

COMPARATIVE INJECTABLE ANESTHETIC PROTOCOLS IN DUCKS

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ABSTRACT

This study was performed to compare the effect of five mixtures of anesthetic protocols in thirty adult domestic ducks of local breed. The birds were randomly divided into five groups; six ducks for each group. In group 1; a combination of medetomidine and ketamine (M-K), (100 µg and 20 mg/kg) drugs were used. While in group 2; a combination of xylazine and ketamine (X-K), (5 mg and 20 mg/kg) were used. For group 3; a combination of acepromazine and ketamine (Acp-K), (2 mg and 20 mg/kg) were used, and in group 4 and 5, combinations of xylazine-ketamine-diazepam (X-K-D) (5 mg; 20 mg and 5 mg/kg), xylazine-ketamine and acepromazine (X-K-Acp), (5 mg; 20 mg and 2 mg/kg), respectively were used. All the used drugs combinations were given via intramuscular route at the pectoral muscle. The time onset of loss of righting reflex was (2.6±0.5 mins), (1.6±0.5 mins), (1.1±0.3 mins), (1.0±0.1 mins) and (1.8±0.3 mins), respectively for a mean duration of time (51.3±7.5 mins), (55.0±2.0 mins), (48.8±7.5 mins), (56.3±4.3 mins) and (53.8±3.8 mins), respectively. While, the sedative effect started within (1.5±0.3 mins), (1.3±0.3 mins), (0.6±0.2 mins), (0.8±0.1 mins) and (1.3±0.3 mins), respectively. All the anesthetic combinations varied in producing proper anesthesia in the experimental ducks. The palpebral reflex was not abolished, and the eyes remained opened throughout the course of anesthesia with almost all the anesthetic combinations. Additional disadvantages accompanied administration of all 5 combinations were; persistent pedal movement, during the whole course of anesthesia. Muscle relaxation in the anesthetized birds in all 5 groups was poor, as seen clinically by the twisted necks and the contracted pedaled legs. A statistical difference ($p < 0.05$) was found in the onset of loss of righting reflex between group 1 (2.6±0.5), compared to group 3 (1.1±0.3) and group 4 (1.0±0.1). The combination of M-K (group 1), produced good analgesia that was found to be significantly better than with the other combinations. Variable differences at respiratory rate indices at the scheduled time were found between treatment groups. But, the respiratory rate of the birds in all anesthetic protocol groups was significantly decreased from the corresponding base line values (time 0), except in K-X-D combination (group 4), in which the decrease was only at 30 minutes after injection.

In conclusion the domestic ducks (*Anas platyhynchos*) was considered as difficult patients for anesthesia by the investigated anesthetic combinations given by intramuscular route, because none of the anesthetic regimen was effective for production of adequate anesthesia and analgesia in this species of the domestic birds.

مقارنة أنواع مختلفة من أدوية التخدير عن طريق الحقن بالعضل في البط

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الخلاصة

أجريت هذه الدراسة لمقارنة تأثير خمسة أنواع من مركبات الأدوية المخدرة في ثلاثون بطاً بالغة من النوع المحلي. قُسمت الطيور عشوائياً إلى خمس مجموعات، ضمت كل مجموعة ستة بطات. في المجموعة الأولى تم استخدام مزيج من المديتومدين والكيثامين وبجرعة (100 مايكرو غرام و 20 ملي غرام/كغم من وزن الجسم). بينما في المجموعة الثانية استخدم مزيج من الزيلازين و الكيثامين وبجرعة (5 ملي غرام و 20 ملي غرام/كغم من وزن الجسم). أما في المجموعة الثالثة، فقد تم استخدام مزيج من الاسبيرومازين و الكيثامين وبجرعة (2 ملي غرام و 20 ملي غرام/كغم من وزن الجسم). وفي المجموعة الرابعة كان المزيج المستخدم يتكون من الزيلازين و الكيثامين و الديازيبام وبجرعة (5 ملي غرام و 20 ملي غرام و 5 ملي غرام/كغم من وزن الجسم). كذلك كان الخليط المستخدم في التخدير في المجموعة الخامسة هو الزيلازين و الكيثامين و الاسبيرومازين وبجرعة (5 ملي غرام و 20 ملي غرام و 2 ملي غرام/كغم من وزن الجسم). في كل المجموع الخمس تم مزج الأدوية المختلفة مع بعضها و تم حقنها في العضلة الصدرية للبط. تم ملاحظة و تسجيل مختلف المراحل المصاحبة لحقن أدوية التخدير أو مضاعفاتها في البط، ومنها وقت حدوث فقدان منعكس وضع الجسم وكان (0.5±2.6) و (0.5±1.6) و (0.3±1.1) و (0.1±1.0) و (0.3±1.8) دقائق على التوالي في المجموع السابقة والذي استمر لفترة من الوقت (7.5±51.3) و (2.0±55.0) و (7.5±48.8) و (4.3±56.3) و (3.8±53.8) دقائق وعلى التوالي. بينما بدأ التأثير المسكن لهذه الخلطات المخدرة خلال (0.3±1.5) و (0.3±1.3) و (0.2±0.6) و (0.1±0.8) و (0.3±1.3) دقائق وعلى التوالي. كل أنواع الخلطات المخدرة المختبرة في هذه الدراسة اختلفت في إحداث التخدير الصحيح في البط. حيث لوحظ عدم اختفاء (زوال) منعكس الجفن مع بقاء العيون مفتوحة خلال كل مراحل التخدير المختلفة. إضافة إلى المساوي الأخرى التي رافقت استخدام هذه الخلطات المخدرة والمتمثلة باستمرار حركة الأرجل التوافقية الدواسة خلال فترات التخدير وعدم الارتخاء الكامل لعضلات الجسم و المتمثل سريرياً بالتواء الرقبة وتقلص عضلات الأرجل. كما لوحظ وجود فرق معنوي ($p < 0.05$) في فقدان المنعكس الخاص بتصحيح وضع الجسم بين المجموعة الأولى (0.5±2.6) مقارنة مع ما وجد في المجموعة الثالثة (0.3±1.1) والمجموعة الرابعة (0.1±1.0). ومن جهة أخرى نجد ان مزيج المديتومدين و الكيثامين المستخدم في المجموعة الأولى أعطى تسكين جيد (فقدان الشعور بالألم) وكان الأفضل معنوياً من بقية الأنواع الأخرى. وعلى الرغم من تسجيل الاختلافات المتنوعة في معدلات التنفس البط في الأوقات المسجلة أثناء التجارب وفي كافة المجموع، غير انه لوحظ وبشكل عام حدوث انخفاض معنوي لمعدل التنفس في الطيور في هذه الدراسة مقارنة بالوقت صفر، عدا في ما شوهد في المجموعة الرابعة (زيلازين - كيثامين - ديازيبام) حيث ان الانخفاض في معدل التنفس حدث في الوقت 30 دقيقة من زمن الحقن.

تم الاستنتاج من هذه الدراسة بأن البط المحلي الداجن صعب التخدير بأنواع المزيج من أدوية التخدير المستخدمة في هذه الدراسة و المعطاة عن طريق الحقن بالعضل، وذلك لعدم الحصول على تخدير ذي مواصفات مقبولة سريريا من نوم وتسكين وإرخاء لعضلات الجسم يسمح بأجراء فحص أو تداخل جراحي في هذه الطيور أثناء أحداثه.

INTRODUCTION

Since along period, domestic (tame) birds are considered as useful animals for the uses of various human activities. Their economic importance is indispensable; as well as its importance in the fields of scientific and practical experiments. It is known to the researchers that their response to the pain less than the mammalian species (1). Despite all that, lots of researches and studies are made to know the best ways and methods to lessen pain during surgical interference in addition to scientific and researching benefits. Thus different methods were used in anaesthesia of mammalian and bird species, where we find that some researchers preferred using inhalation anaesthesia as the best method in birds as they are available to the advantages to reduce pain, rapid induction and recovery especially when inhalant anaesthetics of low blood/gas solubility are used and easier control of anaesthetic depth (2).

Certain surgical procedures, such as tracheal resection may warrant the use of inhalation anesthesia regardless of whether or not an anaesthesia machine is available (3). Advantages of injectable anaesthetic agents include; rapid administration, low cost and minimal equipments (4). Injectable anesthetics used in birds include; barbiturates, chloral hydrate, alpha chloralose, phenothiazine, dissociatives α_2 – adrenergic agonists, alphaxalone/ alphadolone and propofol (4, 5). Data collected on an injectable anaesthetic using a pigeon may not be directly transferable to another species of bird. Nevertheless, information collected on one avian species is likely to be better for extrapolation to another avian species than are data from mammalian species (4, 5).

Analgesia is more effective when provided before the painful stimulus. Combination of analgesics is more effective than using a single agent (6, 7 and 8). Dissociatives anesthetic agent such as Ketamine is rarely used alone because it is associated with poor muscle relaxation, muscle tremors, myotonic contractions, opisthotonus and rough recoveries (3, 9 and 10). Hence it is recommended that be combined with benzodiazepines or α_2 –adrenergic agonists to improve relaxation and depth of anaesthesia (5). And also α_2 -adrenergic agonist drugs are not recommended as single anesthetic or immobilization agent for birds (11).

Previous studies and researchers were found that anaesthesia in ducks differs to a great extent from other birds (4, 5).

The present work aimed to use five different anaesthetic protocols: medetomidine-ketamine; xylazine-ketamine; acepromazine-ketamine; xylazine-ketamine-diazepam; xylazine-ketamine–acepromazine; given by intramuscular route, to specially emphasize the quantity and the quality of the most effective and safe anesthetic combination for duck anaesthesia.

MATERIALS AND METHODS

Thirty adult healthy domestic ducks (*Anas platyhynchos*) were used in this study, mixed in sex; their age ranged from 8-12 months (10 ± 5.2 months) and their body weight were from 1-2 Kg (1.45 ± 4.3 Kg). The ducks were housed

domesticated, fed on grass and grain. The ducks were randomly divided into five groups; six per each group. The anesthetic protocols for each group were as following:

Group1: Combination of medetomidine* and ketamine** (M-K), (100 µg and 20 mg/Kg., B.W.).

Group2: Combination of xylazine*** and ketamine (X-K), (5 mg and 20 mg/Kg. B.W.).

Group3: Combination of acepromazine**** and ketamine (Acp-K), (2 mg and 20 mg/Kg., B.W.).

Group4: Combination of xylazine-ketamine and diazepam***** (X-K-D), (5 mg; 20 mg, and 5 mg/Kg., B.W.).

Group5: Combination of xylazine-ketamine and acepromazine (X-K-Acp), (5 mg; 20 mg, and 2 mg/Kg. B.W.).

All used combinations were given respectively by intramuscular route at the pectoral muscle.

Monitoring of effective analgesia and anesthesia were including assessment of the followings:

1. Minute assessments of the clinical changes observed on the ducks after administration of the drugs combination included: dropping of the wings and ataxia, loss of righting reflex, corneal reflex, loss of muscle tone of the limbs and loss of consciousness. Additionally, the recovery time as seen by signs of regaining of righting reflex and ability for standing and walking.

2. Respiratory rate (RR)/minute for each duck were measured by watching the frequency and degree of motion of the sternum.

3. Analgesia was assessed by duration of application of a noxious stimulus, using a device of Electric Stimulator type 100 (Bioscience Company, England), (12). The noxious stimulus was applied at 5, 15, 30, and 60 minutes after drug administration and was maintained until gross purposeful movements were seen or for a maximum of 5 seconds. The electrical stimulus was delivered to the bird's wing through an aluminum surface on the ends of the electrodes. A withdrawal response to either stimulus was recorded when the bird vigorously flinched its wings.

4. Responses to electrical stimuli were settled for baseline testing individually for each bird, as they were extremely variable, and the threshold to electrical stimulus was scored accordingly:

Present = baseline voltage current electrical stimuli value (control) (0).

Intermittent = voltage current value induced light electrical stimuli (±);

Slow = voltage current value induced slow electrical stimuli (+);

Absent = voltage current value induced no electrical stimulus (++)

5. The last two parameters (RR and analgesia) were measured for each duck from the base line (time 0) to 5, 15, 30, 45 and 60 minutes, after administration of the anesthetic drugs.

Data were statistically analyzed using one-way analysis of variance (ANOVA) followed by the Significant Difference Test. Frequency data were analyzed by Duncan Probability Test. The level of significance was at $P < 0.05$.

* Medetomidine HCl, 1 mg/ml, Domitor®; Orion Corporation, FARMOS, Turku, Finland; ** Ketamine HCl, 50 mg/ml, Holden Medical, Netherlands; *** Xylazine 2%, Sanofi Animal Health, France; **** Acepromazine HCl 2%, KELA Lab NV, Belgium; ***** Diazepam 10 mg/2 ml, The Arab Pharmaceutical Co., Ltd., Jordan.

RESULTS

Intramuscular injection of ketamine (20 mg/Kg) in combination with medetomidine (100 µg/Kg) or xylazine (5 mg/Kg) or acepromazine (2 mg/Kg) or xylazine (5 mg/Kg) and diazepam (5 mg/Kg) or xylazine (5 mg/Kg) and acepromazine (2 mg/Kg), in ducks induced loss of righting reflex, which was neither readily nor smoothly.

The time onset of loss of righting reflex was (2.6±0.5 mins), (1.6±0.5 mins), (1.1±0.3 mins), (1.0±0.1 mins) and (1.8±0.3 mins), respectively for a mean duration of time (51.3±7.5 mins), (55.0±2.0 mins), (48.8±7.5 mins), (56.3±4.3 mins) and (53.8±3.8 mins), respectively. While, the sedative effect started within (1.5±0.3 mins), (1.3±0.3 mins), (0.6±0.2 mins), (0.8±0.1 mins) and (1.3±0.3 mins), respectively (Table 1). After regaining the righting reflex, the ducks remained sedated for time duration ranged from 1.5-2 hours before full recovery was gained. All the anesthetic combinations were varied in producing proper anesthesia in the experimental ducks. The palpebral reflex did not abolish, and the eyes remained opened throughout the course of anesthesia with almost all the anesthetic combinations. Additional disadvantages accompanied administration of all 5 combinations were; persistent pedal movement, which was obvious as a continuous, slow paddling movement of both legs when birds were lying on their backs during the whole course of anesthesia. Muscle relaxation in the anesthetized birds in all 5 groups, was poor, as was seen clinically by the twisted necks either to one side or resting them on their backs in a contracted pattern, in addition to the contracted pedaled legs. A statistical difference ($p \leq 0.05$) was found in the loss of righting reflex between group 1 (2.6±0.5), compared to group 3 (1.1±0.3) and group 4 (1.0±0.1), (Table 1).

The combination of M-K (group 1), produced good analgesia (Absent), at 5, 15, 30, 45 and 60 minutes, after treatment in comparison with control group at the same times (Table 2). Additionally, the analgesic effects of this combination was found to be significantly better than the other combinations at ($p < 0.05$), i.e., X-K (group 2) at times 5 minutes (Intermittent) and 45 minutes (Slow), and Acp-K (group 3), at 15 minutes (Intermittent), 30 minutes (Slow), 45 minutes (Present) and 60 minutes (Intermittent), and X-K-D (group 4) at 5 minutes (Present) and 45 minutes (Intermittent), and with X-K-Acp (group 5), at 15 minutes (Intermittent), 30 minutes (Slow), 45 minutes (Intermittent), and 60 minutes (Intermittent), (Table 2). The combination of X-K (group 2), also produced good analgesia, but only at 15 minutes (Absent) and 45 minutes (Slow), after injection in comparison with control group at the same times (Table 2).

Variable differences at respiratory rate indices at the scheduled time were found between treatment groups. But, the respiratory rate indices of the birds in all anesthetic protocol groups was significantly decreased from the corresponding base line values (time 0), except in X-K-D combination (group 4), in which the decrease was only at 30 minutes after injection in comparison with its base line value, (Figure 1).

Table 1: Monitoring of effective anesthesia and analgesia after intramuscular injection of the five Anesthetic Protocols in ducks.

| Anesthetic protocols | The time onset (in minutes) for appearance of the signs of anesthetic, analgesic and recovery parameters | | | | | | |
|----------------------|--|-------------------------|-------------------|-------------------|-------------------|------------------------------|----------------------|
| | Dropping of Wings & Ataxia | Loss of righting reflex | Loss of conscious | Muscle relaxation | Paddling movement | Regaining of righting reflex | Ability for standing |
| M-K | 1.5± 0.3 a | 2.6±0.5 a | 3.4± 0.6 a | 4.1± 0.7 a | 23.5± 7.3 a | 51.3± 7.5 a | 55.5± 7.4 a |
| X-K | 1.3± 0.3 ab | 1.6±0.5 ab | 1.8± 0.5 b | 2.4± 0.4 a | 4.4± 1.6 b | 55.0± 2.0 a | 60.0± 2.0 a |
| Acp- K | 0.6± 0.2 b | 1.1±0.3 b | 1.6± 0.7 b | 7.5± 1.4 b | 42.5± 2.5 c | 48.8± 7.5 a | 56.3± 6.6 a |
| X-K-D | 0.8± 0.1 ab | 1.0±0.1 b | 1.6± 0.2 b | 7.0± 0.7 b | 9.0± 1.0 b | 56.3± 4.3 a | 73.8± 8.3 a |
| X-K- Acp | 1.3± 0.3 ab | 1.8±0.3 ab | 1.9± 0.4 b | 2.8± 0.6 a | 6.0± 1.4 b | 53.8± 3.8 a | 63.8± 2.4 a |

Values are mean ± SE; Different letters (a, b, and c) in the same column indicates significant differences between treatment groups (P < 0.05).

Table 2: The analgesia effect of the six anesthetic combinations in the experimental ducks

| Control | +5 | +15 | +30 | +45 | +60 |
|--------------------------|----------------------|----------------------|---------------------|-----------------------|---------------------|
| | 0 | 0 | 0 | 0 | 0 |
| M-K 20mg/Kg+100µ/Kg | 3.9±1.4 (++) * | 4.8±1.2 (++) * | 5.9±1 (++) * | 7.3±3.6 (++) * | 5.1±2 (++) * |
| X-K (20+5)mg/Kg | 1.4±0.5 (±) a | 3.7±1.4 (++) * | 2.9±0.9 (+) | 3.6±1.4 (+) * d | 2±1.2 (+) |
| Acp-K (20+2)mg/Kg | 1.8±1 (±) | 1.3±0.8 (±) b | 2.5±0.9 (+) c | 0.8±0.8 (0) d e | 1.5±1 (±) f |
| X-K-D (20+5+5)mg/Kg | 0.8±0.8 (0) a | 2.4±1 (+) | 2.8±1.5 (+) | 1.3±0.6 (±) D | 2.5±1.3 (+) |
| X-K-Acp (20+5+2)mg/Kg | 1.8±1.2 (±) | 1.5±1 (±) b | 2.4±1 (+) c | 1.3±1.3 (±) D | 1.3±1.3 (±) f |

The symbols indicates the scores for analgesia represented by the mean ± SE of voltage electric current induced pain in 6 ducks/ group.

Present= Voltage value of electric current induced pain (0) before drug injection (Control)

Intermittent= Voltage value of electric current induced light pain (±) after drug injection

Slow= Voltage value of electric current induced slow pain (+) after drug injection

Absent= Voltage value of electric current induced no pain (++) after drug injection

Different letters in the same column indicates significant differences between treatment groups (P< 0.05).

* The value significantly different from the control value (time zero), at P< 0.05

a The value significantly different from the M-K group at time +5, at P< 0.05

b The value significantly different from the M-K group at time +15, at P< 0.05

c The value significantly different from the M-K group at time +30, at P< 0.05

d The value significantly different from the M-K group at time +45, at P< 0.05

e The value significantly different from the M-K, and X-K groups, at time +45, at P< 0.05

f The value significantly different from the M-K group at time +60, at P< 0.05

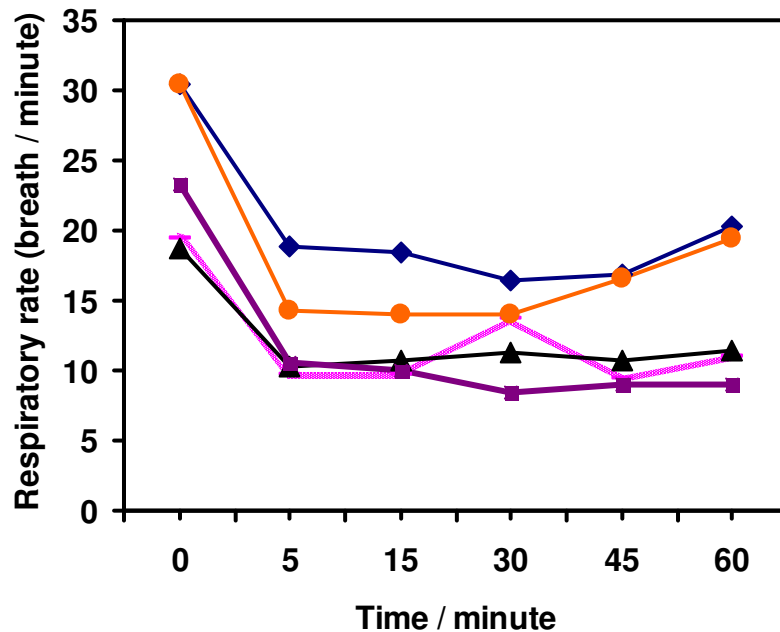


Figure 1: Showing the respiratory rate of the anesthetic birds
Respiratory rate in duck, anesthetized I.M. with combination of
◆ Ketamine (20 mg/Kg) + Medetomidine (100 µ/kg).
-- Ketamine (20 mg/kg) + Xylazine (5 mg/Kg).
● Ketamine (20 mg/kg) + Acepromazine (2 mg/kg).
▲ Ketamine (20 mg/kg) + Xylazine (5 mg/Kg) + diazepam (5 mg/kg).
■ Ketamine (20 mg/kg) + Xylazine (5 mg/Kg) + Acepromazine (2 mg/kg).
Each line presents the mean of 6 ducks.

DISCUSSION

Domestic ducks (*Anas platyrynchos*), as viewed from the present investigation, was difficult patients for anesthesia. The intramuscular anesthetic combinations used in the current procedures, seem to induce unsatisfactory anesthesia in the experimental ducks. The quality of anesthesia was particularly unsatisfactory because of the poor muscle relaxation observed throughout the course of anesthesia, as seen by the torticollis of the neck, and the continuing paddling movement of the legs, when the birds were losing their righting reflexes and laying on their backs. The paddling was either slowly or speedy and never ceased throughout the time when the birds were unconscious. The eyes remained open and the corneal reflex didn't lose with all combinations. In a comparable study (13), in Mallard ducks, various injectable anesthetics, including; xylazine, medetomidine, ketamine, midazolam, buterphanol, fentanyl, sufentanil, methohexital, alphaxalone-alphadolone and propofol, were investigated. None of the anesthetic regimen was effective when given by the intramuscular route. But, intravenous administration of some of the used anesthetic agents was found more effective, particularly ketamine (10 mg/mg dose)+medetomidine (50 µg/kg dose)+midazolam (2 mg/kg dose), combination that produced adequate duration of anesthesia and analgesia of a 30 minute duration.

It was also found that their use, induces 20 minutes duration of transient hyper tension, bradycardia, and apnea; decreased respiratory rate after induction occurred and resuscitation often required; and reversal produced with atipamezole, 0.25 mg, and flumazuil, 0.025 mg, i.v. Administration of intravenous propofol produced smooth, rapid induction and recovery, excellent muscle relaxation, and short duration of anesthesia (13, 14). Inhalant anesthetics, particularly with isoflurane, is currently the method of choice for anesthesia of pet birds (15), but propofol by intravenous injection offers several advantages over isoflurane for field use; equipment is easily portable, lower anesthetic cost (14).

Selection of the dose of Ketamine for bird's anesthesia usually depends on body weight, and its dosing follows the principles of allometric scaling, so that large birds (>1 kg) respond to 10-20 mg/kg, whereas small birds (< 50 grams) require much higher doses, e.g. 70-80 mg/kg (10). On this base, in this study the chosen dose was the maximum for use in birds. But, unexpectedly the outcome of anesthetic results was not fair, possibly because of the inter-species variability in response to Ketamine (10). Other studies used higher doses of ketamine in large birds. In chicken, ketamine (75 mg/kg) given intramuscularly followed 10 minutes later by diazepam (2.5 mg/kg) intravenously, induced slightly better qualities of anesthesia, when compared to those observed in ducks, in the present study, but even though the chickens did not reached surgical anesthesia (9). Ketamine administration brought on a tranquilized state, arousal from which elicited excitation; pain reflexes remained and handling brought on muscle contractions or tremor; diazepam administration after 10 minutes deepened the tranquilized state but did not reach a surgical plane of anesthesia; heart rate was significantly decreased during the anesthetized period (9). Xylazine plus ketamine combinations have been evaluated in several avian species, blood pressure becomes elevated, heart rate is decreased, and hypoxemia, hypoventilation, and hypercapnia occur (16, 17). Others were noticed that the use of ketamine (10-50 mg/kg, i.m.) and diazepam (0.5-2.0 mg/kg, i.m. or i.v.) in pet birds show, less cardiac depressant effect than a combination of ketamine/xylazine, and concluded it as a good choice for very sick birds, but only if isoflurane anaesthesia is not available (18). While the use of ketamine (2 mg/kg, i.m.) and medetomidine (80 µg/kg, i.v.) in Ostriches induces profound sedation and sternal recumbency in 6/8 birds, two birds were moderately sedated but remained standing; provided immobilization; reversed with atipamezole (after propofol anesthesia was discontinued) (19).

In ducks, others were found that combination of medetomidine, midazolam and ketamine was unsafe for use, as it caused respiratory depression, and apnea followed by a fatal decrease in heart rate, and blood pressure. The drug associated changes was primarily attributed to the medetomidine (19, 20), because, ketamine when given alone to ducks was not associated with pulmonary depression, but drug-associated respiratory depression after i.v. administration of xylazine or xylazine-ketamine combination was resulted (21). In the present study, neither medetomidine, or xylazine, or Acp, or xylazine-Acp, and finally xylazine-diazepam, in combination with ketamine was fatal when administered to the experimental ducks, although drug-associated respiratory depression as reflected by the decreased respiratory rate of the anesthetic ducks in all groups was a

significant phenomenon from the corresponding base line values (time 0) of the experimental ducks (Fig. 1).

The significantly increased threshold values to noxious electrical stimulus, mainly during M-K combination and partially with X-K combination throughout the one hour course of assessment of analgesic effects in our ducks, in comparison to the provided analgesia response of the birds with the other anesthetic combination protocol (Table 2), was expected. Because both medetomidine and xylazine, are well known as an excellent enhancement for production of muscular relaxation, analgesia and sedation particularly when combined with ketamine (5).

We concluded that the domestic ducks (*Anas platyrynchos*) can not be anesthetized effectively by the investigated anesthetic combinations given by intramuscular rout, because none of the anesthetic regimen was effective for production of adequate anesthesia and analgesia in this species of domestic birds.

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