ZZT424

Kanatlı Hayvan Besleme

Sıcaklık Stresi, Barsak sağlığı Elektrolit Dengesi ve Broyler Besin Maddesi İhtiyaçları

2017-2018

ZZT424-Kanatlı Hayvan Besleme Ders Notları

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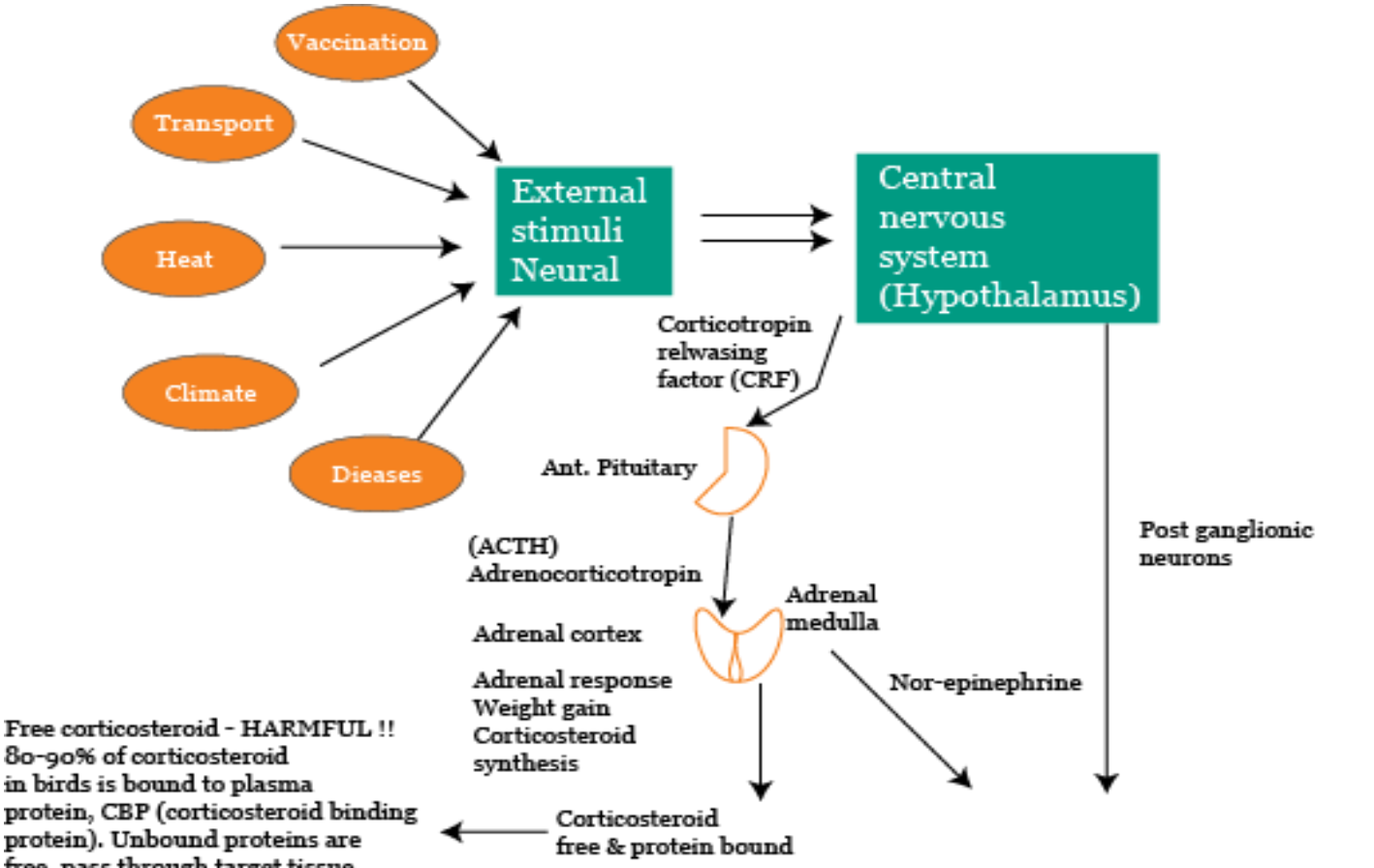
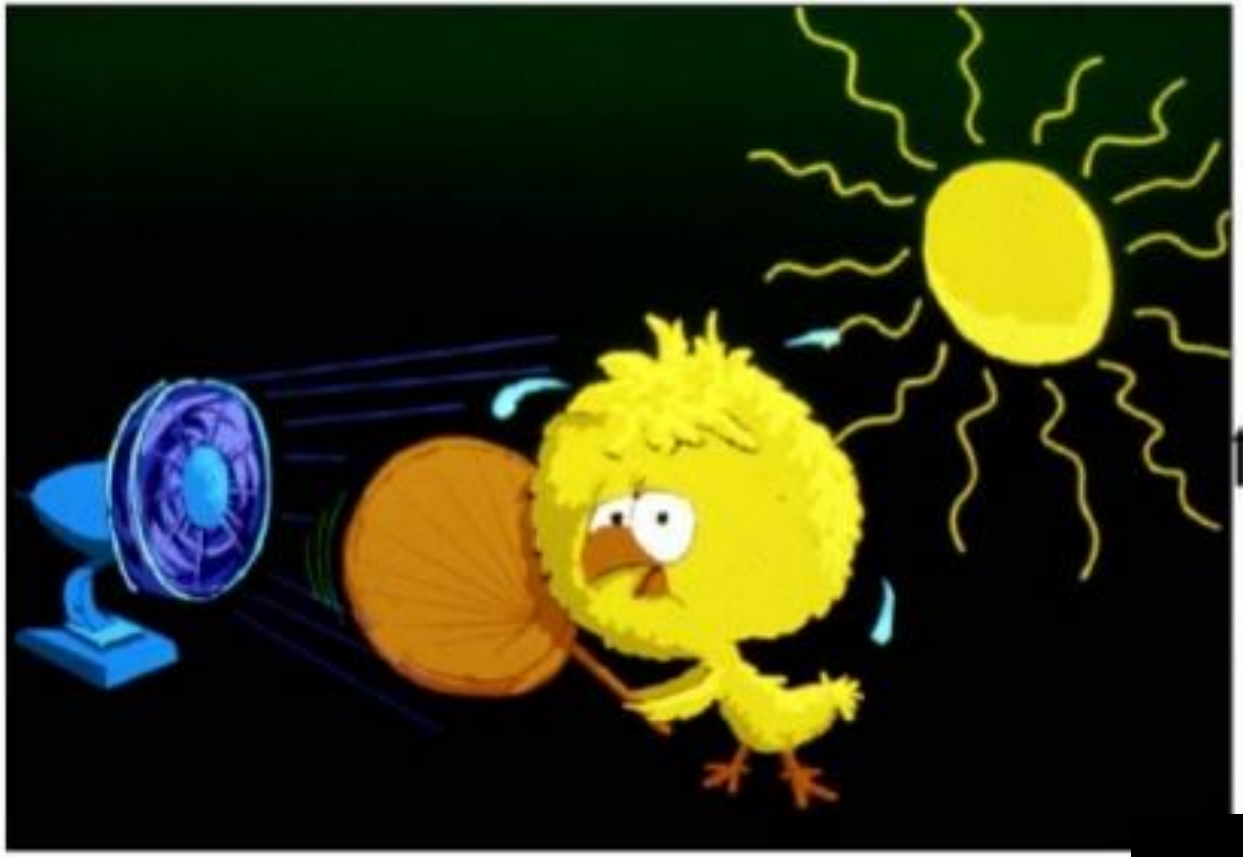
KANATLILARDA SICAKLIK STRESİ VE ETKİLERİ

SICAKLIK STRESİ



Consequences of High Ambient Temperature on Poultry Production



- ↑ Condem-nations
- ↑ Mortality
- ↓ Gain
- ↓ Feed Intake
- ↑ Carcass Fat
- ↓ Feed Efficiency
- ↓ Carcass Quality
- ↓ Disease Resistance

World Tech Support

THE COST OF HEAT STRESS IN BROILERS AND LAYERS

THE CO$T OF HEAT STRESS IN BROILERS AND LAYERS

Increased mortalities

- Sudden death syndrome

Lost fertility

- In males (up to 30%) and females

Productivity Losses

- Depressed appetite
- F.C.R. down by 10%-12%
- Slower growth up to 25% less protein and fat
- Lower egg yield (8%-10) fewer lighter eggs eg - 4g @ 30°C environmental temperature
- Decline in shell quality - more downgrading
- Inferior carcass quality - overfat downgrades
- Indigestibility
- Loss of acid/base balance

Increase in Metabolic Disorders

- Incidence of Ascites increases
- Bone Metabolism is disturbed, eg Tibial dyschondroplasia
- Bigger output of urine - Wet droppings

Add Capital Investment

To provide

- Shade
- Fans
- Cooler pads
- Water sprinklers

Lower Resistance to Disease

Caused by suppression of the immune system (lowered serum immunoglobulin)

- Spread of intercurrent diseases of respiratory and digestive systems
- Mal absorption syndrome

Temperature and Humidity Index Poultry

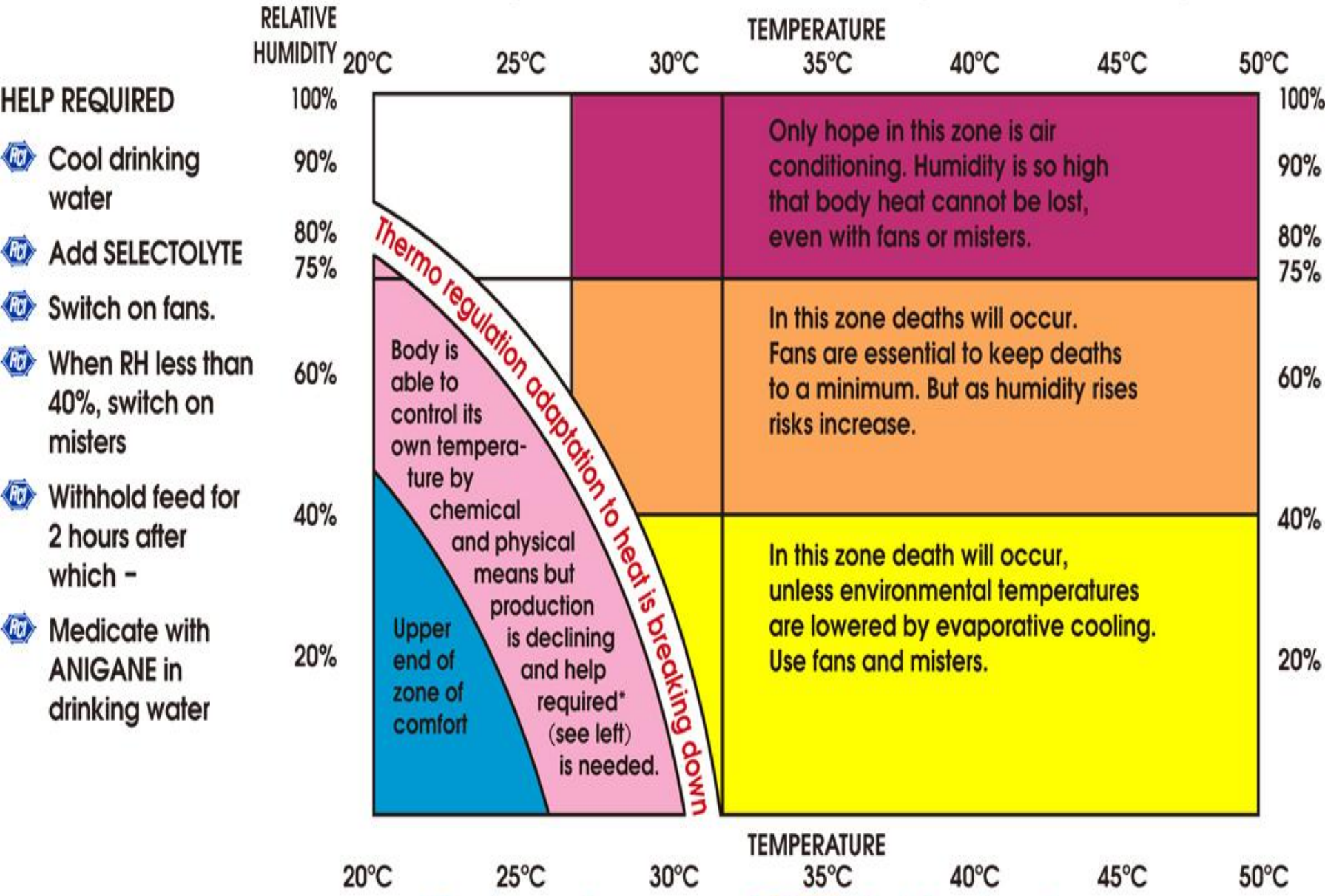
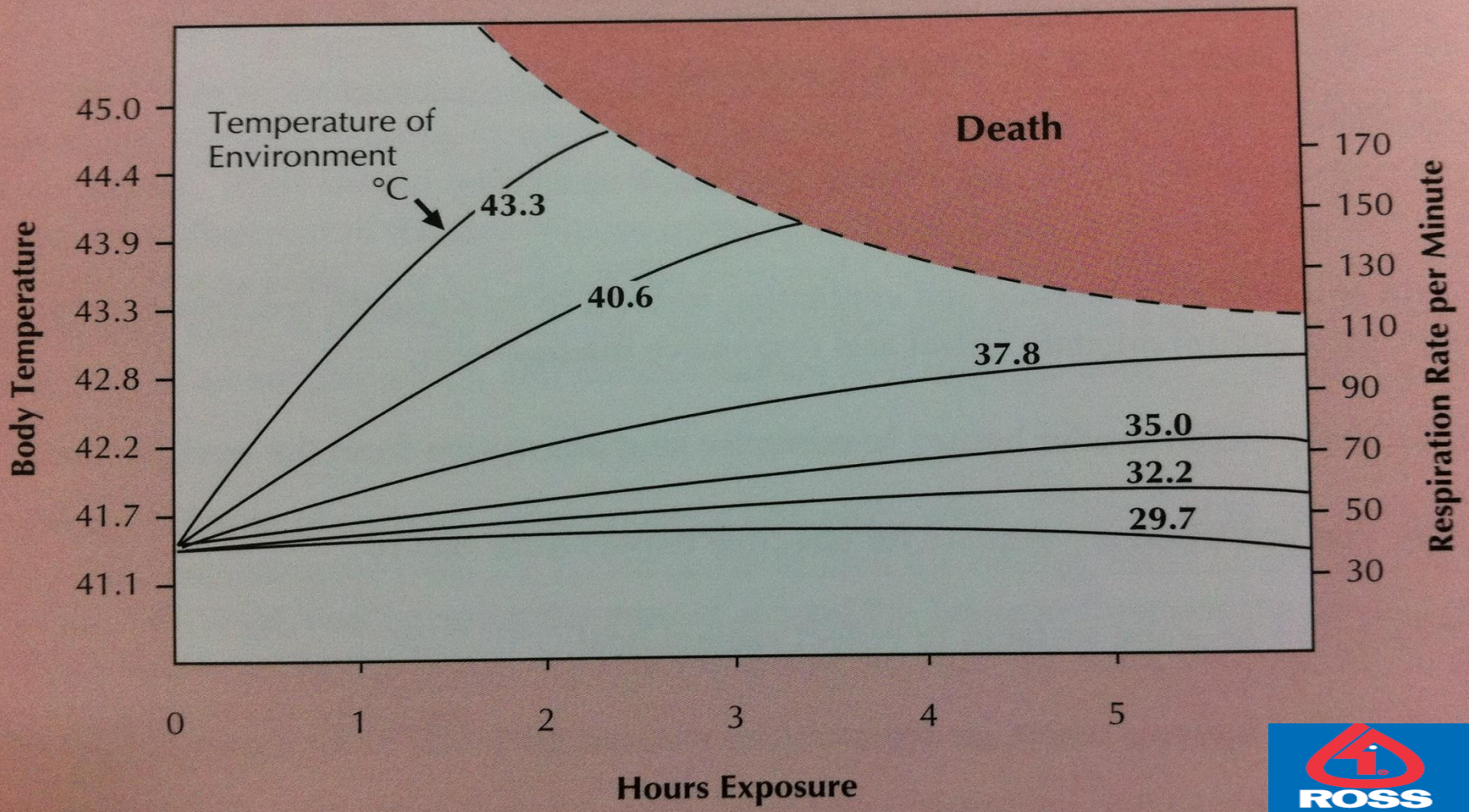


DIAGRAM 15: RELATIONSHIP BETWEEN ENVIRONMENTAL TEMPERATURE, EXPOSURE TIME AND BODY TEMPERATURE



Etlik Piliçlerde Sıcaklık Stresi

Commercial Poultry Nutrition, Third Edition
I. Leeson, S., Summers, J.D.
ISBN 978-1-904761-78-5

Table 5.36 Energy balance of a 2 kg broil

	Feed/day			
	0 g	50 g	100 g	150 g
24°C environment:				
Heat production	192	204	212	236
Sensible loss	160	168	180	192
Evaporative loss	44	40	44	48
Balance	-12	-4	-12	-4
35°C environment:				
Heat production	196	220	240	248
Sensible loss	88	112	96	132
Evaporative loss	72	88	92	96
Balance	36	20	52	20

Sensible: Radiation and Convection
Insensible: Evaporation

Çevre sıcaklığı 30 C'nin üzerine çıktıkça ısı kaybının büyük bir kısmı eveparasyon yolu ile ve soluma ile gerçekleşir ve solunum oranı ciddi şekilde artar

Etlik Piliçlerde Sıcaklık Stresi

37 Male broiler feed intake at 15-30°C

	Male broiler (g feed/bird/day)			
Age (d)	*15 °C*	*20 °C*	*25 °C*	*30 °C*
14	*78*	*72*	*65*	*59*
21	*120*	*110*	*100*	*90*
28	*168*	*154*	*140*	*126*
35	*204*	*187*	*170*	*153*
42	*240*	*220*	*200*	*180*
49	*264*	*242*	*220*	*194*

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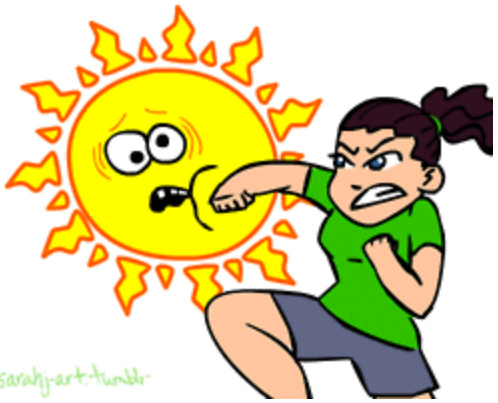
Sıcaklık Stresiyle Mücadele Besleme Uygulamaları



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Feed and nutrition have a significant influence on the way broilers respond to heat stress. One of the most successful ways to aid the health, welfare and performance of broilers during periods of heat stress is to employ good nutrition and feed management practices as described in this Supplement.

Good feed physical quality (crumbs, pellets or mash) will minimise the energy expended to eat and thereby reduce heat generated during feeding. Optimal feed form will also increase compensatory feed intake more efficiently during the cooler periods of the day or night. It is usually best to encourage compensatory feed intake at night.

Increasing nutrient intake during heat stress may have an adverse affect on survivability, however increasing the digestibility of nutrients and use of specialist micro ingredients have been shown to have benefits.

For protein, consideration should be given to increasing amino acid digestibility rather than amino acid density. Excess protein should be minimised and amino acids balanced. The use of synthetic amino acids instead of intact proteins will aid bird performance.

Etlik Piliçlerde Sıcaklık Stresi

Supplying energy in the diet using fats rather than carbohydrates is beneficial. Lipid contains three times as much energy as carbohydrate, resulting in less waste heat and a lower heat increment of feeding.

It is important to consider vitamins and minerals in connection to heat stress. Heat stress increases the birds' urinary and faecal excretion of mineral and trace elements and increased respiration rate depletes blood bicarbonate. Supplementation with sodium bicarbonate or potassium chloride has been shown to be beneficial in reducing the affects of heat stress. This may be due to the affect of minerals increasing water intake.

The following vitamins are known to have a positive affect on the response of birds to heat stress; vitamin E, D, A, C, nicotinic acid and some B-Complex vitamins.

A general approach is to increase the level of vitamins by 1.25% per degree centigrade as the temperature rises from 21 to 28°C. If temperatures exceed 28°C, then further increases in vitamin levels should be made at the rate of 2.5% per degree centigrade. This guideline is dependant upon the vitamin levels used in the standard supplement. Under no circumstances withdraw vitamins from the diet.

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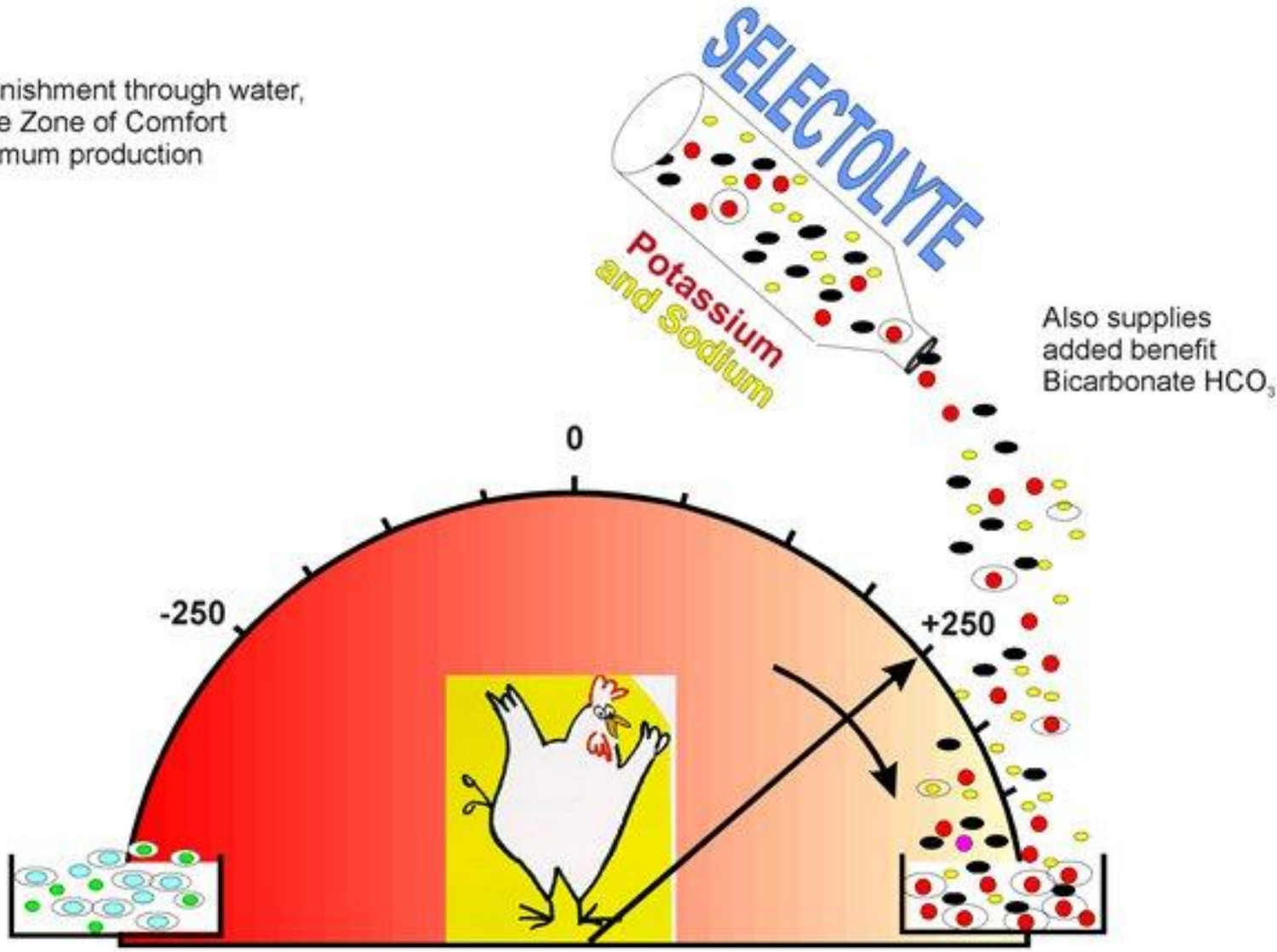
DIETARY ELECTROLYTE BALANCE RESTORED

By constant replenishment through water,
return to the Zone of Comfort
and maximum production



Etlik Piliçlerde Sıcaklık Stresi

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Strategy	Activity
Feed formulation	1. *Reduce crude protein by 2 – 3%.* 2. *Maintain levels of Meth + Cys, Lysine and Threonine.* 3. *Increase diet energy by direct substitution of 2% fat for 2% of major cereal.* 4. *Add 250 mg Vitamin C/kg diet.* 5. *Use only highly digestible ingredients.* 6. *Select appropriate anticoccidials.*
Feed management	1. *Withdraw feed 10 a.m. – 5 p.m.* 2. *Ensure adequate feeder space and drinkers.* 3. *Manage nipple height according to bird age.* 4. *Add 0.5% salt to the drinking water.* 5. *Keep drinking water as cool as possible.*
Bird management	1. *Increase air flow at bird level.* 2. *Maintain litter quality.* 3. *Use lower stocking density.* 4. *Do not disturb birds at time of peak heat distress*

Etlik Piliçlerde Sıcaklık Stresi

Betaine – osmoregulator increases efficiency of absorption of minerals and trace elements

Glucose – increases energy required for extreme temperature

Asparin – increases birds tolerance to heat

In heat stress situations, the choice of coccidiostat should be considered carefully to avoid those associated with increased mortality via increased heat production.

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Etlik Piliçlerde Besleme Bağırsak Sağlığı İlişkisi

Table 5.44 Actions to reduce the incidence of necrotic enteritis in broilers

Action	*Effect*
1. *Minimize feed changes*	*Change in ingredient/nutrient composition is associated with change in gut microflora*
2. *Use highly digestible ingredients*	*Undigested nutrients fuel bacterial overgrowth*
3. *Minimize the use of wheat (< 20% ideally)*	*Increased digesta viscosity leads to greater clostridial activity. Enzyme addition important*
4. *Process wheat through a roller mill*	*Change in digesta viscosity?*
5. *Use only quality fats and oils*	*Rancid fats injure the microvilli*
6. *Ensure low level of urease/trypsin inhibitor in soybean meal*	*Urease can destroy protective mucus barrier*
7. *Use ingredients with minimal levels of mycotoxins, especially up to 28 d of age*	*Toxins can destroy epithelial cells in the microvilli*
8. *Use appropriate ionophore anticoccidials or coccidial vaccines*	*Coccidiosis predisposes clostridial growth*

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Etlik Piliçlerde Yerleşim Sıklığı

Table 5.29 Influence of stocking density on broiler performance

Density (birds/m²)	*49 d B.wt. (g)*	*Feed intake (g)*	*kg/m²*
10.5	*2337^{b}*	*4973^{b}*	*23.4^{a}*
13.5	*2261^{a}*	*4803^{a}*	*28.9^{b}*

Adapted from Puron et al. (1997)

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Etlik Piliçlerde Ana Yaşı

Table 5.30 Broiler growth characteristics as affected by breeder age

	Breeder age (wks)			
	28	*38*	*48*	*58*
Male broiler:				
49 d live wt. (g)	*3186*	*3249*	*3221*	*3273*
0 – 49 d F:G	*1.88*	*1.80*	*1.86*	*1.96*
49 d carcass wt. (g)	*2498*	*2562*	*2610*	-
Deboned breast wt. (g)	*587*	*605*	*607*	-

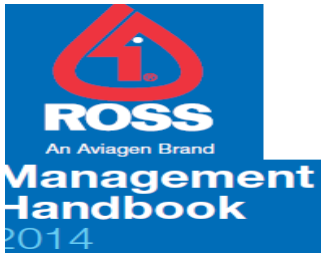
Table 5.31. Change in broiler live weight and carcass weight per 1 g increase in breeder egg weight

	Live weight	*Carcass weight*
Male broiler (49 d)	*+ 5 g/g egg wt.*	*+11 g/g egg wt.*
Female broiler (49 d)	*+ 8 g/g egg wt.*	*+14 g/g egg wt.*

Each 1 g change in 7 d body weight alters 18 d body weight by 3 g (i.e. a chick that is 30 g underweight at 7 d will be 90 g underweight at 18 d. By 49 d the correlation is 1 g @ 7 d 5 g @ 49 d.

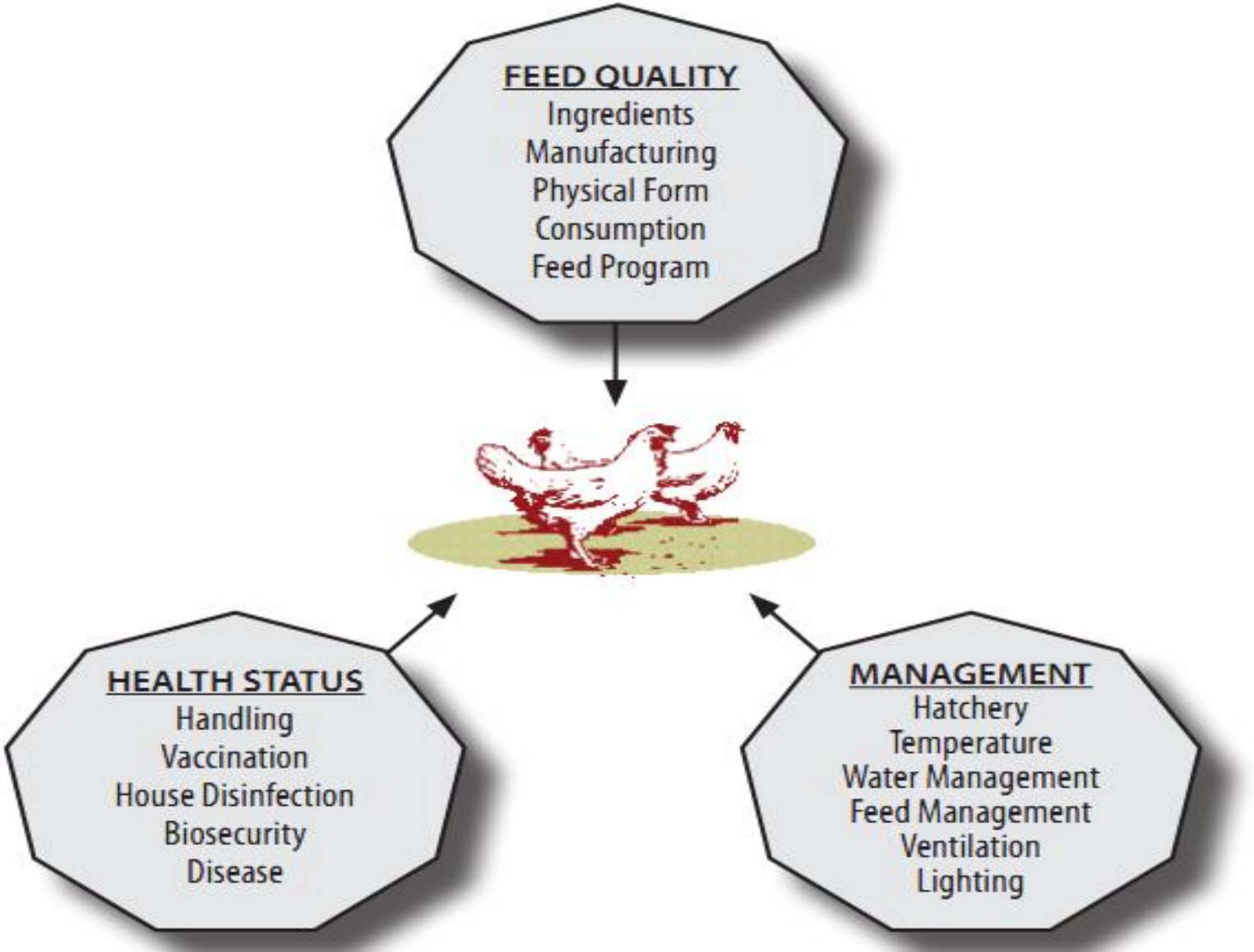
Etlik Piliçlerde Verimlilik Endeksi (EPEF)

- **Broyler Üretiminde Verimlilik Endeksi**=European Efficiency Factor (EPEF) **=((Yaşama Gücü,%*Canlı Ağırlık,kg)/(Kesim Yaşı,gün*FCR))*100**



- 300 ve üzerinde olması önerilir.
- Örnek: 42.günde kesilen, ölüm oranı %4.89, Canlı ağırlığı 2.089 ve FCR 1.71
- EEF=(((2.089*100-4.89))/((42)*(1.71)))*100=**277**

FCR Problemleri



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Feed Formulation and Manufacturing

Errors or difficulties during the feed manufacturing process can lead to feeds of reduced quality being presented to the birds. Some of the problems that can occur during the manufacturing process are highlighted below:

- Changes in types and origins of raw ingredients due to issues of availability, harvest quality, etc.
- Quality of raw ingredients - presence of fungus, mycotoxins, etc.
- Errors during manufacture of mixes and concentrates, such as cross-contamination.
- Incorrect nutritional values within the feed formulation matrix.
- Inappropriate grinding - inadequately or excessively ground raw materials will reduce pellet quality and durability. This may lead to a high percentage of fines in the finished feed and increased segregation during transportation and distribution.
- Inadequate mixing or incorrect raw material inclusion will result in nutrient imbalances in the finished feed.

Mortality and Disease

High mortality, especially late mortality, will result in a significant increase in FCR. The dead birds will have consumed a significant amount of feed but will not contribute to final flock live weight. Causes of mortality need to be addressed urgently.

Diseases such as necrotic enteritis, viral enteritis or conditions like dysbacteriosis, which affect the integrity and functioning of the gut, all have significant implications for the efficiency of feed use and FCR. Adequate biosecurity measures need to be in place to prevent the occurrence of such diseases.

A pellet of greater than 3-4 mm (8/64-10/64 in) in diameter for the grower and finisher is not recommended as it will reduce feed intake and growth rate and may increase FCR.

Etlik Piliç Yemlerinde Elektrolit Dengesi

Johnson & Karunajeewa (1985), concluded that a dietary electrolyte balance lower than 180 mEq/kg and higher than 300 mEq/kg decreases 42d broiler weight, and optimal dietary electrolyte balance was between 250 and 300 mEq/kg. Hulan et al. (1987), investigated the effect of diets containing different $Na^+ + K^+ - Cl^-$ ratios and different calcium levels, and found that the lowest and the highest weight gains were obtained when the "Mongin number" was 174 and 215 mEq /kg, with 1.38 and 0.95% calcium, respectively.

Milliequivalents per liter (mEq/L)						
Substance	Plasma		interstitial fluid		intracellular fluid	
Sodium	142		147		15	
Calssium	5	+154	4	+154,5	150	+ 194
Potassium	5		2,5		2	
Magnesium	2		1		27	
Chloride	105		114		1	
Bicarbonate	24		30		10	
Phosphate	2		2		100	
Sulfate	1	- 154	1	-154,5	20	- 194
Organic acids	6		7,5		–	
Proteins	16		–		63	

Figure 2 Interrelation of electrolytes and acid-base balance

VII. ELECTROLYTE BALANCE DURING PRE-STARTER AND STARTER PHASES

The use of a specific diet for broilers during the first week of age is recommended by several nutritionists. This practice is based on the fact that, at this age, broilers have specific nutritional requirements, which are different from other phases, due to their gastrointestinal tract characteristics. Although there is a minimum requirement for crude protein, the oxidation of amino acids supplied in excess may cause metabolic acidosis (Patience, 1990). Studies have been carried out to analyze the interactions between dietary protein and amino acid levels and electrolyte balance. Borges et al. (2002), evaluated two crude protein levels (21.0 and 23.5%) in pre-starter diets, and three electrolyte balances (166, 260, and 360 mEq/kg) in two experiments and concluded that feeds must be formulated for an electrolyte balance around 260 mEq/kg, independent of protein level. Dall'stella et al. (2007) who evaluated the effects of increasing ratios of methionine + cysteine: lysine in the diet (66, 73, 80 and 87%) with fixed electrolyte balance (240mEq/kg) on performance of broilers from 1 to 7 days, concluded that the different ratios evaluated only affected feed intake, and the best ratio was 76%. Thon et al. (2007a) studied the effect of graded levels of digestible lysine (1.065, 1.215, 1.365, and 1.515 mg/kg) and two electrolyte balance values (250 and 320 mEq/kg) on the performance of broilers in the pre-starter phase (0-7d), and concluded that an electrolyte balance of 250 mEq/kg improved feed conversion, whereas there was no response to different lysine levels. Arginine may be antagonized by lysine, and thus become deficient in the diet (Macari et al., 2002). Thon et al. (2007b) evaluated the effect of graded digestible arginine levels (1.313, 1.443, 1.573, and 1.703 mg/kg) and two electrolyte balance values (250 and 320 mEq/kg) on the performance of broilers in the pre-starter phase and concluded that 1.313 mg digestible arginine/kg feed promotes good live performance.

Borges et al., (1999) added NaCl, $NaHCO_3$, NH_4Cl, and $KHCO_3$ to broiler feed during the first week of age, aiming at determining the best electrolyte balance. Two experiments were conducted: potassium levels remained constant in the first trial, and sodium in the second one. The author concluded that the responses depend on the manipulated electrolyte and that extreme Cl (0.15 and 0.71%), K (0.52 and 1.21%), and Na (0.15 and 0.60%) levels must be avoided. The main response to excessive Cl and K seems to be related to feed intake. In these experiments, optimal electrolyte balance ranged from 199 to 251 mEq/kg. Further studies were then performed by maintaining constant levels of potassium and simultaneously manipulating the levels of potassium and sodium in the diet (Borges et al., 2002). Extreme levels of Cl (0,77%) and K (1,05%) depressed feed intake and should be avoided. The best electrolyte balance in pre-starter (0-7d) ranged between 246 and 277 mEq / kg, Fig. (3).

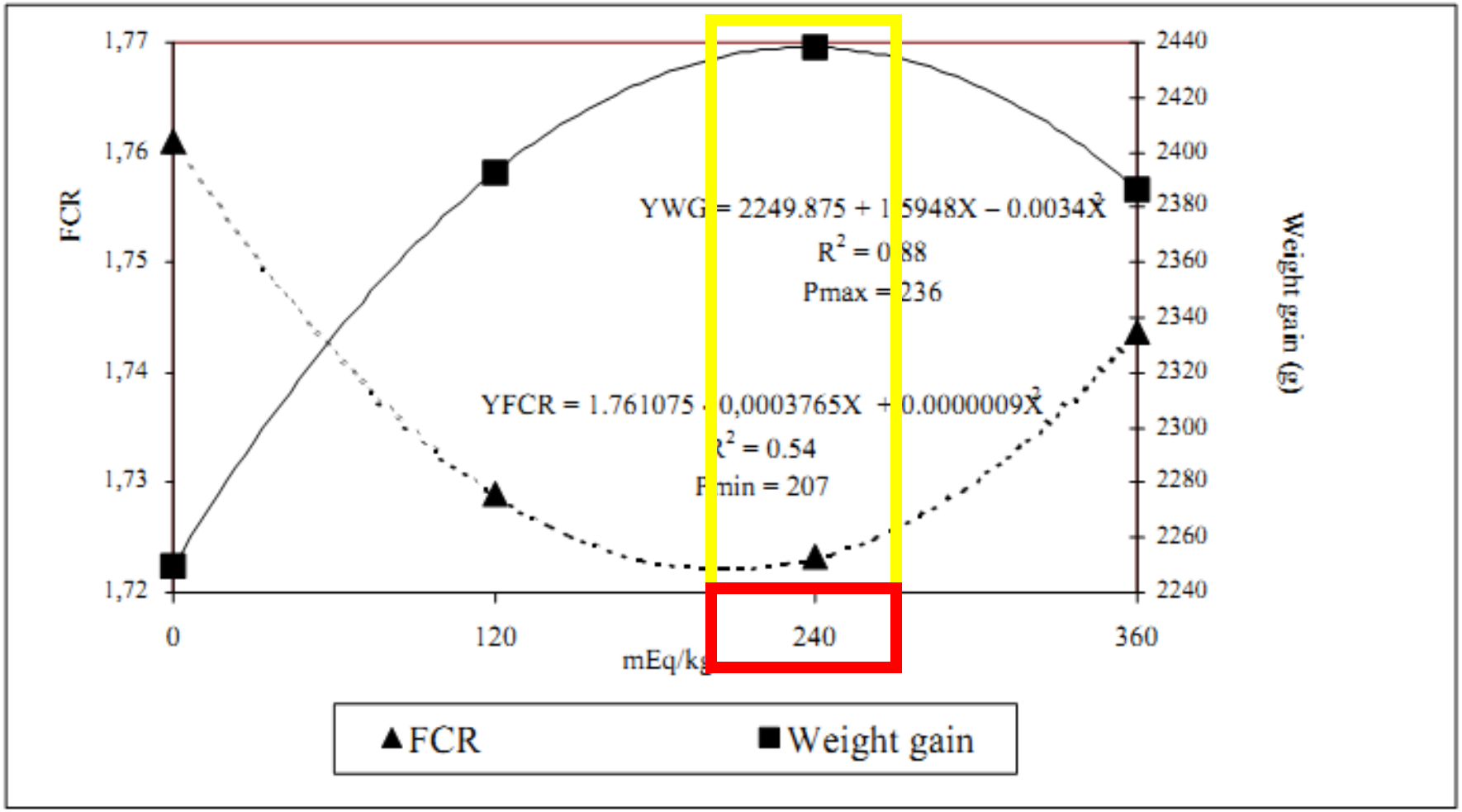

Figure 3 Effect of dietary electrolyte balance on the weight gain and feed conversion. Adapted from Borges et al. (2007).

VIII. ELECTROLYTE BALANCE DURING THE GROWER PHASE AND OVERALL PRODUCTION

During the grower phase (22-42d), Rondon (1999) suggested a dietary electrolyte balance between 249 and 261 mEq/kg for optimal performance. Oliveira (2002), when adding offal meal or feather meal to feeds, concluded that best performance was obtained with an electrolyte balance between 292 and 300 mEq/kg. Borges et al. (2003b) found best weight gain and feed conversion with 240 mEq/kg by manipulating sodium and chloride levels. Using increasing levels of sodium or sodium and potassium, Borges et al. (2004a) concluded that the best electrolyte balance for this phase is between 202 and 235 mEq/kg.

Considering the entire production (1-42d), broilers raised in a thermoneutral environment presented better performance with an electrolyte balance between 201 and 220 mEq/kg (Borges et al., 2003c); however, under heat stress, the best performance was obtained when the electrolyte balance ranged from 207 to 236 mEq/kg feed. In these studies, electrolyte balance was obtained by manipulating dietary sodium and chloride levels.

Water intake is dependent on bird age, environmental temperature, and the level of salts in the diet. Increasing electrolyte ratio linearly increases water intake and the water intake to feed intake ratio; however, after a certain limit, higher water intake may result in wet litter. Broilers fed diets containing 360 mEq/kg from the first week of age presented wetter litter compared to those fed 240 mEq/kg, making management more difficult and affecting performance as higher water intake increased passage rate (Borges et al., 2003b). Stimulating water consumption and body water exchange may be beneficial as higher water

When birds are exposed to acute stress, those fed with electrolyte balance between 140 and 240 mEq/kg had lower body temperatures and blood pH, showing a better acid-base homeostasis, panted less, resulting in lower loss of CO_2. Diets with high $NaHCO_3$ concentration (340 and 360 mEq/kg) caused metabolic alkalosis, independent of the environmental temperature (Borges et al., 2004b). A trial with colostomized broilers raised under thermoneutrality or under chronic heat stress (Borges et al., 2004c) showed that birds are able to regulate the higher volume of water intake by increasing urinary excretion. The amount of excreted electrolytes depends on their concentration in the feed, and on environmental temperature, and the highest electrolytes retention occurred in broilers fed a diet containing 240 mEq/kg.

IX. ELECTROLYTE BALANCE IN BREEDERS

Studies on the application of this concept in commercial layer and broiler breeder are limited. Hamilton and Thompson (1980) and Balnave & Muheereza (1997) found higher egg production in layers as the (Na+K)/Cl ratio increased through the addition of $NaHCO_3$. Eggshell thickness and strength improved (Austic & Keshavarz, 1988), and thin eggshells were reduced (Ernest et al. 1975) when feeds were formulated considering the dietary eletrolytic balance (DEB). Nobakht et al. (2007), working with 24 to 34-week-old layers submitted to different electrolyte balances (0, 120, 240, and 360 mEq/kg), observed significant differences in eggshell quality, weight, thickness, and ashes. Also, specific gravity increased with dietary electrolyte balance. The authors concluded that increasing dietary electrolyte balance up to 360 mEq/kg in layers may improve eggshell quality.

Santos et al. (2005) carried out an experiment with 57,000 broiler breeders to evaluate the impact of the adoption of the electrolyte balance concept (Table 3). Better egg production and feed conversion ratio and lower mortality were observed when the feed was formulated on that concept as compared to the control group. Electrolyte balance concept can be used to adjust bird acid-base balance, and to improve performance. At least 180 mEq/kg feed is recommended.

Table 3 Effect of feed formulated on electrolyte balance (mEq/kg) on the performance of broiler breeders supplemented with sodium and potassium salts.

Parameter	Control 150 mEq/kg	Electrolyte Balance 180 mEq	CV %*
Egg production (%)	55.75 b	56.81 a	1.13
Yield (%)	98.64	98.61	1.40
Mortality (%)	0.535 a	0.285 b	3.58
Feed intake (g/bird/day)	152	152	--
Eggs/bird/week	3.918 b	3.990 a	1.81
FCR (g/egg)	273 b	268 a	1.82

*Coefficient of variation among treatments. In the same row, letter is the same row are statistically different (P≤0.05 by Tukey test). Adapted from Santos *et al.* (2005).

Etlik Piliçlerde Besin Maddesi İhtiyaçları 2009

Nutrient Specifications for As-Hatched Broilers Grown <1.9 kg (4.2 lb) live weight

		Starter		Grower		Finisher	
Age fed	days	0-10		11-24		25-slaughter	
Energy	kcal	3,025		3,150		3,200	
	MJ	12.65		13.20		13.40	
AMINO ACIDS		**Total**	**Digest[1]**	**Total**	**Digest[1]**	**Total**	**Digest[1]**
Lysine	%	1.43	1.27	1.24	1.10	1.09	0.97
Methionine & Cystine	%	1.07	0.94	0.95	0.84	0.86	0.76
Methionine	%	0.51	0.47	0.45	0.42	0.41	0.38
Threonine	%	0.94	0.83	0.83	0.73	0.74	0.65
Valine	%	1.09	0.95	0.96	0.84	0.86	0.75
iso-Leucine	%	0.97	0.85	0.85	0.75	0.76	0.67
Arginine	%	1.45	1.31	1.27	1.14	1.13	1.02
Tryptophan	%	0.24	0.20	0.20	0.18	0.18	0.16
Crude Protein	%	22-25		21-23		19-23	
For optimal portions margin it is recommended that amino acid density be increased up to 5% in all diets							

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Etlik Piliçlerde Besin Maddesi İhtiyaçları 2014

Nutrition Specifications for As-Hatched Broilers - Target Live Weight 2.50 - 3.00 kg (5.50 - 6.60 lb).

		Starter		Grower		Finisher 1		Finisher 2	
Age Fed	days	0 - 10		11 - 24		25 - 39		40 - market	
Energy	kcal	3000		3100		3200		3200	
	MJ	12.55		12.97		13.39		13.39	
AMINO ACIDS		**Total**	**Digest[1]**	**Total**	**Digest[1]**	**Total**	**Digest[1]**	**Total**	**Digest[1]**
Lysine	%	1.44	1.28	1.29	1.15	1.15	1.02	1.08	0.96
Methionine + Cystine	%	1.08	0.95	0.99	0.87	0.90	0.80	0.85	0.75
Methionine	%	0.56	0.51	0.51	0.47	0.47	0.43	0.44	0.40
Threonine	%	0.97	0.86	0.88	0.77	0.78	0.68	0.73	0.64
Valine	%	1.10	0.96	1.00	0.87	0.89	0.78	0.84	0.73
Isoleucine	%	0.97	0.86	0.89	0.78	0.80	0.70	0.75	0.66
Arginine	%	1.52	1.37	1.37	1.23	1.21	1.09	1.14	1.03
Tryptophan	%	0.23	0.20	0.21	0.18	0.18	0.16	0.17	0.15
Leucine	%	1.58	1.41	1.42	1.27	1.26	1.12	1.19	1.06
Crude Protein[2]	%	23.0		21.5		19.5		18.3	

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Farklı ticari etlik piliç hatların metiyonin ve TSAA gereksinimleri

	Dönem	TSAA		Metiyonin	
		Toplam	Sindirilebilir	Toplam	Sindirilebilir
Ross 308[1](2014)	Başlatma	1,08	**0,95**	0,56	**0,51**
	Geliştirme	0,99	**0,87**	0,51	**0,47**
	Bitirme	0,91	**0,80**	0,47	**0,43**
Cobb[2]	Başlatma	0,98	0,86	0,56	0,50
	Geliştirme	0,96	0,84	0,53	0,48
	Bitirme 1	0,88	0,77	0,48	0,43
	Bitirme 2	0,80	0,70	0,44	0,40
ArborAcres[3]	Başlatma	0,97	0,86	0,53	0,46
	Geliştirme	0,85	0,75	0,46	0,41
	Bitirme 1	0,78	0,69	0,42	0,37
	Bitirme 2	0,77	0,68	0,42	0,37
NRC(1994)[4]	Başlatma	0,90	-	0,50	-
	Geliştirme	0,72	-	0,38	-
	Bitirme	0,60	-	0,32	-

[1] Başlatma (0-10 gün), Geliştirme (11-24 gün) ve Bitirme (25-kesim).
[2] Başlatma (0-10 gün), Geliştirme (11-22 gün), Bitirme 1 (23-42 gün) ve Bitirme 2 (42-kesim).
[3] Başlatma (0-14 gün), Geliştirme (15-28 gün), Bitirme 1 (29-36 gün) ve Bitirme 2 (37-kesim).
[4] Başlatma (0-21 gün), Geliştirme (22-42 gün) ve Bitirme (43-56 gün).

Etlik Piliçlerde Besin Maddesi İhtyaçları 2009

Calcium	%	1.05		0.90		0.85		
Available Phosphorus	%	0.50		0.45		0.42		
Magnesium	%	0.05-0.50		0.05-0.50		0.05-0.50		
Sodium	%	0.16-0.23		0.16-0.23		0.16-0.20		
Chloride	%	0.16-0.23		0.16-0.23		0.16-0.23		
Potassium	%	0.40-1.00		0.40-0.90		0.40-0.90		
ADDED TRACE MINERALS PER KG								
Copper	mg	16		16		16		
Iodine	mg	1.25		1.25		1.25		
Iron	mg	40		40		40		
Manganese	mg	120		120		120		
Selenium	mg	0.30		0.30		0.30		
Zinc	mg	100		100		100		
ADDED VITAMINS PER KG		**Wheat based feed**	**Maize based feed**	**Wheat based feed**	**Maize based feed**	**Wheat based feed**	**Maize based feed**	
Vitamin A	iu	12,000	11,000	10,000	9,000	10,000	9,000	
Vitamin D3	iu	5,000	5,000	5,000	5,000	4,000	4,000	
Vitamin E	iu	75	75	50	50	50	50	
Vitamin K (Menadione)	mg	3	3	3	3	2	2	
Thiamin (B1)	mg	3	3	2	2	2	2	
Choline per kg	mg	1,600		1,500		1,400		
Linoleic Acid	%	1.25		1.20		1.00		

MINERALS								
Calcium	%	0.96		0.87		0.78		0.75	
Available Phosphorus	%	0.480		0.435		0.390		0.375	
Magnesium	%	0.05 - 0.50		0.05 - 0.50		0.05 - 0.50		0.05 - 0.50	
Sodium	%	0.16 - 0.23		0.16 - 0.23		0.16 - 0.20		0.16 - 0.20	
Chloride	%	0.16 - 0.23		0.16 - 0.23		0.16 - 0.23		0.16 - 0.23	
Potassium	%	0.40 - 1.00		0.40 - 0.90		0.40 - 0.90		0.40 - 0.90	
ADDED TRACE MINERALS PER KG									
Copper	mg	16		16		16		16	
Iodine	mg	1.25		1.25		1.25		1.25	
Iron	mg	20		20		20		20	
Manganese	mg	120		120		120		120	
Selenium	mg	0.30		0.30		0.30		0.30	
Zinc	mg	110		110		110		110	
ADDED VITAMINS PER KG		**Wheat based feed**	**Maize based feed**	**Wheat based feed**	**Maize based feed**	**Wheat based feed**	**Maize based feed**	**Wheat based feed**	**Maize based feed**
Vitamin A	IU	13,000	12,000	11,000	10,000	10,000	9000	10,000	9000
Vitamin D3	IU	5000	5000	4500	4500	4000	4000	4000	4000
Vitamin E	IU	80	80	65	65	55	55	55	55
Vitamin K (Menadione)	mg	3.2	3.2	3.0	3.0	2.2	2.2	2.2	2.2
Thiamin (B1)	mg	3.2	3.2	2.5	2.5	2.2	2.2	2.2	2.2
Riboflavin (B2)	mg	8.6	8.6	6.5	6.5	5.4	5.4	5.4	5.4
Niacin	mg	60	65	55	60	40	45	40	45
Pantothenic Acid	mg	17	20	15	18	13	15	13	15
Pyridoxine (B6)	mg	5.4	4.3	4.3	3.2	3.2	2.2	3.2	2.2
Biotin	mg	0.30	0.22	0.25	0.18	0.20	0.15	0.20	0.15
Folic Acid	mg	2.20	2.20	1.90	1.90	1.60	1.60	1.60	1.60
Vitamin B12	mg	0.017	0.017	0.017	0.017	0.011	0.011		
MINIMUM SPECIFICATION									
Choline per kg	mg	1700		1600		1500			
Linoleic Acid	%	1.25		1.20		1.00			

Etlik Piliçlerde Besin Maddesi İhtiyaçları

Nutrient Specifications for As-Hatched Broilers Grown to 2.0-2.5 kg (4.4-5.5 lb) live weight

		Starter		Grower		Finisher	
Age fed	days	0-10		11-24		25-slaughter	
Energy	kcal	3,025		3,150		3,200	
	MJ	12.65		13.20		13.40	
AMINO ACIDS		**Total**	**Digest[1]**	**Total**	**Digest[1]**	**Total**	**Digest[1]**
Lysine	%	1.43	1.27	1.24	1.10	1.09	0.97
Methionine & Cystine	%	1.07	0.94	0.95	0.84	0.86	0.76
Methionine	%	0.51	0.47	0.45	0.42	0.41	0.38
Threonine	%	0.94	0.83	0.83	0.73	0.74	0.65
Valine	%	1.09	0.95	0.96	0.84	0.86	0.75
iso-Leucine	%	0.97	0.85	0.85	0.75	0.76	0.67
Arginine	%	1.45	1.31	1.27	1.14	1.13	1.02
Tryptophan	%	0.24	0.20	0.20	0.18	0.18	0.16
Crude Protein	%	22-25		21-23		19-23	

For optimal portions margin it is recommended that amino acid density be increased up

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Etlik Piliçlerde Besin Maddesi İhtyaçları

Calcium	%	1.05		0.90		0.85		
Available Phosphorus	%	0.50		0.45		0.42		
Magnesium	%	0.05-0.50		0.05-0.50		0.05-0.50		
Sodium	%	0.16-0.23		0.16-0.23		0.16-0.20		
Chloride	%	0.16-0.23		0.16-0.23		0.16-0.23		
Potassium	%	0.40-1.00		0.40-0.90		0.40-0.90		
ADDED TRACE MINERALS PER KG								
Copper	mg	16		16		16		
Iodine	mg	1.25		1.25		1.25		
Iron	mg	40		40		40		
Manganese	mg	120		120		120		
Selenium	mg	0.30		0.30		0.30		
Zinc	mg	100		100		100		
ADDED VITAMINS PER KG		**Wheat based feed**	**Maize based feed**	**Wheat based feed**	**Maize based feed**	**Wheat based feed**	**Maize based feed**	
Vitamin A	iu	12,000	11,000	10,000	9,000	10,000	9,000	
Vitamin D3	iu	5,000	5,000	5,000	5,000	4,000	4,000	
Vitamin E	iu	75	75	50	50	50	50	
Vitamin K (Menadione)	mg	3	3	3	3	2	2	
Thiamin (B1)	mg	3	3	2	2	2	2	
Choline per kg	mg	1,600		1,500		1,400		
Linoleic Acid	%	1.25		1.20		1.00		

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