

## Interest of the use of quantitative feed restriction in the production of heavy broilers

C. KOUKI<sup>1</sup>, R. BERGAOUI<sup>1</sup>

<sup>1</sup> Department of Animal Production, National Agronomic Institute of Tunisia, University of Carthage.

\*Corresponding author: [koukichirazpa@yahoo.fr](mailto:koukichirazpa@yahoo.fr)

**Abstract** - 200 chickens, one day old, of Hubbard Classic heavy strain were distributed in 5 groups. A Quantitative feed restriction was used for broiler chickens slaughtered at different ages to estimate his impact on their performances, breast and thigh yields. Feed quantitative restriction (75% of a control group C fed ad-libitum during the experiment) was applied for two weeks as : R42<sub>21-35</sub> chickens restricted from 21 to 35 d of age and slaughtered at 42 days , R49<sub>28-42</sub> chickens restricted from 28 to 42 d and slaughtered at 49 days ; R56<sub>35-49</sub> chickens restricted from 35 to 49 d and slaughtered at 49 days ; R63<sub>42-56</sub> chickens restricted from 42 to 56 d and slaughtered at 63 days. After one week of re-feeding a sample of broilers of each group (C, R42, R49, R56, R63) was slaughtered in order to determinate the weight of the carcass, thigh, breast and to calculate the fat yields. Restricted broiler chickens R63<sub>42-56</sub> have improved their feed conversion during the re-feeding period and had a similar body weight than those of ad-libitum group. Restricted broilers R56 and R63 improved significantly the gain weight during the re-feeding period. At 63 days of age the R63 had a similar breast and carcass weight to that of ad-libitum group contrary to others group having a breast and carcass's weight significantly lower than ad-libitum broilers. The breast, thigh's and carcass yields of restricted chickens slaughtered at different age were not affected by feed restriction. This study showed that gizzard fat and abdominal fat weights of restricted group were significantly lower than those of ad-libitum group. However no significant difference between abdominal fat deposition yields of restricted and ad-libitum group to the different slaughtering ages. Mortality by ascites was reduced significantly at late ages (8 and 9 weeks of age) by feed restriction. A slaughter age of restricted broilers of 63 day may be effective for improvement of growth performances and reducing mortality of fast growth broilers bred to late age for cutting

**Keywords:** ascites, quantitative feed restriction, broiler chickens, slaughter age, breast and thigh yields.

### 1. Introduction

Nowadays, consumers of poultry meat demand faster and easy to bake products with a low fat yield. These products require heavy broilers with high weight of noble parts like breasts and thighs and the intervention of a processing industry. Heavy broiler market for cutting requires production of heavy and late slaughter broilers. However, the increase in the age and weight of the broiler tends to cause problems related to the ascites disease. The incidence of ascites is higher in chickens with high mortality rate during finishing, mostly at warm period of the year, slow weight gain and higher feed conversion (Buys et al 1999). Late slaughter increases abdominal fat deposition (Rabot et al, 1995). Feed restriction can reduce the frequency of the pathologies as ascites (Acar et al, 1995, Jones (1995) , MCGovern et al (1999) et Camacho et al (2004)). Several studies have shown that feed restriction reduces mortality ( Quarter et al, 1990) and abdominal fat ((Palvink et Hurwitz , 1985 ; Palvink et al , 1986), Zubair et al ,1994). Some studies had been reported that feed quantitative restriction improved feed conversion (Deaton, 1995)) and weight gain (Ozkan et al, 2006). Tumova et al (2002) indicate that feed restriction causes an accelerate growth (compensatory growth) while. Palvink and Hurwitz (1985) demonstrate that early growth restriction of broilers induced by feed restriction improved feed efficiency and carcass quality by decreasing fat deposition.

The objective of this study is to estimate the impact of quantitative restriction applied at different ages which aims to produce a heavy broiler with high performances, high yield's meat and reduced fat deposition and to demonstrate if feed restriction limit high mortality related to late slaughter.



## 2. Materials and methods

### 2.1. Experimental design

The present study was conducted with 200 chickens (one day old) of Hubbard Classic heavy strain produced by a commercial hatchery and with an average weight of 43 g. The chicks were distributed at the first day of age in 5 groups. Chickens received in succession during the whole period of the trial a starting, growing and finishing rations (table 1). The chicks were fed ad-libitum until the age of 21 days. By later, they were transferred to allocate 20 cages on 5 treatments. Each treatment was assigned in 4 repetitions of 20 birds per pen. Feed quantitative restriction was applied as approximately 75% of the control group C fed ad-libitum. The other four treatments were: R42<sub>(21-35)</sub> chickens restricted from 21 to 35 and killed at 42 days of age, R49<sub>(28-42)</sub> chickens restricted from 28 to 42 day of age and killed at 49; R56<sub>(35-49)</sub> chickens restricted from 35 to 49 day and killed at 56 ; R63<sub>(42-56)</sub> chickens restricted from 42 to 56 day of age and killed at 63. Each restricted group was re-fed for one week after the restriction period. A sample of animals (n=12) of each group C; R42; R49; R56 and R63 were slaughtered respectively at the slaughters ages (42d , 49d , 56 d and 63d). Broiler's carcasses were cut for determination weight and calculation of carcass, thigh, breast and fat yields.

**Table 1:** composition of the experimental rations

Type of food	CF1E (1d-14d)	CF2E (15d-22d)	CF2G (23d-39d)	CF3G(40d-63d)
CF(%)	23	19	19	18,5
TNM	4	4	4	3,5
MM(%)	5,54	5,49	5,33	5,35
FM(%)	3	3	3,5	3,5
ME(kcal /gMS)	2860	2900	2920	2950

d :day CF : crude fibre ;TNM :Total nitrogenous matter;MM; mineral matter ;FM :Fat matter :metabolizable energy

### 2.2. Statistical analysis

All data were submitted to analysis of variance using the One –Way Anova procedure of Mintab .Differences among treatments were determined as significant at 5% level by Tukey's multiple.

## 3. Results and discussion

### 3.1. Performances

#### 3.1.1. Body weight

Results of body weights are presented in table2 . At ages of 42d and 49d, body weights of restricted groups R42 and R49 were significantly lower than those of control group at the same ages. However, restricted broilers R56 et R63 had at slaughter ages a similar body weights than those of ad-libitum group. Results of our study show that significantly lower weights of R42 and R49 could be attributed to feed restriction applied for two weeks. However restriction on intervals [35d-49d] and [42-56] respectively associated to R56 and R63 had no impact on body weights and restricted broilers had a similar body weight than those of control boilers which were at the same ages.

**Table 2 :** Effects of feed restriction on body weight (g)

Age / treatment	Control ad libitum	R42 <sub>(21-35)</sub>	R49 <sub>(28-42)</sub>	R56 <sub>(35-49)</sub>	R63 <sub>(42-56)</sub>
28d	1162,6a	982,8 b	1154,8 a	1159,1a	1185,1a
35d	1758,2a	1431 ,8c	1551,2b	1719,3a	1729,4a
42d	2306,8ab	2046,2c	1998,9c	2149,2b	2324,3a
49d	2754,1a		2419,0b	2498,16b	2689,6a
56d	3263,8a			3066,30a	3142,2a
63d	3718,5a				3728,2a

a, b ,c–means followed by similar letters in the same lie are not significantly different by Tukey's test (p <0.05)

### 3.1.2. Feed intake:

The feed consumption of all groups were presented in table 3. During the two weeks of restriction period the 4 restricted groups were restricted 75 % compared to those feeded ad-libitum. Each restricted group was refeeded ad-libitum for one week after restriction period. During re-feeding feed intake of restricted groups were significantly lower than that ad- libitum groups with the exception of the R42 group which had a similar feed intake of that of ad- libitum group.

**Table 3 :** Effects of feed restriction on feed intake weight (g)

Age / treatment	Control ad libitum	R42 (21-35)	R49(28-42)	R56(35-49)	R63 (42-56)
Week 4	120,28a	86,89b	123,55a	122,17a	121,87a
Week 5	157,75a	115,61b	116,93b	151,96a	154,36a
Week 6	182,44a	182,49a	134,93b	134,93b	184,96a
Week 7	194,32a		183,28b	148,4c	148,67c
Week 8	197,01a			172,90b	160,59b
Week 9	207,00a				175,94 b

a,b,c –means followed by similar letters in the same lie are not significantly different by Tukey’s test (p <0.05)

### 3.1.3. Gain weight and feed conversion

During two weeks of restriction ‘s period, restricted groups had a gain weight significantly lower than thot of the control group feeded ad-libitum. However R63 group had a similar weight gain at the second week of restriction (table 3).During re-feeding weeks restricted groups R42, R49 expressed a similar gain weight than those of ad -libitum group C. However the restricted group R56 and R63 had gain weights significantly higher than those of ad- libitum group respectively during the re-feeding period .In this case feed restriction improve significantly the gain weight during the re-feeding period of two groups R56 and R63. Feed conversion was improved only for the R63 group which had a feed conversion significantly lower than that of ad -libitum group. However for the other groups R56, R49 and R42 feed conversion were significantly similar to ad- libitum groups (table4). Results showed that feed conversion was also improved among chickens of group R49 during the second week of restriction.

**Table 4:** weight gain (g/d) and feed conversion (g/g) of restricted and control groups

Age / treatment	Control Ad libitum		R42 (21-35)		R49 (28-42)		R56 (35-49)		R63 42-56	
	Weight gain	Feed conversion	Weight gain	Feed conversion	Weight gain	Feed conversion	Weight gain	Feed conversion	Weight gain	Feed conversion
Week 4	64,89a	1,86b	38,68b	2,25a	67,22a	1,84b	68,67a	1,78b	69,10a	1,77b
Week 5	78,33a	1,85a	64 ,15b	1,81a	56,90c	2,071a	80,03ab	1,92a	78,33ab	1,99a
Week 6	78,03a	2,34a	88,73a	2,12a	63,46b	2,05b	61,30b	2,22a	84,54a	2,19a
Week 7	74,77a	2,61a			72,65a	2,52a	58,29b	2,56a	60,84b	2,45a
Week 8	75,60b	2,62a					80,66a	2,15a	65,15 <sup>b</sup>	2,49a
Week 9	67,61b	3,061b							80,21a	2,20a

a,b –means followed by similar letters in the same lie are not significantly different by Tukey’s test (p <0.05)

### 3.1.4. Mortality:

The number of chickens dead from 4 to 9 weeks of age is shown in table 7. The mortality was reduced by feed restriction essentially on late weeks of breeding. This finding is concorted with the studies of Acar et al (1995), Jones (1995) and Mcgovern et al (1999). At advanced ages of 8 and 9 weeks, the mortality in the restricted treatments was significantly lower than in the control.

**Table 7:** Number of broilers dead from 4 to 9 weeks of age

Age /group	C	R42	R49	R56	R63
4W	0	0	0	0	0
5W	0	0	0	0	0
6W	0	0	0	0	0
7W	2,5 ± 5,0	-	-	0	0
8W	15,55±6,47a	-	-	2,5 ± 5,0 b	2,77± 5,55b
9W	15,03±2,02a	-	-		5,62 ± 6,57 b

a-b-means followed by similar letters in the same lie are not significantly different by Tukey's test (p <0.05)

### 3.2. Cutting Results

#### 3.2.1. Carcass, breast and thigh's weights and yields:

Carcasses' weight of restricted group R42, R49, R56 were lower than those of ad-libitum group, however the R63 group had the same carcass's weight than that of a control group. Breast's weight of restricted group was significantly lower than that ad-libitum group excepted the R63 group (table 5). Restricted group thigh's weight was not significantly different among the restricted and ad-libitum groups excepted thigh's weight of R42 group which was significantly lower than that of ad-libitum group. Carcass, breast and thigh's yields of restricted groups and are not significantly different from those of ad-libitum group on different slaughter age (42d, 49d, 56 d and 63d).

**Table 5:** carcass, breast and thigh weights and yields of different groups slaughtered at different ages

Slaughter age Group	42 d		49d		56d		63 d	
	C	R42	C	R49	C	R56	C	R63
Carcass 's weight(g)	1755,5a	1528,1b	2190,6a	1849,1b	2417,6a	2193,5b	2736a	2741,7a
Breast 's weight (g)	617,9a	506,7b	778,3a	625b	885,8b	763,8a	906,7b	916,2b
Thigh 's weight (g)	477,1b	419,2c	581,7a	519,8a	684,2a	637,9a	798,3a	754,6a
Caracss yeild (%)	73,43a	73,59a	77,83a	73,70a	72,69a	74,85a	76,74a	77,346a
Breast ' s yeild (%)	35,58a	33,18a	35,64a	33,92a	36,90a	34,97a	33,40a	33,75a
Thigh's yeild (%)	27,39a	27,56a	26,55 a	28,20a	28,53a	29,21 a	29,14a	27,39a

a,b –means followed by similar letters in the same lie of the same column ( the same age) are not significantly different by Tukey's test (p <0.05)

C : control.

#### 3.2.2. Abdominal fat and Gizzard fat

Abdominal fat was affected by restriction in the present study (table 5) which confirms results from studies of Palvink et al(1986) Rosebrough et al (1986) Acar et al (1995) who showed that feed restriction reduced abdominal fat pad weight contrary to these findings Yu et al (1990) and Fontana et al (1993) who observed no differences in abdominal fat weight between ad-libitum and feed restricted broilers. The lowest abdominal fat percentage was observed in restricted birds (table 6). The gizzard fat's weight of all restricted groups were lower than those of ad-libitum group.

**Table 6:** abdominal fat and gizzard weights (g) and percentage (%)

Slaughter age	42 d		49 d		56 d		63 d	
	C	R42	C	R49	C	R56	C	R63
Abdominal fat	36,32 a	18,37 b	35,23 a	25,38b	38,41a	25,38b	49,39a	29,87b
Gizzard fat	14,40 a	6,95 b	21,61a	11,44b	20,66a	11,06b	32,54 a	19,04b
Abdominal fat's percentage	1,90a	1,20b	1,66 a	1,37 b	1,59a	1,16 b	1,68a	1,10 b
Gizzard fat 's percentage	0,76 a	0,45 b	1,02 a	0,63b	0,86 a	0,50b	1,11a	0,71 b

a,b –means followed by similar letters in the same lie of the same column ( the same age) are not significantly different by Tukey's test (p <0.05)

#### 4. Conclusion

The results of the present study indicate that restriction at late age improve feed conversion and weight gain. So restriction for two weeks applied from 42 day of age to 56 day improve feed conversion and weight gain during re-feeding period and reduce mortality at advanced age. Carcass, breast, and thigh yields were not affected by restriction. Feed restriction reduces abdominal and gizzard fat but has no effect on abdominal and gizzard fat yields. Restriction used in this study may be an alternative to reduce problems of performances and mortality related to late breeding of rapid growth chicken. The present finding showed increasing of slaughter age to 63 day may be effective for improvement of growth performances and mortality of fast growth broilers bred to late age in order to obtain breast and thigh yields similar to broilers fed ad-libitum.

#### 5. References

- Acar N., Sizemore FG, Leach GR, Wideman RF, Owen RL, Barbato GF.,1995 .Growth of broiler chickens in response to feed restriction regimens to reduce ascites. *Poult.Sci.* 74 : 833-843.
- Camacho M. A., Sua´rez M. E ., Herrera J. G ., J. M. Cuca, and. Garcı´a-Bojalil C. M .,2004. Effect of age of feed restriction and microelement supplementation to control ascites on production and carcass characteristics of broilers. *Poult. Sci.* 83:526–532.
- Deaton J.W .,1995.The effect of early feed restriction on broiler performance. *Poult. Sci.* 74,1280-1286.
- Julan B and Wilson B.,1992. Pen oxygen concentration and pulmonary hypertention induced right ventricular failure and ascites in meat type chickens at low altitude .*Avian dis .*,36-733-737.
- McGovern R.H., FeddesJ J.R., Robinson F.E., Hanson J.A.,1999 . Growth performance, carcass characteristics, and the incidence of ascites in broilers in response to feed restriction and litter oiling. *Poult. Sci.* 78, 522-528.
- Ozkan S., Palvink I ., and Yahav S ., 2006 .Effects of early feed restriction on performance and ascites developpement in broiler chickens subsequently raised at low ambient Temperature .*j Poultry science association* 15 : 9-19,
- IncPlavink I ., Hurwitz S.,1985.The performance of broiler chicks during and following a svre feed restriction at an early age. *Poult. Sci.* 64, 348-355.
- Plavink I ., McMurtry J. P., Rosebrough R. W .,1986. Effect of early feed restriction in broilers – I: growth performance and carcass composition. *Growth, Lakeland, v.* 50, p. 68-76.
- Zubair A. K and Leeson S.,1994. Effect of varying period of early nutrient restriction on growth compensation and carcass characteristics of male broilers. *Poult. Sci.* 73:129–136.