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Veterinary Medicine between Sustainable Development and Public Health to Confront Global Changes

# Impact of Transportation Stress on Growth Performance, Behaviour and Welfare of Turkey Pullets

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**Abstract** | One of the most stressful aspects of managing turkey pullets is the transporting procedure. The effects of transportation stress on animal welfare are well understood, but less is known about how transportation affects the behaviour, performance, and crop-filled test of turkey pullets. Therefore, This study aimed to investigate the effect of transportation on the behaviour and growth performance of Turkey. Turkey pullets were classified into 2 groups according to two types of transport, the First Group was150 pullets (Grade marker) one day -old chick (Flight from France) for 4.30 hours with short distance transport and the Second Group was 150 pullets (Grade maker) one day -old chick flight for 30 hours with long distance (flight from Tunisia). Results indicated that the First Group that flies for short distance showed a marked increase in the following behavioural patterns such as foraging behaviour, feeding behaviour and drinking behaviour compared with Second Group that flies for long distance, While growth performance was higher in the First Group (715.90 ±0.68) than the Second Group (615.26±0.79), a full soft rounded crop filled test showed that the First Group was more active than the Second Group. It was concluded that transportation has a significant impact on the growth performance, behaviour and welfare of turkey pullets.

**Keywords**: Turkey pullets, Transportation, Behaviour, Growth performance, Crop filled test ,Welfare

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## INTRODUCTION

The transportation process is one of the most stressful events in poultry and livestock management and has a major negative impact on birds' welfare varying from mild stress to death (Marchewka *et al*., 2013; Lalonde *et al*., 2021). The term "stress" is frequently used in a negative sense, such as having a detrimental impact on the welfare and health of animals. However, the neuroendocrine systems that underlie animals' stress reactions vary depending on the situation and are mostly change-adaptive. Finding a balance between management techniques that might lessen stress and, on the other hand, increase farm animal productivity has become more and more important in the current delicate environment of changing viewpoints in the animal production industry and social awareness (Edward, 2023). The handling of birds during transportation should not cause injury, panic, lasting fear or avoidable stress, and one of the five freedoms for animal welfare is freedom from fear and distress by ensuring conditions and treatment that avoid mental suffering (Scanes *et al*., 2020).

Almost anywhere in the globe, turkeys can be successfully raised if they are fed properly and shielded from diseases, predators, and inclement weather. Turkeys can adapt to many different types of weather. Turkey shares many of the same dynamics that have dominated the grill industry, but has far lesser production, consumption, and commerce than chicken (Dale, 2000). Governments and consumers are paying more attention to the wellbeing of turkeys raised for meat production. Leg health and mobility issues are among the welfare-related challenges in turkey production. (Martrenchar, 1999).

One of the most taxing aspects of managing poultry and livestock is the transportation procedure. (Mitchell, 2009). Depending on their developmental and growth stages, chickens may be moved from one farm to another. Creating a very noisy environment, manually collecting, grabbing, and cratting the birds into designated net cages where they are confined, crowded, and deprived of food and water, loading the cages onto motorized vehicles that then travel to their destination, exposing the birds to wind, cold, heat, vibration, and noise, and manually unloading the birds and placing them in a new housing environment are all part of the multifaceted process of transportation. (Marco-Ramell *et al*., 2016).

Therefore, this study conducted to investigate the effect of transportation on growth performance, behaviour and welfare of turkey pullets.

## MATERIALS AND METHODS

### Experimental Design and Husbandry

The experiment was done in two farms: lotus farm, located in Red Primus Road, center of wadiEl Natrun, Governorate of El Behera and Abd ElSattar Issa farm, located in Belbeis Obour Road, Kilometer 44. A total of 300 Grade marker one day-old chick divided into two groups according to two types of transportation, the First Group, composed of (150) turkey pullets that were selected randomly from the farm for short-distance transportation, took about 4.30 hours (flight from france to Egypt), and the Second Group, composed of (150) turkey pullets that were selected randomly from the farm for long distance transportation (flight from Tunisia to Egypt) with transit in Turkey then to Egypt; this journey took 30 hours. The pullets were randomly assigned to different two groups to ensure that any observed difference in outcomes is not due to preexisting variations between the groups. The study monitored temperature during transportation of pullets; this is important because temperature can affect the well-being and stress levels of the pullets. we use tempmate flash to record the temperature, and to ensure that the temperatures within the chick boxes are consistently between 28 and 32 degrees Celsius, the holding room should have a temperature between 22 and 26 degrees Celsius. When loading, keep the boxes level. Not the box's instructions. Chick boxes kept out of extreme heat or cold in a dry, clean, well-ventilated, and sheltered place. If there is a delay or cancellation, stay in touch with the freight forwarder and the end destination.

### Housing System

The study was carried out at two turkey farms that are specialized agricultural operations dedicated to the breeding, rearing, and processing of turkeys. These farms have typically large-scale facilities that employ modern techniques to ensure optimal growth performance, normal behaviour and efficient production. Turkey pullets are typically housed in large, climate-controlled barns or sheds. These structures provide a controlled environment to protect the birds from extreme weather conditions and predators. Each group was reared in deep litter by saw dust (10 cm thickness) after sprinkling with slacked lime over the floor. Houses were warmed before the chicks arrived. the number of turkeys per group to 5, 7, and 9 pullets /$m^2$. The ventilation system was designed to keep the temperature between 21°C and 23°C every day.

### Feeding System

Turkey pullets were fed twice per day and the feeding quantity 3-4% of body weight per day. Water and feed were supplied by hand whenever needed (Moreki and Ditshupo, 2012). The first feed was supplied on plastic trays (small chick feeders); bright colored markers were placed on top of feed as recommended by Moursy (2003). The basal diet was created to satisfy the nutritional needs of pullets fed starter ration, the basal diet was created containing 28% protein according to NRC (1994) and the diets are reported in Table 1.

### Lighting Regime

During the experiment, the pullets was supplied by using 200 watt bulbs at 2.5 heights above the level of pullets. This provided adequate light intensity at the pullets level as recommended by Mercia (1986). Lights remain on continuously for the first 3 days lighting for 24hr and then the photoperiod was stopped down by 1h/d.

### Brooding Temperature

Electric heaters were positioned between 30 and 46 centimeters above the pen's bottom to provide the ideal brooding

**Table 1:** The composition and nutritive value of the basal starter, grower and finisher diet.

| Ingredients | Starter | Grower | Finisher |
|---|---|---|---|
| | 0-8 weeks | 9-16weeks | 17-24 weeks |
| yellow corn | 41.57 | 51.81 | 67.81 |
| Soybean meal, 44% | 40 | 33 | 21 |
| Corn gluten, 60% | 7 | 2.5 | 3 |
| Fish meal, 65% | 2 | 2 | - |
| Meat meal, 50% | 3 | 3 | - |
| Soybean oil | 2 | 4 | 4.5 |
| Calcium carbonate | 1.25 | 0.85 | 0.85 |
| Calcium dibasic phosphate | 2 | 1.75 | 1.75 |
| Common salt | 0.3 | 0.3 | 0.3 |
| Premix[1] | 0.3 | 0.3 | 0.3 |
| Lysine, Hcl, 78% | 0.30 | 0.21 | 0.21 |
| DL- Methionine, 98% | 0.13 | 0.13 | 0.13 |
| Choline chloride | 0.15 | 0.15 | 0.15 |
| Total | 100 | 100 | 100 |
| **Calculated analysis** | | | |
| ME, Kcal/Kg | 2865.48 | 3060.88 | 3261.88 |
| CP, % | 28.18 | 23.14 | 16.74 |
| EE, % | 2.46 | 2.68 | 2.82 |
| CF, % | 3.98 | 3.61 | 3.04 |
| Ca, % | 1.38 | 1.16 | 0,76 |
| Available phosphorus, % | 0.62 | 0.56 | 0.46 |
| Lysine, % | 1.71 | 1.42 | 0.95 |
| Methionine, % | 0.6 | 0.51 | 0.42 |
| Methionine+cystine, % | 1.1 | 0.92 | 0.74 |

temperature for newly hatched pullets. During the first week of brooding, the temperature was kept at roughly 36–38°C using a thermometer at the level of the chick's back. After that, it was lowered by roughly 3.5°C every week until it reached 20–24°C in the fifth week. Mortality rates rise in the early days of the brooding period when insufficient heat is provided. (Randall and Bolla, 2008). In the winter, brooding turkey pullets need additional heat for five weeks. (Gencoglan *et al*., 2009).

- Identification Different colored paint was put to the pullets' wings, head, and body to help identify them.
- Vaccination: The pullets were vaccinated by Hitchner vaccine (IB –NCD) at 5th day of age, then repeated at 14th day of age, Lasota vaccine: at 30th day of age, then vaccination by lasota periodically every month.
- Medication The pullets were treated by Ciprofloxacin by dose (1ml /litre ) drinking water Colistin: 1/2 gm / litre drinking water. Vit E and Selenium: 1ml / litre drinking water.
- Observation and data collection following transportation, for two groups were documented. by a focal sample technique, collected the data, by using a stopwatch, a photographic camera, and an observation sheet were utilized to document the behavioural pattern. According to Shimmura *et al*. (2007), behavioural patterns according to Abd El Aty (2016), Ingestive behaviour of chicks were fed directly from feeders pullets. Foraging behaviour by scratching and pecking on the floor, ground, or other pen parts according to Bennett *et al*. (1997). Drinking behaviour of chicks obtained water from drinking troughs.
- Live Bird Performance: was noted according to Moursy (2003), live body weight was recorded weekly individually to the nearest gram of each group. Body weight gain was used to determine each body weight gain over the course of two consecutive weeks. Weight growth was equal to W2-W1, where W1 and W2 represent the individual's weight during two consecutive weeks.

## Crop Filled Test

It's helpful to assess how hungry the chicks are and make sure they've all found food and water. The first 24 hours are the most crucial, although the process for evaluating crop fill should be observed over the first 48 hours. Tools An eye-catching frame, Paper and a pen or pencil to record crop fill.

**Procedures:** Two hours after placement, a preliminary examination will show whether the chicks have located water and feed. Assessments of appetite development must be conducted at 8, 12, 24 and 48 hours following arrival on the farm.

- Step 1: Gather 30–40 chicks using the capturing frame, around 10 at a time, from three to four different locations throughout the home (or the surrounding area where spot brooding is employed).
- Step 2: Carefully handle each chick by using your thumb and forefinger to feel its crop in the pen.
- Step 3: Use the following categories to record each chick's crop content: Round, soft, and full, the chicks have discovered water and food. Chicks have feed but little to no water. They are full but hard with the original texture of their meal. The chicks have not discovered any food or water, therefore the crop is empty.
- Step 4: Divide the total number of chicks evaluated by the number of chicks recorded in each category, then multiply the result by 100 to determine the percentage of chicks in each category.
- Step 5: Evaluate your performance in relation to the target crop fill assessment criteria listed below. Results of the target crop fill assessment guidelines: Crop fill meets or surpasses the target parameters. Nothing needs to be done.5 percent or more less crop fill than the target recommendations (e.g., 75 percent or less at 8 hours following installation).

### Statistical Analysis

SPSS V.20 software was used for all statistical analyses (SPSS Inc., Chicago, IL, USA). Data that has been examined using SPSS V.20 software by using t- test, the Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data was described using mean and standard deviation. Significance of the obtained results was judged at the 5% level (Armonk, 2011). For normally distributed quantitative variables, to compare between two groups, and the Duncan test was employed as a post hoc analysis after the .by using t- test to examine the differences within two groups which have been statistically significant. The results were presented as standard error of the mean (SEM) and the significance level was chosen at P< 0.05.

## RESULTS AND DISCUSSION

Road, crate, and vehicle transportation conditions, as well as the number of birds in the crates (Bayliss and Hinton, 1990; Chauvin *et al*., 2011). Environmental elements, such as humidity and temperature (Warriss *et al*., 2005) Season and time of day (Moran and Bilgili, 1995; Petracci *et al*., 2006; Vecerek *et al*., 2006; Drain *et al*., 2007; Voslarova *et al*., 2007; Elsayed, 2014), the distance between the aire port and the poultry farm (Nijdam *et al*., 2004; Voslarova *et al*., 2007; Ondrasovicova *et al*., 2008; Sowinska *et al*., 2013; Vecerek *et al*., 2016), and transportation time (Bayliss and Hinton, 1990; Warriss *et al*., 1992; Nijdam *et al*., 2004; Bianchi *et al*., 2005) all have an impact on the behaviour, performance, and production of chickens (Chauvin *et al*., 2011) concerning the ingestive behaviour of turkey birds.

**Table 2:** The effect of transport-related stress distance on foraging behaviour frequency of turkey pullets throughout three weeks of study/ 8 hours observation weekly.

| Foreign Time | Short distance | Long distance | Sign. |
|---|---|---|---|
| 1st week | 59.00±1.00 | 43.00±2.08 | * |
| 2nd week | 43.00±2.51 | 45.00±5.00 | NS |
| 3rd week | 38.00±2.16 | 48.00±1.15 | * |
| Total | 46.66±2.89 | 45.33±1.78 | NS |

**NS:** Non-significant changes; *Significant at 0.05 probability. The values expressed as Mean ±SE.

As maintenance behaviour in Table 2 the results showed how transportation affected turkey birds' foraging behaviour, As the First Group (short transport distance) exhibited a higher frequency of foraging behaviour in the first week (59.00±1.00 respectively) than the Second Group (long transport distance) (43.00±2.08) however, the difference did not show up in the second week. The obtained results agreed with Sherwin and Kelland (1998); Martrenchar, (1999); Cornetto *et al*. (2002); Gunthner and Bessei (2006); Ventura *et al*. (2012) findings that benefited how transportation affected badly theforaging behaviour of birds. This agreement might be explained by the management programs' similarities.

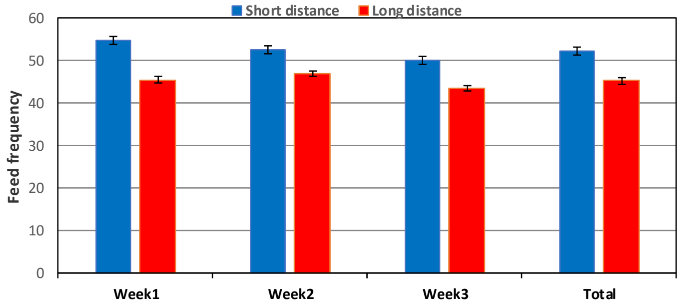


**Figure 1:** The effect of transport-related stress distance on feeding behaviour frequency of turkey pullets throughout three weeks of study / 8 hours observation weekly; There is no significant difference between two groups. The values expressed as Mean ±SE.

Data presented in Figure 1 showed that less feeding behaviour were observed in the Second Group (long transport distance) (54.75 ±2.42) than the first Group (short transport distance) (45.50 ±2.62) in first week, and after that the difference did not reach significance .These results coincided with the findings of Siddharth *et al*. (2024) who found that the birds which put under a lot of stressors such as transportation, for a long time showed a decrease in feeding behaviour and appetite and subsequently reduced their output and compromised their welfare. Also, these results go hand in hand with the data cited by Ulupi *et al*., (2018) who mentioned that management applied stressors, such as food deprivation during transportation, could induce stress resulting in a change in feeding habits and normal behaviour. This agreement may be due to feeding behaviour may affected by means of transport distance.

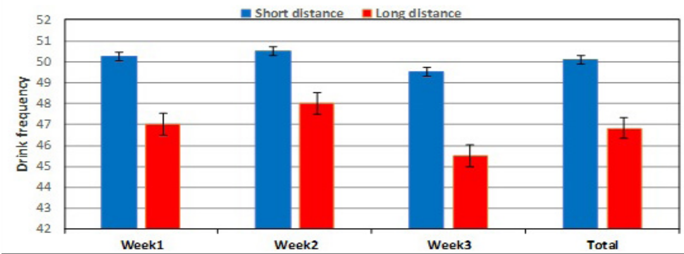


**Figure 2:** The effect of transport-related stress distance on drinking behaviour frequency of turkey pullets throughout three weeks of study / 8 hours observation weekly;There is no significant difference between two groups; The values expressed as Mean ±SE.

Results shown in Figure 2 revealed that there is non significance between two groups, the first Group (short transport distance) (50.08±1.50) and the Second Group (long transport distance) (46.83±1.60). These findings agreed with Marchewka *et al*. (2013) who noted that water withdrawal could have a negative impact on the welfare of turkeys, which may manifest through changes in their behaviour patterns. This similarity may be attributed to the decrease in space allowance during transportation leading to frustration of these birds which is evidenced by reducing drinking behaviour.

**Table 3:** Full soft rounded crop filled test for short and long distance for turkey pullets throughout three weeks of study.

| Different periods | Short distance | Long distance |
|---|---|---|
| 2 hours | $37.66\pm0.88^{c}$ | $34.33\pm1.20^{c}$ |
| 8 hours | $41.33\pm1.20^{b}$ | $38.00\pm1.52^{c}$ |
| 12 hours | $44.00\pm1.52^{b}$ | $43.00\pm2.00^{b}$ |
| 24 hours | $48.33\pm0.66^{a}$ | $44.66\pm1.76^{ab}$ |
| 48 hours | $49.66\pm0.33^{a}$ | $49.33\pm0.33^{a}$ |

Means within the same column carrying different superscripts are Significant different at P < 0.05; The values expressed as Mean ±SE.

The data in Table 3 showed that the effect of transport on determining appetite development of turkey pullets that there is moderate significance between two groups of transport that show full soft rounded crop after 2hours. untill reach 24hours,it indicated that poullets in the First Group (short transport distance) eat and drink faster than Second Group (long transport distance)., but at 48hrs there is no significance, These findings concurred with those of Cobb-Vattress (2015), who suggested that 95% of chicks should have a complete, soft, and rounded crop within 24 hours of implantation. This shows that the pullets have found their food and water.

**Table 4:** Full hard crop filled test for short and long distance for turkey pullets throughout three weeks of study.

| Different periods | Short distance | Long distance |
|---|---|---|
| 2 hours | $3.00\pm0.57^{a}$ | $4.00\pm0.57^{a}$ |
| 8 hours | $2.00\pm0.57^{ab}$ | $3.33\pm0.33^{b}$ |
| 12 hours | $0.66\pm0.66^{bc}$ | $1.33\pm0.88^{c}$ |
| 24 hours | $00.00\pm0.0^{c}$ | $0.66\pm0.66^{c}$ |
| 48 hours | $00.00\pm0.0^{c}$ | $00.00\pm0.0^{c}$ |

Means within the same column carrying different superscripts are significant different at P < 0.05; The values expressed as Mean ±SE.

Data as mentioned in Table 4 shown the effect of transport on determining appetite development of turkey pullets that there is moderate significance between two groups of transport that show full hard rounded crop after 2hours till reach 12hours in both groups but at 24hours the Second Group show full hard crop indicating that chicks in this group eat but did not drink enough amount of water. These results agreed with the result observed by Cobb-Vattress (2015), who found that After 24 hours following implantation, 95% of chicks should have a full, rounded, and soft crop. This indicates that food and water have been found for the pullets. This agreement attributed to using the same environmental conditions.

**Table 5:** Crop empty crop filled test for short and long distance for turkey pullets throughout three weeks of study.

| Different periods | Short distance | Long distance |
|---|---|---|
| 2 hours | $8.66\pm0.33^{a}$ | $11.66\pm1.20^{a}$ |
| 8 hours | $6.66\pm1.20^{a}$ | $8.66\pm1.20^{ab}$ |
| 12 hours | $5.33\pm1.85^{a}$ | $5.66\pm2.07^{b}$ |
| 24 hours | $1.66\pm0.66^{b}$ | $4.66\pm1.76^{bc}$ |
| 48 hours | $0.33\pm0.33^{b}$ | $0.66\pm0.66^{c}$ |

Means within the same column carrying different superscripts are significant different at P < 0.05; The values expressed as Mean ±SE.

As regarding to Table 5 the effect of transport on determining appetite development of turkey pullets showed that there is great significance between two groups of transport that show empty crop after 2hours. Till reach 24hours, indicate that pullets in the Second Group (long transport distance) don't eat or drink more than First Group (short transport distance). At 48hours there is no significance. These results agreed with the finding obtained by Cobb-Vattress (2015), this agreement may be due to use the same managerial practices. A complete ban on long-distance live animal transport may not be tenable, as there may always be the long-distance transport of specialized livestock (turkey for example), but tighter regulations and a transition toward behaviour and welfare of birds serious public health implications of epizootics, whether natural or intentional, and have additional positive social and economic benefits.

**Table 6:** The effect of transport-related stress distance on average body weight (gram) of turkey pullets throughout three weeks of study.

| Different periods | Short distance | Long distance |
|---|---|---|
| First day | $90.06\pm0.29^{a}$ | $75.50\pm0.28^{b}$ |
| First week | $186.03\pm0.81^{a}$ | $152.46\pm0.49^{b}$ |
| Second week | $250.73\pm0.41^{a}$ | $225.60\pm0.74^{b}$ |
| Third week | $715.90\pm0.68^{a}$ | $615.26\pm0.79^{b}$ |

Means within the same rows carrying different superscripts are significant different at P < 0.05;The values expressed as Mean ±SE.

Data presented in Table 6 revealed that the average body weight increased dramatically during the three weeks of the experiment, indicating a significant difference in average live body weight between the two groups. First group (short transport distance) (715.90±0.68) the second group (long transport distance) (615.26±0.79) results were attributed to the impact of transportation and agreed with the findings of (Abdel-Rahman, 2005; Dozier *et al*., 2005; Dozier *et al*., 2006; Estevez, 2007; Metin Petek 2010). Who corroborated that our study found that an increase in travel distance significantly increased the body weight loss in chickens, and they attributed this agreement to the use of the identical environmental circumstances. Also these results coincided with those obtained by Siddharth *et al.* (2024), who cited that feed efficiency and body weight were significantly decreased with decreasing floor space during transportation for long time.

**Table 7:** The effect of transport-related stress distance on body weight gain (gram)of turkey pullets throughout three weeks of study.

| Different periods | Short distance | Long distance |
|---|---|---|
| First week | 95.96±0.89[a] | 81.96±0.57[b] |
| Second week | 64.70±0.90[a] | 73.13±0.96[b] |
| Third week | 465.16±0.81[a] | 389.66±1.14[b] |
| Total gain | 625.83±0.71[a] | 544.76±0.86[b] |

Means within the same rows carrying different superscripts are significant different at $P < 0.05$; The values expressed as Mean ±SE.

The data in Table 7 showed that body weight gain revealed that there is significance difference in the average weight gain at 3 weeks of the study. While the weight gain was significantly higher in First Group (short transport distance) at most weeks of age (625.83±0.71) than the second group(long transport distance)(544.76±0.86). These results agreed with Arikan *et al*, (2017) who found that the reduction of final body mass can be connected to decrease in food consumption because of transport stress, so transportation distance had a major impact on overall losses. Growth in body weight also concurred with (Ondrasovicova *et al*., 2008) who reported that transportation distance from the hatchery to the imported country was found to reduce live body weight in an experimental investigation. This agreement may be due to using the same species.

Further researches on transportation of turkey pullets should be done under certain parameters, such as road, crate, and vehicle conditions, as well as the density of the pullets in the crates. Environmental factors that affect foraging behaviour, feeding intake, body weight, growth rate, and farm welfare productivity include temperature and humidity, season, time of day, distance from the airport to the poultry farm, and transportation time.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the study's findings, it can be said that turkey pullets' feeding, foraging, and drinking habits changed when they were transported over vast distances. Therefore long-distance transportation of turkey pullets should be avoided because it negatively impacts the animals' welfare, growth, behaviour, and health. This vulnerability may be lessened by lowering transport stress and enhancing housing conditions in the new facility, as lowering transport-induced stress is a key goal for enhancing animal welfare. The study recommended that turkey pullets should be transported under certain parameters, such as road, crate, and vehicle conditions, as well as the density of the pullets in the crates. Environmental factors that affect foraging behaviour, feeding intake, body weight, growth rate, and farm welfare productivity include temperature and humidity, season, time of day, distance from the airport to the poultry farm, and transportation time.

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## NOVELTY STATEMENT

The transportation stress had scientifically bad effect on the growth, behaviour and welfare of Turkey Pullets.

## AUTHOR'S CONTRIBUTIONS

The work done by Azza Mohamed Morsi Fahd under supervision of Al-Sadik Y. Saleem and Mohamed Y. I. Youssef. The statistical analysis done by Azhar F. Abdel Fattah. The study funded by Gehad R. Donia. All authors read and approved the final version of the manuscript.

### Conflicts of Interest

The authors declare no conflict of interest.

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