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Phytochemical Analysis and Evaluation of Anticonvulsant Effect of Chamomile (*Matricaria chamomilla* L.) Flower Extract in Chicks

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Abstract

This study was carried out to investigate the effect of chamomile flower aqueous extract on different biochemical parameters in pentylenetetrazole (PTZ) induced-convulsive chicks. Parameters included were serum total antioxidant capacity (T-AOC), serum and brain gamma-aminobutyric acid (GABA), serum cholinesterase enzyme activity (ChE), electrolytes (Na^+,K^+, and Cl^-), total calcium (Ca^{2+}), serum glucose and total protein concentration.

The dried flowers parts of chamomile (*Matricaria chamomilla* L.) were subjected to aqueous extraction and given at (200, 400 and 600mg/kg orally), for its anticonvulsant effects and the effect was compared with the standard anticonvulsant drug sodium valproate (200mg/kg). A dose of 200mg/kg showed full protection against PTZ convulsions, whereas doses of 400 and 600 mg/kg reduced the latency and onset of convulsion. The results suggest that the aqueous extract of chamomile flower may produce anticonvulsant effects via biochemical changes including significant increases in serum T-AOC, serum GABA, serum ChE activity and Na^+, and a significant reduction in K^+ and serum glucose concentration have been observed.

Introduction

Matricaria chamomilla L. (German chamomile) is a species of annual plant of the family Asteraceae (Compositae) found in Iraq [1], and is the most popular variety used for medicinal purposes [2]. It has been used for centuries in most countries as an anti-anxiety, anti-inflammatory, analgesic, anti-microbial, anti-spasmodic and sedative agent [3]. Chamomile flowers head parts contain of biological active flavonoids such as apigenins and apegetrin. And other constituents like amino acids, alkaloids, fatty acids and tannins [4, 5]. Apigenin has the ability to selectively bind with high affinity to GABA receptors and has mild sedative effects [4].

Convulsion is a neurological disorder caused by disorganized, abnormal electrical activity in the brain which results in repeated muscular contraction, relaxation and uncontrolled body movements [6, 7]. Because convulsion is often a symptom of an epileptic seizure, the term convulsion is sometimes used as a synonym for seizure, although not all epileptic seizures lead to convulsions, and not all convulsions are caused by epileptic seizures [8]. Common convulsion causes include infectious, traumatic, metabolic and tumoral conditions or it may be idiopathic other than a possible hereditary predisposition [9].

Anticonvulsant drugs are used in treatment of most neurological disorders commonly associated with certain side effects. The most commonly used anticonvulsants in neurological practice are sodium valproate and carbamazepine which were indicated in the treatment of convulsions and epilepsy [10, 11]. Many investigations have been geared towards finding new anticonvulsant drugs which are effective and have better safety profiles with minimum side effects. Many previous researches and reports have stated that pentylenetetrazole has an effect on the incidence of convulsions through interfering with gamma-aminobutyric acid receptors. Substances that affect GABA synthetic enzymes are defined as convulsants and result in the impairment of GABA function, producing convulsions [12]. Therefore this study evaluates the anticonvulsant properties of chamomile flower aqueous extract (*Matricaria chamomilla* L.), especially those growing in Kurdistan region against PTZ-induced convulsions in chicks.

Material and Methods

A. Collection of Plant Materials

The flower parts of *Matricaria chamomilla* L. were hand harvested from Kurdistan Region of Iraq. The plant was authenticated in Forestry Department/ College of Agriculture / Duhok University. Then the plant was air dried indoors at room temperature to protect it from direct light, and stored until use.

Figure-1: *Matricaria chamomilla* L.

B. Extract Preparation

The method described by Sushma *et al.* (2012) [13] was used for the preparation of the plant extract. The dried milled flower parts were suspended in a soxhlet apparatus, at 25g/250ml of distilled water for 7 to 8 hrs, then the extract was concentrated using a rotatory evaporator (60ºC) for about 3 hrs/ L under reduced pressure. The crude extract was left overnight in dark room to further evaporate and then kept in a dark bottle in a refrigerator (4ºC) and used within 5-10 days. The concentrations of 200,400and 600mg/kg, as described by Samal (2013) [14], were administrated to animals using oral gavages.

C. Laboratory Animals

The experiment was carried out on chicks of both sexes that were purchased from a local hatchery in Duhok Province/Kurdistan Region/Iraq. The chicks were one day old and were left to grow for two weeks, reaching about 220-340 g. The chicks were housed in cages in the research laboratory at the College of Veterinary Medicine. The room temperature was 33-34^{o}C for the first four days and was gradually reduced to 24-28^{o}C in the second week. Normal day light photoperiod (light-dark cycle) was followed. The animals were fed with normal chick food with free access to drinking water.

D. Induction of Convulsion

The method used for induction of convulsion was adapted from that described by Mahmoodi *et al*. (2003) [15]. PTZ (Sigma, USA) was dissolved in normal saline at 80mg/ml and administered to chicks subcutaneously (S.C) in a single dose (80mg/kg in a volume of 0.1ml/100g).The animals were placed in their observation cages. A digital video camera was positioned in front of the cages for recording and observation of the onset, duration and frequency of convulsions for each group.

E. Experimental design

Seventy two chicks were randomly divided into six groups. Each group composed of 12 chicks. The first group served as negative control and was injected subcutaneously with normal saline. The second group (positive control) was injected S.C with freshly prepared solution of PTZ at 80mg/kg. The third group was treated orally with antiepileptic drug (sodium valproate) at 200mg/kg [16] for 6 days. The remaining three groups were received chamomile aqueous extract at 200,400 and 600 mg /kg, respectively through oral route for 6 days. On the 6^{th} day, convulsion was induced to all the groups of chicks except the first group using PTZ subcutaneously in the neck area 30 min after administering the treatments. Animals were observed for a period of 30 min after PTZ injection. The Anti-convulsive property of the plant extract was assessed by its ability to prevent or delay the onset of convulsions. The onset time, latency of convulsions, the number of animals protected from convulsions and the percentage of mortality against PTZ induced convulsions were recorded.

F. Blood Samples Collection

After three hrs from PTZ injection, and followed to observation and register convulsion signs, blood samples were collected after overnight fasting at the end of the experiment (6^{th} day) from the jugular vein [17]. The blood was collected in plastic tubes without anticoagulant and was then left to stand for about 30 min at room temperature. Finally, the serum was separated by centrifugation at 5000 rpm for 10 min, and kept at -20°C until used for biochemical evaluation [18].

G. Dissection and Tissue Samples Preparation

The whole brain tissues were isolated directly after sacrificing of the chicks. The brain was stored in a plastic container and kept at -20°C until used for biochemical estimation [19].

H. Biochemical Analysis

The quantitative estimation of some serum and brain constituents was undertaken for all chick groups. T-AOC in serum, and GABA in serum and brain were determined by ELISA using standard kit (YH Bioresearch Lab. /China). Electrometric estimation of serum and brain ChE activity was measured according to the method described by Mohammed (2007) [20]. Serum Na^+ and K^+ were determined photometrically by a spectrophotometer using standard kit (Gesellschaft/ Germany) according to the method of Trinder (1951) and Hillman and Beyer (1967), respectively [21,22], Cl^- and Ca^{+2} were also determined colorimetrically using standard kit (Biolab/ France) according to the method of Zall *etal.* (1956) and Moorhead and Briggs (1974) respectively [23, 24]. Serum glucose level was determined enzymatically using spectrophotometer and standard kit (Biolab/ France) according to the modified method described by Trinder (1969) [25]. Finally total protein in the serum was determined colorimetrically using standard kit (Biolab/ France) according to the method of Gornall *etal.* (1949) (Biuret method) [26].

I. Phytochemical Analysis of Plant

Qualitative tests were carried out to determine the presence of some pharmacologically active constituents as described by Alagpulinsa (2010) and Enemor (2012)[12,27], for the detection of flavonoids, cardiac glycosides, reducing sugars, saponins, tannins and alkaloids in chamomile flower.

J. Statistical Analysis

All the results were expressed as mean ± standard error of mean. Analysis of variance (ANOVA) followed by Duncan test (SAS program) was used for comparison of different means. The results were considered significant at $P<0.05$.

Results and Discussion

A. Phytochemical Analysis of M. chamomilla L. Extract

Table (1) illustrates the most important biochemical active constituents in plant extract of chamomile flower.

Table -1: Phytochemical Analysis of *M. chamomilla* L. Aqueous Extract.

Compounds	**Availability**	**Reaction**
Flavonoids	Present	Orange color
Cardiac glycosides	Present	Reddish- brown layer
Reducing sugar	Absent	No change in color
Saponins	Present	White foam
Tannins	Present	Blue-dark precipitate
Alkaloids	Present	Orange to red precipitate

Generally, the data presented of phytochemical tests suggested that the aqueous extract of *M. chamomilla* L. contain compounds that may be useful in the management of convulsion and epilepsy [15]. In this study, preliminary phytochemical screening of aqueous extract revealed the presence of flavonoids, cardiac glycosides, saponins, tannins and alkaloids. Phytoconstituents such as flavonoids (apigenin), tannins and saponins have been suggested to modulate central nervous systems activities [28]. PTZ has been classified as a central benzodiazepine receptor antagonist. The pharmacological property of flavonoid isolated from the flowers of the medicinal plant sour orange demonstrated anticonvulsant activity via benzodiazepine receptor agonist [15]. Moreover, apigenin is a flavonoid type of chamomile that had the ability to selectively bind with high affinity to the central benzodiazepine receptors [4]. Flavonoids in the extract of *M. chamomilla* L. flowers might have agonist activity to benzodiazepine receptors decreasing the antagonistic effect of PTZ on this system. No observation of convulsion signs in those chicks treated with the 200mg/kg aqueous extract may be related to the presence of flavonoids in addition to the tannins and alkaloids.

B. General Observations of Experimental Chicks

Convulsion signs were observed after about 5 to 20 min from PTZ injection, represented by rapid onset of sudden jumping, severe muscle contraction, twisting of head and neck to back with whole body congestion, asphyxia and mortality about 20-30% were observed in positive control group in comparison with negative control (normal group) as shown in Figures (2- A,C). Delayed onset signs with less latency and violent sound, muscle contraction, tremor, legs extension and mortality about 10% were observed in those groups treated with 400 and 600mg/kg of plant aqueous extract in comparison with positive control as shown in Figure (2- B). No convulsion signs were detected in both groups of 200mg/kg treated with sodium valproate and 200mg/kg treated with plant extract in comparison with positive control as shown in Figure (2- D).

The behavioral alterations observed in chicks following PTZ injection were tremor, sudden jumping, severe muscle contraction, twisting of head and neck to back, violent sound, asphyxia and legs extension. The present findings are in agreement with the results of Sudipta *et al.* [29] in mice when administrated a convulsive dose of PTZ (80 mg/kg). PTZ effect could be attributed to their interaction with the inhibitory neurotransmitter GABA or with GABA receptor complex. Several studies suggested that the enhancement of GABA neurotransmission has been shown to inhibit seizures, while inhibition of GABA neurotransmission or its activity is known to promote and facilitate convulsion and seizure signs [30, 31].

In this study, chicks were treated with sodium valproate (200mg/kg). It has been shown that the drug provided 100% protection of animals against PTZ. The present findings are in agreement with the results of several studies of [31, 32]. Sodium valproate can suppress various seizure patterns induced by PTZ [33, 34]. Sodium valproate enhances GABA function; it may increase the synthesis of GABA by stimulating the glutamic acid decarboxylase enzyme (GAD). It also produces selective modulation of voltage-gated Na^+ channels through preventing further influx and efflux during sustained, rapid, repetitive neuronal firing [30].

In this study, chicks groups treated with the aqueous extract at 200, 400 and 600mg/kg have shown protection against the epileptic effect of PTZ with full protection in group 200mg/kg likewise sodium valproate. On the other hand, less latency with delayed onset of convulsions has been recorded in groups 400and 600mg/kg of aqueous extract in comparison with positive control group, suggesting that the plant extract's anticonvulsant effective dose is 200mg/kg .

Figure-2: Clinical signs of convulsion induced by PTZ in treated chicks with sodium valproate (drug) and *M. chamomilla* L. aqueous extract. A- severe muscle contraction, twisting of head and neck with death; B- leg extension to outside, tremor and violent sound; C- whole body congestion and asphyxia; D- no signs were observed.

C. Effect of aqueous extract of M. chamomilla L. on serum T-AOC, serum and brain GABA and ChE activity in PTZ treated chicks

As shown in Figure 3, significant reduction of serum T-AOC level was recorded in chicks injected with PTZ. The present finding is in agreement with the results of Hamid (2011) and Bindu *et al*. (2014) [35, 36] who reported that in patients with epilepsy without treatment, serum T-AOC was significantly reduced in comparison with control. Convulsion always reflects abnormal hypersynchronous electrical activity of neurons caused by an imbalance between excitatory (L-glutamate) and inhibitory neurotransmitter (GABA) [37], production and release of excitatory neurotransmitter, such as L-glutamate, induces cascade reactions in the postsynaptic neuron, resulting in the formation of reactive oxygen species (ROS) [38]. ROS has been engaged in the development of convulsions, seizures and epilepsy under pathological conditions and linked to seizure-induced neurodegeneration. Evidences indicate a temporal correlation between free radicals generation and the development of seizures in some pathological conditions [39, 30]. Sodium valproate showed significant elevation of T-AOC and more than the normal level despite injection of PTZ. The present findings are in agreement with Moetazza *et al*. (2013) [40] who reported that in those patients treated with valproate has been shown significant elevation of T-AOC in serum. However, studies carried out by Hamed *et al*. (2004) and Schulpis *et al*. (2006)[41, 42], reported that in epileptic patients treated particularly with sodium valproate a significant decrease of T-AOC level in compared with the normal control. Activity and regularity of some antioxidant enzymes increase in patients treated with sodium valproate [43, 44]. Serum T-AOC levels were observed to increase gradually in correlation with increasing extract concentrations (200, 400 and 600mg/kg), in comparison with positive control, but statistically not significant in group 200 mg/kg. This elevation may be related to the presence of flavonoids, which act as antioxidants. Flavonoids have antioxidant activity, and they are the major constituents of a variety of plants and seeds [45]. Gardiner (1999) [46],Avallone *et al*. (2000)[4] and Zaiter *et al*. (2007) [47] reported the plentiful presence of flavonoids in chamomile flower.

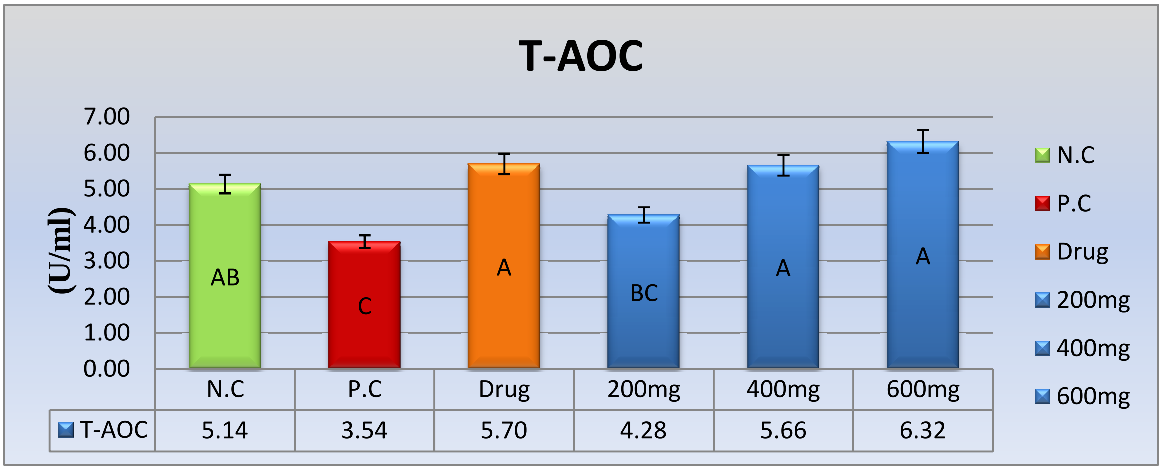

Figure-3: Effect of aqueous extract of *M. chamomilla* L. on serum T-AOC in PTZ treated chicks compared with controls (n=12 chicks in each group, values are expressed as mean ±SE, different letters refer to the significant differences at $p < 0.05$).

In Figure 4 chicks' injection by PTZ display significant decrease of serum GABA in positive control group in compared with negative control. The present finding is in agreement with the study of Mishra *et al.* (2007) [48] and Salah *et al*. (2014) [49] who found significant decrease in serum GABA level in those suffered from febrile convulsion. Jack (2004) [50] referred that glutamic acid is converted to GABA via the enzyme GAD and metabolized by gamma amino butyrate transaminase (GABA-transaminase) within the brain. Substances that affect this enzyme (GAD) or enhance GABA-mediated inhibition are defined as convulsants [51, 12]. Also in the present finding, sodium valproate showed significant increase in the level of serum GABA and is agreement with the study carried out by Abdel Mageid *et al*. (2014) [52].The mechanism of most antiepileptic drugs involve direct or indirect GABA enhancement through a variety of ways, either increasing activity or modulator of GAD such as, sodium valproate or inhibiting GABA reuptake such as, tiagabine [53]. Aqueous extract in various concentrations cause significant elevation of serum GABA. The present findings may be attributed to the chamomile flower flavonoids which enhance GABA function and production through their enzymes system modulators with contributes the presence of tannins and alkaloids. Mahmoodi *et al*. (2003) [15] demonstrated that the flavonoids administration orally and intra peritoneal in rats exposed to PTZ, reduced convulsive response and mortality rate and suggested that the flavonoids have anticonvulsant activity against PTZ.

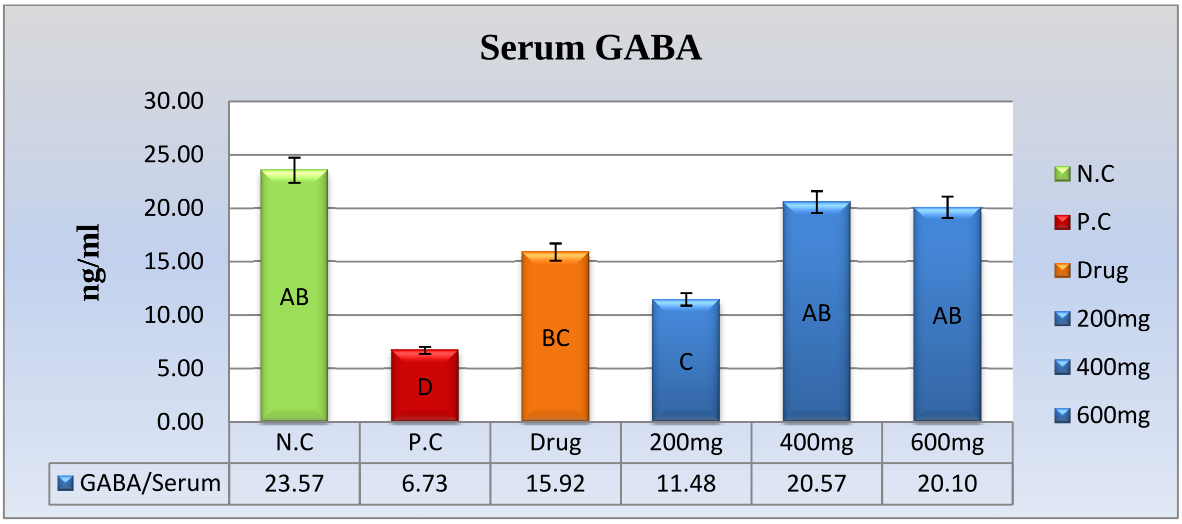

Figure-4: Effect of aqueous extract of *M. chamomilla* L. on serum GABA in PTZ treated chicks compared with controls (n=12 chicks in each group, values are expressed as mean ±SE, different letters refer to the significant differences at $p< 0.05$).

On other hand, GABA concentrations in brain as shown in Figure 5 , positive control did not changed in comparison with negative control and also drug-depended group and all treated groups of aqueous extract did not changed in comparison with positive control.

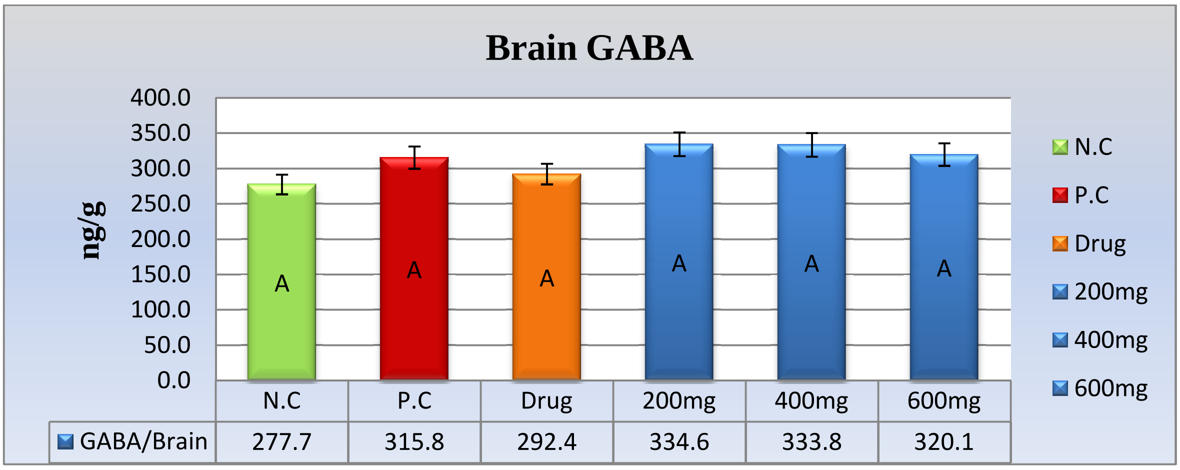

Figure-5: Effect of aqueous extract of *M. chamomilla* L. on brain GABA in PTZ treated chicks compared with controls (n=12 chicks in each group, values are expressed as mean ±SE, different letters refer to the significant differences at $p< 0.05$).

ChE activity show significant reduction in comparison with the negative control. The present findings are in agreement with Ali *et al*. (2012) [54] who referred in a previous study the epilepsy induction in female rats caused a significant decrease of serum ChE activity. Also epilepsy induction by administration of carbofuran (convulsive agent) leads to a maximum inhibition of ChE activity 82-90% in rats [55]. Askar (2012) [56] indicated the prolonged exposure to organophosphorus may cause convulsions through central nervous system effect. Dichlorvos and organophosphorus induced toxicity occur due to irreversibly inhibiting of ChE activity which leads to higher levels accumulation of the neurotransmitter acetylcholine (Ach) at the nerve endings causing subsequent parasympathetic hyperstimulation of the muscarinic and nicotinic receptors in autonomic and central nervous system [20,17]. In this study, significant increase in the activity of serum ChE has been observed in those chicks treated with sodium valproate. This finding are likewise carried out by Tutor-Crespo *et al*. (2004) [57], who found the serum ChE activity increased significantly in a group of epileptic patients treated with anticonvulsant drugs in different ages. The study conducted by Gamit *et al*. (2013) [58], patients of epilepsy treated with sodium valproate had significantly higher levels of much liver enzymes. Changes in serum ChE activity closely reflected the rate of protein formation by the liver [59]. All doses of aqueous extract result in significant increase of serum ChE activity. In alternative medicine sedative, spasmolytic and anxiolytic effect of chamomile flowers [46] could be due to enhancement ChE activity and this may along with GABA effect (Figure-6).

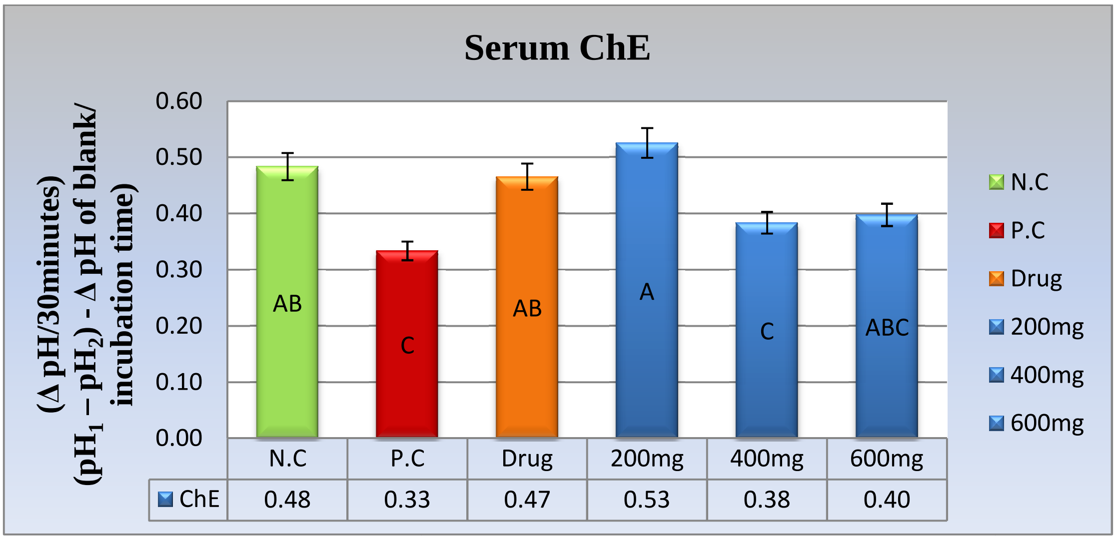

Figure-6: Effect of the aqueous extract of *M. chamomilla* L. on serum ChE in PTZ treated chicks compared with controls (n=12 chicks in each group, values are expressed as mean ±SE, different letters refer to the significant differences at p< 0. 05).

D. Effect of aqueous extract of M. chamomilla L. *on serum electrolytes (Na^+, K^+, Cl^-) and total Ca^{2+} in PTZ treated chicks*

Figures 7, 8 revealed that in positive control, the induction of convulsions in chicks show significant decrease of Na^+ and increase in K^+. The present findings are in agreement with Hozayen *et al*. (2012)[60], who found that in epileptic rats induced by pilocarpine, the serum Na^+ decreased while K^+ increased significantly. However these findings disagree with Abdul Wahid, (2010) [61] who recorded significant elevation of Na^+ and reduction of K^+ in untreated epileptic patients compared with healthy normal control. Several studies provided evidences that the body electrolytes play a vital role for enabling convulsion conditions to develop and biochemical estimation of serum Na^+, K^+, and other ions are essential for the understanding and management of epileptic patients [62]. Some studies imply that the electrolyte mechanisms underlying convulsion produced by PTZ, are an increase in voltage-gated K^+ channel with an imbalance of GABA to glutamate [63]. Glutamate is an ionotropic that upon receptor binding, it increases the permeability of Na^+ and K^+ ions, leading to further influx of Na^+ and K^+ efflux through these channels result in cell membrane depolarization and action potential generation [63]. Also administration of sodium valproate causes significant increase of Na^+, while K^+ is not affected. These findings are in agreement with Hamed *et al*. (2004) [41] in epileptic patients treated with sodium valproate. Sodium valproate enhances GABA systems [30] and binding to the inactivated state of the Na^+ channel. This binding leads to a voltage-gated and frequency-dependent depletion in channel conductance, resulting in a limitation of repetitive neuronal firing with mild or no effect on the generation of single action potentials [64]. Chamomile aqueous extract revealed significant increase of Na^+ in all doses and K^+ reduction at low dose only (200mg/kg) in comparison with the positive control. These results could be attributed to the phytoconstituents of the plant extract that exert their action through GABA to glutamate balance system. Moreover, the GABA-receptor, originally identified as a functional entity being activated by GABA, this response exhibited their action across an activation of both Na^+ and K^+ channels [65].

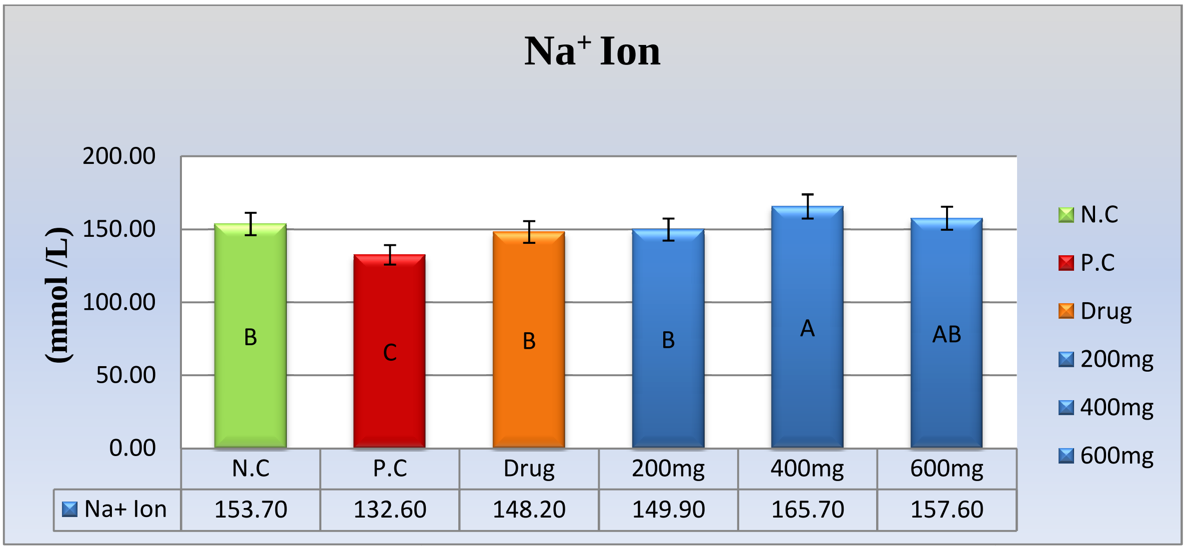

Figure-7: Effect of aqueous extract of *M. chamomilla* L. on serum Na^+ in PTZ treated chicks compared with controls (n=12 chicks in each group, values are expressed as mean ±SE, different letters refer to the significant differences at p< 0.05).

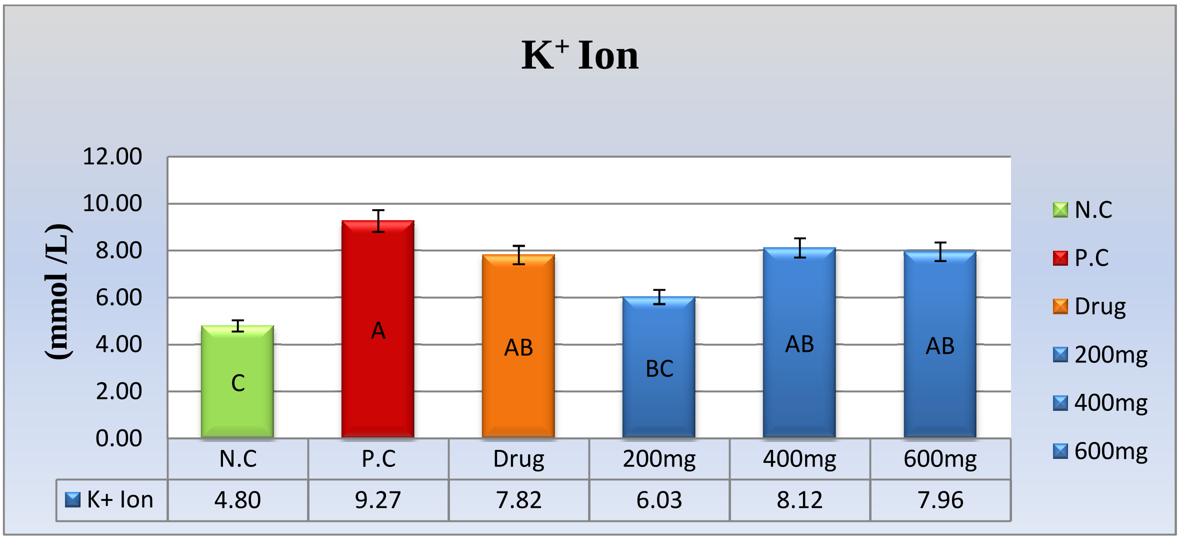

Figure-8: Effect of aqueous extract of *M. chamomilla* L. on serum K^+ in PTZ treated chicks compared with controls (n=12 chicks in each group, values are expressed as mean ±SE, different letters refer to the significant differences at p< 0.05).

Figure 9 shows that Cl^- concentration not affected by PTZ injection. Positive control group did not change significantly in comparison with negative control. Also no changes have been observed in those groups treated with aqueous extract and in sodium valproate group in comparison with positive control.

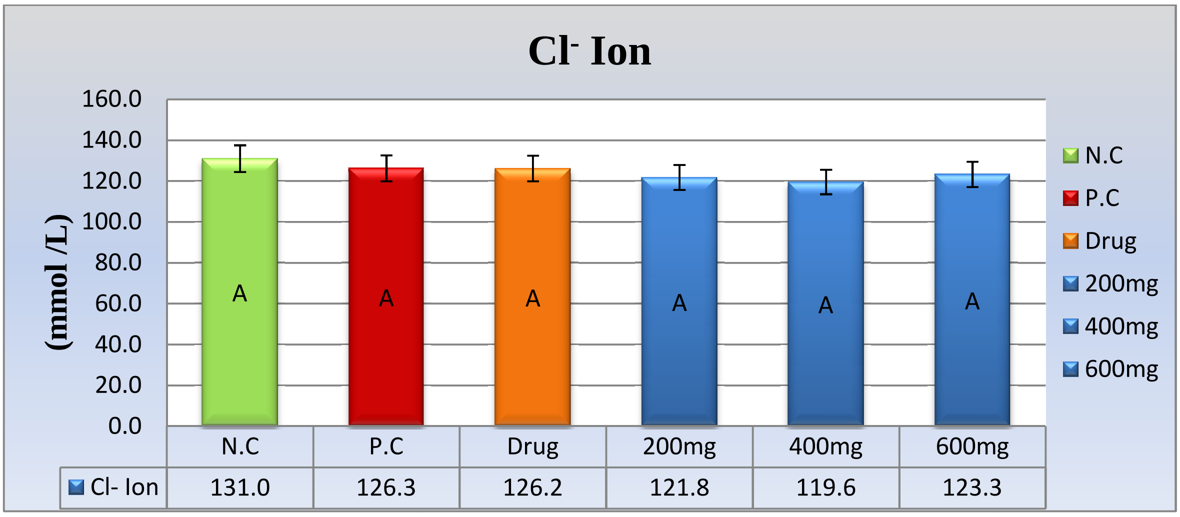

Figure-9: Effect of aqueous extract of *M. chamomilla* L. on serum Cl^- in PTZ treated chicks compared with controls (n=12 chicks in each group, values are expressed as mean ±SE, different letters refer to the significant differences at p< 0.05).

In Figure 10 injection of PTZ caused a significant elevation of serum total Ca^{2+} in comparison with the negative control. On the other hand, this elevation was not restored by sodium valproate and plant extract doses. The present result is in agreement with Kumar *et al*. (2013) [66] while disagree with Abdul Wahid (2010) [61] who found Ca^{2+}ions in serum did not change in untreated epileptic patients in comparison with normal healthy control, also found in treated epileptic patient with sodium valproate, Ca^{2+}serum increased in comparison with the control.

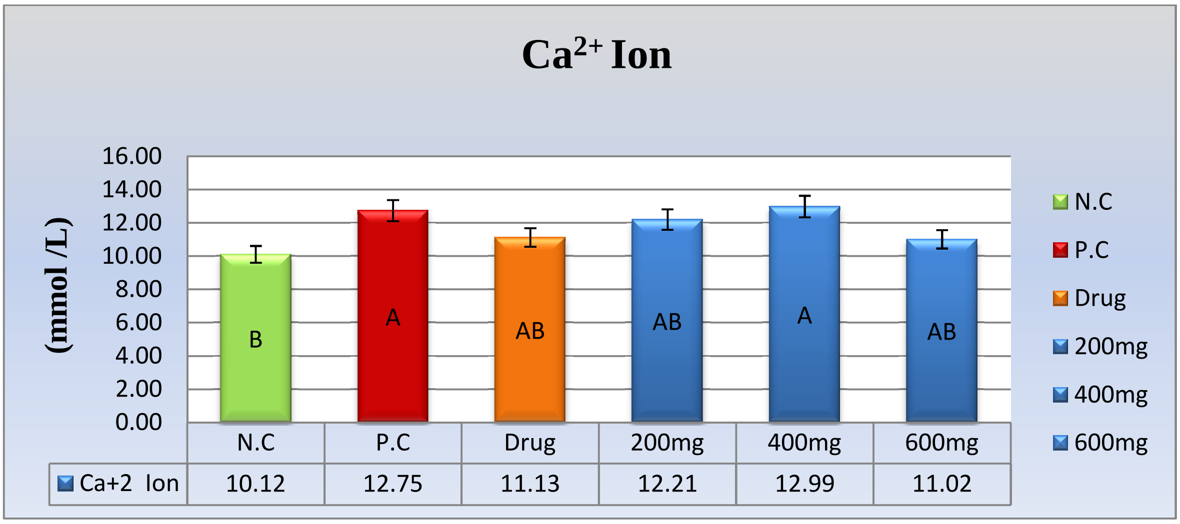

Figure-10: Effect of aqueous extract of *M. chamomilla* L. on serum Ca^{2+} in PTZ treated chicks compared with controls (n=12 chicks in each group, values are expressed as mean ±SE, different letters refer to the significant differences at p< 0.05).

E. Effect of aqueous extract of M. chamomilla L. *on serum glucose and total protein in PTZ treated chicks*

Serum glucose concentration did not differ significantly in chicks under convulsion induction effect. The present finding is incompatible with the studies conducted by Ali (2010) [67] and Ali *et al*. (2012) [54] who found the epilepsy induction by PTZ in rats caused significant increase in serum glucose level in comparison with the normal control. Different result of glucose level measurement was observed by Yuzo *et al*. (1998) [68]. The authors indicated that epileptic rats showed a decrease in serum glucose level due to the frequent occurrence of tonic convulsions and wild jumping associated with low body weight. In the present study, serum glucose levels in those convulsive chicks treated with sodium valproate showed significant increase in comparison with normal group. The mechanisms leading to hyperglycemia during sodium valproate medication are still poorly defined, although the use of sodium valproate may be associated with adverse effects, one of the most common being hyperinsulinemia is known to be associated with weight gain and insulin resistance [79]. Moreover, acute necrotic pancreatitis is associated with the use of sodium valproate and may affect insulin hormones synthesis site and secretion [70, 71]. Significant decrease of serum glucose concentration was shown at doses 400 and 600mg/kg in comparison with the controls. The possible mechanism may be due to the presence of flavonoids [4] which stimulates secretion of insulin from pancreatic cells leading to increased insulin level in blood [72] Flavonoids may also increase the insulin sensitivity [73] (Figure-11).

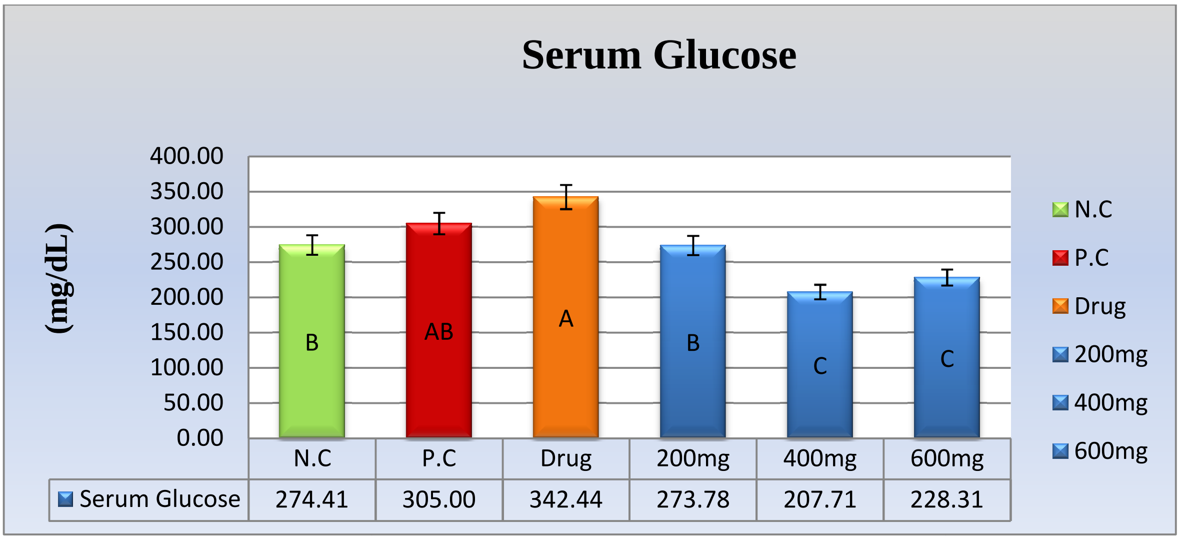

Figure-11: Effect of aqueous extract of *M. chamomilla* L. on serum glucose in PTZ treated chicks compared with controls (n=12 chicks in each group, values are expressed as mean ±SE, different letters refer to the significant differences at p< 0.05).

Total protein in serum was not affected in positive control in comparison with the negative control (Figure 12). This result is in agreement with the study of Natelson *et al*. (1979) [74], who indicated that in idiopathic or generalized epileptic patients, the serum total protein is normal. Treated chicks with sodium valproate show significant increase of serum total protein in comparison with control groups (positive and negative) This result is in agreement with Garzon *et al*. (1985)[75],while in contrast with the study of Babayigit *et al*. (2006)[76]. Several studies suggested that sodium valproate is metabolized to unsaturated toxic products in the body and these products may cause hepatotoxicity [77]. In this study, the elevation of serum total protein in those chicks treated with sodium valproate may be related to toxic and acute pancreatitis effect of sodium valproate. When administrated, the extract caused no changes of serum total protein level in comparison with the control. Unfortunately, till yet, no studies have been conducted to evaluate the effects of herbal extract on total protein level.

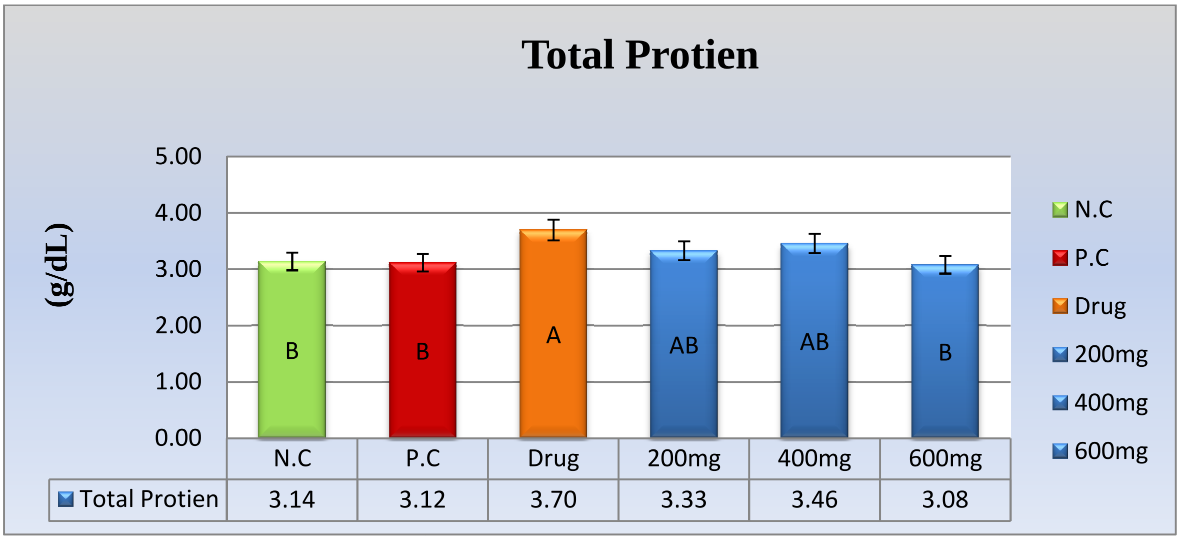

Figure-12: Effect of aqueous extract of *M. chamomilla* L. on serum total protein in PTZ treated chicks compared with controls (n=12 chicks in each group, values are expressed as mean ±SE, different letters refer to the significant differences at $p< 0.05$)

At the end of this study we concluded the *Matricaria chamomilla* L. aqueous extract exhibited anticonvulsant effect and full protection in dose 200mg/kg with reduced latency and development of clinical signs in doses 400 and 600mg/kg this could be attributed to presence of mainly flavonoids with tannins and alkaloids.

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