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Effect of road transportation on body weight loss, respiration rate, pulse rate, and rectal temperature in fed *ad libitum*, fasted or electrolytes drenched buffalo.

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Abstract:

This study was carried out at the Animal Experimental Farm,Animal and Poultry Production Department,Faculty of Agriculture,Assiut University. This work was conducted to investigate the effects of truck transportation on live body weight with and without fasting and some physiological parameters in buffalo. Also the effect of drenched electrolyte fluid on transportation stress was investigated. Fifteen mixed sexes buffalo calves separated equally to three groups according to their body weights were used in the present study.Group A Calves ranged in body weight from 126 to 163.5 kg, group B from 176 to 252 kg, and group C from 275 to 368kg.Insignificant differences among the three animal groups were found in all of the studied parameters.Transportation induced increment percentage of body weight loss, rectal temperature,and increment followed by decrement in respiration rate and pulse rate.Buffaloes Fed *ad libitum* lost more body weight than fasted ones, while drenched electrolyte fluids was less affected by transportation stress. Transport caused rise in rectal temperature and increase in respiration rate and pulse rate in treated buffaloes.Meanwhile, transported and fed electrolyte drenched buffaloes were less affectedby transportationstress.Therefore,drenching the electrolyte fluids treatment had ameliorated the detrimental effects of transport stress throughout the studied parameters such as body weight loss,rectal temperature, respiration rate and pulse rate.

Key words: Buffalo, Transportation stress, Body weight, Electrolyte.

Introduction:

Stress is defined as conduction in an animal that results from the action of one or more stressors that may be of either external or internal origin, whether a stressor can be considered as a harmful depends on the way an organism is able to cope with a threatening situation as it regains homeostasis (Von Borell, 2001). Transportation is an inevitable husbandry practice, which livestock are subjected to as a major stressor (Adenkola *et al.*, 2009a and b Bisalla *et al.*, 2011).

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In Egypt, livestock are transported often without interest of any welfare order and in vehicles designed for transportation of goods and not specifically for transportation of animals such as open trailers, trucks, pick-ups.

There is scarcity of researches dealing with the effects of transportation on buffalo. However, earlier work has shown that transport leads to loss of body weight. After a stress response, negative effect on growth rate has been observed (Broucek *et al.*, 1983).Long transportation of food animals without water and feeds, which occurs very often, is accompanied by drastic loss in body weight (Ayo *et al.*, 1996). Adenkola *et al*,. (2009a) showed that pigs transported for 4 h lose 19.50% while those administered with ascorbic acid lose 7.29% indicating that ascorbic acid was able minimize loss often encountered with road transportation of livestock. Atkinson (1992) reported that dehydration occurs in transported calves and that keeping them in lairage may help in their recovery. Baldock and Sibly (1990) observed that placing ewes in a stationary trailer had no effect on heart rates, but transportation of ewes for 20 min in the trailer produced an increase of 12 beats per minute. Adenkola *et al.*, (2008) reported that rectal temperature recorded during 8-h3) and 4-h journey.Whythens *et al.*, (1985) added that body fluid shifts could be seen to occur quite rapidly. Fluid supplementation has been shown to be effective in reducing the detrimental effects of transport stress on cattle (Sranmek and Pozdosek, 1987 and Schaefer *et al.*, 1990). The economic ramifications of these findings are clear, however, the biological basis of the effects of fluid treatment is less well defined. There was substantial research work on the effects of handling and transportation of cattle, pigs and poultry (Rollin, 1995). Little work was carried out to assess the effects of stress in transported buffaloes, sheep and goats especially under hot and subtropical conditions. This study was carried out to investigate the effects of *ad libitum*, fasted and drenched with electrolytes on truck transported buffaloes of different weights.

Materials and methods

Fifteen mixed sexes buffalo calves were divided equally into three groups according to there body weights were used in the present study. Group A calves ranged in body weight from 126 to 163.5 kg, group B from 176 to 252 kg, and group C from 275 to 368 kg.

All groups were subjected to the following three treatments:

1) Transportation after *ad libitum* feeding.
2) Transportation after Fasting for 16 h.
3) Transportation after *ad libitum* feeding and drenched with electrolytes fluid(two liters/head) which contains sodium chloride

8.6g,Potassium chloride 0.3g and Calcium chloride $2H_2O$ 0.33 g.

All Animals were fasted during the trip and four h after arrival (time needed to finish all measurements). The trip lasted for about 3 h using truck for 250 km distance at speed ranged from 60-80 km/h. The ambient temperature during the trip and while taking the measurements was around 28 to 34 °C. The trip commenced at 7:00 am. At the day of transport, the measurements were taken just before loading the animals (Time 1), immediately after uploading (Time 2), two hours after arrival (Time 3), and four hours after arrival (Time 4). The following measurements were taken:

1- Body weight (kg).
2- Rectal temperature (°C).
3- Pulse rate (beat/min.) estimated by counting the beat of Jugular vein for one minute.
4- Respiration rate (breath/min.) determined by counting the flank movements for one minute.

Statistical analysis: Data were statistically analyzed using three factors (group, treatment and time) analysis of variance, Duncan`s multiple range test and multiple linear correlation as described by Gomez and Gomez (1984). All calculations were performed using SPSS/PC.

Results and discussion

No significant differences among the three animal groups were detected in all the studied parameters.

1. Effect of transportation on body weight loss.

Data in Table (1) and Figure (1) showed that road transport caused highly significant loss in buffalo live body weight. Buffaloes in T1 lost 4.2% of their original transport body weight, while those fasted (T2) or electrolytes supplemented (T3) were less affected by transportation (2.55 %and 2.09 %, respectively). Differences between T1 mean and the other two means were highly significant ($P<0.01$). While, the differences between T2 and T3 means were significant ($P<0.05$). These results are inagreement with those obtained by Broucek *et al*. (1983) that negative effect on body weight has been observed after animal had been stressed. They added that release of thyroid stimulating hormone (TSH), known to affect growth rates, can be inhibited by negative feed back from adrencortical hormone after a stress response.

With respect to the effects at different times of taking the measurements, insignificant differences in body weight loss between Time 3 and Time 4 (2 hours and 4 hours after transport) were averaged over the three treatments (4.07 and 4.82 %, respectively). Both values were significantly higher ($P<0.05$) than the percentage of body weight loss (2.89 %) in Time 1 (immediately after transport).

Both fasted (T2) and electrolytes supplemented (T3) transported buffaloes lost significantly lesser percentages of body weight than those fed *ad libitum* buffaloes (T1). These findings are in concomitance with Schaefer *et al.,* (1997) who reported that the application of oral electrolyte therapy, especially if similar in constituents to interstitial fluid, resulting improvements in both live and carcass weights (less shrink) of up to several percent in treated animals as well as a reduction in meat quality degradation (reduced dark cutting).Similar results were found by Daghash, (2008) that lambs treated with 5% glucose solution were less affected by transportation stress. But, in contrary to our results he found that fasted lambs were more affected by transportation stress than those fed *ad libitum* and transported ones. The same observation was reported by Kannan *et al*., (2000 & 2002) that transportation and prolonged feed deprivation in goats may increase stress and live weight losses.

The use of electrolyte solutions for minimizing the effects of stressors on animals in the marketing process has been advocated in the sheep and beef industries without a full understanding of the effects of transport stress on the acid-base physiology of ruminants (Schaefer *et al.,* 1997).Furthermore, Adenkola *et al.* (2009[b]) showed that pigs transported for 4 h lost 19.50% while those administered with ascorbic acid lost only 7.29% of live weight indicating that ascorbic acid was able to minimize loss often encountered with road transportation of livestock.Much of this loss is actually from carcass components and not simply gastrointestinal tract fill (Jones *et al*., 1988; Warriss, 1990 and Schaefer *et al*., 1997).Indeed, it is well established that different animal species and even animals of the same species but different genetic backgrounds respond differently to the same stressor (Hall *et al.,* 1998).

Table 1: Effect of transportation on body weight loss and some physiological parameters (Mean ± SD) in fed *ad libitum*, fasted or electrolytes drenched buffalo.

			% Body weight loss	Respiration rate (breath/min.)	Pulse rate (beat/min.)	Rectal temperature (°C)
TREATMENT			**	**	**	**
Transp.fed *ad libitum* (T1)			$4.20^{A}\pm0.613$	$23.83^{A}\pm1.96$	$60.45^{A}\pm7.65$	$38.13^{B}\pm3.11$
Transp and fasting (T2)			$2.55^{B}\pm0.412$	$23.45^{B}\pm2.11$	$55.14^{C}\pm4.13$	$37.66^{C}\pm2.981$
Transp and electrolytes (T3)			$2.09^{C}\pm0.311$	$21.31^{C}\pm1.76$	$58.14^{B}\pm5.16$	$38.71^{A}\pm1.971$
TIME			**	**	**	**
Before transport (Time 0)			$0.00^{D}\pm0.00$	$19.70^{D}\pm1.98$	$51.99^{D}\pm4.61$	$37.53^{B}\pm3.25$
Imm. after transport (Time 1)			$2.89^{C}\pm0.193$	$25.25^{A}\pm2.61$	$64.42^{A}\pm6.11$	$38.36^{A}\pm4.11$
2h after transport (Time 2)			$4.07^{A}\pm0.246$	$24.60^{B}\pm2.19$	$59.60^{B}\pm6.91$	$38.33^{A}\pm3.87$
4h after transport (Time 3)			$4.82^{A}\pm0.278$	$22.84^{C}\pm1.96$	$55.63^{C}\pm4.75$	$38.44^{A}\pm4.15$
TIME*TREATMENT			**	**	**	**
Before transp-ort		Before *ad libitum*	$0.00^{j}\pm0.00$	$20.23^{f}\pm3.93$	$52.20^{j}\pm3.96$	$37.62^{e}\pm4.13$
Before transp-ort		Before fasting	$0.00^{j}\pm0.00$	$19.67^{g}\pm4.76$	$49.36^{k}\pm4.15$	$37.14^{f}\pm4.09$
Before transp-ort		Before electro-lytes	$0.00^{j}\pm0.00$	$19.21^{h}\pm3.71$	$54.41^{h}\pm6.11$	$37.82^{de}\pm3.92$
Time after transportation	0 hour	*Ad libitum*	$3.93^{d}\pm0.313$	$27.28^{a}\pm4.61$	$67.75^{a}\pm5.13$	$38.51^{b}\pm3.87$
Time after transportation	0 hour	Fasting	$2.74^{h}\pm0.251$	$25.29^{c}\pm3.79$	$62.23^{c}\pm4.17$	$38.02^{cd}\pm3.11$
Time after transportation	0 hour	Electro-lytes	$2.00^{i}\pm0.119$	$23.17^{d}\pm3.81$	$63.27^{b}\pm3.96$	$38.55^{b}\pm4.151$
Time after transportation	2 hour	*Ad libitum*	$5.72^{b}\pm0.678$	$25.63^{b}\pm4.76$	$62.22^{c}\pm8.71$	$38.13^{cd}\pm3.35$
Time after transportation	2 hour	Fasting	$3.47^{e}\pm0.371$	$25.64^{b}\pm5.81$	$56.30^{f}\pm7.66$	$37.61^{e}\pm4.71$
Time after transportation	2 hour	Electro-lytes	$3.02^{g}\pm0.314$	$23.19^{d}\pm3.71$	$60.29^{d}\pm4.95$	$39.26^{a}\pm4.45$
Time after transportation	4 hour	*Ad libitum*	$7.14^{a}\pm0.612$	$22.20^{e}\pm2.15$	$59.64^{e}\pm6.12$	$38.27^{bc}\pm5.55$
Time after transportation	4 hour	Fasting	$3.97^{c}\pm0.111$	$23.22^{d}\pm3.97$	$52.68^{i}\pm5.42$	$37.86^{de}\pm4.76$
Time after transportation	4 hour	Electro-lytes	$3.35^{f}\pm0.105$	$19.66^{g}\pm2.99$	$54.58^{g}\pm4.16$	$39.20^{a}\pm4.04$

- Different letter in the same column indicate statically significance ($P<0.05$) between values according to Duncan's multiple range tests (small superscript letters to compare the interactions). * significant at 5% and ** significant at 1%

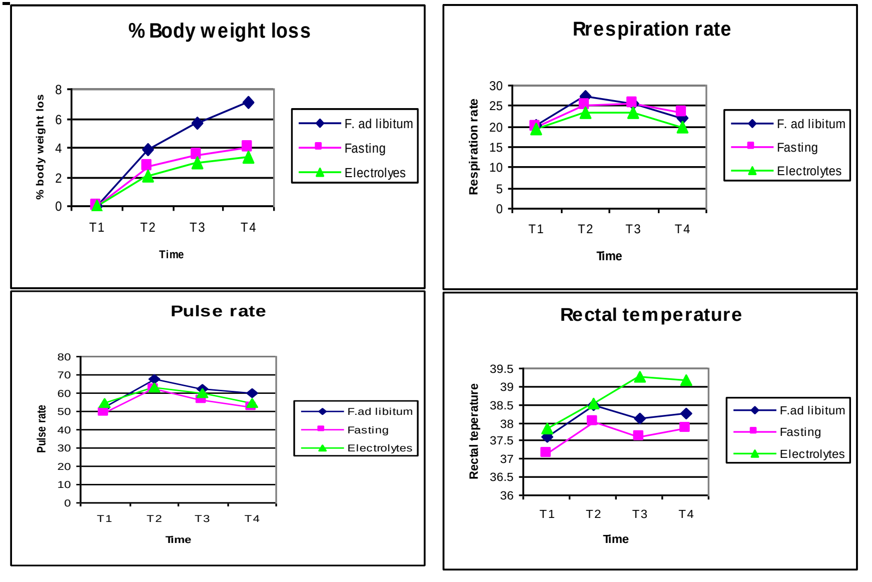

Fig 1 : Effect of transportation times on %body weight loss, respiration rate, pulse rate and rectal temperature in experimental buffaloes.

Treatments:

- Fed *ad libitum* and transported. **Time1: Before transport.**
- Fasted and transported. **Time2: Immediately after transport.**
- Drenched electrolytes and transported. **Time3: 2h after transport.**
Time4: 4h after transport.

2. Effect of transportation on respiration rate.

As shown in Table (1) and figure (1), the respiration rate (breath/min) was highly significantly (P<0.01) lower in transported and drenched electrolytes buffaloes (21.31 breath/min) than those fasted (23.45 breath/min) or *ad libitum* fed (23.83 breath/min) transported buffaloes. These results are coinciding with Daghash, (2008) who reported that transported lambs which treated with 5% glucose solution were less affected by transportation stress and showed lower respiration rate. But, in contrary to our results on buffaloes He found that fasted lambs were more affected by transportation stress than fed *ad libitum* and transported ones. Averaged over the three treatments, the respiration rate was 19.7

(breath/min) before transport (Time 0) and got higher to 25.25 immediately after transport (Time 1) then began to decrease to reach 24.6 then 22.84 at 2h and 4h after transport, respectively. These values highly significantly(P<0.01) differed. Similarly, in study using donkeys during road transportation,

Plyaschenko and Sidorov (1987) observed that respiration rate increased from 22.3 to 40.1 breaths per minute within 15 min of loading and it remained high during the journey.Transported and given electrolytes buffaloes were significantly less affected by transportation and reached the base line 4h after transport. Indicating that giving the buffaloes electrolyte solutions had alleviated the stressful effects of road transportation. Electrolyte and fluid supplementation has been shown to be effective in reducing the detrimental effects of transport stress on animals (Sranmek and Pozosek, 1987 and Schaefer *et al*., 1990).Similarly, during transportation of ostriches, Minka and Ayo (2007b; 2008) reported a significant increase in respiration rate of the birds subjected to 6 h road transportation. Daghash (2008) reported that in transported lambs, immediately after transportation, respiration rate was significantly higher than (before transportation). After that, these values were decreased and the lowest values were observed after 4 hours following transportation

3. Effect of transportation on pulse rate.

Table (1) and figure (1) indicate that buffaloes in T1 showed the highest significantly pulse rate (60.45 beat/min) in comparison with buffaloes in T2 which exhibited the lowest pulse rate 55.14 beat/min while intermediate value (58.14 beat/min) was obtained with buffaloes in T3.

Furthermore, buffalo road transport resulted in highly significant ($P<0.01$) increase in pulse rate from 51.99 beat/min before transport (Time 0) to 64.42 beat/min immediately after arrival (Time 1). Two hours after arrival (Time 2), pulse rate decreased to 59.6 beat/min and reached 55.63 beat/min at 4h after transport (Time 4). Several investigators have reported the immediate increment in pulse rate after transportation (Bianca, 1976; Vihan and Sahni, 1981; Ayo *et al.*, 1998, Ayo *et al.*, 2005,

Bouwknecht *et al.*, 2007 and Zulkifli1 *et al.*, 2010).

Obviously, fasted buffaloes exhibited significantly ($P<0.05$) lower pulse rate in the three times after arrival followed by buffaloes that given electrolytes (Table 1). This was inconsistent with the results of Daghash (2008) who reported that transported and fasted lambs exhibited the highest pulse rate followed by fed *ad libitum* and then lambs which treated with 5% glucose solution.

4. Effect of transportation on rectal temperature.

The differences in rectal temperature were around 1 ^{o}C. Averaged over the three treatments, the transported animals showed significant higher rectal temperature at Time 1 (38.36 ^{o}C) than Time 0 (before transport, 37.53 ^{o}C). No significant differences in rectal temperature were found between Time 1, Time 2 and Time3(38.36, 38.33 and 38.44, respectively) as shown inTable (1) and figure (1).

Transported and electrolytes treated buffaloes (T3) showed significantly higher rectal temperature (38.71 ^{o}C) followed by T1 (38.13 ^{o}C) while T2 showed significantly lower rectal temperature (37.66 ^{o}C).

This was consistent with the results of Daghash, (2008) who reported that rectal temperature in lambs transported and fed *ad libtium* exhibited the highest values, while the lowest value was found in transported and fasted lambs compared to other treated lambs. Also, Horton *et al*., (1996) found that rectal temperature was lower in fasted lambs and this supported by the result of Naqui and Rai (1991) who found lower temperature in fasted lambs.

On the topic of body temperature, Bouwknecht *et al.*, (2001) and Zulkifli1 *et al.*, (2010) found that transportation at ambient temperatures of 30–32^{o}C resulted in hyperthermia (unusually high body temperature) among the goats. The increase in body temperature following transportation could also be attributed to stress-induced hyperthermia. The phenomenon of stress induced hyperthermia has been reported in mammalian species when subjected to mild disturbance (Bouwknecht *et al.*, 2007) and handling (Moe & Bakken, 1997). Stress induced hyperthermia has been closely associated with an activation of the hypothalamic-pituitary-adrenal axis and the sympathetic-adrenal-medullary system.

Rectal temperature (RT), respiratory rate (RR) and heart rate (HR) are important physiological parameters most relevant for on-the-spot evaluation of the health status and adaptability of animals, including poultry species (Bianca, 1976; Ayo *et al.,* 1998). The parameters are easily measured and are of value in the determination of state of stress especially during the process of transportation in rural areas where laboratory facilities may be lacking (Minka and Ayo, 2007b). These parameters are of importance in evaluating the adaptability of domestic animals to various environmental stress factors (Bianca, 1976; Vihan and Sahni, 1981; Ayo *et al.,* 1998), including transportation stress (Ayo *et al.,* 2005). In contrary, Ali *et al.*, (2006) recorded in desert sheep and goats that road transportation for 2 hours resulted in variable and statistically insignificant increases in heart, pulse and respiratory rates in both control and experimental animals.Therefore, the application of electrolyte solutions to minimize transport stress in animals, while fluid supplementation has been showed to be effective in reducing the detrimental effects of transport stress on cattle, sheep and buffalo.

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تأثير النقل البري على وزن الجسم ومعدلي النبض والتنفس ودرجة حرارة المستقيم في حالات التغذية حتى الشبع والصيام وتجريع المحاليل لعجول الجاموس

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أجريت هذه الدراسة في مزرعة بحوث قسم الإنتاج الحيواني والدواجن ، كلية الزراعة، جامعة أسيوط.

استهدف هذا البحث دراسة تأثيرات النقل البري على بعض الصفات الفسيولوجية في عجول الجاموس. واستهدف البحث أيضا دراسة تجريع الجاموس بالمحاليل (الكتروليت) لتقليل أو منع التأثيرات الضارة لإجهاد النقل على الحيوان.

تم استخدام خمسة عشر عجل جاموس من كلا الجنسين تم تقسيمها إلى ثلاث مجموعات حسب الوزن (صغير- متوسط - كبير) وتعرضت الثلاث مجموعات إلى المعاملات التالية:

معاملة المقارنة: وتم فيها التغذية حتى الشبع ثم النقل، **معاملة الصيام:** تم منع التغذية والماء ستة عشر ساعات ثم النقل، **المعاملة بالمحاليل:** وتم فيها التغذية حتى الشبع ثم تجريع كل حيوان ٢لتر محلول إلكتروليتي .

مُنعت كل الحيوانات من الغذاء والماء عند النقل وحتى أخذ آخر قراءة. وتم نقل الجاموس في لوري لمدة ثلاث ساعات لمسافة حوالي ٢٥٠كليومتر بمتوسط سرعة ٦٠-٨٠ كم/ساعة (درجة الحرارة ٢٨-٣٤ درجة مئوية وبدأت الرحلة في السابعة صباحا) بعد ذلك تم تنزيل الحيوانات وأخذ القراءات والعينات.

في يوم النقل تم أخذ القراءات مباشرة قبل النقل (القراءة الأولى) ثم بعد الوصول مباشرة (القراءة الثانية) ثم بعد ساعتين (القراءة الثالثة) وأخيرا بعد أربع ساعات (القراءة الرابعة). وتمت دراسة النسبة المئوية لنقص وزن الجسم الحي، معدل التنفس، معدل النبض ودرجة حرارة المستقيم.

لم توجد فروق معنوية بين الثلاث مجاميع من الجاموس في معظم الصفات المدروسة. حيث أحدث النقل زيادة في النسبة المئوية لنقص وزن الجسم الحي و درجة حرارة المستقيم و أدى النقل كذلك إلى حدوث زيادة يتبعها نقص في معدل التنفس و معدل النبض. بعد النقل انخفض وزن الجسم الحي في مجموعة الجاموس التي غذيت حتى الشبع و المجموعة الصائمة والمجموعة التي تجرعت المحاليل. لكن المجموعة المغذاة حتى الشبع أظهرت أكبر نسبة انخفاض في وزن الجسم الحي عن المجموعة الصائمة. بينما مجموعة الجاموس التي تجرعت المحاليل قبل النقل كانت أقل تأثرا بإجهاد النقل مما يثبت أن هذه المعاملة أدت إلى تقليل الآثار الضارة للنقل. أدى النقل إلى ارتفاع درجة حرارة المستقيم وزيادة معدلي التنفس والنبض في الحيوانات المعاملة. لكن الجاموس الذي تجرع المحاليل قبل النقل كان أقل تأثرا بإجهاد النقل. وقد يرجع ارتفاع درجة حرارته إلى زيادة استجابة قشرة الأدرينال أثناء تداول وتحميل ونقل الحيوانات. لذلك فإن تجريع المحلول الألكتروليتي للحيوانات كان فعالا في منع أو تقليل الآثار الضارة للنقل البري على الحيوانات.