

**PHYSIOLOGICAL STUDIES ON THE LEVEL OF SOME
ELECTROLYTES AND ENZYMES IN NORMAL
AND NEWCASTLE VACCINATED CHICKS**
(With 2 Tables)

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(Received at 8/11/1988)

دراسات فسيولوجية على بعض الأملاح والانزيمات في مصل الدجاج الطبيعي والمحصن ضد
مرض النيوكاسل
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تناولت هذه الدراسة دجاج الهابارد الذي يربى في مصر بواسطة الشركة العامة للدواجن وكان الهدف من هذه الدراسة تأثير التحصين ضد مرض النيوكاسل على بعض الخماثر والأملاح الموجودة بالمصل في الكتاكيت المحصنة ومثيلتها الغير محصنة باللقاح لمعرفة اذا كان هناك أي ناتجة من هذه التحصينات على القلب أو الكبد . وأسفرت النتائج على الآتي: كان أعلى مستوى لخميرة الفوسفاتيز القلوي في الكتاكيت المحصنة بلقاح النيوكاسل والغير محصنة في الاسبوع الأول ، ثم انخفض تدريجها مع العمر . بينما ارتفع مستوى الانزيم في المصل في الاسبوع الثاني بعد التحصين بمقارنته بالكتاكيت الغير محصنة . ولوحظ زيادة مفاجئة في خميرة الفوسفاتيز الحامضي في مصل الكتاكيت المحصنة والكتاكيت الغير محصنة في الاسبوع الثاني مع نقص الفسفور الغير عضوي في المصل . لوحظ ارتفاع في انزيم جلوتاميك ترانس في امينيز في مصل الكتاكيت في الاسبوع الأول والثاني بعد التحصين . كما لوحظ عدم التمكن من تقديره في المصل نتيجة لانخفاض مستواه في دم الكتاكيت الغير محصنة ابتداءً من الاسبوع الثالث . أما بالنسبة للكتاكيت المحصنة بلقاح النيوكاسل فقد أمكن تقديره . يرتفع أنزيم جلوتاميك أوكزال أستيك أمينيز في مصل الكتاكيت المحصنة بلقاح النيوكاسل . ظهرت زيادة معنوية في مستوى أنزيم اللاكتيك ديهاد روجينيز بعد التحصين . هناك نقص معنوي في مستوى الفسفور الغير عضوي في مصل الكتاكيت المحصنة في الاسبوع الثاني بينما وجد أن مستوى الكالسيوم في المصل لاينقص في حين زاد تركيزه في الدم في الأسابيع المتأخرة من التجربة في الكتاكيت المحصنة . من هذه الدراسة يتضح أن تحصين الكتاكيت بلقاح النيوكاسل عترة به في الاسبوع الأول ثم إعادة تحصينها بعترة اللاسوتا من فيروس النيوكاسل في اليوم الواحد والعشرون والواحد والثلاثون هو أنسب الطرق لتربية الدواجن الهابارد في مصر . كما ينصح باضافة بعض الأدوية التي تحمي الكبد من أي انخفاض وقتي في مستوى وظائفه مثل فيتـــامـــين ب₁₂ والأنوسيتول والكولين .

SUMMARY

The present investigation was designed to study the normal levels of some serum enzymes and electrolytes in Hubbard chicks, and the effect of vaccination with Newcastle vaccine for a period of six weeks to clarify if there is any harm inflicted upon the heart or liver.

The data obtained from this study revealed that :

1. The serum level of alkaline phosphatase in normal chicks is high in the first week then decreased gradually by age. While in vaccinated chicks the level was increased at the second week post

vaccination.

2. Serum acid phosphatase was higher in vaccinated chicks at the first two weeks of age then decreased.

3. Vaccination with NDV was accompanied with a rise in the level of SGOT.

4. The level of serum GPT of vaccinated chicks at one week of age was higher. But SGPT level in non vaccinated chicks was raised at the second week and became undetectable till the end of experiment. While invaccinated ones the levels were variable.

5. Levels of LDH in serum of vaccinated chicks were increased.

6. The values of inorganic phosphorous in serum tend to be decreased with age in non vaccinated and vaccinated chicks.

7. A significant rise in serum calcium level was observed from third week in vaccinated chicks.

8. The mean values of serum sodium were raised in vaccinated chicks.

9. Serum potassium level was increased in both vaccinated and non vaccinated chicks.

It could be concluded that vaccination against ND by using B₁ strain on the first week old chicks and lasota a strain on 21 and 31 days is of great value in rearing the Hubbard chickens in Egypt. To overcome such early rise of some enzymatic levels due to a momentary liver dysfunction by prescribing lypotropic drugs at the early stages such as those rich in vitamin B₁₂, inositol and choline.

INTRODUCTION

Newcastle disease has been reported to induce high mortality rate among young chicks. Variations in the different Newcastle strains was found to be an effective way to avoid mortality rates (LANCASTER, 1966).

Damage to an organ or tissue is often followed by appearance of abnormal amounts of certain enzymes of intercellular origin in plasma. the liver is rich in some enzymes and its damage often releases certain enzymes into the blood. Measurement of enzyme activity namely glutamic oxaloacetic transaminase (GOT), glutamic-purvic trans aminase (GPT) and lactic-dehydrogenase (LDH) has been used as tests for liver function (CORNELIUS and KANEKO, 1963). CORNELIUS et al. (1959) were not able to detect any GPT activity in serum of adult white plymouth Rock fowls. While McDANIEL and CHUTE (1961) succeeded in detecting only a very feeble GPT activity in plasma of chickens.

The aim of the present study is to investigate the normal levels of some serum enzymes and electrolytes in non vaccinated and Newcastle vaccinated Hubbard chicks, to clarify if there is any harm inflicted upon the liver or heart as a result of vaccination.

MATERIALS and METHODS

Two hundred and fifty one-day-old Hubbard chicks were allotted into two groups. The first control group was composed of 100 chicks while the second was

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composed of 150 chicks. Chicks of the second group were vaccinated against Newcastle disease at the seventh day of age using Hitchner B₁ strain by dipping (10^9 virus units/chick). At 21 and 31-days-old, the chicks were vaccinated by using lasota strain via drinking water (10^6 virus units/chick).

Fifteen chicks from each group were randomly selected weekly for blood sampling. Collection of blood from chicks was continuous for six weeks. Individual serum samples were obtained. Serum was analysed for determination of alkaline phosphatase activity (ALK pho) according to the method of WATTON (1964). Acid phosphatase activity (AC ph) was determined according to the method of GUTMAN and GUTMAN (1940). GOT and GPT activities were measured by the method of REITMAN and FRANKEL (1957). Serum lactic dehydrogenase (LDH) activity was estimated by the method adopted by WROBLWSKI and LA DUE (1955). Serum inorganic phosphorus was determined according to the method of TAUSSKY and SHORR (1953). Determination of sodium, potassium and calcium levels in sera were estimated using Flame photometer (Model EEL-100, England).

All data were analysed statistically according to FINNEY *et al.* (1957) and "t" test was used to evaluate the differences between the control and vaccinated groups.

RESULTS

The results obtained in table (1) revealed that serum alkaline phosphatase in normal chicks is extremely high in first week then decreased gradually by age till reach its lowest level at six week age. The chicks at one week old which received ND vaccine showed significant decrease in serum alkaline phosphatase at $P/0.01$.

The level of acid phosphatase in the serum was higher in vaccinated than nonvaccinated chicks at one week age. There was an increase in serum levels of this enzyme in both vaccinated and nonvaccinated chicks at two week age. Then the levels of enzyme tend to decrease at $p/0.01$ till the 6th week age in case of vaccinated and 4th week of age in nonvaccinated (table 1).

Vaccination with ND vaccine was accompanied with a rise in the level of GOT (table 1). The level of GPT in serum of vaccinated chicks at one week age was higher than nonvaccinated chicks. GPT level in serum of nonvaccinated chicks was raised at the second week then was not detected in the serum till the end of experiment. While in vaccinated birds the levels of GPT were variable.

Levels of LDH in the serum of vaccinated chicks were increased during the whole period of experiment.

Table (2) revealed that the values of inorganic phosphorus in serum of chicks tend to be decreased with age in nonvaccinated and vaccinated chicks. The lowest values were attained in the vaccinated group.

At the second week post ND vaccine, the level of calcium in serum was decreased than nonvaccinated chicks (table, 2). The significant rise in serum calcium of vaccinated chicks was observed from the third week till the end of the experiment.

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The mean values of serum sodium were raised in vaccinated than nonvaccinated chicks especially at the fifth and sixth weeks old (table, 2). Serum potassium level was increased in both vaccinated and nonvaccinated group from the first week till the end of experiment (table, 2).

DISCUSSION

Data obtained from this study revealed that serum alkaline phosphatase in normal chicks is extremely high in the first week then decreased gradually by age till it reaches its lowest level at the six week of age. These changes correspond with the growth rate and may be attributed to differences in bone formation or to the physiological role in general metabolic activity. These results are in agreement with the findings of TANABE and WILCOX (1961). The variation of serum alkaline phosphatase levels at the first two weeks of the experiment may be due to stress effect of the vaccine. These findings are in agreement with RIVETZ and BOGIN (1982) who found that inoculation of chickens with lentogenic strain of NDV produce no change in the enzyme profile of tissues and serum.

The serum level of acid phosphatase were decreased post vaccination. This result was in agreement with the findings of RIVETZ and BOGIN (1982) who found that infection with NDV causes a decreased level of serum acid phosphatase. MIRAGLIA (1975) found that acid phosphatase was included with enzymes of lipid metabolism in the liver.

Vaccination with Newcastle disease vaccine was accompanied with a rise in the serum level of GOT when compared to non vaccinated chicks. This indicates some damage to an organ or tissue followed by abnormal amounts of this enzyme of intracellular origin to the serum. This finding is confirmed by CORNELIUS et al. (1959) who reported that the liver is rich in some enzymes and its damage often releases certain enzymes into blood. The level of serum GPT was higher in vaccinated chicks at the first two weeks of age. Then the level of GPT was not detected in the serum of non vaccinated chicks. While in vaccinated chicks the level of GPT was variable. These results are in agreement with those of CORNELIUS et al. (1959) who failed to detect any GPT in serum of adult white plymouth-Rock fowls.

Serum LDH in chicks was decreased by age. This was confirmed by McDANIEL (1961) who reported that the average serum LDH level at six weeks is lower than the average levels of younger birds. While the level of LDH in vaccinated chicks with NDV was increased. This may be due to the damage effect of the vaccine on tissues or organs which lead to the rise in its level in serum.

The values of serum inorganic phosphorous were significantly lower than the initial level. The lowest values were attained in the vaccinated group. This was similar to the study of PUNIGRAPY et al. (1969). Serum calcium level was unchanged during the first week then it decreased in vaccinated chicks at the second week. The same results were obtained by BISHARA and FAHIM (1980) who found that serum calcium levels were decreased after vaccination with NDV. While TARTEER (1981) investigated that serum calcium level was nearly the same as those of non vaccinated chicken with NDV.

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From the present study it is evident that ca/p was greater in the older age. This could be attributed mainly due to lowered phosphorus values rather than higher calcium level. The decrease in phosphorus levels in serum of chicks may be attributed to stimulation of metabolic activity with age and or enhancing synthesis of adenosine triphosphatase and other phosphorylated intermediates by the cells binding to lowering its level in blood.

The serum sodium level in chicken which was vaccinated with NDV showed a rise at the fourth and fifth week. This may be due to a side effect of vaccine which induces some dehydration which lead to a rise in sodium level in serum. This was confirmed by HARPER (1981) who found that hypernatremia occur in dehydration.

As a conclusion it is evident from the present results that vaccination against ND by using the B₁ strain on the first week old chickens and lasota on the 21 and 31 days is of a good value in rearing the Hubbard chickens in Egypt. It could be concluded that there is no detrimental destructive liver and heart damage. It could be suggested also that, to overcome such early rise in some enzymatic levels, due to a momentary liver dysfunction, by prescribing lipotropic drugs at the early stages such as those rich in vitamin B₁₂, inositol and choline.

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Table (1): Serum ALK ph., AC ph., LDH, GOT and GPT activities in non vaccinated and Newcastle vaccinated Hubbard chicks

Age in weeks	Treatment and time of blood collection	ALK ph. u/100 ml		AC ph. u/L.		LDH u/ml		GOT u/ml		GPT u/ml	
		non vac.	vac.	non vac.	vac.	non vac.	vac.	non vac.	vac.	non vac.	vac.
1st	one day post B ₁ S.	62.74	41.32**	21.84	23.72**	201.85	410.46*	265.05	155.97*	24.00	78.67*
		+8.64	+0.85	+0.15	+0.58	+33.17	+45.58	+ 8.60	+ 7.07	+3.05	+8.85
2nd	8 days post B ₁ S.	24.16	39.24*	160.92	98.97**	382.22	520.37**	194.81	201.26	44.13	47.07
		+0.45	+2.01	+24.22	+24.45	+23.19	+66.13	+ 8.98	+5.72	+3.02	+3.64
3rd	15 days post B ₁ S. 8 2 days post 1st L.S.	30.35	31.94 ^B	3.55	0.13 ^B	161.67	169.14*	203.32	308.13 ^B	0.00	60.40
		+3.75	+2.26	+0.08	+0.02	+24.90	+28.44	+11.90	+15.53		+3.50
4th	22 days post B ₁ S. 8 7 days post 1st L.S.	30.04	29.23 ^B	6.49	1.31 ^B	361.38	654.32*	187.54	273.82 ^B	0.00	35.73
		+2.44	+2.64	+1.20	+0.20	+26.43	+42.52	+ 3.58	+13.49		+1.67
5th	29 days post B ₁ S. 8 14 days post 1st L.S. 8 4 days post 2nd L.S.	25.57	27.32 ^B	33.51	11.32 ^B	120.94	267.59*	177.74	227.74 ^B	0.00	47.07
		+1.50	+1.99	+6.80	+1.06	+5.38	+24.51	+ 3.72	+ 6.61		+1.91
6th	36 days post B ₁ S. 21 days post 1st L.S. 8 11 days post 2nd L.S.	23.43	27.02 ^B	31.95	11.92 ^B	108.16	256.79*	177.74	227.74 ^B	0.00	47.07
		+0.73	+2.54	+4.07	+1.02	+15.18	+24.18	+ 3.72	+ 6.61		+1.91

** Statistically significant from non vaccinated data at $P < 0.05$
 * Statistically significant from non vaccinated data at $P < 0.01$
 a Statistically significant from initial data at $P < 0.01$

Table (2): The values of serum inorganic phosphorus, calcium, sodium and potassium (in mg/100 ml) of non vaccinated and vaccinated Hubbard chicks.

Age in weeks	Treatment and time of blood collection	Inorganic ph.		Calcium		Sodium		Potassium	
		non vac.	vac.	non vac.	vac.	non vac.	vac.	non vac.	vac.
1st	one day post B ₁ S.	10.93 ±2.96	14.13 ±2.26	15.57 ±0.65	15.83 ±0.83	94.20 ±1.16	101.00 ±1.37	1.17 ±0.04	1.32 ±0.10
2nd	8 days post B ₁ S.	4.68 ±0.26	4.39 ^B ±0.25	18.57 ±1.42	14.13 ±0.74	103.00 ±4.15	102.00 ±1.55	1.67 ±0.26	1.85 ±0.02
3rd	15 days post B ₁ S. and 2 days post 1st L.S.	2.98 ±0.21	3.25 ^B ±0.37	14.00 ±0.86	16.95 ±0.97	100.40 ±1.60	97.00 ±2.72	1.10 ±0.07	1.37 ±0.07
4th	22 days post B ₁ S. and 7 days post 1st L.S.	2.97 ±0.28	2.97 ^B ±0.21	17.00 ±0.82	20.00 ^B ±0.49	105.2 ±0.73	105.80 ±0.73	1.80 ±0.05	1.60 ±0.04
5th	29 days post B ₁ S., 14 days post L.S., and 4 days post 2nd L.S.	2.26 ±0.11	4.40 ^{*B} ±0.22	15.00 ±0.42	18.63 [*] ±1.10	104.67 ±1.58	110.00 ^{*B} ±1.41	1.75 ±0.06	1.88 ±0.13
6th	36 days post B ₁ S., 21 days post 1st L.S., and 11 days post 2nd L.S.	2.23 ±0.10	4.85 ^{*B} ±0.02	15.00 ±0.42	18.63 [*] ±1.10	104.67 ±1.58	110.00 ^{*B} ±1.41	1.76 ±0.06	1.92 ±0.14

+ Standard error

* Statistically significantly different from non vaccinated data at P < 0.01

a Statistically significantly different from initial data at P < 0.01 except in ca. at P < 0.05