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EFFECT OF SEASON, DIETARY NaCl AND HEAT ACCLIMATION ON PERFORMANCE AND CARCASS QUALITY OF BROILER CHICKEN

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SUMMARY

Two trials were conducted using 460 one-day old unsexed Arbor-Acres broiler chicks. The first trial was to study the effect of season and dietary sodium chloride (NaCl). In summer season (33.5±3.5°C), birds were randomly distributed into two groups, one was fed on diet supplemented with 1.0 % sodium chloride, and the other group was served as control. In winter (25.5±3.5°C), birds were fed the control basal diet without salt supplement.

Body weight gain, feed intake, water consumption and carcass characteristics were measured weekly from the fourth to the seventh wk of age.

Body weight and feed consumption were lower but dressing percentage was higher during summer than winter. Feather as a percentage of body weight was significantly lower in summer. High ambient temperature in summer increased the water and ash but decreased protein contents of the carcass specially at the 6^{th} and 7^{th} wk of age. Addition of dietary sodium chloride during summer season improved body weight gain and carcass quality.

The second trial was carried in summer to study the effect of heat acclimation. Birds were distributed into four groups and were treated as the following: Control group (C), heat stressed group (HS), early heat acclimated group (EHA) and biweekly heat stressed group (BWHS).

Early heat exposure to 38°C (at the first three days of age) did not affect body weight. However, body weight of BWHS decreased significantly as compared with other groups. Higher total body water (TBW%) was observed in birds of heat stressed groups.

Heat acclimation either early or biweekly to 38 °C had no significant effect on carcass dressing%, it decreased the percentage of moisture and increased the percentage of protein and fat.

Keywords: Broiler, ambient temperature, sodium chloride, weight gain, carcass

INTRODUCTION

Under Egyptian conditions, about 6 months is classified as hot-humid climate, ambient temperature exceeds 30°C with more than 40 % relative humidity. Consequently, heat stress is considered as one of the most important factors affecting poultry industry.

High temperature decreases feed intake and weight gain, moreover it increases mortality of broilers. Temperature of 25°C produces a small reduction in the rate of growth in broiler older than 3 wk of age, however, at 30°C the effects are manifested (Arce *et al.*, 1992).

To alleviate the effect of climatic heat stress , some managerial techniques were used such as the control of the conditions under which the birds are kept, and proper manipulation of their diet and/or by acclimation to heat stress at early ages. Some compounds , such as sodium bicarbonate and sodium chloride have been used to reduce the effect of heat stress (Smith and Teeter, 1993; Ahmed and Maghraby, 1995 and Gorman *et al.*, 1997) .

Thermotolerance can be improved by acclimation (Hillman *et al.*, 1985). The weight gain lost during early life temperature conditioning can be regained by compensatory growth. The mechanism of the conditioning induced thermotolerance has not been elicited (Yahav and Hurwitz, 1996).

The objective of this study was to evaluate the effect of rearing season, supplementary NaCl during hot season and heat acclimation at early ages on productive performance and carcass quality of broilers at different ages .

MATERIALS AND METHODS

The present study was carried out in the Poultry Research Farm, Animal Production Department, Faculty of Agriculture, Cairo University.

Two trials were conducted using one-day old Arbor-Acres broiler chicks. In the first trial two experiments were carried out, the first one was in summer (July and August) and the second one was in winter (December and January). The average ambient temperature and relative humidity were 33.5±3.5°C and 46.5±11.5% in summer versus 25.5±3.5°C and 54.4±4.5% in winter. In summer experiment, two hundred chicks were randomly distributed into two groups being fed a control diet (21% protein and 2800 kcal ME/Kg diet) or the same diet but supplemented with 1.0 % sodium chloride (NaCl). In winter experiment , 200 birds were fed the control diet without salt supplement.

Individual body weight (BW), pen feed consumption (FC) and water consumption (WC) were recorded weekly. Slaughter test (body weight , feather and dressing %) was carried out. Chemical components of carcass;

moisture%, protein%, fat and ash% were determined according to the methods of A.O.A.C. (1980) . Eight birds from each group during summer and winter were taken for carcass measurements at 4, 5, 6 and 7 weeks of age.

The second trial was carried out in summer, 60 one-day old Arbor-Acres chicks were assigned to 4 groups. In group one (control, C) birds were kept under normal ambient temperature of summer. Birds in group 2 (heat stressed group, HS) were exposed to a constant 38°C for 3 hours at 7 weeks of age. Chicks in group 3 (early heat acclimated group, EHA) were exposed to a constant temperature of 38°C allover the first three days of age and to 38°C for 3 hours at 7 weeks of age. While chicks in group 4 (biweekly heat stressed group, BWHS) were exposed to a constant temperature of 38°C allover the first 3 days of age and biweekly thereafter. Individual body weight was recorded weekly. Nine birds from each group were taken at 7 weeks of age in all groups (after heat exposure in groups 2, 3 and 4) for determination of total body water (TBW), carcass dressing % and chemical composition of carcass. Total body water was determined using. antipyrine method as described by Weiss (1958).

Data were subjected to standard statistical analysis of variance (One-way ANOVA) according to SAS (1988) and Duncan's Multiple Range Test ($P \leq 0.05$).

RESULTS AND DISCUSSION

1.Effect of season and dietary NaCl supplementation

Feed consumption

Feed consumption in both seasons is presented in Table 1 and Fig. 1. It is clear that feed consumption was lower in summer than in winter by about 36 - 43 % at all ages causing a reduction in body weight by about 23 - 37 % . Feed consumption per bird increased with increasing age in both seasons. However, feed consumption % to body weight decreased with advancing age. Similar results were found by May and Lott (1992) who found that feed intake as percentage of body weights decreased with increasing age at ambient temperature of 24 and 35°C . Ross and Michie (1987) ; Marsden *et al.* (1987) and Wolfenson *et al.* (1987) reported that high environmental temperature (30-35°C) reduced significantly feed intake compared with moderate temperature (25°C). The reduced feed intake at high ambient temperature may be caused by a direct effect on various regions of the brain acting in food intake control mechanism. On the other hand, the blood flow and the motility of the intestine decreased (Van-Handel-Hruska *et al.* , 1977), which may result in an increase of food passage time and delay in the thermogenic effect of food intake.

Addition of NaCl to the diet in summer slightly counteracted the reduction in feed consumption which occurred during hot season at different ages (Table 1). Ahmed and Maghraby (1995) found in broiler that daily feed intake increased with increasing NaCl in the diet (6g/bird). Furthermore, Smith and Teeter (1993) found that NaCl addition to drinking water of broilers kept under heat stress increased daily feed intake by about 8g/bird.

Table 1. Feed and water consumption during different age stages in winter and summer

Age (week)	Winter		Summer		Summer + NaCl	
	g/day /bird	% of BW*	g/day /bird	% of B.W.	g/day /bird	% of B.W.
			Feed consumption			
4	79.57	7.30	48.23	7.00	54.43	7.05
5	105.62	7.20	64.09	6.11	67.03	6.15
6	119.72	6.90	68.53	5.54	67.83	5.32
7	132.55	6.20	85.23	5.15	88.87	5.20
			Water consumption			
4	182.03	16.70	148.82	21.60	169.07	21.90
5	236.18	16.10	200.36	19.10	210.91	19.35
6	256.78	14.80	243.94	19.72	252.83	19.83
7	303.59	14.20	322.89	19.51	335.48	19.63

* B.W. Body Weight

Table 2. Body weight, total body solids and total body water of broilers in winter and summer at different ages (mean±SE)

Age (week)	Body weight (g)			Total body solids (g)			Total body water (ml)		
	Winter	Summer	Summer + 1%NaCl	Winter	Summer	Summer + 1%NaCl	Winter	Summer	Summer + 1%NaCl
4	1090^{Da}	689^{Dc}	771^{Db}	278^{Da}	216^{Db}	222^{Db}	812^{Da}	473^{Dc}	549^{Db}
± SE	32.1	34.6	31.2	8.0	12.0	9.5	30.0	23.4	22.9
5	1467^{Ca}	1049^{Cb}	1090^{Cb}	514^{Ca}	349^{Cb}	344^{Cb}	954^{Ca}	700^{Cc}	746^{Cb}
± SE	37.8	31.4	31.4	14.6	9.0	11.2	26.2	23.6	22.1
6	1735^{Ba}	1236^{Bb}	1275^{Bb}	694^{Ba}	446^{Bb}	434^{Bb}	1041^{Ba}	790^{Bc}	841^{Bb}
± SE	21.4	41.9	62.2	8.4	18.8	21.0	14.0	23.5	41.3
7	2139^{Aa}	1655^{Ab}	1709^{Ab}	938^{Aa}	648^{Ac}	708^{Ab}	1201^{Aa}	1007^{Ab}	1001^{Ab}
± SE	58.3	47.2	42.5	26.2	23.2	16.7	33.2	29.1	26.4

^{A,B,C} Means in the same column within each trait bearing different superscripts are significantly different ($p \leq 0.05$).

^{a,b,c} Means in the same row within each trait bearing different superscripts are significantly different ($p \leq 0.05$).

Water consumption

Table 1 and Fig. 1 present water consumption in both seasons at different ages. The water consumption per bird increased with increasing age. However, the opposite trend was observed with water consumption as percentage from body weight (Table 1). Similar results were found by May and Lott (1992) who found that at 24°C and 35°C, water consumption as

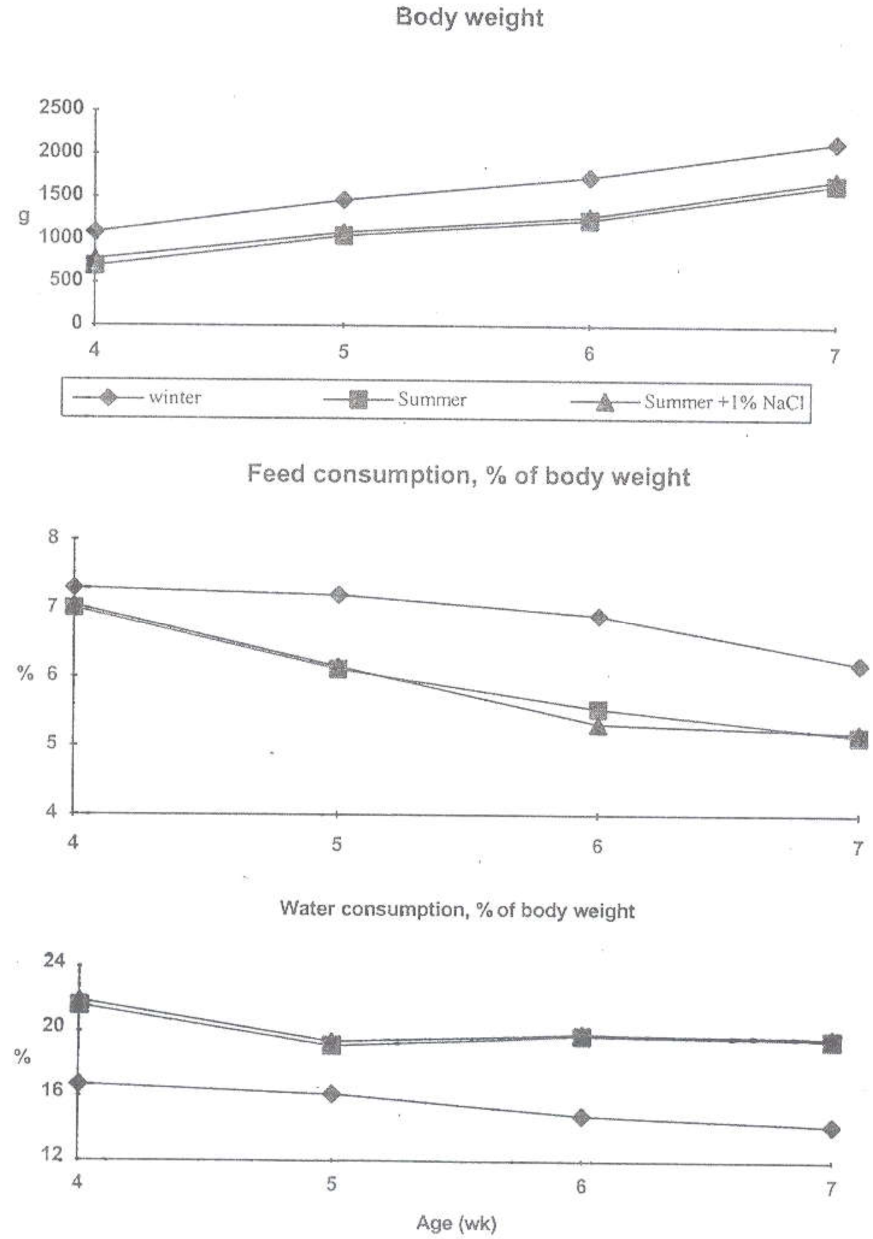

Figure 1. Effect of season and salt supplement on body weight (g), feed and water consumption as a percentage of body weight at different ages

percentage of body weight decreased with increasing age. Water intake % of body weight was higher in summer than in winter (Fig. 1). Deyhim and Teeter (1991) found in broiler that water consumption increased by about 91 ml/bird/day with increasing ambient temperature from 24°C to 35°C. Daghir (1995) reported that drinking water played an important role in cooling broilers.

It was reported that as birds accumulate heat in their tissues , several responses to increase the dissipation of heat are invoked to reduce the heat load. Water consumption increases when chickens are exposed to high ambient temperature (Deyhim and Teeter, 1991 and May and Lott , 1992) and survival in hot is dependent upon the consumption of large volume of water (Fox, 1951). The immediate increase in water consumption meets the immediate demands of evaporative cooling from respiratory surface and the associated decrease in the feed consumption reduces the contribution of metabolic heat to the total heat load that requires dispersion.

Addition of NaCl to the diet increased water intake per bird by about 12.0, 5.0, 3.5 and 3.8% at 4, 5, 6 and 7 weeks of age, respectively. An increase in water consumption was found by Ahmed and Maghraby (1995) , Deyhim and Teeter (1991) and Smith and Teeter (1993) due to NaCl addition to the diet or drinking water.

Body weight

Body weight increased significantly with increasing age in both seasons . Growth rate during the brooding phase until the 4th week of age was significantly higher (by about 37%) in winter than in summer (Table 2 and Fig. 1). These results are in agreement with Reece and Lott (1982). The addition of 1.0% NaCl to broiler ration during hot season caused an increase in growth rate of about 12% at the 4th week of age, while at 7th week of age the increase was about 3.3% . Results were consistent with Ahmed and Maghraby (1995) and Smith and Teeter (1993). They reported that during hot environmental conditions body weight gain increased with NaCl addition to the diet and water. Apparently the higher body weight at 7 weeks of age in NaCl supplemented group than the control one was mainly due to more body solids, while total water was almost the same (Table 2). So, the addition of NaCl to the diet did not influence the water content in birds but it slightly improved the true body weight gain (Total body solids) .

The low growth rate which occurred in summer was due to high ambient temperature (30-37°C) which has a direct effect on central nervous system (CNS) to reduce feed consumption as shown in Table 1 and consequently total body solids (TBS) as shown in Table 2. The lower body weight during the brooding and growing periods in summer than in winter is in accordance with results found by Recce and Lott(1982) and Khalifa *et al.* (1994). They found that, birds reared during the growing period in winter (or low temperature) gained more weight than those reared in summer.

Dressing percentage

Dressing percentage in winter increased significantly from 4 to 5 weeks of age , but it decreased after that up to 7 weeks of age (Table 3) . In summer, dressing % increased, generally, with increasing age in birds fed diets with or without NaCl addition. Dressing percentage was significantly higher in summer than in winter at all ages, except at 5 weeks of age, it was lower in summer than in winter. On the other hand, in winter , the reduction in dressing percentage from 5 to 7 weeks of age may be due to the increase in visceral tissues and its adjoining fat with age progress and to significant increase in feather percentage during this age stage (from 5.1 to 9.8 %).

Table 3 . Feather and dressing percentages of body weight in winter and summer at different ages (mean ± SE)

Age (week)	Feather %			Dressing %		
	Winter	Summer	Summer +1% NaCl	Winter	Summer	Summer +1% NaCl
4	7.9^{Ba}	5.9^{Ab}	6.5^{Aab}	59.9^{Bb}	62.7^{Bab}	66.5^{CBa}
± SE	0.2	0.4	0.7	1.6	1.5	0.5
5	5.1^{Ca}	4.3^{Ca}	5.4^{Aa}	67.0^{Aa}	61.9^{Bb}	67.1^{Ba}
± SE	0.40	0.3	0.4	1.1	1.5	0.5
6	7.4^{Ba}	5.0^{BCc}	6.6^{Ab}	56.6^{Bb}	63.5^{Ba}	65.5^{Ca}
± SE	0.3	0.2	0.3	0.7	1.8	0.5
7	9.8^{Aa}	6.3^{Ab}	6.3^{Ab}	57.8^{Bb}	70.1^{Aa}	71.5^{Aa}
± SE	0.1	0.4	0.3	1.4	0.9	0.2

^{A,B,C} Means in the same column within each trait bearing different superscripts are significantly different ($P \leq 0.05$).
^{a,b,c} Means in the same row within each trait bearing different superscripts are significantly different ($P \leq 0.05$).

Similar trends were obtained by Ferry and Avigdor (1992) . They found that in 6 weeks old broilers dressing carcass % increased from 64.4 to 64.4 and 65.9 % with increasing of ambient temperature from 15 to 20 and 32°C, respectively. Moreover, it has been hypothesized that the reduced feather cover may be of advantage in thermoregulation at high ambient temperatures (Eberhart and Washburn, 1993) by increasing sensible heat loss (Yahav *et al.*, 1998).

The addition of 1.0 % NaCl to the diet improved carcass dressing % in summer. The significant increase in dressing % with NaCl supplementation may be due to the significant increase in carcass fat content at 4 and 5 weeks of age and/or to the significant increase in protein content of carcass at 7 weeks of age (Fig. 2) .

Feather percentage

Feather percentage decreased significantly from 4 to 5 weeks of age in winter and summer due to the vast increase of body weight in both seasons. This percentage increased significantly thereafter up to 7 weeks of age due to slower growth rate (Table 3). Feather % of birds fed NaCl diet was not affected by advancing age. Feather % was significantly higher in winter than summer at all ages (Table 3) . This increase in plumage during cold season is an adaptive mechanism for low temperature by increasing insulation. Similar trend was found by Dawoud (1991). Table (3) reveals that NaCl addition to diet caused an increase in feather % in summer, being significant at 6 weeks of age, however, it was lower than that in winter .

Carcass quality

Carcass moisture % significantly decreased in winter until the 6th week of age with slight increase thereafter (Fig. 2). This reduction may be due to the significant increase in carcass fat content with increasing age (Fig. 2). Sturkie (1965) suggested that the reduction in body water with increasing age may be attributed to a reflection of increasing body fat. Similar trend was found in summer with or without addition of NaCl (Fig. 2). Moisture percentage of carcass was higher in summer than winter after 5 weeks of age. This result may be due to the higher carcass fat content with advancing age in winter than in summer (Fig. 2) or due to higher water retention in summer as adaptive mechanism for hot climate (Table 2). Similar results were found by Lyon (1983) and Dawoud (1991). Addition of NaCl in summer caused a significant reduction in moisture % (8.3%) associated with significant increase in fat % (35.6%) at older ages.

Fat percentage of carcass, significantly increased with age in both seasons (Fig. 2). The increase was more pronounced in winter than in summer. Similar trend was found by Dawoud (1991). The significant higher fat % in broilers reared in summer than winter at 4 weeks of age (7% versus 5.7%) reflects increased metabolic heat production for body temperature maintenance in low temperature (winter). Therefore, the ME required per kcal of carcass was increased with lower temperature as stated by Olson *et al.*(1972) and Chwalibog and Eggum (1989) .They added that maximum fat synthesis occurred at an environmental temperature of 32°C. However, the result of Sonaiya (1989) indicated that energy per gram of dry tissue increased with decreasing ambient temperature and the energy -gained value for birds reared at 22°C was higher than 32°C.

Protein percentage significantly increased in winter with age up to 6 weeks, then it significantly decreased at 7 weeks of age (Fig. 2). In summer, no significant changes were occurred in protein percentage with age. Addition of NaCl had similar trend to that found in winter. Protein % of carcass, was higher in summer than winter at 4 and 5 weeks of age, then it was lower in summer than winter. These results are in agreement with results obtained at 6 weeks of age by Dawoud (1991). Daghir (1995) reported that at 9 weeks of age body protein content was significantly decreased with high ambient temperature. Protein percentage of carcass at 7 weeks of age was significantly higher in NaCl group than in both control summer and winter groups (22.3 versus 20.9 and 21% respectively).

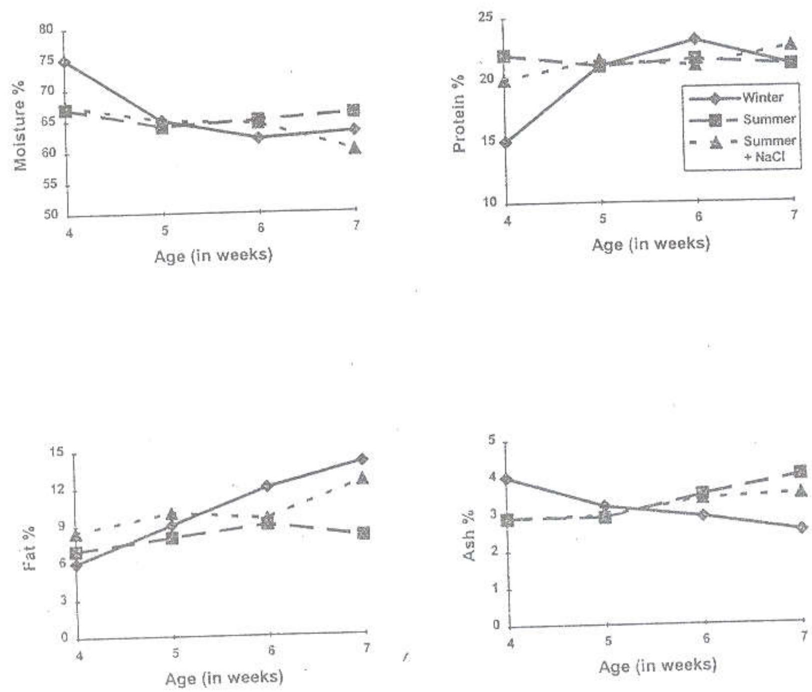

Fig. 2. Effect of season and salt supplement on chemical composition of broiler carcass

Ash % decreased significantly in winter with age progress. However , in summer it was significantly higher at 6 and 7 weeks of age than at 4 and 5 weeks of age (Fig. 2). The trend of ash with age in birds supplied with 1.0 % NaCl during summer was similar to that of control group in summer and reverse to that obtained in winter. Ash % was significantly higher in winter than summer at 4 and 5 weeks of age. An opposite trend was obtained at 6 and 7 weeks of age (Fig. 2) . Similar results were found by Dawoud (1991) with broiler at 8 weeks of age. Daghir (1995) reported that higher sodium and potassium contents were found in carcass of heat -stressed birds. The values of ash % in carcass of birds fed NaCl were between values obtained in summer and winter (Fig. 2).

It can be concluded that the increase in body weight with age in winter was due to an increase in body solids which in turn was due to the increase in fat and protein, while ash decreased. In summer, the percentage increase in weight was due to increase in fat %, while protein % was almost stable with an increase in ash%. The addition of 1.0%NaCl in summer (hot season) improved carcass quality (high protein % and fat % in carcass). This addition enhanced protein, fat deposition and an increase in ash contents with age.

2. *Effect of heat acclimation*

Body weight of biweekly heat stressed group (BWHS) decreased significantly as compared to the control group or other heat stressed groups (HS and EHA)(Table 4). It was lower than that of C, HS and EHA by about 8.9%, 17.9% and 13.3%, respectively. However, early heat exposure did not affect body weight of birds which in good agreement with May (1995) who reported that early heat exposure in broilers (5 or 6 days-old exposed to 36.1°C for 24 hr.) did not affect body weight gain.

Table 4 . Effect of heat stress on body composition and carcass dressing % of broilers (mean ± SE)

Traits	C	HS	EHA	BWHS
Body weight (g)	1500^{C}	1663^{A}	1575^{B}	1366^{D}
± SE	40.1	33.7	43.3	37.3
Total body solids (%)	45.0^{A}	42.2^{B}	41.6^{B}	41.6^{B}
± SE	0.4	0.2	0.5	0.4
Total body water (%)	55.0^{B}	57.8^{A}	58.4^{A}	58.4^{A}
± SE	0.4	0.2	0.5	0.4
Carcass dressing (%)	62.6^{A}	62.6^{A}	61.0^{A}	62.3^{A}
± SE	1.2	1.2	2.3	0.4

C:Control Group, HS:Heat Stressed Group, EHA:Early Heat Acclimated Group, BWHS:Biweekly Heat Stressed Group.

^{A,B,C,D} Means in the same row bearing different superscripts are significantly different (P≤0.05).

Early exposure to high environmental temperature conforms a measure of resistance to subsequent exposure to high temperature. This has been reported as acclimation when subsequent exposure closely follows prior exposure (Reece *et al.*, 1972 and May *et al.*, 1987). Neonatal prior exposure that precedes the subsequent exposure by many weeks has also been reported as effective (Arjona *et al.*, 1988 and 1990). The mechanism whereby neonatal prior exposure improves resistance during subsequent exposure has not been clearly defined.

Total body solids % was significantly higher in C than that in the other three groups (Table 4). This lower TBS% in heat stressed groups was due to higher TBW% which is in adaptive mechanism against water loss through evaporative coolin during heat stress. Meanwhile in case of BWHS this is also due to lower growth rate (body weight is significantly lower than C).

Heat acclimation either early or biweekly to 38 °C had no significant effect on carcass dressing %, however, it decreased the percentage of moisture and increased the percentage of protein and fat (Fig. 3) to be at levels near that found in winter results (Fig. 2, Trial 1). Decreased growth rate and enhanced fatness in biweekly heat acclimated birds seem rather contradictory. Ain Baziz *et al.* (1996) reported that a reduction of basal metabolic rate and physical activity under heat exposure might spare energy stored as fat, conversely in mammals high ambient temperature seems to decrease carcass fat. In broilers, effect of heat exposure on fat deposition needs further investigations.

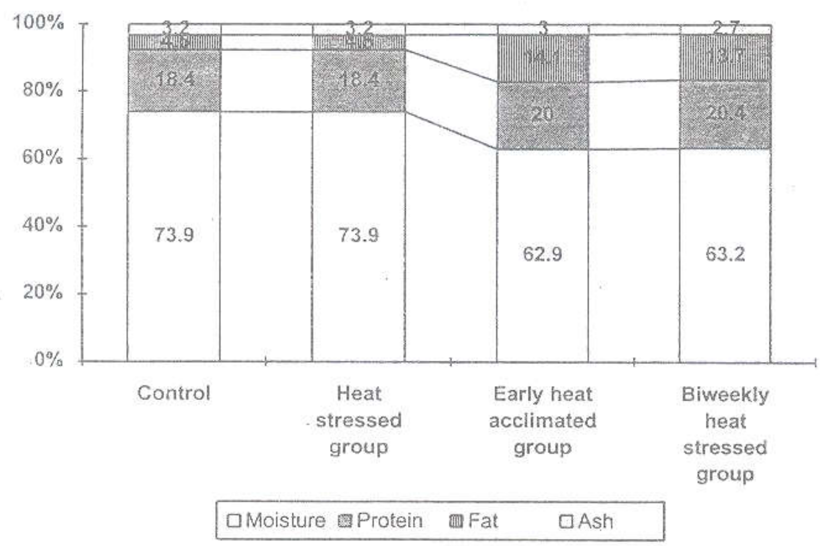

Fig. 3. Effect of heat stress on carcass composition of broiler at 7 weeks of age

It can be concluded that early heat acclimation can be one of the best methods to alleviate the effect of heat stress on performance of broilers during last few weeks (2-3 weeks) before marketing age. While, biweekly heat stress had an adverse effect on performance. Shafie *et al.* (1979) and Yahav and Hurwitz (1996) supported this conclusion, that the technique of temperature conditioning takes advantage of thermoregulation mechanism of immature chicks during the first week of life.

REFERENCES

Ahmed, Nagwa. A. and Nagwa. A. Maghraby, 1995. Physiological responses of broilers to dietary sodium bicarbonate during summer season .Egypt. J. Anim. Prod. 32: 111-119 .

Ain Baziz, H., P. A. Geraert, G. C. F. Padilha and S. Guillaumin, 1996. Chronic heat exposure enhances fat deposition and modifies muscle and fat partition in broiler carcasses. Poultry Sci., 75:505-513.

A.O.A.C., 1980. Association of Analytical Chemists. Official Methods of Analysis. 13*th* ed. Assoc. Offic. Anal. Chem., Washington, DC.

Arce, J., B. Buiz, H. Navarro, R. Cartes, E. Avila, C. Lopez and J. Buenrastro, 1992. Manual del estres calarico en aves. Ed. Asociacion Americana de la soya, Mexico D.F.

Arjona, A. A., D. M. Denbow, and W. D. Weaver, Jr., 1988. Effect of heat stress early in life on mortality of broilers exposed to high environmental temperatures just prior to marketing. Poultry Sci., 67:226-231.

Arjona, A. A., D. M. Denbow, and W. D. Weaver, Jr., 1990. Neonatally-induced thermotolerance: Physiological factors. Comp. Biochem. Physiol. A. Comp. Physiol. 95:393-399.

Chwalibog and Eggum, 1989. Effect of temperature on performance, heat production, evaporative heat loss and body composition in chickens . Archiv fur Geflugelkunde 52 , 179 - 184 .

Daghir, N.J., 1995. Poultry production in hot climates CAB INTERNATIONAL .

Dawoud, A. M. I.1991. Studies on the change of body fluid compartments during growth in the broilers. Ms.C. Thesis, Fac. Agric. Al-Azhar University.

Deyhim, F. and R.G. Teeter, 1991. Sodium and potassium chloride drinking water supplementation effects on acid-base balance and plasma corticosterone in broilers reared in thermoneutral and heat-distressed environments . Poultry Sci., 70: 2551-2553 .

Eberhart, D. E. and K. W. Washburn, 1993. Variation in body temperature response of naked neck and normally feathered chickens to heat stress. Poultry. Sci., 72:1385-1390.

Ferry Leenstra, and Avigdor Cahaner, 1992. Effect of low, normal, and high temperature on slaughter yield of broilers from lines selected for high weight gain, favorable feed conversion, and high fat content. Poultry Sci. 71: 1994-2006.

Fox, T.W., 1951. Studies on heat tolerance in domestic fowl . Poultry Sci., 30:477-483.

Gorman, I., D. Balnave and J.R. Roberts, 1997. Effect of temperature and dietary sodium bicarbonate supplementation on the mineral excretion of broilers. Aust. J. Agric. Res. 48:703-707.

Hillman, P. E., N. R. Scott and A. Van Tienhoven, 1985. Physiological responses and adaptations to hot and cold environments. "Stress physiology in Livestock" CRC Press, Inc., M.K. Yousef, ed. Boca Raton, F.L.

Khalifa, H.H., N.F. Abdel-Hakim and A.M.I. Dawoud, 1994. Effect of growing season on growth rate and body fluid compartments of broilers . Egypt. J. Anim. Prod. 31: 403-418 .

Lyon, B. G., 1983. Effects of salt and phosphate treatments on deboned meat from light and heavy fowl. Poultry Sci., 63 : 321-330 .

Marsden, A., T.R. Morris and A.S. Cromarty, 1987. Effects of constant environmental temperature on the performance of laying pullets. Brit. Poultry Sci., 28 : 361-380 .

May, J. D., 1995. Ability of broilers to resist heat following neonatal exposure to high environmental temperature. Poultry Sci., 74:1905-1907.

May, J. D. and B.D. Lott, 1992. Feed and water consumption patterns of Broilers at high environmental temperatures. Poultry Sci., 71:331-336.

May, J. D., J. W. Deaton and S. L. Branton, 1987. Body temperature of acclimated broilers during exposure to high temperature. Poultry Sci., 66:378-380.

Olson, D.M., M.I. Sunde and H.R. Bird, 1972. The effect of temperature on ME determination and utilization by the growing chick. Poultry Sci., 51: 1915-1922.

Reece, F.N. and B.D. Lott , 1982. Typical broiler chicken growth rates. Poultry Sci., 61: 1013 -1014 .

Reece, F.N., J. W. Deaton and L.F. Kubena, 1972. Effects of high temperature and humidity on heat prostration of broiler chickens. Poultry Sci., 51:2021-2025.

Ross, S.P. and W. Michie, 1987. Environmental temperature and dietary protein concentrations for growing turkeys . Brit. Poultry Sci., 28 : 213-218.

SAS , 1998 . SAS User's Guide : Statistics , SAS Inst., Inc., Cary Nc.

Shafie, M.M., A.M. Borady and N.H. Abdelmutaal, 1979. Acclimation of Fayoumi chickens to contant and varying temperature. Egypt. j. Anim. Prod., 19:187-203.

Smith, M.O. and R.G. Teeter, 1993. Carbon dioxide, Ammonium chloride, Potassium chloride, and performance of heat distressed Broilers. J. Appl. Poultry Res. 2: 61-66 .

Sonaiya, E.B., 1989. Effect of environmental temperature, dietary energy, sex and age on nitrogen and energy retention on the edible carcass of broiler.

Brit. Poultry Sci., 30:735-745 .

Sturkie, P.D., 1965. Avian physiology. *2nd* Ed. Comstock . Publishing Association Cornell. Univ. Press. Ithaca-New York. USA.

Van Handel-Hruska, J.M., T.N. Wegner and J.O. Nordstrom, 1977. Avian cardiovascular responses following high environmental temperature acclimation. In Federation proceedings, Federation American Society of Experimental Biology, 36 : 524 (Àbstr.).

Weiss, H. S., 1958. Application to the fowl of the antipyrine dillution technique for the estimation of body composition. Poultry. Sci., 37:484-489.

Wolfenson, D., D. Sklan, Y. Graber, O. Kedar, I. Bengal, and S. Hurwitz, 1987. Absorption of protein, fatty acids and minerals in young turkeys under heat and cold stress. Brit. Poultry. Sci., 28 : 739-742 .

Yahav ,S. and S. Hurwitz, 1996. Induction of thermotolerance in male broiler chickens by temperature conditioning at an early age. Poultry Sci., 75:402-406.

Yahav, S., D. Luger, A. Cahaner, M. Dotan, M. Rusal and S. Hurwitz, 1998. Thermoregulation in naked neck ckickens subjected to different ambient temperatures. Brit. Poultry Sci., 39:133-138.

تأثير الموسم و كلوريد الصوديوم فى الغذاء و الأقلمة للحرارة على الإنتاجية وجودة الذبيحة في دجاج التسمين

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أجريت في هذه الدراسة تجربتين واستخدم فيهما ٤٦٠ كتكوت تسمين أربور إيكـرز عمـر يـوم. أجريت التجربة الأولى لدراسة تأثير الموسم وإضافـة كلوريـد الصوديـوم فـى الغـذاء أثنـاء الصيـف (متوسط درجة الحرارة المحيطة فى الصيف ٣٣,٥ ± ٣,٥° م) قسمت الطيور فى الصيف عشوائياً إلى مجموعتين وتم تغذية المجموعة الأولى على عليقة مقارنة، والثانية فتم تغذية الطيور فيهـا علـى العليقة المقارنة مضافا إليها كلوريد صوديوم بنسبة ١ ٪. أما فـى الشـتاء (متوسـط درجـة الحـرارة المحيطة بالطيور ٢٥,٥ ± ٣,٥°م) فقد غذيت الطيور على عليقة مماثلة للعليقة المقارنة في الصيف . تم قياس معدل الزيادة في الوزن ، كمية الغذاء والماء المستهلك وصفات الذبيحة على أعمـار ٤ ، ٥ ،٦ ، ٧ أسابيع من العمر .

وجد أن وزن الجسم وكمية الغذاء المستهلك أقل في الصيف عن الشـتاء ، بينمـا ارتفعـت كميـة الماء المستهلكة ونسبة تصافى الذبيحة . أدت درجة الحـرارة المرتفعـة خـلال فصـل الصيـف إلـى زيادة نسبة الماء والرماد وانخفاض البروتين في مكونات الذبيحة عند الأسبوع السادس والسابع مـن العمر. إضافة كلوريد الصوديوم للعليقة خلال فصل الصيف أدى إلى تحسين وزن الجسـم وصفـات الذبيحة.

أجريت التجربة الثانية فى الصيف لدراسة الأقلمـة علـى الحـرارة حيث قسـمت الطيـور الـى ٤ مجموعات كالتالى: مجموعـة مقارنـة و مجموعـة الإجهـاد الحـرارى ومجموعـة التعريـض المبكـر للحرارة ومجموعة الإجهاد الحرارى كل أسبوعين. وجد أن التعريض المبكر للحرارة لدرجة ٣٨°م فى الثلاثة أيام الأولى من العمر لم يؤثر على وزن الجسـم، بينمـا أنخفـض وزن الجسـم معنويـا فـى المجموعة المعرضة للإجهاد الحرارى كل أسبوعين بالمقارنة بالمجموعات الأخرى.

كانت أعلى نسبة للماء الكلى للجسم فى طيور مجموعة الإجهاد الحرارى. ولم تؤثـر الأقلمـة المبكرة لإرتفاع درجة الحرارة أو التعريض للحرارة كـل أسـبوعين (٣٨ ° م) علـى نسـبة تصـافى الذبيحة، بينما أدت الى نقص نسبة الرطوبة وإرتفاع نسبة البروتين والدهن فى الذبيحة.