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Growth Performance and Physiological Responses of Male Rabbits as Influenced by Drinking Saline Well Water

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Abstract. The present study was undertaken to investigate the effect of drinking low (800 ppm TDS/L), medium (3004 ppm TDS/L) and high (5284 ppm TDS/L) levels of salinity in natural well water as compared to tap water (232 ppm TDS/L) on the growth and physiological performance of male rabbits. Twenty eight male New Zealand White rabbits (age 4 months, average body weight 2.4 ± 0.2 kg) were randomly assigned into 4 groups: group 1 animals were served as control which given tap water and group 2, 3 and 4 animals were offered well water contained 800, 3004 and 5284 ppm TDS/L, respectively for a period of 12 weeks. Results indicated that drinking natural well water did not significantly influence body weight gain, dry matter and protein intakes. Rabbits drank the low saline well water had a significantly lower total water intake than those drank the tap water or the other two levels of TDS. Moreover, there found no effect on digestible crude protein, rectal temperature, respiration rate, carcass traits and relative organ weights. Rabbits drank the medium and high saline water exhibited significant higher values of digestibilities of dry matter, organic matter, crude protein, ether extract, nitrogen-free extract and total digestible nutrients. Whilst, plasma total protein and globulin increased ($p < 0.05$) in treated than control animals, however albumin concentration was not affected by treatment. There were no significant effects on plasma total lipids and the activities of plasma aspartate aminotransferase, alanine aminotransferase, lactate dehydrogenase and acid phosphatase. On the other hand, cholesterol and creatinine concentrations and the activity of alkaline phosphatase were significantly ($p < 0.05$) decreased in plasma of treated than control animals. However, urea concentrations were significantly ($p<0.05$) lower in plasma of animals drank medium and high than low TDS or control animals. It can be concluded that rabbits drank saline well water containing up to 5284 ppm TDS/L exhibited no harmful effects on growth performance and physiological parameters. Therefore, water used in the present experiment could be used as an acceptable and safe source of water for raising New Zealand White rabbits under desert condition of Northern West Coast of Alexandria, Egypt.

Introduction

Water is an indispensable entity for animal production being the most important nutrient for livestock and second only to oxygen as immediately essential for life [1]. However, water salinity is the major factor limiting the suitability of a particular water source for livestock. Recent Egyptian agricultural policy has been directed towards intensive land reclamation in the desert area. The animals in this area are usually dependant on drinking well water with varying degrees of salinity which commonly increases during the dry season [2].

Rabbits are considered useful contributors to the meat supply in many developing countries. The greatest potential for the usage of meat rabbits is in those countries, which experience shortages in animal protein [2]. Most of the previous studies investigated the effects of high saline-tap water (tap water supplemented with salts) on rabbit performances [3,4,5]. Available reports on the effect of drinking natural saline well water on the productive, physiological performances and biochemical parameters of rabbits are lacking especially under desert conditions of Egypt [2]. Blood constituents represent the major reflection to the variations due to feed and/or water supplements to an animal. Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) are important and critical enzymes in the biological processes. They are considered as a specific indicator for hepatic dysfunction and damage [6]. Acid phosphatase (AcP) is a marker enzyme for lysosomes thus related to general cell metabolism. Alkaline phosphatase (AlP) enzyme is a sensitive biomarker to metallic salts since it is a membrane bound enzyme related to the transport of various metabolites [7,8]. Lactate dehydrogenase (LDH) is one of the metabolic requirements for tissues and involved in energy production. LDH activity indicates the switching over of anaerobic glycolysis to aerobic respiration. Also, It can be used as an indicator for cellular damage, clinical practice and cytotoxicity of toxic agents [9]. Therefore, this study aimed to investigate the tolerability, growth performance, feed efficiency, physiological responses, blood constituents and carcass composition of male rabbits exposed to different degree of salinity of natural well water raised indoor under desert condition.

Materials and Methods

Animals and management

Twenty-eight growing male New Zealand White rabbits (age of 4 months with an initial weight of 2.4 Kg) were used. The animals were individually housed in stainless steel cages and weighed out weekly throughout the experimental period. The animals were kept indoor with a temperature of 27-32 ° C and relative humidity of 65-80%. Feed and water were provided *ad libitum*. They were fed on a commercial pelleted ration consisting of 30% Berseem hay (*Trifolium alexandrinum*), 25% yellow maize, 26.2% wheat bran, 14% Soybean meal, 3% molass, 1% calcium chloride, 0.4% sodium chloride, 0.3% mixture of minerals and vitamins and 0.1% methionine. The proximate analysis and mineral content of the dietary pellets were analysed according to the Association of Official Analytical Agricultural Chemists [AOAC, 10] (Table 1).

Saline well water

Saline well water were obtained from three wells at northern west coast of

Alexandria (Baheeg, Elazaim and Sidi Kerare). Tap water was obtained from Hormone Laboratory, Institute of Graduate Studies and Research, Alexandria University, Alexandria, Egypt. Tap and well water samples were chemically analysed according to the AOAC [10] in the water analysis laboratory, Central Laboratory for Food & Feed (CLFF), Agriculture Research Center, Cairo, Egypt. Chemical analyses of tap and natural saline well water are presented in Table 2.

Table 1. Chemical composition of the commercial pelleted ration formulated for rabbits (%, DM basis)

Chemical composition (%)	**DM**	**OM**	**CP**	**CF**	**EE**	**NFE**	**Ash**
	87.02	91.8	20.1	13.6	2.2	55.9	8.2

Mineral content	Na (%)	K (%)	Ca (%)	Mg (%)	P (%)	Cu (ppm)	Fe (ppm)	Zn (ppm)	Se (ppm)
	0.67	1.07	1.05	0.47	0.60	14	612	24	0.11

Table 2. Chemical analysis of tap and natural saline well water used in the study

Type of analysis	**Tap water (Control)**	**Saline well water (TDS)**		
		Low	**Medium**	**High**
Hardness (mg $CaCO_3$/L)	156.8	469.38	946.94	2355.1
Carbonate $(CO_3)^{-2}$ (mg/L)	0.0	18	36	12
Bicarbonate $(HCO_3)^{-2}$ (mg/L)	228	372.1	207.4	422.43
Sulfate $(SO_4)^{-2}$ (mg/L)	111.5	240.4	644.7	879.9
Chloride Cl^{-} (mg/L)	33	234	248	279
Nitrate (mg/L)	4.2	41.4	16.2	2.19
TDS (mg/L)[1]	232	800	3004	5284
TSS (mg/L)[1]	104	252	428	932
TS (mg/L)[1]	336	1052	3432	6216
Na (mg/L)	34.6	770	1430	1690
Ca (mg/L)	36.65	113.3	166.3	570.8
K (mg/L)	4.83	22.62	40.21	48.58
Mg (mg/L)	11.85	115	286	274
Fe (mg/L)	0.27	0.55	0.44	5.47
Cu (mg/L)	0.008	0.03	0.02	0.121
Zn (mg/L)	0.02	0.1	0.06	0.1
Se (μg/L)	0.01	0.06	0.04	0.07

[1]TDS: Total dissolved solids   TSS: Total suspended solids
TS: Total solids

Experimental design

The effect of drinking saline well water (low, medium and high with 800, 3004 and 5284 ppm TDS/L, respectively) on the performance, blood constituents and carcass composition of rabbits were examined in a 12-week experiment. A total of 28 growing male New Zealand White rabbits were randomly assigned into 4 experimental treatments. These treatments were control (7 bucks provided with tap water, 232 ppm

TDS/L), low saline well water (8 bucks), medium saline well water (7 bucks) and high saline well water (6 bucks). The experiment lasted for 12 weeks and conducted during the period between March and June 2000. At the end of the experimental period three animals from each group were randomly selected for slaughter purposes and the brain, heart, lung, spleen, kidneys, liver and urinary bladder were immediately removed. The organs were weighed after blotting them dry and the organ/body weight ratio was calculated. Live body weight, daily feed and water intakes, rectal temperature (RT, °C) and respiration rate (RR, resp./min) of each animal were weekly recorded throughout the experimental period in the morning.

During the last seven days of the experimental period four animals from each experimental group were individually housed in a metabolic cage to evaluate the effect of drinking saline well water on the nutritive values of the experimental diets. Feed samples were collected and prepared for proximate analysis and feces and urine were quantitatively collected once a day at 8.00 A.M. Digestibilities of dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fiber (CF) and nitrogen free extract (NFE) were determined and expressed on a dry matter basis from feed and fecal sample contents [11]. Proximate analyses were determined by the standard AOAC [10], while nitrogen-free extract (NFE) was determined by the calculated difference.

Blood biochemical measurements

Blood samples were collected from the ear vein of all animals every other week throughout the 12-week experimental period. Five milliliter of blood samples was collected in heparinized tubes using a 3-CC syringe fitted with 18-gauge needle and placed immediately on ice. Plasma samples were collected after blood centrifugation at 860 X g for 20 minutes, and stored at -20 °C prior to analysis.

Plasma total protein (TP) was determined by the method of Lowry *et al.* [12] using bovine serum albumin as a standard protein, and plasma albumin (A) was measured according to the method of Doumas *et al*. [13], total globulin (G) concentration was calculated as the difference between total protein and albumin. Plasma urea was quantitated according to Patton and Crouch [14]. Creatinine was measured according to Henry *et al*. [15]. Total lipids (TL) and cholesterol were determined according to the methods of Knight *et al*. [16] and Watson [17], respectively. The activities of plasma aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were assayed by the method of Reitman and Frankel [18]. The activity of plasma lactate dehydrogenase (LDH) was determined by the method of Cabaud and Wroblewski [19]. Alkaline phosphatase (AlP) and acid phosphatase (AcP) activities were determined according to the methods of Principato *et al.* [20] and Moss [21], respectively.

Statistical analysis

Data collected were analyzed as a complete randomized block design [22] using the General Linear Model procedure of SAS [23]. Means were compared by Duncan Multiple Range Test [22].

Results and Discussion

Growth performance, digestibility and nutritive values

Using natural saline well water at the level of 800, 3004 or 5284 ppm TDS in the present experiment as the source of drinking water to male rabbits had no adverse effect on productive performance and mortality of male rabbits (Table 3). This is in agreement with the findings of the NRC [24] and Bahman *et al*. [25] who considered that up to 5000 mg TDS/L of drinking water was safe for dairy cows. In addition, sheep and camels can tolerate salinity up to 13000 ppm without any adverse effect on performance [26]. The present study indicated that drinking saline well water did not cause significant effects on body weight, feed and water intakes, protein efficiency, digestible crude protein and digestibility of crude fiber in comparison to those drank tap water (Table 3). On the other hand, it has been found that the medium and high levels of salinity promoted ($p<0.05$) better digestibility coefficients (dry matter, DM; organic matter, OM; crude protein, CP; ether extract, EE and nitrogen free extract, NFE) and nutritive value (total digestible nutrients, TDN) (Table 4). The insignificant changes in body weight may be due to the insignificant changes in feed intake. These findings are in agreement with those of Abd El-Gawad [27] who found that drinking saline well water did not cause significant changes in body weight of goats. Also, Bahman *et al*. [25] reported that dry matter and water intakes were not affected by drinking brackish well water containing 3574 mg TDS per L compared to desalinated water (449 mg TDS per L) in dairy cows. Moreover, cows offered brackish well water gained slightly but not significantly more weight than cows consuming desalinated water. Ahmed et al. [28] found that rams drank saline well water containing 9100 ppm TDS improved digestion, feed utilization, body gain and mineral balance. Similar results were also reported for camels receiving up to 1.0% sodium chloride in the drinking water [29]. Furthermore, it has been found that diluted sea water containing 7650 ppm TDS promoted better digestion in camels but not in sheep [30]. Similar trend was observed by Jaster *et al*. [31] who reported that feed intake and digestibility were unaffected in cows drank tap water supplemented with 2500 ppm sodium chloride. On the other hand, results obtained by Ayyat *et al*. [4] revealed that rabbits drank tap water supplemented with 3000, 4500 or 6000 ppm salt resulted in significant decreases in live body weight, daily gain, feed conversion ratio, protein efficiency and total body solids. Also, El-Sherif and El-Hassanein [32] found that salty water (diluted sea water containing 13100 ppm TDS) caused a decline in average body weight of growing ram lambs, while water consumption increased. Croom et al. [33] found that feeding 5% NaCl decreased total gain, average daily gain, carcass weight and the efficiency of organic matter utilization in growing steers. Obviously, the explanation for such declines might be attributed to either the differences in source of water, the higher TDS (13100 ppm) used in such studies or the differences in the response of different species.

Table 3. Effect of drinking natural saline well water on some productive traits of male rabbit (means ± SE)

Parameter	Control	Saline well water (TDS)		
		Low	Medium	High
Initial live weight (g)	2596 ±118.8	2520±77.9	2536±75.2	2678±76.7
Final live weight (g)	3079±123.6	3056±71.0	3021±127.1	3194±147.4
Live weight gain (g/day)	5.7±0.77	6.4±1.05	5.8±1.40	6.5±1.39
Dry matter intake (g/day)	102.9±2.20	97.3±2.00	98.4±2.20	100.0±2.00
Protein intake (g/day)	20.7±0.45	19.6±0.42	19.8±0.45	19.4±0.42
Protein efficiency*	3.6±0.04	3.1±0.02	3.4±0.04	3.0±0.03
Total water intake (ml/day)	360±9.3^{a}	308±8.7^{b}	338±9.3^{a}	337±8.6^{a}

* Protein Efficiency = PI / LWG.
^{ab} Within a row, means with different superscript letters differ significantly ($p < 0.05$).

Table 4. Effect of drinking natural saline well water on nutrients digestibility coefficients, TDN and DCP of pelleted ration fed to male rabbits (means ± SE)

Parameters	Control	Saline well water (TDS)		
		Low	Medium	High
Digestibility (%)				
Dry matter	65.70±3.74 ^{b}	63.75±2.95 ^{b}	71.00±2.79 ^{a}	70.11±2.29 ^{a}
Organic matter	67.89±3.59 ^{b}	64.55±3.22 ^{b}	72.90±2.74 ^{a}	70.28±0.82 ^{a}
Crude protein	66.80±3.66 ^{b}	66.93±4.70 ^{b}	72.74±5.61 ^{a}	69.13±1.51 ^{a}
Ether extract	90.19±3.41 ^{b}	94.59±1.23 ^{ab}	95.85±1.08 ^{a}	95.41±1.11 ^{a}
Crude fiber	34.51±1.45 ^{b}	28.62±3.25 ^{c}	38.00±3.80 ^{a}	31.62±5.17 ^{b}
Nitrogen free extract	74.25± 5.44 ^{b}	74.00±1.96 ^{b}	80.07±2.50 ^{a}	79.02±0.97 ^{a}
Nutritive value (%)				
TDN*	64.05±3.58 ^{b}	63.63±2.29 ^{b}	69.25±2.31 ^{a}	67.08±0.78 ^{a}
DCP**	13.09±0.72	13.11±0.92	14.25±1.10	13.54±0.30

*TDN = Total Digestible Nutrients.
**DCP = Digestible Crude Protein.
^{abc}Means within a row with different superscripts are significantly different ($p < 0.05$).

Carcass composition

Results shown in Table 5 exhibit no significant effect of saline well water on the carcass weight, dressing percentage and relative weights of brain, liver, kidney, spleen, urinary bladder, heart and lungs of animals when compared with those of the control group. These results are in agreement with those of Abdel-Samee and El-Masry [2] who reported that except for kidney weight, saline well water had no significant effect on carcass weight, dressing percentage and weights of liver and spleen of rabbits. Also, Habeeb *et al*. [5] reported that heart and lungs weights of rabbits were not affected due to drinking water with different levels of salinity (2000, 3000, 4000, or 5000 ppm) in water. On the other hand, Ayyat *et al*. [4] reported that carcass weight, dressing percentage and body solids of rabbits drank 3000, 4500 or 6000 ppm were significantly lower than those of the control animals, but there was no effect on liver weight. The decrease in carcass and its components of rabbits that drank saline water in the previous study could be due to depression in digestibility of the different nutrients and its utilization and consequently in protein and fat deposition [5, 34]. In the present study, the water used contained a mixture of different minerals (Table 2), not only sodium chloride. Therefore, the disagreement between the present study and other studies can be explained by differences in mineral composition of the water used. In addition, most of the previous studies investigated the effect of high saline water (tap water supplemented with sodium chloride and/or diluted sea water).

Table 5. Effect of drinking saline well water on carcass traits and relative organ weights (g/100 g body weight) of slaughtered male rabbits (mean ± SE)*

Parameter	Control	Saline well water (TDS)		
		Low	Medium	High
Preslaughter weight (g)	3231±209.7	2842±111.8	2876±434.7	3249±159.1
Carcass (g)	1882±136.3	1625±59.1	1684±331.2	1895±116.4
Dressing (%)	58.21±0.57	57.23±1.62	57.67±2.90	58.26±1.04
Brain (%)	0.24±0.02	0.23±0.03	0.30±0.05	0.21±0.02
Liver (%)	2.20±0.14	2.44±0.16	2.18±0.28	2.12±0.14
Kidney (%)	0.51±0.03	0.49±0.02	0.47±0.04	0.47±0.03
Spleen (%)	0.04±0.01	0.05±0.01	0.04±0.003	0.04±0.003
Bladder (%)	0.10±0.02	0.08±0.01	0.07±0.01	0.07±0.01
Heart (%)	0.22±0.01	0.26±0.03	0.23±0.01	0.25±0.02
Lungs (%)	0.56±0.03	0.46±0.09	0.49±0.07	0.47±0.04

* Values are means of three animals per group.

Thermo-respiratory responses

Drinking saline well water did not cause significant ($p > 0.10$) effect on RT and RR. The values of RT were 39.2, 39.3, 39.2 and 39.2 C° for control, low, medium and high levels of saline well water, respectively. The corresponding values for RR were 67.8, 64.9, 63.5 and 65.3 resp./min, respectively. These results mean that those animals did not suffer any adverse stress from the salinity in their drinking water. These results are in agreement with the finding of Jaster *et al*. [31] in dairy cows. Similar results were reported by Abd El-Gawad [27] who found that drinking saline well water did not cause significant changes in rectal temperature, while respiration rate was increased in goats.

On the other hand, Habeeb *et al*. [5] and Marai and Habeeb [34] reported that rabbits drinking saline water showed significant increase in RT and RR, and they attributed such increases to the fact that animals were suffering from excess salt stress (5000 ppm/L) which affected body heat thermoregulation.

Blood biochemical profiles

Plasma TP and G were significantly (P<0.05) higher, whereas plasma A was not affected in rabbits given well water when compared with those of the control group (Table 6). These results are in accordance with the findings of Abd El-Gawad [27] who reported that drinking saline well water caused significant increases in serum TP and G in goats.

Table 6. Effect of drinking natural saline well water on plasma biochemical parameters and enzyme activities of male rabbits (mean ± SE)

Parameter	Saline well water (TDS)			
	Control	**Low**	**Medium**	**High**
TP (g/dL)	6.12 ± 0.07^{a}	6.49 ± 0.07^{b}	6.54 ± 0.08^{b}	6.49 ± 0.0^{b}
A (g/dL)	2.43±0.04	2.42±0.04	2.41±0.05	2.43±0.05
G (g/dL)	3.78 ± 0.06^{a}	4.01 ± 0.07^{b}	4.08 ± 0.08^{b}	4.02 ± 0.08^{b}
TL (mg/dL)	287±14.3	285±13.1	284±12.2	270±11.4
Cholesterol (mg/dL)	31.9 ± 1.51^{a}	27.3 ± 1.01^{b}	27.5 ± 1.42^{b}	26.2 ± 0.96^{b}
Urea (mg/dL)	56.1 ± 2.33^{a}	53.0 ± 1.99^{ab}	50.1 ± 1.54^{b}	50.2 ± 1.38^{b}
Creatinine (mg/ dL)	1.04 ± 0.03^{a}	0.91 ± 0.03^{b}	0.92 ± 0.04^{b}	0.92 ± 0.03^{b}
AST (U/L)	50.4±0.86	51.0±0.66	51.4±0.79	51.1±0.93
ALT (U/L)	30.9±0.54	30.46±0.55	31.2±0.51	31.0±0.59
LDH (U/L)	1261±41	1189±27	1201±38	1230±31
AlP (U/L)	134.2 ± 6.14^{a}	99.5 ± 6.45^{b}	107.0 ± 8.28^{b}	106.9 ± 7.88^{b}
AcP (U/L)	33.8 ± 1.75^{a}	32.6 ± 2.83^{a}	32.6 ± 1.96^{a}	32.2 ± 1.40^{b}

TP: Total protein A: Albumin G: Globulin TL: Total lipids
AST: Aspartate aminotransferase ALT: Alanine aminotransferase
LDH: Lactate dehydrogenase AlP: Alkaline phosphatase
AcP: Acid phosphatase
^{ab} Within a row, means with different superscript letters differ significantly (p < 0.05).

The present results indicated that drinking saline well water caused significant (p<0.05) reduction in plasma cholesterol and creatinine, while urea levels were not affected by drinking water with low TDS, rather it decreased at the medium and high TDS. On the other hand, total lipids was not different among treatments (Table 6). The results of urea and creatinine in the present study are in concordance with the finding by

Khamis et al. [30] in sheep and camels. Moreover, Weeth and Haverland [35] reported that blood urea was decreased when heifers were drinking saline water. They attributed the lowered blood urea of heifers to their increased water consumption and the consequent increase in urination. As urea and creatinine represent the two main nitrogenous components that are eventually excreted by kidney, therefore changes in their levels in the plasma would reflect the insufficiency of kidney tubules or kidney malfunction [36]. Thus, the decrease in plasma urea and creatinine especially at medium and high TDS in the present study would suggest that no alterations in the kidney function had occurred. Also, our results showed that total lipids in plasma was not changed by drinking saline water. Conflicting results are available on the effects of drinking saline water on plasma total lipids were reported elsewhere [4, 5]. This disagreement might be ascribed to the various levels and sources of water salinity.

Enzyme activities

Drinking well water did not cause significant changes on the activities of AST, ALT, LDH or AcP as compared with the control group (Table 6). It seems that saline well water did not affect liver function because the increment of the activities of AST, ALT and LDH in plasma is mainly due to the leakage of these enzymes from the liver cytosol into the blood stream [37]. The high leakage of such enzymes represent a liver damage and disturbance of normal liver function [6]. Generally, the increased enzymatic activity in the serum or plasma is a result of tissue damage which causes the release of intracellular enzymes. A possible explanation for insignificant effects on the activities of AST, ALT, LDH and AcP in plasma is that the saline water used in the present study had no damaging effect on the liver. This is supported by that the liver weight of rabbits was not influenced by drinking saline water (Data not shown).

Drinking natural saline well water caused a significant ($p<0.05$) reduction in plasma alkaline phosphatase (AlP) activity compared with that of the control group. The decrease in plasma AlP activity confirmed the finding of none harmful effect due to saline water on the liver. Moreover, such a decrease in AlP activity might be a consequence to an inhibitory effect(s) of specific mineral(s) on the activity of such enzyme.

It has been concluded that New Zealand White rabbits can tolerate saline well water up to 5284 ppm without harmful effects on growth and physiological performances, and functions of liver and kidney. Consequently, the results of the present study are of interest to the program of rabbit raising in the Northern West Coast of Alexandria, Egypt where wells with different degree of salinity are available in the area for human and animal consumption. This is of benefit for developing a long period project to utilize such water resources. Additionally, more experiments are required to define the tolerance level of salinity for raising rabbits as well as other animal species.

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النمو و المعايير الفسيولوجية لذكور الأرانب نتيجة شرب مياه الآبار المالحة

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ملخص البحث. في هذه الدراسة تم تتبع تأثير شرب مستويات مختلفة من مياه الآبار المالحة الطبيعية المتحصل عليها من مناطق بهيج – كرير- العزايم التابعة لبرج العرب في الساحل الشمالي الغربي لمحافظة الإسكندرية علي الصفات الإنتاجية و النمو والخصائص الفسيولوجية لذكور الأرانب. في هذه التجربة تم تقسيم المياه حسب درجة الملوحة الذائبة الكلية إلى ٣ مستويات:

(أ) المستوي المنخفض و يحتوي علي ٨٠٠ جزء في المليون ملوحة ذائبة كلية.
(ب) المستوي المتوسط و يحتوي علي٣٠٠٤ جزء في المليون ملوحة ذائبة كلية.
(ج) المستوي المرتفع و يحتوي علي٥٢٨٤ جزء في المليون ملوحة ذائبة كلية.

و من هنا تم استخدام ٢٨ من ذكور الأرانب النيوزيلندي الأبيض (في عمر ٤ شهور و متوسط وزن جسم ٢،٤±٠،٢ كجم) وعوملت لمدة ١٢ أسبوع حيث قسمت هذه الذكور عشوائيا إلى ٤معاملات هي:

١- المجموعة الضابطة (عدد الحيوانات = ٧) و هي المجموعة المقدم لها ماء الصنبور كمياه للشرب (٢٣٢ جزء في المليون ملوحة ذائبة كلية) علي مدار التجربة.
٢- المجموعة الثانية (عدد الحيوانات = ٨) و هي المجموعة المقدم لها المستوي المنخفض (٨٠٠ جزء في المليون) من الملوحة في مياه الشرب.
٣- المجموعة الثالثة (عدد الحيوانات = ٧) و هي المجموعة المقدم لها المستوي المتوسط (٣٠٠٤ جزء في المليون) من الملوحة في مياه الشرب.
٤- المجموعة الرابعة (عدد الحيوانات = ٦) و هي المجموعة المقدم لها المستوي المرتفع (٥٢٨٤ جزء في المليون) من الملوحة في مياه الشرب.

وأظهرت النتائج في نهاية التجربة:عدم وجود فروق معنوية نتيجة شرب مياه الآبار علي كل من وزن الجسم ومعدل استهلاك الغذاء و الماء و البروتين والنسبة المئوية للبروتين

المهضوم و معدل النمو اليومي وكذا الحالة الفسيولوجية للحيوانات المعاملة حيث لم تتغير درجة حرارة المستقيم و معدل التنفس و أيضا خصائص الذبيحة. أيضا لم يتأثر نشاط إنزيمات الاسبارتيت أمينو ترانسفيريز والآلانين أمينو ترانسفيريزواللاكتيك دى هيدروجينيز والفوسفاتيز الحامضى و كذلك تركيز الألبيومين في الحيوانات المعاملة عنها في المجموعة الضابطة. في حين أدى شرب مياه الآبار ذات مستويي الملوحة المتوسط والعالي إلى زيادة معنوية $(p<0.5)$ لمعاملات هضم المادة الجافة و المادة العضوية و البروتين الخام و الدهون و الكربوهيدرات و مجموع المادة الغذائية المهضومة وكذلك تركيز البروتين الكلي والجلوبيولين في بلازما الدم. وفي المقابل انخفض كل من الدهن الكلي والكوليستيرول واليوريا والكرياتينين و كذلك نشاط إنزيم الفوسفاتيز القاعدي في الحيوانات المعاملة مقارنة بالمجموعة الضابطة.

ومن هنا تخلص الدراسة إلى أن شرب مياه الآبار المالحة في حدود درجات الملوحة المختبرة في هذه التجربة بواسطة ذكور أرانب النيوزيلندي لم تسبب آثارا ضاره علي النمو والنشاط الفسيولوجي للحيوانات لذلك ينصح لمتملكي الأراضي الجديدة بتربية الأرانب النيوزيلندي و إمدادها بماء الآبار المالحة المحتواة علي ما يصل إلى ٥٠٠٠ جزء في المليون ملوحة ذائبة كلية بدون التخوف من حدوث أضرار علي صحة وإنتاجية الحيوان.