ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

International Journal of Poultry Science 7 (12): 1185-1189, 2008
ISSN 1682-8356

Fear Behaviour, Ease of Capture and Performance Traits of Growing Meat Type Chickens

K. Ghareeb[1,2]* and J. Böhm[1]
[1]Institute of Nutrition, Department of Veterinary Public Health and Food Science, University of Veterinary Medicine, Veterinärplatz 1, A-1210 Vienna, Austria
[2]Department of Animal Behaviour and Management, Faculty of Veterinary Medicine, South Valley University, Qena, Egypt

Abstract: The damaging effects of fear on a number of performance indicators in poultry and other farm animals are becoming increasingly recognized. Indeed, there is a growing evidence for the negative association between growth and fearfulness (an underlying behavioural characteristic). The present study examined the putative relationship between fearfulness and body weight in growing broiler chickens at age of harvesting (35-42 days old). As fearfulness is particularly influential trait in domesticated species, the finding that such trait respond to artificial selection may have important implications for poultry welfare and performance. However, it is not known how fearfulness and growth influenced human-animal interactions. The present experiment investigated also the influence of fearfulness and live body weight of broilers on the ease with which birds could be caught and handled. Furthermore, due to increasing the price of cereal grains in the last two years, it become necessary to evaluate the body weight gain and feed conversion efficiency at earlier age of growing period (5 wk) and comparing data from normal harvesting age in Europe (6 wk). The results showed a significant correlation between fearfulness and human animal interactions. Indeed, the duration of tonic immobility was higher for the birds captured first (rank 1) compared with birds captured afterwards (rank 2). This indicates that birds captured firstly were more fearful than birds afterwards. Moreover, the ease of capture rank was negatively correlated with the duration of tonic immobility at week 5 (-.364) and with the number of tonic immobility inductions at week 6 (-.238). This suggests that more fearful birds (birds had longer tonic immobility duration and higher number of tonic immobility inductions) were captured more easily than less fearful ones. Interestingly, body weight had a significantly negative correlation with the number of inductions required to induce tonic immobility reaction at week 6 (-.415, $p < 0.05$). This may indicate that heavier birds were less fearful (required less number of induction trials to induce tonic immobility) than lighter birds. Furthermore, the body weight gain was higher at week 5 (628±29g) than at week 6 (585±40g). The feed intake and feed conversion rate were lower at week 5 (985g and 1.57, respectively) than at week 6 (1075g and 1.84, respectively). This indicates that harvesting of growing broilers at week 5 is better for the broiler producers in the term of the economic costs especially after the elevation of prices of cereal grains during the last two years. Finally, there was no significant effect of age on either the tonic immobility duration or number of inductions required to induce tonic immobility reaction ($p > 0.05$).

Key words: Fear behaviour, performance, ease of capture

INTRODUCTION

Welfare and productivity of growing broilers at time of harvesting (35-42 d) received a great attention nowadays. The higher body weight gain and less feed consumption are the main goals of broiler farmers especially after the higher prices of cereal grains in the last two years. From the other hand, welfare of broilers and decreasing the levels of fearfulness of birds are the largest interests of poultry welfare scientists and behaviourists. Intense and prolonged fear can seriously jeopardize the performance as well as the welfare of poultry. Indeed, there is a mounting evidence that fear behaviour (which may lead to tramping, clawing and smothering) and fearfulness (propensity to be easily frightened by diverse alarming stimuli) are negatively associated with a number of performance indicators in poultry including growth, food conversion efficiency, egg production and product quality (Jones, 1996). In this study we focus on the putative relationship between fear and growth performance in broilers. A number of previous studies have reported that panic and hysteria are often associated with reduced growth rates (Mills and Faure, 1990), exposure to frightening events depresses weight gain in chicks (McFarlance *et al.*, 1989), medium-hybird laying hens characterized as fearful have lower body weights than less fearful ones (Bessei, 1984) and regular handling not only reduces fear of chickens from humans but also improves their growth rates (Thompson, 1976, Jones and Hughes, 1981, Gross and Siegel, 1982). Moreover, in quail, a line

selected for high body weight showed shorter tonic immobility duration (low fear) than a line selected for low body weight (Jones *et al*., 1997). Similarly, fear is increased following bidirectional selection of laying chickens for low rather than high body weight at 8 weeks of age (Mauldin and Siegel, 1979). Furthermore, a line of Japanese quail selected for an exaggerated plasma corticosterone response to an immobilization stressor is accompanied not only by increased fearfulness but also by stunted growth (Satterlee and Johnson, 1988; Jones *et al*., 1992; 1994a; Jones, 1996).

It was shown that fear as measured by tonic immobility duration was decreased with increasing the age of chicks when the chicks were repeatedly tested (Ratner and Thompson, 1960). Similarly, Hill *et al*. (1994) reported that older chicks (10 days) remained immobile significantly longer than younger chicks (3 days). However, fear levels of growing boilers at time of harvesting (5 and 6 weeks old) were not investigated yet. Such data on fear level at those ages are important to investigate the relation between growth and fearfulness. Moreover, at time of broiler harvesting, birds are subjected to capture and handling before transport to the slaughter houses. Manual handling is, in itself, frightening to the birds (Scott and Moran, 1992, 1993a, b) and converted handling of broilers increased the level of fearfulness compared with upright handling (Zulkifli *et al*., 2000). On contrast, Duncan (1989) concluded that handling per se which is stressful and not the rough manner in which it is carried out. Furthermore, low fearful birds characterized by greater ease of capture in quails (Mills and Faure, 2000). However, the effect of ease of capture of broilers on fear levels as indicated by tonic immobility was not studied yet. Therefore, the present study was conducted to investigate the effect of age, body weight and ease of capture on fearfulness of broilers at time of harvesting. In addition, the productive performance traits (weight gain and feed conversion rate) were compared at harvesting age (5 and 6 weeks).

MATERIALS AND METHODS

Animal, housing and diets: Ninty, 1-d-old (males and females) broiler chicks of a commercial strain (Ross 308) were reared in floor pens of a deep litter system at the Research farm of the Veterinary Medicine University of Vienna. Chicks were fed a starter diets from d 1-13 and grower diets from d 14-42 (Table 1) based on wheat, soya meal, maize, rapeseed oil and a premix with vitamins, minerals, amino acids, salt and dicalcium phosphate.

The chicks were initially maintained at 35°C; the temperature was gradually lowered by 2°C/wk to 25°C by the end of wk 5 and this temperature was maintained for the duration of the experiment. During the first two weeks, continuous lighting was provided after which the duration of light was decreased gradually (2 h daily) to 20 hours by the wk 3, which was maintained throughout the experiment. Feed and water were provided *ad libitum*.

Table 1: Composition of the experimental diet (%)

Ingredient	Starter	Grower
Wheat	39.25	38.00
Soybean meal 48	29.00	27.00
Maize	20.00	22.65
Rape seed oil	6.25	7.00
Dicalcium-phosphate	0.58	0.70
Lysine	0.26	0.15
Methionin	0.28	0.25
Premix[a]	4.38	4.25
Calculated composition[b]		
Crude protein	21.13	20.13
ME (MJ/kg)	12.69	12.95
Lys	1.34	1.19
Met	0.80	0.75
Ca	1.01	1.00
P	0.71	0.71
Na	0.12	0.12
Analyzed composition[c]		
Crude protein	25.51	25.09
Starch	2.55	52. 74
Sugar	49.01	2.52
Lys	1.24	1.09
Met	0. 86	0.84
Ca	1.29	1.24
P	0.89	0.92
Na	0.38	0.36

[a]Provided per kg: 185g Calcium; 58g Phosphorus; 50g, Methionin; 25g Sodium; 250000IU Vit A; 82500IU Vit D3;826mg Vit E; 50mg Vit B1; 225mg Vit B2; 75mg Vit B6; 825mg Vit B12; 37mg Vit K3; 12500mg Cholinchloride; 1000mg Nicotinic acid; 245mg Ca-Pantothonate; 25mg Folic acid; 1240mg, Biotin; 1500mg Iron; 500mg Copper; 1750mg Manganese; 1250mg Zinc; 32mg, Iodine; 5mg Cobalt; 6mg Selenium. [b]Based on a dry matter content of 88%, [c]Based on a dry matter content of 91%.

Growth performance traits: Body weight and feed consumption. Chicks were weighed individually and the feed consumption was measured weekly during the 6-wk experiment. Cumulative weight gain and feed consumption were determined, whereas weekly and cumulative feed conversion rates were calculated.

Behavioural measurement of fearfulness:

Tonic immobility (TI) reaction: TI reaction was carried out in a separate room having the same conditions as the bird room. Birds were out of auditory and visual contact with the other birds. TI is induced by manual restraint. The bird was placed on its back in a U shaped cradle covered with cloth. The bird was then restrained with one hand on it's sternum for 45 seconds while holding the head and neck by the other hand. Towards the end of the induction period, hand pressure was gradually lifted so that if the chick still moved, another induction period was started immediately, until the movement ceased. After removal of the hands, a stop

watch was started. The experimenter then retreated, moving out of sight of the bird and observed the behaviour of the bird. The number of induction trials to attain tonic immobility lasting a least for 20 seconds the duration of tonic immobility reaction, that is, the latency until self righting. If the bird righted in less than 20 seconds, it was considered that tonic immobility had not been induced and the restraint procedure was repeated. Conversely, if a bird did not show a righting response over the 10 min test period, a maximum score of 600 seconds was given for duration.

At 5 wk old, 20 birds were tested individually for the duration of tonic immobility reaction. These birds were individually identified with a blue dye on the wing feather and returned back. At 6 wk old the TI test was repeated using another 20 birds to evaluate the effect of age on the level of fearfulness of the birds. All the birds subjected for the test were individually weighed to test the correlation between fearfulness and body weight of birds. Furthermore, the rank of ease of capture of the birds were recorded (the 10 birds that were captured firstly given rank 1 and the 10 birds that captured afterwards given rank 2) to investigate the effect of ease of capture on fearfulness of broilers at harvesting ages (5-6 weeks).

Statistical analysis: Statistic SPSS[6] program version 15.0 was used for data analysis. Kolmogorov Smirnov test was used to test the normal distribution of the data. Results are given as means±SEM. T test of independent samples was used to investigate the effects of both age and ease of capture rank on tonic immobility duration. Pearson correlation coefficient was used to evaluate the relationship between body weight, tonic immobility duration, number of tonic immobility inductions and rank of ease of capture. Statements of statistical significance were based on $p = 0.05$.

RESULTS

Growth performance traits: The weekly body weight, feed intake, body weight and feed conversion rate are presented in Table 2.The body weight gain was higher at week 5 (628±29g) than at week 6 (585±40g). Furthermore, the feed intake was lower at week 5 (985g) than at week 6 (1075g). In addition, the feed conversion rate was lower at 5 weeks old (1.57) than at 6 weeks old (1.84).

Fearfulness and capture rank: Tonic immobility duration had a significant tendency regarding the rank of ease of capture ($p < 0.1$, Table 3) at week 5. The duration of tonic immobility was higher for the birds captured first (rank 1) compared with birds captured afterwards (rank 2). This indicates that birds captured firstly were more fearful than birds afterwards. However, there was no significant effect of capture rank on fearfulness of broilers at week 6 ($p > 0.05$, Table 3).

Influence of age on fearfulness of growing broilers: There was no significant effect of age on either the tonic immobility duration or number of inductions required to induce tonic immobility reaction ($p > 0.05$, Table 4). However, the duration of tonic immobility was numerically longer at week 5 (311 seconds) compared with week 6 (214 seconds).

Correlation between behavioural measurements: There was a significant positive correlation between the duration of tonic immobility and the number of inductions required to obtain tonic immobility reaction at week 6 (0.381, $p < 0.05$, Table 6). This indicates that more fearful required more induction trials to attain tonic immobility reaction. Moreover, the duration of tonic immobility was negatively correlated with the ease of capture rank at week 5 (-0.364, $p < 0.05$, Table 5). This suggests that more fearful birds (longer tonic immobility duration) were captured more easily than less fearful ones. Interestingly, the number to tonic immobility inductions showed a moderate negative correlation with rank of ease of capture at week 6 (-0.238, Table 6) which indicates also that more fearful birds (higher number of tonic immobility inductions) were captured easily and firstly.

Correlation between body weight and behavioural measurements: There was no significant correlation between body weight and tonic immobility duration either at week 5 or week 6 (Table 5, 6). However, body weight had a significantly negative correlation with the number of inductions required to induce tonic immobility reaction at week 6 (-.415, $p < 0.05$, Table 6). This may indicate that heaver birds required less number of induction trials to induce tonic immobility (were less fearful) than lighter birds. Furthermore, no significant correlation was detected between body weight and rank of capture either at week 5 or week 6 (Table 5, 6).

DISCUSSION

Fear is now widely regarded as an undesirable state of suffering by many members of the public, the scientific community, welfare and policy groups, as well as by a growing number of farmers. Fear is often adaptive in ideal circumstances (Jones, 1996) but neither we nor the animals in our care live in an ideal world. In reality, many farming systems prevent the animals from responding in an adaptive fashion to potentially threatening stimuli. In these circumstances, fear can be a powerful and potentially damaging stressor, particularly if it is intense or persistent. As fearfulness is particularly influential trait in domesticated species, the finding that such trait respond to artificial selection may have important implications for poultry welfare and performance. However, it is not known how fearfulness and growth influenced human-animal interactions.

Table 2: Growth performance traits of experimental birds

Age	Body weight (g/bird)	Body weight gain(g/week)	Feed intake (g/bird/week)	Feed conversion rates
Week 1	87±2	52±2	96	1.88
Week 2	279±6	194±6	367	1.91
Week 3	627±10	345±11	453	1.31
Week 4	1138±15	511±18	878	1.71
Week 5	1768±23	628±29	985	1.57
Week 6	2351±31	585±40	1075	1.84

Results are presented as means±SEM.

Table 3: Effect of ease of capture on fearfulness of growing broiler chickens as indicated by tonic immobility reaction

	Ease of capture rank		
Behavioural measurements	1	2	P
A) At week 5:			
Tonic immobility duration	408±89	214±54	0.080
Number of TI inductions	1.30±0.15	1.50±0.22	0.470
B) At week 6:			
Tonic immobility duration	279±70	280±80	0.997
Number of TI inductions	1.60±0.30	1.20±0.13	0.246

Results are presented in means±SEM, $p < 0.05$ is significant (T-test of independent samples).

Table 4: Influence of age on fearfulness of growing broiler chickens as indicated by tonic immobility reaction

	Age (weeks)		
Tonic immobility reaction	5	6	P
Tonic immobility duration	311±55	214±54	0.673
Number of TI inductions	1.4±0.13	1.4±0.17	9.999

Results are presented in means±SEM, $p < 0.05$ is significant (t-test of independent samples).

Therefore, the present experiment investigated the influence of fearfulness and live body weight of broilers on the ease with which birds could be caught and handled.

The results reported in the present study showed a significant impact of human-animal interaction on fearfulness of broiler chickens. Indeed, the underling level of bird's fearfulness (the duration of tonic immobility) was negatively correlated with the ease of capture rank. This means that the greater ease of capture of birds was associated with their low level fearfulness. This greater ease of capture of low fear birds than high fear birds may be explained by reduced fear of humans. Similarly, Mills and Faure (2000) reported in Japanese quail that birds selected for low fear based on tonic immobility reaction had greater ease of capture than birds selected for high fear.However, a line of Japanese quails selected for high stress based on adrenocortical response to immobilization did not differ from a line selected for low stress in their ease of capture (Satterlee and Jones, 1997).

It was shown that whatever the species of animal or type of husbandry system, interactions between humans and animals are of importance with respect to both production traits and welfare. For example, in poultry, aversive manipulation during harvesting and transport prior to slaughter can lead to stress and consequent falls in meat quality (Duncan *et al*., 1986; Remignon *et al*., 1998) and inappropriate fear reactions may lead to panic and the death of birds due to suffocation or trampling as hundred or even thousands of birds crowed in to the corners of the poultry house (Mills and Faure, 1990).

Moreover, there was no significant correlation was recorded in the present experiment between body weight of birds and their rank for ease of capture. The greater ease of capture was recorded in a line of quail selected for light body weight than a line selected for heaver body weight (Mills and Faure, 2000). It could be argued that any potentially greater difficulty in catching the lighter birds may have been offset by their elevated fear of humans (Jones *et al*., 1994b). However, the number of tonic immobility inductions was negatively correlated to their body weights. This indicates that lighter birds were more fearful than heavier ones. The results reported here showed also that, more fearful birds required more induction trials to attain tonic immobility reaction. The negative correlation between fearfulness and body weight reported here is in agreement with Jones *et al*. (1997) who found that quails of lighter body weight was more fearful than quails of heaver body weight. Moreover, medium-hybird laying hens characterized as fearful have lower body weights than less fearful ones (Bessei, 1984). In contrast, Mills and Faure (2000) reported that the birds of lighter body weight were less fearful than heaver ones.

As the birds grew older, their body weights were significantly increased due to the influence of age. However there was no significant effect of age on the fearfulness of broiler in growing period. In contrast, a number of previous studies in broilers had been reported that older birds were more fearful than younger ones (Ratner and Thompson, 1960; Hill *et al*., 1994).

Table 5: Correlation between body weight, ease of capture and tonic immobility measurements in growing broiler chickens at the age of 5 weeks

	TI duration	No. of TI inductions	Ease of capture
Number of TI inductions	0.137		
Ease of capture	-0.364*	0.135	
Body weight	0.089	-0.033	0.018

Pearson's Correlation Coefficient, *Correlation is significant ($p<0.05$).

Table 6: Correlation between body weight, ease of capture and tonic immobility measurements in growing broiler chickens at the age of 6 weeks

	TI duration	No. of TI inductions	Ease of capture
Number of TI inductions	0.381*		
Ease of capture	-0.017	-0.238	
Body weight	0.375	-0.415*	0.157

Pearson's Correlation Coefficient, *Correlation is significant ($p<0.05$).

In conclusion, the human animal interaction (the ease with which birds could be caught and handled) had a negative impact on fearfulness of growing meat type chickens.

REFERENCES

Bessei, W., 1984. Genetische Beziehungen zwischen Leistung, Befiederung and Scheu bei legehenen. Arch. Gefluegelk., 48: 231-239.

Duncan, I.J.H., G. Slee, P. Kettlewell, P. Berry and A.J. Carlisle, 1986. Comparison of the stressfulness of harvesting broiler chickens by machine and hand. Br. Poult. Sci., 27: 109-114.

Duncan, I.J.H., 1989. The assessment of welfare during handling and transport of broilers. In: J.M. Faure and A.D. Mills (Eds): Proceedings of the 3rd European Symposium on Poultry Welfare. World's Poult. Sci. Assoc., French Branch, pp: 93-107.

Gross, W.B. and P.B. Siegel, 1982. Socialization as a factor in resistance to disease, feed efficiency and response to antigen in chickens. Am. J. Vet. Res., 43: 2010-2012.

Hill, W.L., T.M. Fleming and E.M. Shrier, 1994. Tonic immobility and high intensity calls in a precocial chick as a function of age, diet and time of the day. Develop. Psychobiol., 27: 331-342.

Jones, R.B. and B.O. Hughes, 1981. Effects of regular handling on growth in male and female chicks of broiler and layer strains. Br. Poult. Sci., 22: 461-465.

Jones, R.B., 1996. Fear and adaptability in poultry: insights, implications and imperatives. World Poult. Sci. J., 52: 131-174.

Jones, R.B., A.D., Mills, J.M., Faure and J.B. Williams, 1994a. Restraint, fear and distress in Japanese quail genetically selected for long and short tonic immobility reactions. Physiol. Behav., 56: 529-534.

Jones, R.B., D.G. Satterlee and F.H. Ryder, 1992. Fear and distress in Japanese quail chicks of two lines genetically selected for low or high plasma corticosterone response to immobilization stress. Horm. Behav., 26: 393.

Jones, R.B., D.G. Satterlee and F.H. Ryder, 1994b. Fear-of humans in Japanese quail selected for low or high adrenocortical response. Physiol. Behav., 56: 379-383.

Jones, R.B., D.G. Satterlee and H.L. Marks, 1997. Fear-related behaviour in Japanese quail divergently selected for body weight. Appl. Anim. Behav. Sci., 52: 87-98.

Mauldin, J.M. and P.B. Siegel, 1979. "Fear", head shaking and production in five populations of caged chickens. Br. Poult. Sci., 20: 39-44.

McFarlance, J.M., S.E. Curtis, R.D. Shanks and S.G. Carmer. 1989. Multiple concurrent stressor in chicks. 1. Effect on weight gain, feed intake and behaviour. Poult. Sci., 68: 501-509.

Mills, A.D. and J.M. Faure, 2000. Ease of capture in lines of Japanese quails (Coturnix japonica) subjected to contrasting selection for fear or sociality. Appl. Anim. Behav. Sci., 69: 125-134.

Mills, A.D and J.M. Faure, 1990. Panic and hysteria in domestic fowl: a review. In: Zayan and R. Dantzer (Eds), Social stress in domestic animals, Kluwer Academic press, Dordrecht, pp: 248-272.

Ratner, S.C. and R.W. Thompson, 1960. Immobility reaction (fear) of domestic fowl as a function of age and prior experience. Anim. Behav., 8: 186-191.

Remignon, H., A.D. Mills, D. Guemene, V. Desroiers, M. Garreau-Mills, M. Marche and M.G. Marche, 1998. Meat quality traits and muscle parameters in high and low fear lines of Japanese quail (Coturnix japonica) subjected to acute stress. Br. Pout. Sci., 39: 372-378.

Satterlee, D.G. and R.B. Jones, 1997. Ease of capture in Japanese quail of two lines divergently selected for adrenocortical response to immobilization. Poult. Sci., 76: 469-471.

Satterlee, D.G. and W.A. Johnson, 1988. Selection of Japanese quail for contrasting blood corticosterone response to immobilization. Poult. Sci., 67: 25-32.

Scott, G.B. and P. Moran, 1992. Behavioural responses of laying hens to carriage on horizontal and inclined conveyorsAnim. Welf.,1: 269-277.

Scott, G.B. and P. Moran, 1993a. Fear levels in laying hens carried by hand and by mechanical conveyors. Appl. Anim. Behav. Sci., 36: 337-345.

Scott, G.B. and P. Moran, 1993b. Effect of visual stimuli and noise on fear levels in laying hens. Appl. Anim. Behav. Sci., 37: 321–329.

Thompson, C.I., 1976. Growth in the Hubbard broiler: increased size following early handling. Develop. Psychobio., 9: 459-464.

Zulkifli, I., M.T.C. Norma, C.H. Chong and T.C. Loh, 2000. Heterophil to lymphocyte ratio and tonic immobility reactions to preslaughter handling in broiler chickens treated with ascorbic acid. Poult. Sci., 79: 402-406.