) who clearly stated that H2-blocker should be suggested to mimic the side-effects of NSAIDs. Diarrhea and vomiting were recorded as the most observed side-effects following meloxicam and ketoprofen medication and diarrhea after metamizole, paracetamol, & diclofenac sodium medication. Monteiro-Steagall *et al.* (2013) reported similar results in dogs in 35 studies. However, Luna *et al.* (2007) reported gastrointestinal bleeding in dogs following long-term medication with carprofen, etodolac, flunixin meglumine, ketoprofen, & melo-

xicam. Other mid-term and long-term unprecedented sequelae need to be investigated.

CONCLUSION:

The current study revealed that meloxicam is the most suggested analgesic for pain management in small animal practice irrespective of tissues injured, followed by ketoprofen. However, dexamethasone is the primary choice when pain is severe. The 3-days course of analgesic therapy and H2-blockers co-therapy is a rational practice in dogs and cats. It is also decent and sensible practice to be aware of potential adverse effects of each analgesic. Results of this study might be useful for the veterinarians and pet owners in selecting appropriate pain relief. However, extensive study involving the representative veterinarians from around the country would better signify the national scenario. Veterinarians should impose ultrasonography and endoscopy to monitor adverse effects on gastrointestinal tract. And most importantly, veterinarians are suggested to get constant updates of new possibilities with insignificant side effects. Journal articles, conference presentations and proceedings, case reports are important sources of updated information on analgesic therapy.

ACKNOWLEDGEMENT:

The authors acknowledge the participated veterinarians interviewed.

CONFLICTS OF INTEREST:

The authors declare no conflict of interest.

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Citation: Das DK, Zinnurine S, Sarkar ER, and Sikder S. (2022). Meloxicam is the primary choice of analgesic for dogs and cats; a cross-sectional clinical study in Bangladesh. *Int. J. Agric. Vet. Sci.*, **4**(5), 86-93.
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