Dept. of Hygiene and Animal Nutrition
Fac. Vet. Med., Suez Canal University.
Head of Dept. of Prof. Dr. M.A. Sobeih

INFLUENCE OF FEED AND WATER DEPRIVATION ON PROCESSING WEIGHTS AND YIELDS, COOKING LOSSES AND MEAT COMPOSITION OF DUCK CARCASSES AT 8 & 10 WEEKS OF AGE

(With 8 Tables)

By

M.T. IBRAHIM and M.A. YASSIEN*

(Received at 19/11/1993)

تأثير الحرمان من الطعام والماء على أوزان وناتج تجهيز وطهى ومكونات اللحم فى ذبائح البط عند عمرى ثمانية وعشرة أسابيع

محمد ابراهيم ، مكرم يس

اجريت هذه التجربه لدراسة تأثير كل من الحرمان من الطعام أو الطعام والماء (حرمان كلى) لعدة ساعات (٦ ، ١٢ ، ١٨ ساعه) قبل الذبح على أوزان وناتج تجهيز وطهى وتركيب اللحم فى ذبائح البط عند عمرى ثمانية وعشرة أسابيع . كذلك تم دراسة كفاءة البط بعد تجاوز عمر الثمانية أسابيع لظروف معينه وقد خلصت هذه التجربه إلى ما يلى : عدم وجود فروق معنويه بين المعاملات عند العمر الواحد بالنسبه لوزن المزرعه والوزن عند الذبح ووزن الذبيحه والذبيحه المبرده بينما كانت هذه الزياده معنويه عند عشرة أسابيع مقارنة بمثيلتها عند ثمانية أسابيع من العمر . وجود علاقه طرديه بين نسبة النقص فى الوزن الحى نتيجة الحرمان وزيادة ساعات الحرمان عند ٨ ، ١٠ أسابيع من العمر وكانت أكثر وضوحاً عند العشرة أسابيع . قل ناتج الذبيحه وناتج الذبيحه المجهزه للطهى فى المجموعات التى لم تحرم كلياً سواءاً عند عمر ٨ أو ١٠ أسابيع وأيضاً عند المقارنه بين العمرين . أرتفعت النسبه المئويه للماء المكتسب نتيجة التبريد تدريجياً مع زيادة ساعات الحرمان من الطعام عند كل من العمرين وكان ذلك صحيحاً أيضاً بالنسبه للبط المحروم كلياً من الطعام والماء حتى ١٨ ساعه مع أرتفاع هذه النسبه عند عمر عشرة أسابيع عنها عند عمر ثمانيه . لا توجد فروق معنويه بين المعاملات بالنسبه للوزن قبل الطهى ووزن المطهو عند عمر ٨ أسابيع بينما ظهرت هذه الفروق عند عمر ١٠ أسابيع .

كانت نسب الفقد الناتج عن الطهى معنويه بين المعاملات المختلفه فى العمر الواحد بينما لم تكن كذلك عند مقارنتها بين العمرين . أثبت تحليل اللحم عدم وجود فروق معنويه بين المعاملات أو بين العمرين بالنسبه لكل من الرطوبه والبروتين والرماد فى حين كانت هناك فروق معنويه فى نسبة الدهون بين المعاملات المختلفه عند عمر ١٠ أسابيع فقط وتناسب الدهن عكسياً مع عدد ساعات الحرمان . كذلك كانت الزياده فى الدهون معنويه عند عمر ١٠ أسابيع عن عمر ٨ أسابيع . أرتفع استهلاك العليقه فى حين تضاءلت نسبة التحويل الغذائى بدرجه ملحوظه حيث بلغت ٢ ر ٩ ، ٩٠ ر ٩ فى الأسبوعين التاسع والعاشر .

---

*: Dept. of Food control (meat hygiene)

SUMMARY

The influence of depriving ducks offeed or both feed and water (total deprivation) for 0, 6, 12 and 18h prior to slaughter on live-weight shrinkage, eviscerated carcass yield, ready-to-cook yield, water uptake during chilling, cooked weight, cooking losses and meat composition was studied at 8 and 10 weeks of age. The performance of ducks after the 8-= week of age was also discussed. No significant differences were found among treaments at the two experimental ages for farm, slaughter, eviscerated and chilled weights, while they were significantly higher at 10 than 8 weeks of age. A gradual increase in live-weight shrinkage was observed as the period of deprivation increased at the two experimental ages, this shrinkage became higher at 10 weeks of age. The eviscerated yield and ready-to-cook yield were lower at 0-h deprivation treatments either at 8 or 10 weeks of age but there was no significant difference between the two ages regarding eviscerated of ready-to-cook yields. Percentage of water uptake during chilling at the two ages increased gradually as the feed deprivation time increased. Ducks on total deprivation absorbed water in this manner until 18-h of deprivation, when there was a significant decrease in water uptake. The water uptake was significantly lower at 10 than 8 weeks of age. No significant differences were found among treatments for pre cook and cooked weights at 8 & 10 weeks of age but were significantly higher at 10 than 8 week of age. Cooking losses were differed significantly among treatments but not between the two ages. Meat analysis revealed no significant differences among treatments and ages moisture, protein and ash. Fat content differ significantly among treatments at 10 weeks of age and decreased with increasing deprivation time. The muscle content of fat was significantly higher at 10 than 8 weeks of age. The feed intake was high while feed conversion was extremely low, 9.2 & 9.9 during the 9-=week of age respectively.

INTRODUCTION

Before the slaughtering, birds are usually subjected to a period of fasting. Deprivation periods of 8 to 12h result in

the highest eviscerated yields and minimize the potential for fecal contamination of the broiler carcasses (*SMIDT* et al., *1964; WABECK, 1972; MURPHY and GOODWIN, 1978; and BENOFF, 1982). FARR (1979)* reported that the birds be taken off feed but not water for 10 to 12h. the eviscerated yields were significantly lower in chickens that have been fasted longer than 12h than birds subjected to shorter fasting periods *(MAY and BRUMSON, 1955 and BRUMSON, 1957).*

The duration and type of deprivation affect the composition and quality of boiler meat. Muscle moisture decreased when food and water withdrawal periods were lengthened from 10 to 20h *(KAMUS and FARR, 1981)*, but feed withdrawal periods of 15h did not influence protein, fat or ash contents of the turkey muscles *(NGOKA* et al., *1982). SALMON (1979)* stated that the eviscerated carcass of medium white turkeys increased in weight 24g/kg during chilling for 18h in a mixture of ice and water, however, *MARION* et al., *(1968)* reported 41.6g/kg during chilling in ice slush. *MORAN* et al., *(1970 & 1971)* reported gains of approximately 60/kg for turkeys of similar weight and 54 to 69g/kg for smaller turkeys during chiling for 16h in water at 2 to 4 C. An experiment on white pekin ducks was therfore designed to investigate the effect of deprivation of feed only or both feed and water for 0, 6, 12 and 18h prior to slaughter on live-weight shrinkage, eviscerated yield, ready-to-cook yield, water uptake, cooking losses and meat composition. These parameters were determined at the age of 8 and 10 weeks in order to shed light upon the significance of feeding ducks more than 8 weeks, due to certain circumstances, from the economical point of view.

MATERIAL and METHODS

Six hundreds white pekin ducklings, one-day old, were reared in hygienic pen bedded by a layer of chaffed wheat straw. Ducklings were fed ad libitum on starter diet containing 22% protein and 2894 kcal ME/kg diet for the first two weeks then fed on a finisher diet containing 16% protein and 3019 kcal ME/kg diet (Table 1) to satisfy the needs recommended by NRC (1984). The diet offered as wet mash and fresh clean water was constantly available. When birds were 8 weeks old, 112 females of nearly equal weights were carefully chosen and from which 56 females, 2080g average body weight, were directly taken and divided into 7 groups each of 8birds, Ducks were either fed ad libitum to slaughter (0-h treatment) or subjected to the following deprivation periods: 6,12 or 18h feed deprivation or 6,12 or 18h feed and water deprivation prior to slaughter.

At the begining of the deprivation period, birds were caught and immediately weighed. Before the birds returned to their respective cages, feeding troughs were removed. In the cases where birds were to be deprived of water, the watering troughs were removed also. The 0-h birds were not deprived of feed or water before slaughter.

Just prior to the slaughter, each bird was weighed to determine the live shrinkage (loss of liveweight) due to deprivation.

Carcasses were eviscerated and the eviscerated weight was measured for each carcass (excluding giblets, feet and neck). Carcasses were chilled in an ice water bath, for 15h, then carcasses were drained for 15 min and weighed to obtain the chilled weight.

Deprivation shrinkage was calculated as the loss in weight between farm weight and slaughter weight. Other data calculated included eviscerated yield, ready-to-cook yield, percentage of water uptake, losses calculated on a slaughter weight basis and total losses based on farm weight basis. All these parameters were measured on 5 birds from each group. For cooking losses these 5 birds were boiled for 1h then drained, cooled to the room temperature and weighed.

For meat analysis, the pectoralis major and the biceps femoris muscles were removed from the carcasses of 3 birds. The meat was used for the determination of moisture, protein, fat and ash according to A.O.A.C. (1980). The other 56 female ducks, 2095g average body weight, were fed on the finisher diet for another two weeks. At 10 weeks of age, these birds were divided also into 7 groups and treated in the same manner as mentioned before.

Split-plot design was performed on the obtained data according to *COCHRAN AND COX (1966)*.

RESULTS

Are presented in tables 1 to 8.

DISCUSSION

Table 1 revealed the processing weight and yields of ducks subjected to feed or feed and water deprivation at 8 & 10 weeks of age. Farm weights, taken directly before the treatments at 8 weeks of age, and body weight ranged from 2076.1 to 2114.4g and did not differ significantly among treatments. In addition, no significant differences were observed among treatments for slaughter weight (1947.1 to 2051.6g), eviscerated weight (1246.8 to 1307.6g), and chilled weight (1343.1 to 1411.9g).

At 10 weeks of age, there were no significant differences also among treatments for farm weight (2315.7 to 2393.0g), slaughter weight (2183.5 to 2288.9g), eviscerated weight (1405.3 to 1469.8g) and chilled weight (1500.0 to 1576.5g).

The percentage of weight loss due to deprivation before slaughter was stated as deprivation shrinkage. A gradual and significant increase ($P<0.05$) in deprivation shrinkage was noticed as hours of deprivation increased either at 8 or 10 weeks of age (Table 2). This was in agreement with the finding reported by *WABECK (1972) and SCOTT et al. (1978)* who reported that, live weight shrinkage increased linearly with increasing withdrawal times in broilers. Ducks at 8 weeks of age on the feed deprivation treatments experienced a 4.5% average deprivation shrinkage, whereas ducks on total deprivation shrank 5.1%, while at 10 weeks of age it was 5.8 & 5.5% on the feed and total deprivation respectively.

Eviscerated yield was not affected by increasing deprivation time. Ducks at 0-h deprivation had a significantly lower ($P<0.05$) eviscerated yield than all other treated groups at 8 weeks of age, also it had the lowest value at 10 weeks of age (Table 2). The average eviscerated yield of ducks on feed deprivation and total deprivation was 64 & 63.4% respectively at 8 weeks of age while it was 63.6 & 64.6% at 10 weeks of age.

Ready-to-cook yield of ducks at 0-h deprivation either at 8 or 10 weeks was significantly lower ($P<0.05$), and at 10 weeks of age, ducks had the lowest value (62.2%) than other treatments (Table 2). The average ready-to cook yield of ducks on feed and total deprivation was 69.6 & 68.6% respecively at 8 weeks of age, while it was 68.7 & 68.9% at 10 weeks of age. *SCOTT et al. (1978)* stated a 1.5% yield difference between 6-h and 14-h total deprivation treatments in broilers. In the present study 0.9 & 0.2 differences were observed between yield of 6-h and 18-h total deprivation treatment at 8 & 10 weeks of age respectively, this may be attributed to the species difference.

The water uptake increased gradually as the time of feed deprivation increased at 8 weeks of age (Table 2). However, for total deprivation at 8 weeks of age and feed & total deprivation at 10 weeks of age, the water uptake was slightly increased at 6h and 12-h then dropped at 18-h. *SALMON (1979)* found that water uptake was not influenced by feed withdrawal or total withdrawal treatment of 12 and 24h in medium white turkeys. In broilers, there was also no drop in water uptake after 18-h withdrawal *(MAY and BRUNSON, 1955; BRUMSON, 1957; SMIDT et al., 1964; WABECK, 1972; MURRHY and GOOWIN, 1978 and SCOTT et al., 1978).*

Table 3 presents the comparison between ducks at the 8 & 10 weeks age regarding processing weight and yields at the different deprivation treatments. Farm weights recorded just prior to treatments were significantly higher at the age of 10 weeks. This high increase in farm weights was reflected on the other estimated weights so that slaughter weight, eviscerated weight and chilled weight were significantly higher at 10 weeks of age than at 8 weeks of age.

Deprivation shrinkage was significantly high ($P<0.05$) at 10 weeks of age in all treatments, which at 6 & 18-h total deprivation and at 12-h feed deprivation ($P<0.01$).

Respecting eviscerated yield and ready-to-cook yield, there were no significant differences between ducks at either 8 or 10 weeks of age. Water uptake was significantly low at 10 weeks of age except at 12-h feed deprivation.

The cooking losses of dufcks subjected to varying periods of feed or feed and water deprivation at 8 & 10 weeks of age are presented in Table 4. Precook weights (chilled weight) and cooked weight showed non significant differences among the seven groups either at the age of 8 or 10 weeks. Cooking loss as a percentage based on precook weight showed significant difference ($P<0.05$) at 8 & 10 weeks of age (Table 4). The 0-h deprivation had the highest losses (34 & 35.5%) at 8 & 10 weeks of age respectively, while the lowest losses were observed at the 18-h total deprivation (30.1 & 31.8%). Ducks in feed deprivation treatments experienced 32.7 & 33.7% average cooking loss at 8 & 10 weeks of age respectively, while the average cooking losses of ducks in total deprivation were 30.8 and 33% respectively. These findings were not in agree ment with those recorded by *NGOKA* et al. *(1982)* who found that feed withdrawal for 15h did not affect the cooking loss in turkey.

A significant difference ($P<0.05$) was observed in the percentage of loss based on slaughter weights (Table 4). The 0-h deprivation had the highest loss (56 & 56.9%) at both 8 & 10 weeks of age, while the 18-h total deprivation treatments had the lowest loss either at 8 or 10 weeks of age (51.8 & 53.2% respectively). With the exception of loss in the 0-h deprivation treatment, at both ages, the other treatments have no significant differences.

Regarding total loss percentage based on farm weight, at 8 weeks of age, the 12-h feed deprivation treatment had the lowest loss (53.8%), while the other treatments were not significantly differ. At 10 weeks of age, the 12-h total deprivation treatment had the lowest loss among the treatment (55.6 %).

Tables 5 illustrates the comparison between ducks at the age of 8 & 10 weeks regarding processing weights and yields at the different deprivation treatments. Precook and cooked weights were significantly higher at 10 than 8 weeks of age. This may be a reflection to the higher farm weight of ducks at 10 weeks of age. Cooking loss revealed no significant differences between the treatments at 8 & 10 weeks of age except in the 6-h total deprivation treatment where the cooking loss was significantly higher at the age of 10 weeks. No significant difference was observed between the two ages among the treatments. The same was true in case of total losses except the 12h fed deprivation treatments had significant increase at 10 weeks of age. *NGOKA et al. (1982)* found that the age did not affect the cooking loss percentage in turkey when processed at 16 and 20 weeks of age, a matter which is in accordance with the present study.

Table 6 shows the meat analysis of duks subjected to varying hours of feed or feed and water deprivation. Moisture, protein and ash contents of the meat revealed no significant differences among the treatments, the same for fat content at 8 weeks of age. *KAMUS and FARR (1980)* found a decrease in muscle moisture with increasing hours of withdrawal in broilers, also *NGOKA et al. (1982)* found that feed withdrawal affect significantly the moisture content in muscles of turkey but this was not observed in the present study, this may be due to species difference. The fat percentage at 10 weeks of age had the hgihest value in the 0-h deprivation treatment (1.46%) while it lowered significantly ($P<0.05$) at the 18-h total deprivation (1.26%). It was also observed that fat content in muscles of the ducks decreased with increasing the time of deprivation. *NGOKA et al. (1982)* mentioned that feed withdrawal periods of 15h did not influence protein, fat or the contents of turkey muscles.

The comparison between ducks at the 8 and 10 weeks of age, regarding meat analysis at different deprivation treatments, is presented in Table 7. No significant differences were found between ducks at 8 & 10 weeks of age concerning either muscle content of moisture, protein or ash. However, fat content at 10 weeks of age was signficantly high along all treatments than at 8 weeks of age, which indicate that the fat content increased with increasing age. This in agreement with *NGOKA et al. (1982)* who reported that the fat content of turkey muscles increased significantly ($P<0.01$) with advancing age. *ALLAM (1985)* also mentioned that the body gain in ducks became more fatty after the 8 week of age.

The average daily feed intake, weight gain and feed conversion of ducks during the 9 week of age are presented in Table 8. This table reveals that the ducks consumed 9.2 & 9.9Kg feed per Kg gained during the 9^{th} and 10^{th} week respectively, *KRAVCENKO (1971)* mentioned that the amount of feed consumed by meat type ducks ranged from 3.26 to 3.4 Kg per Kg during the first 8 weeks of life. Similar results were obtained by *IBRAHIM (1990)* who reported that pekin ducks consumed 3.2-3.8 Kg feed per Kg gain. Therefore, it is clear that the feed conversion becomes very low after the 8 week of life and the rearing of ducks after this time is very expensive.

In conclusion, it is considered desirable to starve ducks perior to slaughter to empty their digestive tracts and the ducks industry will have greater flexibility in terms of feed and water deprivation without influencing the final quality of ducks meat specially when it is not more than 12h. The low feed conversion after the 8 week of life makes rearing of ducks after this time non economical.

REFERENCES

Allam, S. (1985): The Domestic Birds and Rabbits. 4 Ed. Anglo Egyptian Lib. Cairo (Arabic text book).

A.O.A.C. (1980): Official Methods of Analysis. 13 ed. Association of Official Analytical Chemists, Washington, DC.

Benoff, F.H. (1982): The "live-shrink" trap: Catch weights a must. Broiler Ind. 14(1): 56- 60.

Brunson, C.C. (1957): Effect of length of fasting period with subsequent ice-chilling on eviscerated yield and moisture content of broiler carcasses. Poultry Sci, 36:1107(Abstr).

Cochran, W.G. and Cox, G.M. (1986): Experimental Designs 2ed., John Wiley and Sons Inc, New York.

Farr, A.J. (1979): The broiler's last 49 hours: Feed withdrawl time can affect weight, Shrink, dreassed yield and contamination upon slaughter. Poult. Dig. 38: 638-639.

Ibrahim, M.T. (1990): Comparative performance of white pekin ducklings reared under two systems of housing. Fourth Sci. Cong. Fac. Vet. Med., Assiut Univ.

Kamus, N.L. and Farr, A.J. (1981): Withdrawal and haul effects on moisture uptake, retention and intestinal scores. Poultry Sci. 60: 1604 (abstr).

Kravecnko, S.I. (1971): Animal protein requirements for fattening ducks. Trudy Har'kov: Sef'skohoz. Inst., 91 (128), 45-50.

Marion, W.W.; Jungk, R.A.; Hotchkiss, D.K.; Berg, R.W. and Hamre, M.L. (1968): Class, weight and method of chilling influences on water absorption by turkeys. Food Technology. Champaign, 22: 1319-1322.

May, K.N. and Brunson, C.C. (1955): Effect of length of starvation period on eviscerated yield of broilers. Poultry Sci. 34: 1210 (Abstr.).

Moran, E.T.; Orr, H.L. and Larmond, E. (1970): Production efficiency, grades and yields with the large white Trukey as related to sex and age. Poultry Sci. 49: 475-493.

Moran, E.T; Orr, H.L. and Larmond, E. (1971): Sex and age related production efficiency, grades and yields with the small white broiler-fryer type turkey. Poultry Sci. 50: 411-425.

Murphy, B.D. and Goodwin, T.L. (1978): Effect of food and water withdrawal from broilers on weight loss and carcass yields. Arkansan Farns Res. 27(5): 9.

Ngoka, D.A.; Froning, G.W.; Lowry, S.R. and Bobji, A.S. (1982): Effects of sex, age, preslaughter factors and holding conditions on the quality and chemical composition of turkey breast muscles. Poultry Sci. 61: 1996-2230.

NRC (1984): Nutrient Requirements of Poultry. 8 ed. Natl. Acad. Press. Washington, D.C.

Salmon, R.E. (1979): Effect of food and water deprivation on live-weight shrinkage, eviscerated carcass yield and water absorption during chilling of turkey carcasses. Br. Poult. Sci. 20: 303-306.

Scott, T.R.; Kamus, N.L.; Farr, A.J. and Johnson, W.A. (1978): Study on simultaneous and staggered feed and water withdrawal schedules on processing factors. Poultry Sci. 57: 1161 (Abstr).

Smidt, M.J.; Formica, S.D. and Fritz, J.C. (1964): Effect of fasting prior to slaughter on yield of broilers. Poultry Sci. 43: 931-934.

Wabeck, C.J. (1972): Feed and water withdrawal time relationship to processing yields and potential fecal contamination in broilers. Poultry Sci. 51: 1119-1121.

Table 1: Physical Composition of the diets used

Ingredient	Starter	Finisher
Yellow corn, ground	62.0	76.0
Soybean meal (44%)	25.3	8.0
Broiler concentrate*	10.0	10.0
Wheat bran	2.4	5.7
Limestone	0.3	0.3
Add. kg/ton		
DL-Methionine	0.2	0.2
Lysine	2.3	2.15
Common salt	2.3	2.3
Calculated protein %	22.2	16.3

(*) Composed in percentages of: meat meal (55%)60; fish meal (65%)30; Ca carbonate3; dicalcium phosphate 2.5; vit. & mineral mixutre 2; sodium chloride 1.3 and DL. methionine 1.2 (From Loohmann Tierernahrung GMBH, Germany).

Table 2: Processing weights, and yields of ducks subjected to varying periods of feed or feed and water deprivation at 8 & 10 weeks of age.

Deprivation treatment	Farm Weight		Slaughter Weight		Eviscerated weight		Chilled weight		Deprivation shrinkage[1]		Eviscerated yield[2]		Ready-to-cook yield[3]		Water uptake[4]	
	8	10	8	10	8	10	8	10	8	10	8	10	8	10	8	10
	g	g	g	g	g	g	g	g	%	%	%	%	%	%	%	%
(0-h)	2051.4	2321.6	2051.6	2285.0	1265.9	1422.9	1367.8	1527.3	0[a]	0[a]	61.6[a]	62.2[a]	66.5[a]	66.7[a]	8[ab]	7.4[b]
6-h (A)[5]	2114.4	2377.2	2041.1	2277.2	1307.6	1444.4	1411 9	1545.0	3.4[b]	4.1[b]	63.9[b]	63.4[a]	69.2[bc]	67.7[a]	8.1[ab]	7.1[b]
6-h (B)[6]	2100.4	2393.0	2030.7	2288.9	1285.0	1469.8	1383.7	1576.5	3.3[b]	4.3[b]	63.2[b]	64.1[b]	68.0[b]	68.8[b]	7.8[ab]	7.2[b]
12-h (A)	2046.1	2367.2	1968.0	2214.7	1264.2	1405.3	1371.3	1523.3	3.7[b]	6.3[c]	64.0[b]	63.3[a]	69.5[c]	68.6[b]	8.4[bc]	8.5[c]
12-h (B)	2091.7	2315.7	1976.7	2206.9	1250.3	1421.0	1364.3	1531.2	5.4[c]	4.7[b]	63.1[b]	64.3[b]	69.0[bc]	69.3[b]	9.0[cd]	7.7[b]
18-h (A)	2109.2	2387.1	1975.9	2216.2	1269.4	1426.8	1385.7	1547.0	6.3[d]	7.1[d]	64.2[b]	64.2[b]	70.0[c]	69.7[b]	9.1[d]	8.4[c]
18-h (B)	2086.4	2361.3	1947.1	2183.5	1246.8	1426.5	1343.1	1500.0	6.6[d]	7.4[d]	63.9[b]	65.3[b]	68.9[bc]	68.6[b]	7.6[a]	5.1[a]

[ad] Means within a column with no common superscripts differ significantly ($P < 0.05$).

1 (Farm weight - slaughter weight/farm weight) x 100

2 (Eviscerated weight/slaughter weight) x 100

3 (Chilled weight/slaughter weight) x 100

4 (Chilled weight - eviscerated weight/eviscerated weight) x 100

5 Feed deprivation

6 Feed and water deprivation

Table 3: Comparison between ducks at 8 & 10 weeks of age regarding processing weights and yields at the different deprivation treatments.

Deprivation treatment	Farm Weight		Slaughter Weight		Eviscerated weight		Chilled wight		Deprivation shrinkage[1]		Eviscerated yield[2]		Ready-to-cook yield[3]		Water uptake[4]	
	8	10	8	10	8	10	8	10	8	10	8	10	8	10	8	10
	g	g	g	g	g	g	g	g	%	%	%	%	%	%	%	%
(0-h)	2051.4	2321.6**	2051.6	2285.0*	1265.9	1422.9*	1367.8	1527.3*	0	0	61.6	62.2	66.5	66.7	8	7.4*
6-h (A)[5]	2114.4	2377.2**	2041.1	2277.2*	1307.6	1444.4*	1411.9	1545.0*	3.4	4.1	63.9	63.4	69.2	67.7	8.1	7.1**
6-h (B)[6]	2100.4	2393.0**	2030.7	2288.9**	1285.0	1469.8**	1383.7	1576.5*	3.3	4.3*	63.2	64.1	68.0	68.8	7.8	7.2*
12-h (A)	2046.1	2367.2**	1968.0	2214.7**	1264.2	1405.3*	1371.3	1523.3*	3.7	6.3**	64.0	63.3	69.5	68.6	8.4	8.5
12-h (B)	2091.7	2315.7*	1976.7	2206.9*	1250.3	1421.0*	1364.3	1531.2*	5.4	4.7	63.1	64.3	69.0	69.3	9.0	7.7**
18-h (A)	2109.2	2387.1**	1975.9	2216.2*	1269.4	1426.8*	1385.7	1547.0*	6.3	7.1	64.2	64.2	70.0	69.7	9.1	8.4*
18-h (B)	2086.4	2361.3**	1947.1	2183.5*	1246.8	1426.5*	1343.1	1500.0*	6.6	7.4*	63.9	65.3	68.9	68.6	7.6	5.1**

** Highly significant ($P < 0.01$)

* Significant ($P < 0.05$)

Table 4: Cooking losses of ducks subjected to varying hours of feed or feed and water deprivation at 8 & 10 weeks of age.

Deprivation treatment	Precook weight+		Cooked weight		Cooking loss[1]		Loss[2]		Total loss[3]	
	8	10	8	10	8	10	8	10	8	10
	g	g	g	g	g	g	g	g	%	%
(0-h)	1367.8	1527.3	904.5	986.1	34.0^{c}	35.5^{c}	56.0^{b}	56.9^{b}	56.0^{b}	57.6^{bc}
6-h (A)[4]	1411.9	1545.0	947.9	1031.7	33.0^{bc}	33.3^{abc}	53.7^{a}	54.8^{ab}	55.2^{ab}	56.7^{abc}
6-h (B)[5]	1383.7	1576.5	946.3	1033.5	31.5^{abc}	34.3^{abc}	53.5^{a}	54.7^{a}	55.0^{ab}	56.9^{abc}
12-h (A)	1371.3	1523.3	944.7	1026.5	31.1^{ab}	32.5^{a}	52.1^{a}	53.8^{a}	53.8^{a}	56.6^{abc}
12-h (B)	1364.3	1531.2	941.4	1030.0	30.9^{ab}	32.8^{ab}	52.5^{a}	53.3^{a}	55.1^{ab}	55.6^{a}
18-h (A)	1385.7	1547.8	917.3	1000.2	33.9^{c}	35.3^{bc}	53.6^{a}	55.0^{ab}	56.6^{b}	58.1^{c}
18-h (B)	1343.1	1500.0	939.9	1024.7	30.1^{a}	31.8^{a}	51.8^{a}	53.2^{a}	55.1^{ab}	56.7^{abc}

a-c Means within a column with no common superscripts differ significantly ($P < 0.05$)

1 Cooking loss = 1 - (Cooked weight/precook weight) x 100

2 Loss = 1 - (Cooked weight/slaughter weight) x 100

3 Total loss = 1 - (Cooked weight/farm weight) x 100

4 Feed deprivation

5 Feed and water deprivation

\+ Chilled weight

Table 5: Comparison between ducks at 8 & 10 weeks of age regarding processing weights and yields at the different deprivation treatments.

Deprivation treatment	Precook weight[+]		Cooked weight		Cooking loss[1]		Loss[2]		Total loss[3]	
	8	10	8	10	8	10	8	10	8	10
	g	g	g	g	%	%	%	%	%	%
(0-h)	1367.8	1527.3*	904.5	986.1*	34.0	35.5	56.0	56.9	56.0	57.6
6-h (A)[4]	1411.9	1545.0*	947.9	1031.7*	33.0	33.3	53.7	54.8	55.2	56.7
6-h (B)[5]	1383.7	1576.5*	946.3	1033.5*	31.5	34.3*	53.5	54.7	55.0	56.9
12-h (A)	1371.3	1523.3*	944.7	1026.5*	31.1	32.5	52.1	53.8	53.8	56.6*
12-h (B)	1364.3	1531.2*	941.4	1030.0	30.9	32.8	52.5	53.3	55.1	55.6
18-h (A)	1385.7	1547.8*	917.3	1000.2*	33.9	35.3	53.6	55.0	56.6	58.1
18-h (B)	1343.1	1500.0*	939.9	1024.7*	30.1	31.8	51.8	53.2	55.1	56.7

* Significant ($P < 0.05$)

Table 6: Meat analysis of ducks subjected to varying hours of feed or feed and water deprivation at 8 & 10 weeks of age.

Deprivation treatment	Moisture (%)		Protein (%)		Fat (%)		Ash (%)	
	8	10	8	10	8	10	8	10
(0-h)	73.85[a]	73.61[a]	24.02[a]	23.89[a]	1.04[a]	1.46[c]	1.03[a]	0.98[a]
6-h (A)[1]	74.22[a]	74.00[a]	23.93[a]	23.83[a]	1.02[a]	1.44[bc]	0.95[a]	0.90[a]
6-h (B)[2]	73.81[a]	73.62[a]	23.83[a]	23.80[a]	1.01[a]	1.45[c]	0.94[a]	0.90[a]
12-h (A)	73.53[a]	73.32[a]	24.01[a]	23.69[a]	1.02[a]	1.36[abc]	1.01[a]	0.98[a]
12-h (B)	73.50[a]	73.28[a]	23.90[a]	23.78[a]	0.99[a]	1.32[ab]	1.00[a]	0.97[a]
18-h (A)	73.37[a]	73.15[a]	23.81[a]	23.81[a]	1.01[a]	1.31[a]	0.98[a]	0.95[a]
18-h (B)	73.20[a]	72.99[a]	23.84[a]	23.78[a]	0.97[a]	1.26[a]	1.04[a]	1.00[a]

[a-c] Means within a column with no common superscripts differ significantly ($P < 0.05$)

[1] Feed deprivation

[2] Feed and water deprivation

Table 7: Comparison between ducks at 8 & 10 weeks of age regarding meat analysis at the different deprivation treatments.

Deprivation treatment	Moisture (%)		Protein (%)		Fat (%)		Ash (%)	
	8	10	8	10	8	10	8	10
(0-h)	73.85	73.61	24.02	23.89	1.04	1.46**	1.03	0.98
6-h (A)[1]	74.22	74.00	23.93	23.83	1.02	1.44**	0.95	0.90
6-h (B)[2]	73.81	73.62	23.83	23.80	1.01	1.45**	0.94	0.90
12-h (A)	73.53	73.32	24.01	23.69	1.02	1.36**	1.01	0.98
12-h (B)	73.50	73.28	23.90	23.78	0.99	1.32**	1.00	0.97
18-h (A)	73.37	73.15	23.81	23.81	1.01	1.31**	0.98	0.95
18-h (B)	73.20	72.99	23.84	23.78	0.97	1.26**	1.04	1.00

** Highly significant ($P < 0.01$)

[1] Feed deprivation

[2] Feed and water deprivation

Table 8: The average daily feed, intake, weight gain and feed conversion of ducks during the 9th & 10th week of age.

Week	Feed intake g/bird/day	Av. weight gain (g)	Feed conversion g feed/g gain
9	180.1	136.4	9.2
10	183.2	129.0	9.9