J.Agric. Chem. and Biotech., Mansoura Univ., Vol.2 (9): 165 - 174, 2011

CHANGES IN BODY WEIGHT, FEEDING EFFICIENCY RATIO AND SOME BLOOD PARAMETERS IN RATS FED EGG YOLK OR EGG WHITE DURING MALNUTRITION AND REFEEDING PHASES

Hassan, M.SH. ; A. M. Zaki ; F.S.Hatour and Hanaa S. Saleh
Agric. Chem. Dept. Fac. of Agric. Minia Univ. El-Minia, Egypt.

ABSTRACT

The present investigation was performed to examine the changes in body weight, feed efficiency ratio (FER), organs development and some blood parameters in albino rats received daily ingestion of lower levels of two food additives: egg yolk (EY) and egg white (EW) at two levels (5% and 10%) for 30 days (malnutrition phase) followed by daily ingestion of balanced levels of 15% EY or EW (refeeding phase) for other 30days.

Results showed that lower levels of EY or EW reduced the final body weight, daily feed intake and FER during malnutrition. In spite of refeeding, these rats with diets of 15% EY or EW for 30 days still had lower weight and they did not quite reach control value. The diet of 10% EW enriched with 5% cholesterol reduced the FER. The weights of organs: liver, kidneys, spleen, heart, testes were reduced in both phases as compared to control (15% casein). Blood hematological parameters showed reduction in HB conc. during malnutrition .In refeeding phase, rats fed on diet of EY 15%, the counts of RBCs (10.6×10^6) exceeded the control (8.8×10^6). Reduction in WBCs counts was observed in blood of rats fed on EW 5%. Packed cell volume (PCV) ranged between 31.3-40.1% in malnutrition and 38.9 – 45.1% in refeeding phase. Other parameters as mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) showed indefinite trend in the present study.

Keywords: Food additives, egg yolk, egg white, FER, blood hematological parameters

INTRODUCTION

Nutrition is a basic human need, and although malnutrition has been declining in some regions throughout the world, it remains high in many developing countries, thus affecting vast number of children (de Onis *et al*, 1993).Food additives are substances that are added to foods to increase the nutritional value, enhance the flavor or texture, to prevent spoilage or improve the appearance .Egg Yolk (EY) and egg white (EW) are one of such food additives. It is well known that egg contain the highest quality food protein known. It is the second to mother's milk for human nutrition.

Nowadays, a question rises up: Is it healthier to eat only the EY or eat only the EW? Recent nutrition studies now claim that the yolk of an egg is actually much healthier than the egg white .However; egg-eaters have trouble determining which part is actually healthiest. EW contains no dietary cholesterol with a fine balance of amino acids, and the amount of fat in an EW is extremely limited .But the yolk of an egg contains large amounts of dietary cholesterol and saturated fatty acids. Ingrid Seuss-Baum (2007) pointed to the re-evaluation of egg parts i.e. EY or EW in nutrition, focusing

on the nutritional content and extending to functional substances found naturally in eggs.

The blood is one of the major systems of the body in humans and animals, supporting normal viability, integrity and adaptive responses the function state of the blood systems change dramatically according to the nature, strength, and duration of exposure to external factors.

The aim of the present study was to evaluate the effect of additive substance as EY and EW of high protein quality on body weight and FER (food efficiency ratio) as well as some blood parameters in rats during malnutrition phase or refeeding phase.

MATERIALS AND METHODS

Materials:

Eggs were obtained from Shosha poultry Farm, El-Minia Governorate El- Minia .Egypt .Eggs were balanced for 10 min. in boiling water (100°C) and prepared to be dried, then egg white (EW) was separated carefully from egg yolk (EY). Both fractions were dried at 40- 50 □C then grinded and kept in glass bottles for biological evaluation. Total nitrogen content was determined in both (A.O.A.C.,1986) to determine total protein (N× 6.25). Egg white contained 9.2%protein and egg yolk contained 15.7% protein.

Animal feed and Management:

A total number of 36 male albino rats (Sprague – Dawley strain) 2 months age and weighting 111.5-115.9 gram were obtained and housed in the Biological Lab of Biochemistry Department , Faculty of Agriculture, Minia University .Rats were kept in polyethylene cages with controlled ambient temperature (23-25 °C) and lightening alternating 12hr period of light and dark for an adaptation period of 10 days. During the adaption period, the animals were allowed free access of balanced diet and water was provided *ad libitum* .After that the animals were randomly assigned to six groups (each group contains 6 rats). The control group (6 rats) fed on a balanced diet containing 15% casein for 60 days (composition of the diets is given in Table, 1).The other five groups were fed on one of the balanced diets for 30 days containing 5% egg yolk (EY), 10% EY, 5% egg white (EW), 10 % EW and 10% EW containing 5% cholesterol to induce protein malnutrition. At the end of malnutrition phase (30days) all five groups were fed on diets with 15% protein corresponding to each group for 30 days as refeeding phase (Table,1). At day 30 of malnutrition feeding and at the end of refeeding period (60days), two animals from each group were bled from optical nerve plexus. Also; body weights of rats were recorded. The animals were scarified under light ether anesthesia. At the end of each phase: liver, kidneys, spleen, heart and testis were excised immediately and weighed. However, mean daily body weight gain daily feed intake and mean feed efficiency ratio (%) were recorded. Blood samples collected were placed in tubes which contain anticoagulant (EDTA) for complete hematological studies and determination of hemoglobin.

Table (1): Composition of the diets containing egg white (EW) or egg yolk (EY) (%).

Ingredients	control	Diets containing EY		Diets containing EW		
		5%	10%	5 %	10%	10 %
(Malnutrition phase , 30 days)						
Casein	15	-	-	-	-	-
Starch	50	60	55	60	55	50
Cellulose	24	24	24	24	24	24
Corn oil	5	5	5	5	5	5
Vit. mix	1	1	1	1	1	1
Min .mix	5	5	5	5	5	5
Cholesterol	-	-	-	-	-	5
(Refeeding phase, 30 days)						
		15 %	15 %	15 %	15 %	15 %
Casein	15	-	-	-	-	-
Starch	50	50	50	50	50	45
Cellulose	24	24	24	24	24	24
Corn oil	5	5	5	5	5	5
Vit. mix	1	1	1	1	1	1
Min. mix	5	5	5	5	5	5
Cholesterol	-	-	-	-	-	5

Hemoglobin concentration was determined according to recommendation of the ICSH: (International Committee for Standardization in Hematology, 1967). Blood parameters of Erythrocyte Count (RBCs) and total leucocyte Count (WBCs) were determind and calculated as reported by Dacie and Lewis, (1991). Packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were also calculated (Dacie and Lewis, 1991).

Statistical analysis were performed in triplicate, Values are the mean of six determinations ± SD (Kenney and Keeping, 1962) .

RESULTS AND DISCUSSION

Data presented in Table (2) show clearly that the diets of lower egg yolk (EY) or egg white (EW) percentage (5 and 10%) in the malnutrition phase affected severely and reduced the final body weight , daily body weight gain and daily feed intake . Such effects were resulted in lower or negative feed efficiency ratio (FER%) and recorded – 5.18% to – 3.55% , as compared with control (rats fed diets with 15% casein) which had FER of 4.47%. However, the diet of 10% EW enriched with 5% cholesterol reduced also FER (-4.84%).

On the other hand, data presented in Table (3) show that the FER in the refeeding phase was improved markedly as the percentage of EY or EW were raised to 15% in fed diets where FER of such diets ranged from 4.05 to 4.42% as compared with control(4.03%) .

The results showed also that the malnutrition of protein affected body weight of rats and FER during the whole experimental period (Table, 4). These groups, in spite of refeeding rats, still had lower body weight and they

did not quite reach control value. FER of diets of 5% EY or EW were 0.17% and 0.12 % (respectively) as compared with control (4.23%).

Table (2): Effect of diets containing egg yolk (E Y) or egg white (E W) on body weight and feeding efficiency ratio of rats (Malnutrition phase , 30 days)

Group	Mean initial b .wt (g)	Mean Final b. wt (g)	Mean Daily b. w. gain (g)	Daily feed intake(g)	Mean Feed efficiency Ratio(%)
C* 15%	113.9± 11.3	131.0±17.1	0.57	12.7	4.47
EY 10 %	115.9±06.7	126.2±07.9	0.42	11.9	-3.55
E Y 5%	113.5±09.0	097.9±05.2	-0.52	10.5	-4.92
E W 10%	113.4±11.6	102.0±02.7	-0.38	11.1	-3.42
E W 5%	111.5±12.3	096.4±10.1	-0.50	9.7	-5.18
EW10%+CHLO**	112.2±12.2	101.0±04.2	-0.50	10.4	-4.84

*Casein **Cholesterol(5%) All Values are means± SD of 6 animals.

Table (3): Effect of diets containing egg yolk (EY) or egg white (EW) on body weight and feeding efficiency ratio of rats (Refeeding phase, 30 days)

Group	Mean initial b .wt (g)	Mean Final b.wt (g)	Mean daily b. w. gain (g)	Daily feed intake(g)	Mean Feed efficiency Ratio(%)
C* 15%	131.0±17.1	146.5±08.6	0.52	12.9	4.03
EY 15 %	126.2±07.9	144.0±22.9	0.59	13.1	4.05
E Y 15%	097.9±05.2	114.7±08.7	0.56	12.6	4.42
E W 15%	102.0±02.7	121.0±05.9	0.63	13.2	4.09
E W15%	096.4±10.1	112.9±12.6	0.55	12.8	4.29
EW15%+CHLO**	101.0±04.2	115.4±10.7	0.48	12.9	3.72

*Casein **Cholesterol(5%) All Values are means± SD of 6 animals.

Table (4): Effect of diets containing egg yolk (E Y) or egg white (E W) on body weight and feeding efficiency ratio of rats during the experimental period (Malnutrition phase , 30 days followed by Refeeding phase, 30 days).

Group	Mean initial b .wt (g)	Mean Final b. wt (g)	Mean Daily body weight gain (g)	Daily feed intake(g)	Mean Feed efficiency Ratio(%)
C* 15%	113.9±11.3	146.5±08.6	0.54	12.8	4.23
EY 10 %	115.9±06.7	144.0±22.9	0.47	12.5	3.74
E Y 5%	113.5±09.0	114.7±08.7	0.02	11.6	0.17
E W 10%	113.4±11.6	121.0±05.9	0.13	12.2	1.45
E W 5%	111.5±12.3	112.9±12.6	0.02	11.3	0.21
EW10%+CHLO**	112.2±12.2	115.4±10.7	0.05	11.7	0.46

*Casein **Cholesterol(5%) All Values are means± SD of 6 animals.

The present results are in good accordance with Sarinsnerand *et al*, (1990) who reported that rats fed freely a diet low in protein had lower weight as compared to controls .They added that, a group that was fed on a diet very low in protein gained almost no weight. Mona (2002) reported that there was a significant decrease of body weight of malnutrition group than control rats. She added that refeeding failed to attain control group. Dip (1994)

pointed that the severe protein malnutrition in early life can permanently change and form of the body. Presets- Carneiro *et al.* (2006) reported that rats fed on 9.5% low protein diet (LPD) had a significant reduction in food intake and body weight compared to those on the diet containing 23% protein. Moreover, Hudgens *et al.*(2004) demonstrated in newborns and adult animals as well as in humans, that protein-deficient diets impair protein synthesis .On the other side , David *et al* .(2005) mentioned that ,six week of eggs ingestion had no effect on body mass index (BMI).

Growth and Organs development:

Data presented in Table (5) showed clearly that weight of rats' organs i.e., liver, spleen ,kidneys, heart and testes in rats received casein diet (control) were higher , in general , than in rats fed EY or EW during malnutrition phase .Results also show an increase in the weights of kidneys (1.97gram) and testes (1.54 gram) in rats fed on EY10% in refeeding phase, control rats recorded 1.93 gram and 1.54 gram for kidneys and testes respectively .Such results are in accordance with reports of others , Fashakin and Unokiwedi(1993) reported that the amount of food consumed by animals greatly influence growth response .Aoyama et al .,(2001) stated that liver weight was lower in rats fed on egg protein than in rats fed the casein diet . Kaynar *et al.*,(2006) showed that correlation between body weight and weights of organs and among organs may be useful to propose strategies to enhance health status and body condition in animals and humans.

Table (5): Effect of Egg yolk (EY) and Egg white (EW) in malnutrition and refeeding phases on relative weight of liver, kidneys , spleen, heart , testis to total body weight of male albino rats

Group	Liver	Kidney	Spleen	Heart	Testes
(Malnutrition phase , 30 days)					
C* 15%	3.72±0.30	1. 23±0.10	0.52±0.031	0. 53±0.02	0.96±0.03
EY 10 %	3.24±0.43	1.05±0.20	0.44±0.023	0. 51±0.05	0.93±0.04
E Y 5%	2.46±0.24	0.96±0.00	0.41±0.041	0. 42±0.04	0.83±0.06
E W 10%	2.93±0.20	0.92±0.01	0.45±0.027	0.44±0.05	0.85±0.05
E W 5%	2.87±0.41	0.83±0.01	0.33±0.017	0.42±0.04	0.84±0.03
EW10%+CHLO**	3.52±0.32	0.81±0.10	0.32±0.024	0.40±0.04	0.81±0.02
Mean	3.12	0.97	0.41	0.45	0.87
Group	Liver	Kidney	Spleen	Heart	Testes
(Refeeding phase, 30 days)					
C* 15%	3.94±0.21	1.93±0.04	0.56±0.03	0. 61±0.03	1.33±0.05
EY 15 %	3.86±0.54	1.97±0.03	0.53±0.05	0.52±0.04	1.54±0.04
E Y 15%	3.53±0.43	0.92±0.02	0.42±0.02	0.55±0.03	1.32±0.05
E W 15%	3.52±0.32	0.97±0.04	0.46±0.05	0.56±0.04	1.14±0.04
E W 15%	3.31±0.34	0.95±0.03	0.42±0.03	0.57±0.03	1.12±0.04
EW15%+CHLO**	3.26±0.41	0.94±0.04	0.50±0.02	0.52±0.03	1.21±0.06
Mean	3.57	1.26	0.48	0.56	1.28

*Casein

**Cholesterol(5%)

All Values are means± SD of 6 animals.

Hematological parameters:

The blood hematological parameters that was considered in the study are shown in two phases i.e., malnutrition and refeeding (Table, 6). Results show that hemoglobin (HB) concentration in rats fed on casein (control) was to be in the range of 13.9 – 14.3 mg/ dl. There were marked reductions in HB concentrations in rats fed on EY or EW diets and ranged between 9.9 to 12.9 mg / dl . Rats fed on diets of EW 5% had the lowest values (9.3 and 10.4 mg/ dl) .Results also show that RBCs counts ranged between 8.8× 106 and 8.9× 106 in blood of control rats .In refeeding phase , rats fed on diet of EY15% the counts of its RBCs (10.6 ×106) exceeded the control counts (8.8× 106). Such results are confirmed by the reports of Greengard et al., (1964) reporting that ninety – five percent of the iron in egg found in the yolk. Nys and Sauveur (2004) reported that EY contained 4.8 mg iron/ 100 gram while EW contained only 0.1 mg iron/100 mg.

The total WBCs count in animals fed casein (control) ranged between 7.4 ×103 – 7.8 ×103 . WBCs counts in rats fed diets of EY 10% reached 8.0× 103 – 9.5× 103 . Results show also that there was a reduction in WBCs counts in blood of rats fed on diets containing EW especially with EW 5%.

Animals of various experimental diets containing EY or EW had packed cell volume (PCV mg/ dl) or haematocrit values ranged between 31.3 to 40.1 in malnutrition phase (Table ,7) and increased in refeeding phase 38.9 – 45.1 (Table 7) . However, PCV values of control animals were 38.2 – 40.8.

In this respect , the present results are in accordance with the normal lab values reported by Exotic Animal Companion Medicine Hand book of Veterinarians (2003), where rat hematologic reference ranges were :RBC (6.76- 9.75× 10^6 mm3), PCV (37.6 - 50.6%), WBC(6.6 – 12.6 ×10^3 mm3) and hemoglobin (11.6 – 16.1 g / dl).

The obtained results concerning MCV, MCH or MCHC (Table 7) show indefinite trend during malnutrion or refeeding phases when rats fed various experimental diets using casein, EY or EW (with or without cholesterol). It is known that MCV indicates the average erythrocyte volume used for diagnosis of anemia's, MCH and MCHC are used as a part of standard in reporting hemogram. However , evaluation of red cell distribution size in combination with MCV may be useful to diffentiate etiology of hematopoetic diseases .Our results may need more further studies especially of the biochemical blood parameters to support our findings.

Table (6): Effect of Egg yolk (EY) and Egg white (EW) in malnutrition and refeeding phases on some blood parameters (HP, RBC^s and WBC^s) in albino rats.

Malnutrition phase , 30 days)(									
Group	HB(mg/dl)			RBC's $\times 10^6$/mm^3			WBC's×50/mm^3		
	Zero	30 days	Mean	Zero	30 days	Mean	Zero	30 days	Mean
C* 15%	14.6±0.3	13. 9±0.2	14.3	9.1±0.54	8.7±0.1	8.9	6.9±0.5	7.4±1.2	7.2
EY 10 %	13.8±0.5	12.0±0.3	12.9	9.1±0.5	7.0±0.4	8.1	6.0±0. 5	9.5±0.5	7.8
E Y 5%	14.0±0.3	11.0±0.6	12.5	9.3±0.9	6.4±0.1	7.9	6.3±0.7	5.4±0.6	5.9
E W 10%	13.5±0.6	11. 8±0.8	12.7	9.2±0.6	8.1±0.3	8.7	6.4±0.8	7.4±0.4	6.9
E W 5%	13.8±0.4	09.3±0.6	11.6	8.9±0.5	6.4±0.8	7.7	6.3±0.5	6.9±0.6	6.6
EW10%+CHLO**	13.9±0.3	12.0±0.2	12.9	8.6±0. 5	8.1±0.4	8.4	6.5±0.6	7.9±0.7	7.2
Refeeding phase,30 days)(									
Group	HB(mg/dl)			RBC's $\times 10^6$/mm^3			WBC's×50/mm^3		
	Zero	30 days	Mean	Zero	30 days	Mean	Zero	30 days	Mean
C* 15%	13.9±0.2	13.9±0.4	13.9	8.7±0.1	08.8±0.5	8.8	7.4±1.2	7.8±0.4	7.6
EY 15 %	12.0±0.3	12.8±0.6	12.4	7.0±0.4	10.6±0.2	8.8	8.8±0.5	8.0±0.3	8.4
E Y15%	11.0±0.6	12.2±0.5	11.6	6.4±1.0	07.3±0.8	6.9	5.4±0.6	7.7±0.7	6.6
E W 15%	11.8±0.8	12.3±0.4	12.1	8.1±0.3	09.5±0.8	8.8	7.4±0.4	6.9±0.2	7.2
E W15%	09.3±0.6	10.4±0.8	09.9	6.4±0.8	08.1±0.7	7.3	6.9±0.6	5.0±0.4	5.9
EW15%+CHLO**	12.0±0.2	12.4±o.2	12.2	8.1±0.4	09.5±0.4	8.8	7.9±0.7	7.6±1.2	7.8

*Casein
**Cholesterol(5%)
All Values are means± SD of 6 animals.

Table (7): Effect of Egg yolk (EY) and Egg white (EW) in malnutrition and refeeding phases on some blood parameters (PCV, MCV , MCHM and MCHC) in albino rats.

Malnutrition phase , 30 days)(												
Group	PCV (%)			MCV $\times 10^{-3}$(fl)			MCH $\times 10^{-3}$(pg)			MCHC(g / dl)		
	Zero	30 days	Mean	Zero	30 days	Mean	Zero	30 days	Mean	Zero	30 days	Mean
C* 15%	48.1±1.2	40.8±1.8	44.5	53.5±1.8	46.9±1.5	50.2	16.2±0.6	16.0±0.1	16.1	30.4±0.1	34.1±0.9	32.30
EY 10 %	46.8±2.4	40.1±0. 7	43.5	51.3±0.0	57.3±2.2	54.3	15.2±0.3	17.1±0.5	16.2	29.5±0.5	29.9±0.4	29.70
E Y 5%	47.0±2.1	32.1±0.7	39.6	50.6±2.4	50.4±5.9	50.5	15.1±0.9	17.3±1.7	16.2	29.8±0.6	34.3±1.0	32.05
E W 10%	47.6±0.8	33.8±0.9	40.7	51.7±2.3	41.7±0.5	46.7	14. 7±0.3	14.5±0.4	14.6	28.7±0.8	34.9±1.5	31.80
E W 5%	48.8±0.8	31.5±1.5	40.2	52.8±2.3	49.2±3.1	51.0	14.9±0.5	14. 5±0.7	14.7	28.3±0.3	29.4±0.4	28.90
EW10%+CHLO**	46.9±1.5	31.3±1.2	39.1	54.5±1.2	38.6±0.5	46.6	16.2±0.5	14.8±0.5	15.5	29.7±0.3	38.3±0.7	34.00
Refeeding phase,30 days)(												
Group	PCV (%)			MCV $\times 10^{-3}$(fl)			MCH $\times 10^{-3}$(pg)			MCHC(g / dl)		
	Zero	30 days	Mean	Zero	30 days	Mean	Zero	30 days	Mean	Zero	30 days	Mean
C* 15%	40.8±1.8	38.2±1.7	39.5	46.9±1.5	43.5±0.6	45.2	16.0±0.1	15. 9±0.5	15.9	34.1±0.9	38.6±2.6	36.35
EY 15 %	40.1±0.7	45.1±2.6	42.6	57.3±2.2	36.2±1.5	46.8	17.1±0.5	10.3±0.4	13.7	29.9±0.4	28.4±0.2	29.20
E Y15%	32.0±0.7	42.0±1.7	37.0	50.4±5.9	57.5±3. 8	53.9	17.3±1.6	16.7±1.1	17.0	34.3±1.0	29.1±0.1	31.70
E W 15%	33.8±0.9	41.6±1.5	37.7	41.7±0.5	41.8±0.8	41.8	14.5±0.4	12.3±0.2	13.4	34.9±1.5	29.4±0.7	32.20
E W15%	31.5±1.5	38.9±2.9	35.2	49.2±3.1	48.1±0.7	48.7	14. 5±0.7	12. 8±0.2	13.7	29.4±0.4	26.6±4.5	28.00
EW15%+CHLO**	31.3±1.2	42.2±2.5	36.8	38.6±0.5	44.4±0.8	41.5	14.8±0.5	13.1±0.3	13.9	38.3±0.7	29.4±1.1	33.90

***Casein**

****Cholesterol(5%)**

All Values are means± SD of 6 animals.

REFERENCES

AOAC ,(1986) Official Methods of Analysis of the Association of Official Analytical Chemists, 14th ed. Washington D.C.USA.

Aoyama, Y.; M. Wada, and Masashi M. (2001) Orotic Acid added to Casein, but not to Egg Protein Soy Protein Wheat Gluten Diets Increases 1, 2-Diacylglycerol Levels and Lowers Superoxide Dismutase Activities Rat Liver Biosci. Biotechnol. Biochem., 65(10), 2166-2173.

Dip, B. (1994) Outcome of low birthweight. *Horm Res* 42: 223_230.

Dacie, J.V. and Lewis, S.M. (1991) Practical Haematology. Churchill Livingstone. Edinburgh .Seventh edition. 521-534.

David, L. K., Marian, A. E., Haq, N., Valentine, Y. N., Wendy, C., Beth P. C. & Martha, L. H. (2005): Egg consumption and endothelial function: a randomized controlled crossover trial, International Journal of Cardiology, 99: 65_70.

de Onis M., Monteiro C., Akre J.,and Clugston G. (1993) The worldwide magnitude of protein-energy malnutrition: an overview from de WHO Global Database child growth. Bull World Health Organ 71: 703 - 712

Exotic Animal Companion Medicine Handbook for Veterinarians, Johnson-Delaney, C., (1996), Zoological Education Network.

Fashakin, J.B. and Unokiwedi, C.C. (1993) National valuation of 'warankasi' and'waragusi' prepared from cow milk partially substituted with melon milk. Nigerian Food Journal 11: 128 – 134.

Greengard O, A Sentenac, and N Mendelsohn .(1964) Phosvitin, the iron carrier of egg yolk. Biochim Biophys Acta 90:406-407.

Hudgens J, Langkamp-Henken B, Stechmiller JK, Her-rlinger-Garcia KA, and Nieves C Jr (2004) Immune function is impaired with a mini nutritional assessment score indicative of malnutrition in nursing home elders with pressure ulcers. J. Pareter Enteral Nutr 28: 416_422.

Ingrid Seuss-Baum (2007) Chapter 18 Nutritional Evaluation of Egg Compounds. Bioactive Egg Compounds (ed. by Rainer Huopalahti, Rosina LÓpez-Fandin˜o,Marc Anton and Rüdiger Schade) © Springer-Verlag Berlin Heidelberg.

ICSH (1967) : International Committee for Standardization in Hematology .

Kaynar O., Armagan H., Ahmet Y., Zafer O., Fikrulla K., Emel B. B.I Bal, Harun P. and Fuat E.. (2006) Reference Values for some Physiological and Biochemical Parameters in Rats at puberty. Journal of Animal and Veterinary Advances 5(12):1121-1128.

Kenney, J. F. and Keeping, E. S.(1962). "The Standard Deviation" and "Calculation of the Standard Deviation." §6.5-6.6 in Mathematics of Statistics, Pt. 1, 3rd ed. Princeton, N J: Van Nostrand, pp. 77-80,

Mona, A.M.G. (2002) Effect of different proteins supplementation on protein malnourished rats. M. Sc. Thesis .Fac .of .Agric. Cairo Univ.

Nys Y., Sauveur B. (2004) Valeur nutritionnelle des oeufs. INRA Prod. Anim 17:385–393.

Prestes-Carneiro, L.E' , Rodrigo D. Laraya, Paula R., Colacino S., Ricardo Alberto M., Ionice Felipe P., Felipeand P., and Cezar M. (2006) Long-Term Effect of Early Protein Malnutrition on Growth Curve, Hematological Parameters and Macrophage Function of Rats. J. Nutr. Sci. Vitaminol, 52,414-420.

Sarinsnerand. G. V., Schelp, F. Hiller, H.H. Gauthier, F.Siegert, M. and Reutter, W. (1990) Nutritionally induced elevation of serum proteinase inhibitors and reduced 3 methylhistidine excretion in the rat. International J. for Vitamin and Nutrition Research. 60(3):279-287.

التغيرات في وزن الجسم وكفاءة معدل التغذية وبعض مكونات الدم في الفئران المغذاة على صفار البيض أو بياض البيض خلال مرحلتي سوء التغذية وفترة التدعيم

محمد شعبان حسن ، عادل محمد ذكى ، فوزي سليمان هاتور و هناء سالم صالح
قسم الكيمياء الزراعية – كلية الزراعة – جامعة المنيا – المنيا – مصر

تم إعداد هذا البحث لدراسة التغيرات في وزن الجسم وكفاءة معدل التغذية (FER) ووزن بعض الأعضاء الداخلية وكذا بعض مكونات الدم على ذكور الفئران البيضاء المغذاة على بعض مضافات التغذية مثل صفار البيض أو بياض البيض خلال مرحلتي سوء التغذية (بمستوى ٥-١٠%) أو مرحلة الدعم (١٥%) على مدى ٣٠ يوم لكل مرحلة.

أظهرت النتائج أن التغذية بمستويات منخفضة من صفار البيض (EY) وبياض البيض (EW) أدت إلى نقص واضح لكل من وزن الجسم ومعدل استهلاك الغذاء وكفاءة معدل التغذية خلال فترة سوء التغذية. وفى مرحلة الدعم تم رفع مستوى كل من EY و EW إلى ١٥% و لم تصل اى من هذه التقديرات في النهاية إلى مستوى المجموعة الضابطة (كنترول). وأدت وجبة مكونة من ١٠% بياض البيض (EW) + ٥ % كولسترول إلى نقص في كفاءة معدل التغذية لفئران هذه المجموعة. وخلال مرحلة سوء التغذية ومرحلة الدعم أظهرت النتائج نقص واضح في أوزان بعض الأعضاء الداخلية مثل الكبد والكليتين والطحال والقلب والخصيتين عند مقارنتها بمجموعة الكنترول (15% casien).

أظهرت النتائج انخفاض في تركيز الهيموجلوبين خلال مرحلة سوء التغذية لخلايا الدم.وأدت التغذية بمستوى ١٥% صفار بيض إلى زيادة عدد كرات الدم الحمراء (١٠.٦×١٠^{٦}) عند مقارنتها بالكنترول (٨.٨×١٠^{٦})أثناء مرحلة الدعم. وفى مرحلة سوء التغذية كان هناك نقص في عدد كرات الدم البيضاء.

تراوحت قيم (PCV) بين ٣,٣١-١,٤٠% في مرحلة سوء التغذية وبين٩, ٣٨ -٤٥,١ % في مرحلة الدعم.

أما باقي التقديرات مثل (MCH) و (MCHC) و(MCV) لم تظهر النتائج اتجاه واضح للتغيرات في محتواها.

قام بتحكيم البحث

أ.د / سامى طلعت ابو طالب	**كلية الزراعة – جامعة المنصورة**
أ.د / فؤاد عبد الرحيم احمد	**كلية الزراعة – جامعة القاهرة**