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Preliminary studies on the effects of using drainage water for drinking on productive traits of rabbits in Egypt

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SUMMARY - An investigation was carried out to study the effects of using drainage water on productive performance of commercial rabbits. The nitrate and nitrite values of drainage water were higher from the maximum permissible levels. Drinking of drainage water during pregnancy was accompanied by decrease in litter size and litter weight as days of drinking drainage water increased, while bunny weight and daily gain gradually increased by increasing of days of drinking drainage water either during gestation or suckling period. The productive performance of does drank drainage water for six days at the beginning of the suckling period was inferior to that of does drank tap water. Mortality rate in the offsprings increased by increasing days of drinking drainage water during gestation or suckling period. The greatest effect of drinking drainage water on rabbits productive performance was during the suckling period.
Key words: Commercial rabbits, drainage water, performance traits.

INTRODUCTION

The highest productivity of rabbits population cannot be achieved without assuring the hygienic conditions of water supplies. Chemical constituents of drainage water are important parameters for defining its quality and the constituents present in high concentrations may have harmful osmotic effects, causing poor performance, illness or even death (Hasan, 1993). Moreover, using of chemical fertilizers is an important source of nitrates in drainage water and represent most highly oxidized phase in nitrogen cycle. Thus the biological oxidation in manure disposed to cultivated crop land, lead to formation of nitrates at superficial layer of soil, which escapes with drainage water (Adreano *et al.*, 1971). In Egypt, the drainage water may be used for irrigation or drinking of animals due to scarcity of the

fresh Nile water at ends of the irrigation network. The aim of the present work was to study the effect of using drinking drainage water on productive traits of commercial rabbits, under Egyptian conditions.

Material and methods

MATERIALS

This work was carried out at the San El-Hagar Agricultural Company Farm, San El-Hagar area, Sharkeya Province, Egypt, during a one-year that started in January, 1993. The data set included three commercial rabbit breeds {Bauscat (Bau), New Zealand White (NZW) and Californian (Cal)}. The study included three trials. The first was carried out on pregnant does and the second and the third on suckling does. In each of the first and second trails, does were divided into three groups. The first, second and third groups were given drainage water for drinking for 10, 20 days and for all period, respectively, from beginning of each of pregnancy and suckling, respectively. The third trial included only two groups. First was given drainage water for drinking for 6 days from the beginning of suckling and the second group was given fresh tap water for drinking (control). Drinking water was provided by automatic drinkers with nipples. Chemical composition of tap and drainage water is presented in Table 1. Bacteriological control of drainage water was carried out by filtration. The drainage water was mostly hyper-chloration and accordingly was not treated by chlorination.

The animals were fed *ad libitum* on a commercial pelleted rabbit ration. The composition of that ration was 18% crude protein, 3% ether extract, 14% crude fibre, 2% mineral mixture (1% Ca, 0.7% P and 0.3 Na) and 63.0% soluble carbohydrate. The digestible energy was 2600 Kcal/kg ration. The does and bucks were housed separately in individual galvanized wire batteries. Batteries for does were provided with external nest boxes for delivery and nursing young. Does were allocated to the bucks at random at each mating period and inbreeding was minimized by avoiding closely related matings (full-sib, half-sib and parent-offspring matings). The buck:doe ratio was low (1:6). The animals were reared under similar environmental conditions.

METHODS

Data were collected on offsprings at birth, 21 and 30 days. The study included 2742 complete normal parturitions. The weaning age was 30 days. Weights were recorded to the nearest gram. Traits analysed were litter size (LS) and litter weight (LW) at birth (LSB & LWB), 21 (LS21 & LW21), 30 (LS30 & LW30) days; daily gain (DG) at 20, 21-30 and 30 days; stillbirths (Sb%), mortality from birth to 20 days (M20 %), mortality from 21 to 30 days (M21-M30%), pre-weaning mortality (M30%) and total mortality (TM) {Sb+M30}.

The method of least-squares means was carried out by using the General Linear Model from SAS program (1989). Percentages of mortality were subjected to arc-sin transformation. The data were

statistically analysed according to the following models:

Model 1 for all traits in first or second trial:

$Y_{ijk} = \mu + B_i + G_j + e_{ijk}$ where
Y_{ijk}= all traits in first or second trial,
μ = overall mean,
B_i = fixed effect due to *ith* breed, i= 1, 2 and 3 (1= Bau, 2= NZW 3=Cal),
G_j = fixed effect due to the *jth* water groups, j= 1, 2 and 3 (1=10 days, 2= 20 days and 3= all periods of drinking drainage water during either pregnancy or suckling) and
e_{ijk}= residual random effect.

Model 2 for all traits in third trail:

$Y_{ijklm} = \mu + B_i + G_j + P_k + S_l + e_{ijklm}$ where
Y_{ijklm}= all traits in third trail,
μ and B_i as defined in model 1,
G_j= effect due to the *jth* water groups, j= 1 and 2 (1= drinking drainage water for 6 days from beginning suckling period and 2= drinking fresh tap water as a control group),
P_k= effect due to k*th* parity k=1,..≥7,
S_l= effect due to the l*th* season at delivery, l= 1,..4 (1= Winter 2= Spring 3= Summer 4=Autumn) and
e_{ijklm}= residual random effect.

Results

CHEMICAL COMPOSITION OF WATER USED IN THE STUDY:

Maximum permissible levels (in drinking water) and chemical composition of tap and drainage water are shown in Table 1. The nitrate and nitrite values in the drainage water sample were higher than the maximum permitted levels and pH and other components lies within the maximum permissible levels recommended by W.H.O. (1970 and 1971) and I.S.A. Poultry Services Limited (1981).

EFFECTS OF USING DRAINAGE WATER FOR DRINKING OF DOES DURING PREGNANCY ON THEIR OFFSPRINGS:

Table 2 summarizes the means ± S.E. of doe performance traits of the three groups drinking drainage water during 10, 20 and all days of gestation period. The means of litter size at birth and 21 days were significantly (P<0.01 and 0.05, respectively) higher in Group 2 than Group 3. The means of litter weight at birth and 21 days were significantly (P<0.01) lower in Group 3 than in the other groups. Litter size and litter weight at weaning did not show any significant differences among the three groups. Bunny weight at birth was significantly (P<0.001) lower in Group 3 than in the other groups, While, it increased significantly (P<0.05 and 0.001) in the same group at 21 days and at weaning than in others. Daily gain at the different periods studied increased significantly (P<0.05 and 0.001) in Group 3 than in the other groups. Group 3 showed the highest percentages (P<0.01) of Sb, M20 and TM, followed by Group 2. M20 increased significantly (P<0.01) in Group 3 than in the other groups. Sb, M20 and TM significantly (P<0.01) increased in Group 3 than in the other groups. M21-30 and M30 did not show significant differences among the three groups.

EFFECTS OF USING DRAINAGE WATER FOR DRINKING OF DOES DURING SUCKLING ON THEIR OFFSPRINGS:

Table 3 summarizes the means ± S.E. of doe performance traits of the three groups drinking drainage water during the suckling period. The means of litter size at birth and 21 days were significantly (P<0.01 and 0.05) lower in Group 1 than in the other groups, except litter size at 21 in Group 3 which was higher than in Group 1, although differences between the three groups at weaning were not significant. The means of litter and bunny weights at weaning were significantly (P<0.01) higher in Group 1 than in the other groups, while litter and bunny weights at birth and 21 days were not significantly different between the three groups. DG30 was significantly (P<0.01) lower in Group 1 than in the other groups. DG20 and DG21-30 were not significantly different between the three groups. The highest percentages (P<0.05 and 0.001) of M20, M21-30 and M30 were found in Group 3. Sb and TM were not significantly different between the three groups.

Table 4 summarizes the means ± S.E. of doe performance traits given either tap or drainage water for the first 6 days during the suckling period. Litter size and litter weight decreased significantly (P<0.01 and 0.001) in does drinking drainage water than in those drinking tap water at the different periods studied. Bunny weights at birth and weaning decreased significantly (P<0.05) in does drinking drainage water than in those drinking tap water, while at 21 days from suckling difference between the two groups was not significant. DG21-30 and DG30 were significantly (P<0.05) lower in pups delivered from mothers drinking drainage water than in those of the group given tap water. DG20 showed no significant difference between the two groups. Sb, M20 and TM increased significantly (P<0.05) in does drinking drainage water than in those given tap water. The differences between the two groups in M21-30 and M30, were not significant.

Discussion

The continuous decrease (P<0.01) in litter size and litter weight with the increase in days of drinking drainage water during gestation period. The gradual increase in bunny weight and daily gain by the increase in days of drinking drainage water during gestation or suckling period. These results may be due to salt retention (capillaries permeability). Also, the results included that, the does drank drainage water for six days at the beginning of suckling period showed a performance inferior to the does drank tap water. The does drank 6-day drainage water had a lower litter size, litter weight, bunny weight and daily gain and a higher mortality rate. These results agree with Morisse *et al* (1988), who referred that for the incidence of high nitrite water, and its effect on rabbit growth and mortality. Also, Sell and Roberts (1963) found that 0.4% dietary potassium nitrite depressed growth, lowered liver vitamin A stores and caused hypertrophy of the thyroid gland in chicks. On the other hand, Waggoner *et al*. (1985) found that

nitrates at 20 ppm and above were definitely detrimental to performance of chicks. In general, Rand *et al.*, (1976) stated that nitrite is the intermediate state of nitrogen, both in the oxidation of ammonia to nitrate and in the reduction of nitrate which might occur in waste water treatment plants, water distribution system and in natural water.

Mortality rate was increased by increasing of drinking days of drainage water during gestation or suckling period. These results may be due to nitrite acts in the blood to oxidize the haemoglobin to methemoglobin, which does not perform as an oxygen carrier to the tissue, consequently, anoxia and death may ensure (NRC, 1977). On the other hand, acute toxicity of nitrate occurs as a result of reduction to nitrite, a process that can occur under specific conditions in the stomach, as well as, in the saliva. When blood is treated with chlorates or nitrites, methemoglobin is formed (Harper, 1975). Moreover, drinking drainage water by pregnant does resulted in foetal malformation which was apparent overall the skeleton (El-Darawany *et al.* 1994).

Conclusions

Use of drainage water for drinking rabbit depends on type of fertilizer, which is an important source of nitrate and nitrite and other substances in it. Chemical impurities in water especially nitrate and nitrite may be deleterious to rabbit health and may cause severe losses in performance. Physical properties and microanalysis of the drainage water compared with the corresponding in the tap water and their specific effects on the lesions, serology and performance of rabbits should be focused in more details.

References

ADRIANO, D.C., PRATT, P.F., BISHOP, S.E., BROCK, W., CLIVER, J. and FAIRBANK, W. (1971). Nitrogen load of soil and ground water from land disposal of dairy manure. Reprinted from California Agriculture, December, 1971.

EL-DARAWANY., A.A., ZENATE ABD EL-GUADE, A.A., ABD EL-RAZIC, M.A. and SIAD-AHMED, A.M. (1994). Teratogenicity of drainage water in rabbits embryos. Egyptian Journal of Rabbit Sciences. *4*:60-69.

HARPER, H.A. (1975). *Review of physiological chemistry*. *15th* Edition, Lange Medical Publications, Los Altos, California.

HASAN, A.M. (1993). Water quality and their effects on poultry vaccines. M.V.Sc. Thesis, Faculty of Veterinary Medicine, Suez Canal University.

I.S.A. POULTRY SERVICES LIMITED. (1981). Institute of selecting animal. Old Hall hatchery, Orton Longue Vile.

MORISES, J.P., BOILLETOT, E. AND MAURSCE, R. (1988). Incidence of nitrites in rabbits. *4th* Congress of the World Rabbit Science Association Proceedings, Budapest, Hungary. 427-432.

N.R.C. (1977). National Research Council Sub-Committee on Drinking Water and Health.

National Academy of Sciences, Washington, D.C.

RAND, M.C. (W.P.C.F.), ARNOLD, E. (A.P.H.A.) and MICHAEL, J. (A.W.W.A.) (1976). Standard methods for the examination of water and waste water. 14*th* Edition edited by A.P.H.A.-A.W.W.A.-W.P.C.F.

SAS STATISTICAL ANALYSIS SYSTEM INSTITUTE INC. (1989). SAS User's Guide: Statistics, Version 6 Edition, Cary, NC.

SELL, J.L. and ROBERTS, W.K.(1963). Effect of dietary nitrate on the chick growth, liver vitamin A stores and thyroid weight. Journal Nutrition, *79*:171-178.

WAGGONER, R.E., GOOD, R.W. and GOOD, R.E. (1985). Water quality and poultry production. Arbor Aeers information. (Cited after Abu-Zeid 1988).

W.H.O. WORLD HEALTH ORGANIZATION (1970). European standards for drinking water. 2nd Ed., Geneva.

W.H.O. WORLD HEALTH ORGANIZATION (1971). International standards for drinking water. palais de Nations, Geneva.

Table 1. Maximum permissible levels in drinking water and chemical composition of tap and drainage water and change percentage.

Items	Maximum permissible levels (ppm/l)	Water		
		Tap (ppm/l)	Drainage (ppm/l)	Change (%)
pH	6.5-9.2	6.78	7.60	
Calcium	75	13	18	38.46
Magnesium	30	6	19	216.66
Potassium	-	3	6	100.00
Sodium	250	106	178	67.92
Iron	-	0	0	0
Manganese	-	0	0	0
Lead	-	0	0	0
Zinc	-	0.2	11	5400.00
Phosphorous	-	19	140	636.84
Nitrite	0-0.1	0.19	8	4110.52
Nitrate	0-45	43	74	72.09
Carbonate	75-125	39	58	48.71
Bio-carbo	-	153	190	24.18
Sulfate	0-200	3	18	500.00
Chloride	0-200	95	126	32.63
EC mmho/cm	-	1.02	1.20	78.43
Ts	750	652.5	768.0	2.37

Table 2. Performance traits of the three groups of does drinking drainage water during 10, 20 and all days of gestation period.

Traits #	Overall mean & levels of significance	Drainage water supply during gestation period (Days)		
		Group 1 (112 does)	Group 2 (70 does)	Group 3 (41 does)
Gestation period (Days)	31.95ns	32.02±0.12a	32.01±0.15a	31.66±0.19a
Litter size at:				
Birth	7.49**	7.32±0.27ab	8.04±a	6.98±0.43b
21 days	6.55*	6.49±0.24ab	6.91±a	6.00±0.42b
Weaning	6.38ns	6.39±0.24a	6.64±a	5.84±0.41a
Litter weight (gm) at:				
Birth	416.23**	430.31±16.71a	4403.60±20.73a	336.59±26.27b
21 days	1909.87**	2002.00±77.48a	1976.90±96.13a	1543.70±121.84b
Weaning	3975.34ns	3842.00±180.82a	4061.40±224.36a	4192.70±248.35a
Bunny weight (gm) at:				
Birth	56.94***	60.03±1.94a	57.92±2.41a	46.56±3.08b
21 days	358.31*	342.44±29.32a	333.94±36.25a	465.48±51.65b
Weaning	743.37***	651.47±49.19a	703.94±59.98a	1141.54±85.41b
Daily gain (gm):				
DG20	14.91*	14.08±1.46a	13.70±1.81a	20.38±2.58b
DG21-30	38.49***	30.90±2.41a	37.00±2.94a	67.61±4.19b
DG30	22.77***	19.68±1.64a	21.46±1.99a	36.12±2.84b
Mortality (%)				
Sb	11.11***	6.76a	10.01a	24.86b
M20	7.89**	7.01a	6.70a	12.31b
M21-30	2.73ns	2.65a	3.50a	1.64a
M30	10.03ns	8.78a	9.85a	13.76a
TM	20.09***	14.86a	18.51a	37.09b

Within each row, mean bearing different letters, differed significantly.
* P<0.05, **P<0.01, ***P<0.001 and ns not significant.
# Key to abbreviations for traits are given in Materials and Methods.

Table 3. Performance traits of the three groups of does drinking drainage water during 10, 20 and 30 days of suckling period.

Traits #	Overall mean & levels of significance	Drainage water supply during suckling period (Days)		
		Group 1 (72 does)	Group 2 (88 does)	Group 3 (63 does)
Litter size at:				
Birth	6.85**	5.68±0.42a	6.92±0.36b	7.03±0.36b
21 days	4.75*	4.15±0.38a	5.17±0.33b	4.85±0.33ab
Weaning	4.60ns	4.00±0.36a	4.98±0.32a	4.50±0.32a
Litter weight (gm) at:				
Birth	363.42ns	345.36±24.27a	372.80±21.10a	366.64±21.24a
21 days	1469.63ns	1473.09±132.01a	1465.67±114.7a	1427.26±115.52a
Weaning	2827.54**	2924.23±181.80a	2817.75±158.1b	2829.90±159.10b
Bunny weight (gm) at:				
Birth	39.73ns	40.63±3.4a	37.85±2.95a	41.28±2.98a
21 days	365.02ns	423.43±53.84a	361.97±46.84a	324.53±47.19a
Weaning	629.26**	699.74±28.45a	585.81±24.76b	626.87±24.94b
Daily gain (gm):				
DG20	15.71ns	18.55±2.69a	15.61±2.34a	13.68±2.36a
DG21-30	26.92ns	28.88±4.91a	22.51±4.28a	30.41±4.31a
DG30	19.25**	21.53±0.95a	17.84±0.83b	19.18±0.83b
Mortality (%)				
Sb	28.61ns	35.76a	26.49a	23.36±a
M20	14.49*	10.30a	13.57ab	20.58±b
M21-30	3.14***	0.41a	2.59a	7.05±b
M30	15.72***	9.58a	15.43a	23.13±b
TM	41.74ns	39.57a	41.76a	44.74±a

Within each row, mean bearing different letters, differed significantly.
* P<0.05, **P<0.01, ***P<0.001 and ns not significant.
# Key to abbreviations for traits are given in Materials and Methods.

Table 4. Performance traits of two groups of does given tap and drainage water for drinking during the suckling period.

Traits #	Overall means & levels of significance	Tap water (No.2194 records)	Drainage water (No.548 records)
Litter size at:			
Birth	7.08**	7.12±0.08a	6.86±0.13b
21 days	6.08***	6.17±0.07a	5.61±0.13b
Weaning	5.91***	5.99±0.07a	5.45±0.13b
Litter weight (gm) at:			
Birth	402.15***	405.36± 4.0a	385.97± 7.3b
21 days	1754.98***	1781.33±19.0a	1622.00±35.2b
Weaning	3616.30***	3704.04±37.6a	3173.57±69.7b
Bunny weight (gm) at:			
Birth	50.44*	51.03±0.46a	47.62± 0.86b
21 days	319.98ns	318.20±5.58a	329.30±10.47a
Weaning	642.48*	647.06±5.47a	618.79±10.25b
Daily gain (gm):			
DG20	13.24ns	13.15±0.28a	13.74±0.52a
DG21-30	32.79*	33.49±0.63a	29.15±1.18b
DG30	19.57*	19.73±0.18a	18.80±0.34b
Mortality (%)			
Sb	16.22*	15.46a	19.83b
M20	9.70*	9.36a	11.31b
M21-30	2.88ns	2.95a	2.58a
M30	11.24ns	11.03a	12.26a
TM	25.54*	24.54a	30.22b

Within each row, mean bearing different letters, differed significantly.
* P<0.05, **P<0.01, ***P<0.001 and ns not significant.
# Key to abbreviations for traits are given in Materials and Methods.