

The Effects of Egg Weight and Extra Oxygen Addition into the Last Stage of Incubator on Hatching Results in Turkeys at High Altitude

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Abstract – The aim of this study was to examine the effects of egg weight and extra oxygen (O₂) addition into incubator at high altitude and the last stage on hatching results in turkeys. It was used 780 eggs in investigation. All eggs were distributed randomly into two hatching cabinets (Çimuka Company) which were operated. The first cabinet was oxygenated at 25 % whereas no O₂ added to the second cabinet between days 25 and 28 incubation and called control group. The number of chicks hatching was recorded day 28. At day 28 of incubation, all unhatched eggs were opened and examined macroscopically for the time of embryonic death. In the result of the study, albumin index an shell thickness in the egg quality characteristics, fertility (%) and hatching chick weight in hatching results, blood glucose level in hatching chicks was significantly affected by egg weight (p<0.05). Fertile hatchability (%), heart weight and RBC (red blood cell) in hatching chicks was significantly affected by adding oxygen in incubator at the last stage (p<0.05). As a result, hatchability increased O₂ supplementation to incubator at high altitude. The effect of hypoxia at high altitude concluded toward to decrease heart weight and red blood cell concentration, although hemoglobin concentration did not change with O₂ supplementation to incubator.

Keywords – High Altitude, Oxygen Supplement, Egg Weight, Turkey.

I. INTRODUCTION

Turkey production has begun to gain importance in poultry in the world recently. Profitability which is the main aim in commercial poultry production is directly affected by salable number of chicks acquired, concordantly the quality of chicks acquired has importance, too. The age, feeding and genotype of parent stock, egg weight, maternal immunity, storage conditions of hatching eggs, altitude as well as general incubation conditions (temperature, humidity, ventilation and turning) affect the quality of chicks [16], [29], [18]. The characteristics of growth and development in both mammal and avian embryos are closely related to oxygen. Hypoxia slows down metabolic rate at chicken embryos and as a result of this, it prevents organ growth and the results causing death may happen depending upon intensity of hypoxia other study [6]. Oxygen is a gas which provides maintainability of metabolic activities in living organism cells and it controls the growth and development of living being. The O₂ consumption of embryo increases exponentially after especially first two weeks' incubation period [27]. It is known that fertile hatchability of eggs reduces in the hatchery where situated in the places above specially 914

meters [26]. This is because partial pressure of O₂ is lower than sea level and it causes hypoxia. During embryo development of poultry eggs in the incubator at high altitude, symptoms that are impossible to recover may happen at specially digestion and respiratory organs. This situation is known to affect fertile hatchability and subsequent performance of chicks adversely. Generally egg size in addition to body size in avian species and between avian species grows, nevertheless big avian species are prone to give smaller eggs in proportion to body size [23], [20].

It was stated that when hatching egg weight of poultry species was under certain limits, optimum fertile hatchability could be obtained [21]. It was stated the weight of chick that is when it comes out of its shell, depending upon the increase of hatching egg weight increased significantly. Egg weight and incubation period of yolk was related to early release and yolk reserve needed at release [32]. Reference [28] pointed out that key determinant factors were egg weight and water loss from egg during incubation in the linear mathematical formula which he developed by considering factors affecting chicks' weight (at hatch and daily age) in order to predict the weight of daily chicks at the end of incubation. Turkeys' egg weight constituted approximately % 63 of egg weight setted in the machine [25]. It was stated that the correlation between egg and embryo weight in turkeys was low and not important on the twelfth day, but pretty high at hatchling [9]. Besides, embryos reached at % 40 of their hatching weight on the twentieth day of incubation [8].

In the past years, selection strategies were applied in turkeys to increase the amount of breast meat, so the amount of breast meat was raised both at embryonic developmental period and after hatchling [30], [31]. As embryonic developmental rate is high in turkeys, which are situated in the four poultry species, more energy for embryos are reserved [15]. Additional energy is reserved for development of pectoral muscle tissue and having more breast meat in modern turkeys other study [5]. Also, egg is able to supply sufficient space for development of embryo and sufficient number of pores in eggshell for gas exchange [22] when the egg gets bigger, porosity of eggshell, water loss of egg and transmittance increase [2]. The size of egg increases together with its parent age, and when embryos obtained from young parents are compared to old parents' ones in same incubation conditions, they develop more slowly in the last week of incubation [14]. There are metabolic differences between embryos obtained from parent genotypes at different ages and higher rate of

metabolism events happen because of much heat generation in embryos obtained from old parents [17].

This research was planned to investigation affects on hatching results of adding O₂ to hatching turkey's eggs with different weights being incubated at high altitude in the last period of incubation.

II. MATERIALS AND METHODS

In the research, hatching turkey eggs were used, which imported from Cuddyfarm company in Canada. The tests were done in the two incubators (Çimuka brand) in which were in Poultry Unit, in Animal Science Department, Faculty of Agriculture, Van Yüzüncü Yıl University. Humidity and temperature degrees were measured with wet and dry thermometer as well as with digital parts on machine. Moreover, oxygen (O₂) measurements of hatcher of incubator were regularly performed with digital oximeter.

Hatching eggs were pre-heated before loading at 26.7 °C and % 65 NR for 24 hours. The eggs to be put into incubator were weighed one by one at scales which had a sensitivity ±0.01g. Hatching eggs were separated into total three weight groups as 80-92.99 g, 93-99.9 g and 100-115 g.

Before setter and transfer (twenty-fifth day), egg weight (EW) loss was determined in the formula indicated below by measuring weights of all eggs.

$$\text{Egg Weight Loss (\%)} = \frac{\text{EW at setter} - \text{EW at transfer}}{\text{EW at setter}} \times 100$$

Quality characteristics of eggs in each weight group were determined. Before testing, after ten eggs taken randomly by each weight group were weighed at scales which had a sensitivity of 0, 1, shape index, albumen index, yolk index and eggshell thickness were determined. The values of shape index, albumen index and yolk index were determined according to formula below.

$$\text{Shape Index} = \frac{\text{Egg Width (mm)}}{\text{Egg Length (mm)}} \times 100$$

$$\text{Albumen Index} = \frac{\text{Albumen Height (mm)}}{\text{Mean of Albumen's length and width (mm)}} \times 100$$

$$\text{Yolk Index} = \frac{\text{Yolk Height (mm)}}{\text{Yolk Diameter (mm)}} \times 100$$

780 hatching turkey eggs in total were placed into 2 incubators (390 / machine) randomly and evenly. Forty eggs that were in the group of 80-92.99 g and 100-115 g and 50 eggs that were in the group of 93-99.9 g were place into each of the incubators recurrently. Extra O₂ whose O₂ ratio was % 24 was added to each of the incubators by using ventilation hatch according to oximeter measure- -ments since the 25th day of incubation. No extra O₂ was added to other eggs in the another incubator as a control group, level

of O₂ was founded as % 19-20 according to measurements in the incubators. Eggs were automatically turned once in an hour in 45 degree angle in setter. Incubation profile is given table 1.

Transfer of eggs was done on the 25th day and was categorized as fertile and infertile eggs by candling.

$$\text{Fertility} = \frac{\text{Number of Fertile Eggs}}{\text{Total Number of eggs}} \times 100$$

Following hatching process, by being broke all eggs that didn't hatch any chicks Early Term Embryonic Mortalities (ETM), Mid Term Embryonic Mortalities (MTM), Late Term Embryonic Mortalities (LTM) and Pip Mortality rates and fertile hatchability (FH) were determined and calculated according to formula below.

$$\text{ETM} = \frac{\text{Number of Embryos die on 0-12}^{\text{th}} \text{ days}}{\text{Number of Fertile Eggs}} \times 100$$

$$\text{MTM} = \frac{\text{Number of Embryos die on 13}^{\text{rd}}\text{-24}^{\text{th}} \text{ days}}{\text{Number of Fertile Eggs}} \times 100$$

$$\text{LTM} = \frac{\text{Number of Embryos die on 25}^{\text{th}}\text{-28}^{\text{th}} \text{ days}}{\text{Number of Fertile Eggs}} \times 100$$

$$\text{FH} = \frac{\text{Total saleable chicks}}{\text{Number of Fertile Eggs}} \times 100$$

Table 1. Incubation Profile

Day	Hour	Temperature (°F)	Wet-Bulb Thermometer (°F)	Ventilation (%)	
				Min	Mak.
0	00.00	80.0	85 Fh	0	0
1	00.00	100.2	87 Fh	0	0
2	00.00	100.0	87 Fh	0	0
3	00.00	99.8	87 Fh	0	0
4	00.00	99.8	87 Fh	0	0
5	00.00	99.6	83 Fh	0	0
6	00.00	99.6	83 Fh	0	0
7	00.00	99.6	83 Fh	0	0
8	00.00	99.6	83 Fh	0	0
9	00.00	99.6	83 Fh	0	0
10	00.00	99.4	83 Fh	0	0
11	00.00	99.4	83 Fh	0	0
12	00.00	99.2	83 Fh	0	0
13	00.00	99.2	81 Fh	30	50
14	00.00	99.0	81 Fh	30	50
15	00.00	99.0	81 Fh	30	50
16	00.00	99.0	81 Fh	30	50
17	00.00	98.8	81 Fh	30	70
18	00.00	98.8	81 Fh	30	70
19	00.00	98.8	81 Fh	70	100
20	00.00	98.7	81 Fh	70	100
21	00.00	98.7	81 Fh	70	100
22	00.00	98.5	81 Fh	70	100
23	00.00	98.5	81 Fh	70	100

24	00.00	98.5	84 Fh	80	100
24	10.00	98.5	85 Fh	30	50
25	00.00	98.5	87 Fh	30	50
25	12.00	98.5	87 Fh	30	50
25	15.00	98.5	89 Fh	40	60
26	00.00	98.0	90 Fh	40	60
26	07.00	98.0	92 Fh	50	70
26	15.00	98.0	93 Fh	60	80
27	10	97.8	88 Fh	80	100
27	15.00	97.5	88 Fh	80	100
27	20	97.0	88 Fh	80	100

III. RESULTS

Quality characteristics of hatching turkey eggs used in this research according to egg weight groups were given in the table 2. There was no significant difference ($p > 0.05$) between egg weight groups in the terms of shape index and yolk index. Shape index at 92.9 g, 93-99.9 g and 100-115 g eggs was determined 70.23, 70.40 and 71.52 respectively; yolk index was determined 39.13, 38.93 and 37.52 respectively. Albumen index and eggshell thickness was significantly affected by egg weight groups. While the highest albumen index value was found to be 7.29 at eggs that weighed 100-115 g, the albumen index value of eggs that weighed 80-92 g was found to be 6.02, 5.90 was the albumen index value of eggs that weighed 93-99.9 g. While the highest eggshell thickness was found to be 0.39 at eggs that weighed between 93 and 99.9 g, it was found to be 0.38 at eggs which weighed between 100 and 115 g. 0.37 was the albumen index value of eggs which weighed between 80 and 92.2.

Cervical dislocation was applied to 5 daily chicks from every group. Blood was taken from chicks, it was centrifuged at 10000 spin for ten minutes and glucose, triglyceride and lipoprotein (VLDL) that has very low specific weight were determined in the serum. By using tubes with EDTA, red blood cells (RBC) and hemoglobin (Hb) were found out.

Data was analyzed at SPSS (ver: 16) packaged software by General Linear Model (GLM) technique. *Duncan's Multiple Range Test* was applied to determine variations between mean of groups ($p < 0.05$) on testing.

Table 2. Quality Characteristics of Hatching Eggs

Egg weight Groups (g)	Egg Weight (g) $\bar{x} \pm S\bar{x}$	Shape Index $\bar{x} \pm S\bar{x}$	Albumen Index $\bar{x} \pm S\bar{x}$	Yolk Index $\bar{x} \pm S\bar{x}$	Eggshell Thickness (mm) $\bar{x} \pm S\bar{x}$
80-92.9	89.22±0.642 c	70.23±0.57	6.02±0.355 b	39.13±0.561	0.37±0.007 c
93-99.9	96.56±0.695 b	70.4±0.414	5.9±0.358 b	38.93±0.552	0.39±0.007 a
100-115	103.72±0.685 a	71.52±0.729	7.29±0.472 a	37.52±0.76	0.38±0.006 ab
SEM	1.162	0.343	0.251	0.376	0.004
P Value	<0.001	0.257	0.036	0.166	0.055

a,b,c: Means within columns with no common superscript differ significantly ($p < 0.05$).

In the research, the affect of egg weight on fertility (%) and egg weight loss (%) was stated in the table 3. Egg weight affected statistically fertility ($p < 0.05$). The highest fertility 87.46% was obtained in the group of eggs between 100 and 115 g and the lowest fertility 84.12% was obtained in the group of eggs between 80 and 92.9. The affect of egg weight on egg weight loss was not important statistically. Of eggs whose weight was 80-92.9 g, 93-99.9 g and 100-115g were determined as 14.76%, 14.55% and 14.60% respectively (table 3).

Table 3. The affect of egg weight on fertility (%) and egg weight loss (%).

Egg weight	Fertility (%) $\bar{x} \pm S\bar{x}$	Egg weight loss (%) $\bar{x} \pm S\bar{x}$
80-92.9 g	84.12±0.949 c	14.76±0.488
93-99.9 g	86.19±.534 ab	14.55±0.517
100-115g	87.46±0.358 a	14.60±0.538
SEM	0.588	0.292
P Değeri	0.032	0.957

a,b,: Means within columns with no common superscript differ significantly ($p < 0.05$).

The affect of Oxygen addition and egg weight on fertile hatchability at daily chicks and incubation characteristics were stated in the table 4. The affect of oxygen addition to incubator on initial weight was not important ($p > 0.05$) statistically. Additionally, while initial weight in the group where oxygen added was found to be 63.09 g, it was found to be 62.66 g in the control group. The affect of oxygen addition and egg weight interaction on initial weight was not important ($p > 0.05$) statistically.

The affect of egg weight on initial weight was not important ($p < 0.05$) statistically. The egg of which highest initial weight was 100-115 g was obtained as 67.60 g in the group of weight and this group was followed respectively by egg groups whose weight were 93-99.9 and 92.9 g. Also, it was followed as 63.27 g and 57.29 g respectively. (table 4)

The affect of oxygen addition to incubator on fertile hatchability was important statistically ($p < 0.05$). While the highest fertile hatchability was found to be 84.46% in the group to which oxygen added, it was found to be 80.12% in the group of control. The affect of egg weight on fertile hatchability was not important statistically ($p > 0.05$). The

affect of oxygen addition and egg weight interaction on fertile hatchability was not important ($p>0.05$) statistically (table 4).

The affect of oxygen addition to incubator on early term mortality was not important ($p>0.05$) statistically. While early period mortality was found to be 6.9% in the group to which oxygen added, it was found to be 7.19% in the control group. The affect of egg weight on early term mortality was not important ($p>0.05$) statistically. It was found to be 7.36%, 6.41% and 7.37% in the egg groups whose weight was 100-115g, 93-99.9 g and 80-92.9 g respectively. The affect of oxygen addition and egg weight interaction on early term mortality was not important ($p>0.05$) statistically (table3).

The affect of oxygen addition to incubator on mid term mortality was not important ($p>0.05$) statistically. While middle period mortality in the group to which oxygen added was found to be 2.76%, it was found to be 2.97% in the control group. The affect of egg weight on mid term mortality was not important ($p>0.05$) statistically. It was determined as 2.47%, 3.53% and 2.61% in the eggs groups whose weight was 100-115g, 93-99.9 g and 80-92.9 g respectively. The affect of oxygen addition and egg weight

interaction on mid term mortality was not important ($p<0.05$) statistically (table3).

The affect of oxygen addition to incubator on late term mortality was not important ($p>0.05$) statistically. While late period mortality rate was found to be 3.83% in the oxygen adding group, it was found to be 5.65% in the control group. The affect of egg weight on late term mortality was not important ($p>0.05$) statistically. It was determined as 3.26%, 4.49% and 6.48% in the eggs weight groups was 100-115g, 93-99.9 g and 80-92.9 g respectively. The affect of oxygen addition and egg weight interaction on late term mortality was not important ($p<0.05$) statistically (table 3).

The affect of oxygen addition to incubator on pip mortality was not important ($p>0.05$) statistically. While pip mortality rate was found to be 2.05% in the oxygen adding group, it was found to be 4.07% in the control group. The affect of egg weight on pip mortality was not important ($p>0.05$) statistically. It was determined as 3.29%, 2.89% and 2.99% in the egg weight groups was 100-115g, 93-99.9 g and 80-92.9 g. respectively The affect of oxygen addition and egg weight interaction on pip mortality was not important ($p>0.05$) statistically (table 3).

Table 3. The affect of oxygen addition and egg weight on hatching traits.

Feature	IW (g) $\bar{x} \pm S\bar{x}$	FH (%) $\bar{x} \pm S\bar{x}$	ETM (%) $\bar{x} \pm S\bar{x}$	MTM (%) $\bar{x} \pm S\bar{x}$	LTM (%) $\bar{x} \pm S\bar{x}$	PIPM (%) $\bar{x} \pm S\bar{x}$
Oxygen Addition						
O ₂	63.09±0.273	84.46±1.255 a	6.9±0.814	2.76±0.786	3.83±0.787	2.05±0.600
Control	62.66±0.291	80.12±1.317 b	7.19±1.007	2.97±0.713	5.65±0.978	4.07±0.871
P Value	0.205	0.042	0.845	0.865	0.154	0.113
Egg weight (EW)						
80-92.9 g	57.29±0.224 c	80.56±2.285	7.37±1.731	2.61±0.961	6.48±1.125	2.99±1.224
93-99.9 g	63.27±0.211 b	82.69±1.404	6.41±0.405	3.53±0.918	4.49±0.951	2.89±0.823
100-115g	67.60±0.189 a	83.62±1.609	7.36±0.868	2.47±0.909	3.26±1.027	3.29±1.051
P Value	<0.001	0.431	0.832	0.740	0.127	0.958
O₂ X EW						
O ₂ X 80-92.9 g	57.47±0.316	81.87±2.659	6.93±2.330	2.61±1.520	6.03±0.833	2.56±1.480
O ₂ X 93-99.9 g	63.44±0.289	84.62±2.221	6.41±0.641	3.21±1.696	3.85±1.110	1.92±1.110
O ₂ X 100-115g	67.7±0.243	86.89±0.767	7.36±1.373	2.48±1.443	1.63±0.813	1.65±0.823
Control X 80-92.9 g	57.09±0.317	79.24±4.160	7.8±3.059	2.61±1.520	6.93±2.330	3.42±2.261
Control X 93-99.9 g	63.09±0.309	80.77±1.110	6.41±0.641	3.85±1.110	5.13±1.696	3.85±1.110
Control X 100-115g	67.5±0.296	80.35±1.287	7.36±1.373	2.46±1.408	4.90±1.391	4.94±1.461
SEM	0.199	1.028	0.629	0.516	0.647	0.567
P value	0.954	0.700	0.961	0.967	0.692	0.708

a,b,c: Means within columns with no common superscript differ significantly ($p<0.05$).

IW: Initial Weight

PIPM: Pip Mortality

The affect of oxygen addition and egg weight on heart weight and blood parameters at daily chicks was given in the table 4.

The affect of oxygen addition to the incubator on heart weight was important ($p<0.05$) statistically. While the lowest heart weight was found to be 0.35 g in the oxygen adding group, it was found to be 0.39 g in the control group.

The affect of egg weight on heart weight was not important ($p>0.05$) statistically. It was determined 0.38 g, 0.37 g and 0.36 g in the eggs' group whose weight was 100-115g, 93-99.9 g and 80-92.9 g respectively. The affect of oxygen addition and egg weight interaction on heart weight was not important ($p>0.05$) statistically (table 4).

The affect of egg weight on blood glucose level was important ($p < 0.05$) statistically. The highest glucose level was obtained 260,46 mg/dl in the 80-92,9 g egg group, it was found to be 258,90 mg/dl and 253,86 mg/dl in the egg group whose weight was 100-115 g and 93-99.9 g respectively. The affect of oxygen addition to incubator on glucose level was not important ($p > 0.05$) statistically. While the glucose amount was found to be 257,47 mg/dl in the oxygen adding group, it was found to be 258,01 mg/dl in the control group. The affect of oxygen addition and egg weight interaction on glucose level was not important ($p > 0.05$) statistically (table 4).

The affect of oxygen addition to incubator triglyceride amount was not important ($p > 0.05$) statistically. While the triglyceride amount was found to be 104.97 mg/dl in the oxygen adding group, it was found to be 105.47 mg/dl in the control group. The affect of egg weight on triglyceride level was not important statistically and it was determined 106.42 mg/dl, 106.86 mg/dl and 105.06 mg/dl in the egg group whose weight was 100-115g, 93-99.9 g and 80-92.9 g respectively. The affect of oxygen addition and egg weight interaction on triglyceride level was not important ($p > 0.05$) statistically (table 4).

The affect of oxygen addition to incubator on lipoprotein level was not important ($p > 0,05$) statistically. The lipoprotein level was found to be 21.93 mg/dl in the oxygen adding group, it was determined as 21.87 mg/dl in the control group. The affect of egg weight on lipoprotein level

was not important ($p < 0.05$) statistically. It was determined 22.40 mg/dl, 21.10 mg/dl and 22.20 mg/dl in the egg group whose weight was 100-115g, 93-99.9 g and 80-92.9 g respectively. The affect of oxygen addition and egg weight interaction on lipoprotein level was not important ($p > 0.05$) statistically (table 4)

The affect of oxygen addition to incubator on red blood cell amount was important ($p < 005$) statistically. While the lowest red blood cell amount was found to be 1.98 million/ mm^3 in the oxygen adding group, it was determined 2.25 million/ mm^3 in the control group. The affect of egg weight on red blood cell was not important ($p > 0,05$) statistically. It was determined 2.10 million/ mm^3 , 2.13 million/ mm^3 and 2.13 million/ mm^3 in the egg group whose weight was 100-115g, 93-99.9 g and 80-92.9 g respectively. The affect of oxygen addition and egg weight interaction on red blood cell amount was not important ($p > 0.05$) statistically (table 4).

The affect of oxygen addition to incubator on hemoglobin amount was not important ($p > 0.05$) statistically. While the hemoglobin amount was found to be 14.85 g/dl in the oxygen adding group, it was determined 15.89 g/dl in the control group. The affect of egg weight on hemoglobin level was not important ($p > 0.05$) statistically. It was determined 15.50 g/dl, 15.28 g/dl and 15.33 g/dl in the egg group whose weight was 100-115g, 93-99.9 g and 80-92.9 g respectively. The affect of oxygen addition and egg weight interaction on hemoglobin level was not important ($p > 0.05$) statistically (table 4).

Table 4. The affect of oxygen addition and egg weight on heart weight and blood parameters.

Feature	HW (g) $\bar{x} \pm S\bar{x}$	Glikoz (mg/dl) $\bar{x} \pm S\bar{x}$	Trigliserit (mg/dl) $\bar{x} \pm S\bar{x}$	VLDL (mg/dl) $\bar{x} \pm S\bar{x}$	RBC (milyon/ mm^3) $\bar{x} \pm S\bar{x}$	Hb (g/dL) $\bar{x} \pm S\bar{x}$
O₂ Addition						
O ₂	0.35±0.006 b	257.47±1.328	104.97±0.799	21.93±0.43058	1.98±0.030 b	14.85±0.218
Control	0.39±0.008 a	258.01±2.050	105.47±1.131	21.87±0.43498	2.25±0.023 a	15.89±0.180
SEM	0.06	1.20	0.68	0.30	0.03	0.17
P Value	<0.001	0.808	0.727	0.914	<0.001	0.002
Egg Weight (EW)						
80-92.9 g	0.36±0.007	260.5±2.44 a	105.38±0.886	22.20±0.416	2.13±0.0555	15.33±0.282
93-99.9 g	0.37±0.013	253.9±1.47 b	103.86±1.559	21.10±0.605	2.13±0.0561	15.28±0.302
100-115g	0.38±0.012	258.9±1.78 ab	106.42±0.957	22.40±0.476	2.10±0.0535	15.50±0.322
SEM	0.006	1.201	0.682	0.30077	0.03079	0.169
P Value	0.227	0.051	0.357	0.195	0.788	0.823
O₂ X EW						
O ₂ X 80-92.9 g	0.34±0.009	257.34±1.393	105.06±1.427	22.40±0.678	1.98±0.047	14.84±0.401
O ₂ X 93-99.9 g	0.35±0.008	253.50±1.446	103.76±1.268	20.80±0.663	1.99±0.050	14.84±0.356
O ₂ X 100-115g	0.35±0.014	261.58±2.513	106.08±1.546	22.60±0.748	1.99±0.071	14.86±0.459
Control X 80-92.9 g	0.37±0.166	263.58±4.474	105.70±1.202	22.00±0.548	2.27±0.039	15.82±0.278
Control X 93-99.9 g	0.39±0.174	254.22±2.754	103.96±3.054	21.40±1.077	2.27±0.045	15.72±0.433
Control X 100-115g	0.40±0.179	256.22±2.095	106.76±1.293	22.20±0.663	2.21±0.041	16.14±0.225
SEM	0.108	2.080	1.182	0.521	0.053	0.294
P Value	0.876	0.114	0.989	0.745	0.755	0.853

a,b: a,b,c: Variations between means which take different letters at same column are important statistically($p < 0,05$).

HW: Heart Weight

VLDL: Lipoprotein which has very low specific weight

RBC : Red Blood Cell

HGB : Hemoglobin

IV. DISCUSSION

In this research, the result that different egg weight not affecting shape index and yolk index and yolk index shows

similarities with other study [2]. It was the same as reference [2] stated that no variation could be found between egg weight groups in terms of shape index. Albumen index and eggshell thickness has increased. The

highest albumen index was determined in the eggs whose weight was 100-115g and the highest eggshell thickness was determined in the eggs whose weight was 93-99.9 g. Reference [12] pointed out that at genotypes there was a linear relation between fertile hatchability and egg weight, albumen weight, percentage of albumen.

The affect of egg weight in terms of fertility was important statistically ($p < 0.05$). In the research, the highest and lowest fertility rate was determined in the eggs whose weight was 100-115g and 80-92.9 g respectively. Findings obtained correspond to other study [2]. Reference [2] pointed out that as the weight in the turkey eggs increased, the fertility rate increased. The affect of egg weight in terms of egg weight loss was not important ($p > 0.05$) statistically. The affect of egg weight in terms of fertile hatchability was important ($p < 0.05$) statistically.

Reference [2] stated that so long as egg weight increased, initial weight increased. When chicks hatching from eggs compared to light eggs, they had heavier initial weight and this difference continued till the age of 56 days [1]. The affect of egg weight in terms of fertile hatchability was not important ($p > 0.05$) statistically. As long as egg weight increased, incubation efficiency and fertile hatchability raised [19]. On the contrary, the best hatchability was obtained from bronze turkey eggs with medium weight [10].

The affect of egg weight on early term mortality, mid term mortality and late term mortality was not important ($p > 0.05$) statistically. It was reported that late term mortality was high at turkey hatching heavy eggs [24]. While the affect of egg weight on pip mortality rate was not important ($p < 0.05$), the highest rate and the lowest rate was determined in the eggs whose weight was 100-115g and 93-99.9 g respectively. Reference [22] pointed out that during inner pip, heavy eggs demanded more oxygen in comparison to small eggs. Extreme eggs which were under 70 g and over 100 g at turkeys in comparison to eggs which were between 70 and 100 g gave bad results in terms of pip mortality [19].

The affect of egg weight on blood glucose level was important ($p < 0.05$) statistically. The highest glucose level was determined 260.46 mg/dl in the 80-92.9 g egg and it was found to be respectively 258.90 mg/dl and 253.86 in the eggs whose weight was 100-115 g and 93-99.9 g respectively. The affect of egg weight on heart weight, triglyceride, lipoprotein, hemoglobin and red blood cells was not important ($p > 0.05$) statistically.

The affect of oxygen addition in terms of initial weight was not important statistically ($p > 0.05$). The findings obtained show some similarities with other study other study [4]. Reference [6] stated that oxygen addition lowered embryo weight on hatcher period. References [33], [36] reported that oxygen addition to hatching broiler eggs increased fertile hatchability. The affect of oxygen addition to incubator on fertile hatchability was important statistically ($p < 0.05$). The finding obtained aimed at increasing fertile hatchability as a result of oxygen addition show similarities with other studies [7], [13], [11], [4].

The affect of oxygen addition to incubator on early term mortality was not important statistically ($p > 0.05$).

Reference [4] stated that oxygen addition to incubator at broiler hatching eggs decreased the early term mortality. The affect of oxygen addition to incubator on middle term mortality was not important statistically ($p > 0.05$). The affect of oxygen addition in terms of late period mortality was not important statistically ($p > 0.05$). Reference [34] determined that the late period mortality rate in the group to which oxygen added was lower than control group.

Oxygen addition to incubator at boiler hatching eggs decreased late period mortality rate [4]. The affect of oxygen addition to incubator on pip mortality was not important statistically ($p > 0.05$). Heart weight was found lower in the oxygen adding group when compared to control group ($p < 0.05$). Oxygen applications Hybro G⁺ boiler parent hatching eggs at %17, %21 and % 25 levels between 9th and 19th days had no affect on heart weight at hatch [35]. The affect of oxygen addition to incubator on glucose level was not important statistically ($p > 0.05$).

Oxygen addition to boiler eggs on the last three days of incubation had no affect on glucose level [33]. Reference [34] stated oxygen addition increased the blood glucose of chicks. The affect of oxygen addition to incubator on triglyceride and lipoprotein was not important statistically ($p < 0.05$). The red blood cell level was determined higher in the control group when compared oxygen adding group. However, Reference [33] stated that oxygen addition to boiler eggs on the last three days of incubation had no affect on red blood cell level. In terms of blood hemoglobin level, not having affect of oxygen addition to incubator show similarities with [33]. Researchers pointed out that oxygen addition to boiler egg on the last three days of incubation had no affect on blood hemoglobin level.

V. CONCLUSION

1. The highest albumen index level was obtained from eggs of 100-115 g when compared to other egg weight groups.
2. The highest eggshell thickness was obtained from eggs of 93-99.9 g and the lowest eggshell thickness was obtained from eggs of 80-92.9 g.
3. The lowest fertility rate was obtained from eggs of 80-92.9g and the highest fertility rate was obtained from eggs of 100-115g.
4. The highest fertile hatchability was determined in the oxygen adding group.
5. A decrease was determined in the heart weight of chicks on hatch when oxygen added.
6. When oxygen added, a decrease was determined at the red blood cells in blood.
7. The highest blood glucose level was determined at eggs of 80 – 929 g.
8. In terms of observed all characteristics, interaction between oxygen addition and egg weigh was not determined ($p < 0.05$).

When a general evaluation was made; when hatching turkey eggs were hatched at high attitude, it was found out that increasing initial chick depending upon egg weight. Also, while adding oxygen to incubator at high attitude increased fertile hatchability, hypoxia affect due to high

altitude decreased heart weight and red blood cells in spite of oxygen addition, on the other hand the level of hemoglobin didn't change.

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