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# EFFECT OF QUINALDINE SULFATE, CLOVE OIL AND TRICAINE METHANESULFONATE ANESTHESIA ON PHYSIOLOGICAL, BIOCHEMICAL PARAMETERS AND MORTALITY OF NILE TILAPIA (*Oreochromis niloticus)*

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***Abstract***

The present study was carried out to evaluate and compare between the Quinaldine Sulfate, Clove Oil and tricaine methanesulfonate (MS-222) anesthetics and their effect on Nile tilapia (*Oreochromis niloticus*). After anesthesia, plasma glucose, cortisol, cholesterol (CHOL) and triglyceride (TGL), AST, ALT, total protein, uric acid and creatinine were measured and they are stress responses in the Nile tilapia (*Oreochromis niloticus*) and modulation of these responses by quinaldine sulfate, clove oil and MS-222 anesthesia. There were dose-related increases in plasma levels of glucose, cortisol, cholesterol (CHOL) and triglyceride (TGL), AST, ALT, total protein, uric acid and creatinine due to stress responses in the Nile tilapia (*Oreochromis niloticus*) after 24 and 48 hrs. with continuous exposure to quinaldine sulfate, clove oil and tricaine methanesulfonate. Results showed that there was a significant difference between values of glucose, cortisol, cholesterol (CHOL) and triglyceride (TGL), AST, ALT, total protein, uric acid and creatinine in each treatment in compare to control group. Clove oil, quinaldine sulfate and MS-222 make changes in serum glucose, cortisol, cholesterol (CHOL) and triglyceride (TGL), AST, ALT, total protein, uric acid and creatinine levels in Nile tilapia (*Oreochromis niloticus*). and there is significantly higher circulating in the glucose, cortisol, cholesterol (CHOL) and triglyceride (TGL), AST, ALT, total protein, uric acid and creatinine levels after exposure to clove oil, quinaldine sulfate and MS-222 than control group. All fish in the present study were died in the control group but 30 % of fish that exposed to clove oil were died and 55% of fish exposed to quinaldine were died but 70 % of fish exposed to MS-222 were died. On the other hand, the recovery times in the groups that treated with clove oil 7-9 min., quinaldine 6-8 min. and MS-222 anesthesia is 5-7 min. respectively. The results showed that Physiological and biochemical parameters of Nile tilapia (*Oreochromis niloticus*) are affected by different concentrations of quinaldine sulfate, clove oil and MS-222

anesthesia. Histological examination of the fish following anaesthesia revealed sporadic ectasia in gill lamellae 24 h after anaesthesia in of fish. No histopathological changes were demonstrated in liver. Results of the examinations suggest that the use of quinaldine sulfate, clove oil and MS-222 does not cause irreversible damage in Nile tilapia. The clove oil is better than quinaldine sulfate and MS-222 anesthesia to Nile tilapia (*Oreochromis niloticus*).

**Key words:** quinaldine sulfate, clove oil, MS-222, biochemical profile, histology.

## INTRODUCTION

The use of an anesthetic for fish to attenuate the physiological response to stress (Nomura *et al.,* 2009). Many chemical anesthetics have been used in fishery research, including MS-222, clove oil and quinaldine sulphate, (Ortuno *et al.,* 2002; Small, 2003 and Kiessling *et al.,* 2009). MS-222 and clove oil are the two most widely used anesthetic chemicals in fishery research (Boyer *et al.,* 2009 and Shi *et al.,* 2009). Clove oil is derived from *Syzygium aromaticum* (Eastern Hemisphere) or *Eugenia caryophyllata* and *Eugenia aromaticum* (Western Hemisphere), and contains three main components: eugenol, eugenol acetate and caryophyllene (Rahimi *et al,* 2012). Anaesthetics are used to immobilize fish by inhibiting their central and peripheral nervous systems. In aquaculture transportation and blood sampling (Wagner *et al.,* 2003 and Weber *et al.,* 2009). Clove oil is a pale yellow liquid derived from the leaves and has been shown to be safe for humans. Therefore, present information indicate clove oil may be the best anaesthetic for use in commercial aquaculture. Therefore, many studies have focused on the effects of MS-222 or clove oil on immobilization and recovery times (Small, 2003), swimming performance and cardiovascular function (Hill and Forster, 2004). Clove oil need a longer recovery time after anaesthesia (Prince and Powell, 2000, Wagner *et al.,* 2003 and Zahl *et al.,* 2009). Some studies found that MS-222 or clove oil affect blood biochemical parameters, including glucose (Davis and Griffin, 2004), cortisol (Wagner *et al.,* 2003). Presently, it is one of the most important cultured sturgeon species, producing caviar in China and around the world (Shi *et al.,* 2009). Blood parameters, such as cortisol, glucose, lactate, pH, hematocrit, etc.

(Atanasoff, 2016). MS-222, clove oil and quinaldine sulphate (Small, 2003 and Kiessling *et al.,* 2009). Depressing central and peripheral nervous systems in fish. In aquaculture, blood sampling, surgery, vaccination, and so on (Wagner *et al.,* 2003 and Weber *et al.,* 2009). Also, attenuate the physiological response to stress (Nomura *et al.,* 2009). In fishery research and aquaculture practice (Shi *et al.,* 2009). Also, consumed by humans (Pirhonen and Schreck, 2003). Clove oil is also safe for humans. The recovery should occur within 5 min after placing the fish in clean water and anesthetics may potentially alter blood biochemistry and affect the accuracy of sampling (Boyer *et al.,* 2009). Histological examination of the fish following anesthesia revealed sporadic ectasia in gill lamellae 24 hrs. after anesthesia in of fish. No histopathological changes were demonstrated in liver. Results of the examinations suggest that the use of quinaldine sulfate, clove oil and MS222 does not cause irreversible damage in Nile tilapia. The aim of this study was to show effect of quinaldine sulfate, clove oil and MS222 on physiological and biochemical parameters during transportation of Nile tilapia.

## MATERIALS AND METHODS

Nile tilapia (*Oreochromis niloticus*) were obtained from Central Laboratory for Aquaculture Research, Abbassa, Abo-Hammad, Sharkia, Egypy. The fish were transferred to the physiology Laboratory and reared indoors in 1m width and 5m length and 0.8m depth fiberglass tanks filled with about 3000 L of dechlorinated tap water, and aerated by air stones. Water temperature, pH and dissolved oxygen were 25 ± 0.7°C, 7.4 ± 0.2 and 6.1 ± 0.5 mg L)1, respectively. *Oreochromis niloticus* (average weight of 100 ± 5 g and mean total length of 20 ± 1 cm. Fish were exposed to different concentrations of 50, 100, and 200 ppm of quinaldine sulfate, 20, 40 and 80 ppm of clove oil and 100, 150 and 200 ppm of MS-222 respectively and different time 24 and 48 hrs. respectively these concentrations were added during transportation of Nile tilapia *(Oreochromis niloticus)* and kept in plastic bags at 25°C. Each plastic bag includes 12 L of dechlorinated water and 10 fish Nile tilapia *(Oreochromis niloticus)*. Blood samples were taken from caudal vein after 24 and 48 hrs. Blood samples were evaluated 24 and 48 hrs. after anesthesia with quinaldine

sulfate, clove oil and MS-222 anesthesia. Plasma glucose, cortisol, cholesterol (CHOL) and triglyceride (TGL), AST, ALT, total protein, uric acid and creatinine were determined by spectronic.

**Histological examination of tissues.**

For histological examination of tissues of Nile tilapia after blood sampling, samples of gills and liver were taken for histological examinations. The samples taken were immediately fixed in 10% formaldehyde, drained and embedded in paraffin. Sections were made of the paraffin blocks and stained with haematoxylin-eosin.

**Data analysis.**

Statistical analysis was performed using one-way analysis of variance (ANOVA). The results were processed with software Statistica. All results were presented as mean and standard error of the mean (Mean±SE). The statistical significance of parameters was determined in the T test at $P<0.05$.

## RESULTS

The present study carried out to evaluate and compare between the the effect of quinaldine sulfate, clove oil and MS-222 anesthesia and select the best one for uses in aquaculture. The effect of quinaldine sulfate, clove oil and MS-222 (50, 100, and 200 ppm of quinaldine sulfate, 20, 40 and 80 ppm of clove oil and 100, 150 and 200 ppm of MS-222 respectively) and different time 24 and 48 hrs. respectively on ALT activity was lower in the 100 ppm and 200 ppm of quinaldine sulfate and 150 and 200 ppm of MS-222 than 50 ppm of quinaldine sulfate and 100 ppm of MS-222 group, which was highly significant than the control group. Also, ALT activity was lower in the 20 ppm, 40 ppm and 80 ppm of clove oil group, which was no significant than the control group. But, AST activity increased when the fish exposed to 50, 100, and 200 ppm of quinaldine sulfate, 20, 40 and 80 ppm of clove oil and 100, 150 and 200 ppm of MS-222 respectively) and different time 24 and 48 hrs. compared to control group (Tables 1, 2 & 3). Also, AST activity was lower in the 100, and 200 ppm

of quinaldine sulfate and 150 and 200 ppm of MS-222 than 50 ppm of quinaldine sulfate and 100 ppm of MS-222 group, which was highly significant than the control group. AST activity was lower in the 20 ppm of clove oil than 40 ppm and 80 ppm of clove oil group, which was highly significant than the control group. Glucose concentrations in the fish exposed to quinaldine sulfate, clove oil and MS-222 anesthesia concentrations was lower in the 100, and 200 ppm of quinaldine sulfate, 40 ppm and 80 ppm of clove oil and 150 and 200 ppm of MS-222 than 50 ppm of quinaldine sulfate, 20 ppm of clove oil and 100 ppm of MS-222 group, which was highly significant than the control group. Level of cholesterol and triglycrides in the fish exposed to quinaldine sulfate, clove oil and MS-222 anesthesia concentrations were lower in the 100, and 200 ppm of quinaldine sulfate, 40 ppm and 80 ppm of clove oil and 150 and 200 ppm of MS-222 than 50 ppm of quinaldine sulfate, 20 ppm of clove oil and 100 ppm of MS222 group, which was highly significant than the control group (Table 1, 2 & 3). Cholesterol and triglycrides also used as an indicator of anesthetic stress. Uric acid and creatinine concentration were responding to fish exposed to quinaldine sulfate, clove oil and MS-222 anesthesia concentrations (50, 100, and 200 ppm of quinaldine sulfate, 20, 40 and 80 ppm of clove oil and 100, 150 and 200 ppm of MS-222 respectively as shown in (Table 1, 2 & 3). clove oil, quinaldine sulfate and MS-222 make changes in serum cortisol levels and there are significantly higher circulating cortisol levels after exposure to clove oil, quinaldine sulfate and MS-222 than control group. Also, there are significantly different between treated groups with clove oil, quinaldine sulfate and MS-222 as shown in Tables 1, 2 & 3.

**Table 1.** Effect of quinaldine sulfate on physiological and biochemical changes during transportation of Nile tilapia.

| Treatments /parameters | Control | 50 ppm of quinaldine sulfate | | 100 ppm of quinaldine sulfate | | 200 ppm of quinaldine sulfate | |
|---|---|---|---|---|---|---|---|
| **Time** | **0 hrs.** | **24 hrs.** | **48 hrs.** | **24 hrs.** | **48 hrs.** | **24 hrs.** | **48 hrs.** |
| **AST (u/l)** | 51.1 ± 0.53 | 66 ± 0.8*** | 63 ± 0.7*** | 62 ± 0.9*** | 60 ± 0.9** | 57 ± 0.8** | 61± 0.3*** |
| **ALT(u/l)** | 25.1± 0.6 | 29± 0.7*** | 28. ± 0.4*** | 26 ± 0.9* | 25± 0.8 | 25± 0.7 | 26± 0.8* |
| **ALP (u/l)** | 30.3± 0.8 | 28± 0.6* | 28 ± 0.26* | 28 ± 0.8* | 27± 0.8** | 27± 0.8** | 28± 0.8* |
| **Glucose (mg/dl)** | 104.4 ± 1.74 | 119.3 ± 1.2** | 120.6 ± 1.99** | 114± 1.3** | 109 ± 1.2* | 107.1± 1.66* | 107± 1.1* |
| **Cortisol (µg/dL)** | 2.2 ± 0.5 | 4.6 ± 0.2* | 4.7 ± 0.3 * | 4.8 ± 0.3 ** | 5 ± 0.5 ** | 5.5± 0.4*** | 6 ± 0.7*** |
| **Cholesterol (mg/dl)** | 193.4 ± 2 | 219.5± 22.2*** | 222.9± 2.11*** | 201± 2.5* | 204± 2* | 203 ± 2.2* | 202 ± 2* |
| **Triglycerides (mg/dl)** | 3.1 ± 1.4 | 10 ± 2.6*** | 10.4± 2*** | 8.5± 1*** | 8 ± 1** | 4.7 ± 1* | 4.7 ± 1.8* |
| **Total protein (g/dl)** | 6.1± 0.3 | 6. 7 ± 0.6* | 6.9 ± 0.17* | 6.5 ± 0.8* | 6.9 ± 0.7* | 6.8 ± 0.6* | 6.5 ± 0.9* |
| **Uric acid (mg/dl)** | 13.3 ± 0.4 | 17 ± 0.5** | 18.3± 0.2*** | 16.9± 0. 1** | 18.4± 0.5*** | 14± 0.2* | 13 ± 0.5 |
| **Creatinine (mg/dl)** | 0.25 ± 0.1 | 0.42 ± 0.01* | 0.5 ± 0.02* | 0.5± 0.02* | 0.62 ± 0.03* | 0.5 ± 0.02* | 0.5 ± 0.05* |

* Significant at $p<0.05$, ** highly significant at $p< 0.01$, *** very highly significant at $p < 0.001$ (significant differences between treated groups and control)

**Table 2.** Effect of clove oil on physiological and biochemical changes during transportation of Nile tilapia.

| Treatments /parameters | control | 20 ppm of clove oil | | 40 ppm of clove oil | | 80 ppm of clove oil | |
|---|---|---|---|---|---|---|---|
| **Time** | **0 hrs.** | **24 hrs.** | **48 hrs.** | **24 hrs.** | **48 hrs.** | **24 hrs.** | **48 hrs.** |
| **AST (u/l)** | 51.1 ± 0.53 | 55.2 ± 0.9* | 59.5 ± 0.8** | 60. 9 ± 0.6** | 60 ± 0.99** | 57 ± 0.68** | 60± 0.33** |
| **ALT(u/l)** | 25.1± 0.6 | 24.4± 0.7 | 23. ± 0.4* | 24 ± 0.9 | 22 ± 0.8* | 24 ± 0.6 | 24 ± 0.5 |
| **ALP (u/l)** | 30.3 ± 0.8 | 29± 0.8 | 28 ± 0.22* | 26 ± 0.7** | 28 ± 0.5 | 29 ± 0.66 | 29± 0.7 |
| **Glucose (mg/dl)** | 104.4 ± 1.74 | 109.3± 1.32** | 111.6± 1.99*** | 115± 1.3*** | 108.6 ± 1.22* | 109.1 ± 1.66* | 105± 1.1 |
| **Cortisol (µg/dL)** | 2.2 ± 0.5 | 3.2 ± 0.1* | 3.8 ± 0.4 * | 4.1 ± 0.6 * | 4.7 ± 0.2 * | 5.0 ± 0.6 ** | 5.4 ± 0.3*** |
| **Cholesterol (mg/dl)** | 193.4 ± 2 | 206.5± 2.22** | 203.1± 2.11* | 201.3± 2.5* | 203. 9± 2.1* | 203.3 ± 2.6* | 201.4± 0.2* |
| **Triglycerides (mg/dl)** | 3.1 ± 1.4 | 10.4± 2*** | 10.4± 2*** | 4.1 ± 1.4 | 5.1 ± 1.4* | 6.1 ± 1.4* | 6.1 ± 1.4* |
| **Total protein (g/dl)** | 6.1± 0.3 | 6. 7 ± 0.3* | 6.9 ± 0.15* | 6.5 ± 0.1 | 6.9 ± 0.3* | 6.8 ± 0.1* | 6.5 ± 0.8 |
| **Uric acid (mg/dl)** | 13.3 ± 0.4 | 16 ± 0.5** | 16.3± 0.2** | 17.9±0. 1*** | 15.4 ± 0.5* | 16 ± 0.2** | 17 ± 0.5*** |
| **Creatinine (mg/dl)** | 0.25 ± 0.1 | 0.52 ± 0.01* | 0.6 ± 0.02** | 0.6 ± 0.02** | 0.72 ± 0.03*** | 0.6 ± 0.02** | 0.6 ± 0.05** |

* Significant at $p<0.05$, ** highly significant at $p< 0.01$, *** very highly significant at $p < 0.001$ (significant differences between treated groups and control).

**Table 3.** Effect of tricaine methanesulfonate on physiological and biochemical changes during transportation of Nile tilapia.

| Treatments /parameters | Control | 100 ppm of Tricaine Methanesulfonate | | 150 ppm of Tricaine Methanesulfonate | | 200 ppm of Tricaine Methanesulfonate | |
|---|---|---|---|---|---|---|---|
| **Time** | **0 hrs.** | **24 hrs.** | **48 hrs.** | **24 hrs.** | **48 hrs.** | **24 hrs.** | **48 hrs.** |
| **AST (u/l)** | 51.1 ± 0.53 | 66 ± 0.7*** | 67.5 ± 0.7*** | 64. ± 0.8*** | 63± 0.7** | 53 ± 0.5* | 54 ± 0.2* |
| **ALT(u/l)** | 25.1± 0.6 | 24.1± 0.5 | 25. ± 0.22 | 25 ± 0.78 | 26 ± 0.56* | 22 ± 0.3* | 22 ± 0.8* |
| **ALP (u/l)** | 30.3 ± 0.8 | 27± 0.7* | 27 ± 0.1* | 26 ± 0.4* | 25 ± 0.1** | 25 ± 0.2** | 26± 0.1* |
| **Glucose (mg/dl)** | 104.4± 1.74 | 123.6± 1.7** | 133.2 ± 1.3** | 125± 1.3** | 119 ± 1.2** | 119.8± 1.7** | 117± 1.7** |
| **Cortisol (µg/dL)** | 2.2 ± 0.5 | 4.8 ± 0.6** | 5.1 ± 0.5** | 5.6 ± 0.3 *** | 5.7 ± 0.8*** | 5.6 ± 0.4 *** | 6.1 ± 0.7*** |
| **Cholesterol (mg/dl)** | 193.4± 2 | 214.8± 1.2*** | 218.1± 2.5*** | 217± 2.3*** | 211± 2.5** | 212 ± 2.4** | 206± 2.2* |
| **Triglycerides (mg/dl)** | 3.1 ± 1.4 | 11.4 ± 2.6*** | 11± 2*** | 8.8± 1** | 8 ± 1** | 5.7 ± 1.8* | 4.7 ± 1.8* |
| **Total protein (g/dl)** | 6.1± 0.3 | 6. 6 ± 0.6 | 6.8 ± 0.11 | 7 ± 0.5* | 6.2 ± 0.2 | 6.3 ± 0.4 | 6.2 ± 0.7 |
| **Uric acid (mg/dl)** | 13.3 ± 0.4 | 16 ± 0.2** | 16.3± 0.7** | 16.6± 0. 8** | 15.7 ± 0.4* | 15± 0.11* | 15 ± 0.7* |
| **Creatinine (mg/dl)** | 0.25 ± 0.1 | 0.30 ± 0.01 | 0.41 ± 0.01* | 0.51 ± 0.02** | 0.61± 0.02** | 0.51 ± 0.01** | 0.61± 0.04** |

* Significant at $p<0.05$, ** highly significant at $p< 0.01$, *** very highly significant at $p < 0.001$ (significant differences between treated groups and control).

Number of fish death were recorded in treated groups with clove oil, quinaldine sulfate and MS-222 during the experimental period. Table 4 show that all fish in the present study were died in the control group but about 30 % from fish treated with clove oil were died, 55% of fish that exposed to quinaldine were died but 70 % of fish that exposed to MS-222 were died. Induction time in min. was lower in all anesthetized groups in comparison to recovery time. The recovery time in the Nile tilapia (*Oreochromis niloticus)* treated with clove oil (10 ± 1 min.) was significantly higher than that of the quinaldine sulfate (8 ± 1 min.) and of the MS-222 (6 ± 1 min.) anesthesia groups.

**Table 4.** Effect of quinaldine sulfate, clove oil and tricaine methanesulfonate anesthesia on mortality and recovery time of Nile tilapia (*Oreochromis niloticus*).

| parameters | Control | | quinaldine sulfate 50 ppm | | clove oil 20 ppm | | tricaine methanesulfonate 100 ppm | |
|---|---|---|---|---|---|---|---|---|
| | 24 hr | 48 hr | 24 hr | 48 hr | 24 hr | 48hr | 24 hr | 48 hr |
| **No of fish** | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| **Mortality** | 10 | 10 | 4± 1 | 6± 1 | 2± 1 | 5± 1 | 5± 1 | 7± 1 |
| **Recovery (min)** | 0.0 | 0.0 | 6 ± 1 | 8 ± 1 | 7 ± 1 | 9 ± 1 | 5± 1 | 7 ± 1 |

Histological examination of the fish following anesthesia revealed sporadic ectasia in gill lamellae 24 h after anesthesia in of fish. No histopathological changes were demonstrated in liver. Results of the examinations suggest that the use of quinaldine sulfate, clove oil and MS-222 does not cause irreversible damage in Nile tilapia figures 1 &2.

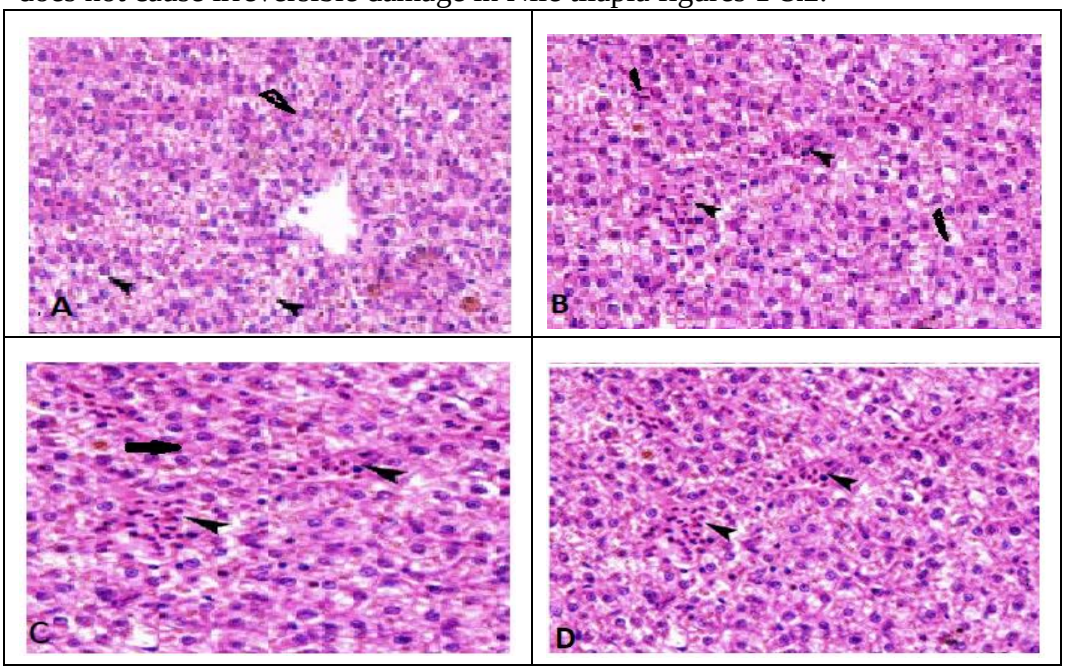


**Fig. 1 (A).** Normal liver histology in control fish showing normal hepatocytes (B, C & D) liver after exposed to quinaldine sulfate, clove oil and MS222 anesthesia respectively showed no changes in the liver cells (A, B, C & D) Bars = 400 µm.

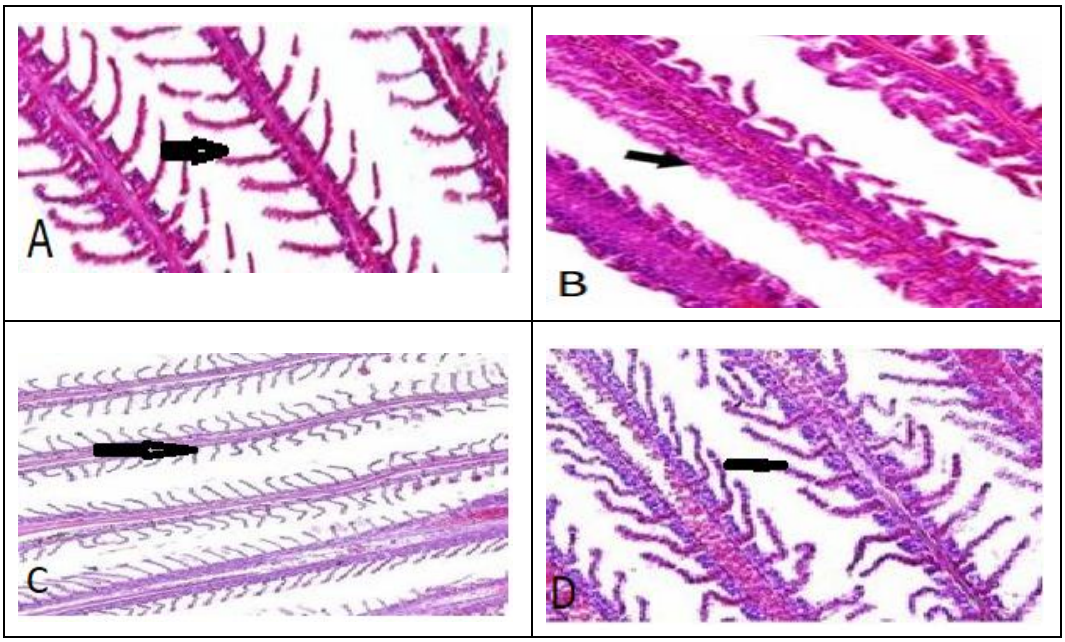


**Fig. 2 A.** Showing normal gill tissue with primary and secondary gill lamellae (B, C & D) after exposed to quinaldine sulfate, clove oil and MS222 anesthesia respectively showed shorter gill lamellae and ballooning dilatation of lamellae and showed capillary ectasia of gill filaments immediately after exposed to quinaldine sulfate, clove oil and MS222 anesthesia respectively. (A & C) Bars = 200 µm and (B & D) Bars = 400 µm.

## DISCUSSION

Our study showed the effect of quinaldine sulfate, clove oil and (MS222) on physiological and biochemical parameters during transportation of Nile tilapia. Also, results showed that physiological and biochemical parameters of Nile tilapia (*Oreochromis niloticus*) are affected by different concentrations of quinaldine sulfate, clove oil and MS222 anesthesia and clove oil is better than quinaldine sulfate and MS222 anesthesia for Nile tilapia (*Oreochromis niloticus*). Anesthetics are routinely used to reduce stress in fish during blood sampling in order to obtain resting or baseline levels of blood variables (Congleton and Wagner, 2006 and Shi *et al.*, 2006), but unsuitable anesthetic concentrations or prolonged exposure time can induce stress and change the blood biochemical parameters. So, in this study we determine the appropriate

anesthetic concentration and exposure time to minimize stress these agreements with Wagner *et al.* (2003). There are a highly significant differences occurred in the fish exposed to quinaldine sulfate, clove oil and MS222 anesthesia concentrations (50, 100, and 200 ppm of quinaldine sulfate, 20, 40 and 80 ppm clove oil and 100, 150 and 200 ppm of MS222 respectively) compared to control group according to Wagner *et al.* (2003). And the use of blood parameters may help to provide indicators to determine optimal concentration range of anesthesia and decrease stress. Generally, cortisol has been used as an indicator of different stressors for fishes (Wagner *et al.,* 2002). This study reported that the change of AST activity was relative to liver impairment agreement with Shokr, (2011), and the increase of AST activity could enhance the metabolism of amino acid (Sala- Rabanal *et al.,* 2003; Shi *et al.,* 2006 and Nile *et al.,* 2007). Therefore, the present results suggest the increase of AST levels might make Nile tilapia *(Oreochromis niloticus)* obtain more energy when they were exposed to higher concentrations of quinaldine sulfate, clove oil and MS222 anesthesia. Overall, glucose, uric acid, creatinine, cholesterol, TGL and AST levels were well correlated with anesthetic concentrations, which could be potentially used as indicators of anesthetic stress. The concentrations of quinaldine sulfate and MS222 reported by (Ruibal *et al.,* 2002; Wagner *et al.,* 2003; Congleton and Wagner, 2006 and Shi *et al.,* 2006); and the concentrations of clove oil reported by (Small, 2003 and Kildea *et al.,* 2004). In the present study, there were correlations between quinaldine sulfate, clove oil and MS222 concentrations and most blood variables. TGL, ALT and AST levels did respond to quinaldine sulfate, clove oil and MS222 concentrations. The ALT activity was lower in the 100 ppm and 200 ppm of of quinaldine sulfate and 150 and 200 ppm of MS222 than 50 ppm of quinaldine sulfate and 100 ppm of MS222 group, which was highly significant than the control group as agreement with Gontijo *et al.,* (2003). On the other hand, AST activity increased when the fish exposed to quinaldine sulfate and Ms222 anesthesia concentrations compared to control group as discussed by Pirhonen and Schreck (2003). Wagner *et al.* (2003) reported that glucose concentrations in the fish exposed to quinaldine sulfate, clove oil and MS222 anesthesia

concentrations compared to control group as agreement with our study which reported that glucose concentrations was lower in fish exposed to high concentrations of anesthesia compared to low concentrations group. Level of cholesterol and triglycerides in the fish were lower in fish exposed to high concentrations of anesthesia compared to low concentrations group. Wagner *et al.* (2003) reported that level of cholesterol and triglycerides in the fish exposed to quinaldine sulfate, clove oil and MS222 anesthesia was highly significant than the control group. Present study showed that the Cholesterol and triglycrides also used as an indicator of anesthetic stress as reported by Pirhonen and Schreck (2003) which was reported that MS-222 and clove oil had similar depressive effects on food intake by rainbow trout. Feng *et al*, (2011) and Kamble *et al* (2014) reported that the effect of clove oil as an anesthetic for common carp. The present study revealed that the clove oil caused a significant increase in the levels of glucose and aspartate aminotransferase agreement with (Labarrére *et al.*, 2013; Shokr, 2011 and Velišek *et al*., 2011). Creatinine (Cr) is formed from creatine and secreted by fish's kidneys which contribute little to the excretion of nitrogenous wastes and therefore the interpretation of the values of creatinine cannot be taken into account in the assessment of renal disorders (Gontijo *et al.*, 2003). In this study the concentration of creatinine in the anesthetic group was not significantly affected by clove oil. Also, these parameters (ALT, AST, Glucose concentrations, cortisol, triglycerides, cholesterol levels and uric acid) were used as an indicator of anesthetic stress (Gontijo *et al.*, 2003). All fish in the present study were died in the control group but 30 % of fish exposed to clove oil were died, 55% of fish exposed to quinaldine were died but 70 % of fish exposed to MS 222 were died. On the other hand, the recovery times in the groups treated and control was zero because all fish were died but reached to 6-8 min in the groups treated with quinaldine, 7-9 min in the groups treated with clove oil and 5-7 min in the groups treated with MS222. These result are agreement with (Wagner *et al.*, 2003; Atanasoff, 2016 and Shokr, 2011) who reported that fish health by studying blood biochemical properties. Anesthetic

recovery time, which includes the time from induction to the return to normal activity, was lower in the quinaldine sulfate and MS222 anesthesia than in the clove oil. These findings similar to those of Wagner *et al.,* (2003) and Gontijo *et al.,* (2003) who report that this increased time can be beneficial in surgical practice, biometrics, and spawning because these manipulations necessitate relatively long periods of anesthesia after removal of the fish from the anesthetic solution.

Histological examination of tissues of Nile tilapia showed capillary ectasia of gill filaments immediately after exposed to quinaldine sulfate, clove oil and MS222. sporadic ectasia was only demonstrated at the ends of gill lamellae in the fish. No histopathological changes were demonstrated in other tissues liver following anesthesia as reported by (Atanasoff, 2016). Therefore, present information indicate clove oil may be the best anesthetic for use in Nile tilapia aquaculture.

## CONCLUSION

The results of this study show that the effect of quinaldine sulfate, clove oil and of MS222 on physiological parameters during transportation of Nile tilapia *(Oreochromis niloticus).* The quinaldine sulfate, clove oil and MS-222 caused a significant increase in the levels of (ALT, AST, Glucose concentrations, cortisol, triglycerides and cholesterol levels and uric acid in the anesthetic group compared with the control group. The data show that they were used as an indicator of anesthetic stress in Nile tilapia *(Oreochromis niloticus).* quinaldine sulfate, clove oil and MS-222 had a different influence on blood biochemistry of Nile tilapia *(Oreochromis niloticus),* with clove oil producing less stress response. The results supported previous findings that clove oil is a reasonable alternative to quinaldine sulfate and MS-222. Also, the recovery period of quinaldine sulfate, clove oil and MS-222 on Nile tilapia *(Oreochromis niloticus)* were 7 min., 10 min, and 8 min respectively. So the clove oil is sheaper and natural than quinaldine sulfate and MS-222. Also, the clove oil is better than quinaldine sulfate and MS-222 in the handling and blood sampling from Nile tilapia *(Oreochromis niloticus).* Therefore, present

information indicate clove oil may be the best anesthetic for use in Nile tilapia aquaculture.

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# تأثير الكوانلدين سلفات وزيت القرنفل والترايكيين ميثانسلفات علي القياسات الفسيولوجية والبيوكيميائية اثناء نقل البلطي النيلي

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## الملخـص العربــي

في هذه الدراسة تم دراسة تأثير الكوانلدين سلفات و زيت القرنفل و الترايكيين ميثانسلفات كمخدر للبلطي النيلي فتم تعريض الأسماك لتركيزات مختلفة من الكوانلدين سلفات و زيت القرنفل و الترايكيين ميثانسلفات. كان الهدف من هذه الدراسة هو إظهار تأثير تركيزات مختلفة من الكوانلدين سلفات و زيت القرنفل و الترايكيين ميثانسلفات على العوامل الفسيولوجية والبيوكيميائية أثناء نقل البلطي النيلي. أخذت عينات الدم من الوريد الذيلي بعد 24 و 48 ساعة من التخدير وذلك لقياس البلازما الجلوكوز و الكورتيزول ، الكوليسترول و الترايجلسريد و AST وALT و البروتين الكلي و حمض اليوريك والكرياتينين وهي دلائل علي الاستجابة للاجهاد للبلطي النيلي وهذه الاستجابات بواسطة الكوانلدين سلفات و زيت القرنفل و الترايكيين ميثانسلفات أدت الي زيادة ذات صلة بالجرعات في مستويات البلازما من الكورتيزول ، الجلوكوز ، الكوليسترول ( (CHOL و Triglyceride (TGL)، AST، ALT ، البروتين الكلي ، حمض اليوريك والكرياتينين وهي تدل علي الإجهاد للبلطي النيلي بعد 24 ساعة و 48 ساعة من التعرض المستمر للكوانلدين سلفات و زيت القرنفل و الترايكيين ميثانسلفات و كانت ردود الفعل للاجهاد ظاهرة علي القياسات الفسيولوجية و البيوكيميائية. وخلصت هذه الدراسة إلى أن التعرض قصير الأمد للكوانلدين سلفات و زيت القرنفل و الترايكيين ميثانسلفات للبلطي النيلي يمكن أن يعوق الاستجابات البيوكيميائية الحيوية للتعامل مع الضغوطات ولكن التعرض للتخدير على المدى الأطول يمكن أن يحفز نفسه على الاستجابة للبيوكيمياء الحيوية للبلطي النيلي. تشير هذه النتائج إلى أن الاضطرابات الفسيولوجية للبلطي النيل خلال إجراءات الاستزراع الروتيني يمكن تخفيضه عن طريق اختيار العلاج المناسب بالمخدر. أظهرت النتائج علي وجود فروق ذات دلالة إحصائية بين القيم الفسيولوجية و البيوكيميائية في كل معاملة مقارنة بالمجموعة الضابطة.

كما أوضحت النتائج أن التغيرات الفسيولوجية والبيوكميائية في البلطي النيلي تتأثر بتركيزات مختلفة ٥٠ وحدة بالمليون من الكوانلدين سلفات و٢٠ وحدة بالمليون من زيت القرنفل و١٠٠ وحدة بالمليون من الترايكيين ميثانسلفات وان زيت القرنفل أفضل من تخدير الكوانلدين سلفات و الترايكيين ميثانسلفات علي البلطي النيلي.