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Fear and behavior of young pheasants reared with or without parent figure

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Abstract

Modern game birds rearing methods use mechanical incubators to hatch eggs and artificial brooders to intensively rear birds. However, the lack of parental care can have consequences on behavior and welfare of these birds affecting also survival after their release in the wild. In this study, we compared the response of 4-week-old young pheasants (brooded by a foster mother hen and artificially brooded) to two behavioral tests (duration of tonic immobility and response to aerial predator). Tonic immobility was significantly different between the two groups of birds indicating a higher level of fear in artificially brooded pheasants compared to brooded pheasants. Pheasants brooded by a foster hen showed a stronger response to aerial predator compared to artificially brooded pheasants. The foster hen seems to have a positive effect on pheasant chicks' behavior reducing the fear and improving the ability to perceive threats.

Keywords

Fear, anti-predator behavior, tonic immobility, foster mother hen

Introduction

The releasing of farm-reared pheasant (*Phasianus colchicus*) or other *phasianida* is a common practice in many Europeans countries mainly to restock the wild population for the purposes of recreational hunting, but also to restocking threatened (endangered) populations or to reintroducing local extinct populations.[1] Nevertheless, the success of these practices is useful to provide additional birds for shooting in the winter, but it is critical for creating a self-sustaining population of wild game birds due to the low survival rate and low reproductive success of intensive farm-reared birds.[2–5] In addition, the annual efficiency by which releasing captive reared pheasants increased the numbers of shot birds declined from 50% to under 35% in the last decades in Britain.[6]

Captive rearing can have a marked effect on welfare, with animals in captivity exhibiting more stress than their wild counterparts.[7,8] Modern rearing methods maximize production of birds using mechanical incubators to hatch eggs and artificial brooders to intensively rear birds. Lack of parental care has a strong impact on the behavior of these animals.[9,10]

Although galliformes are precocial birds able to move around and feed independently shortly after hatching, in natural situation, maternal contact extends for several weeks.[11,12] The period of maternal contact has important benefits for chicks allowing them to develop food preferences and favoring the behavioral synchronization.[13]

In galliformes, the hen has an important role in mediating the chick's response to threats; the presence of the mother acts to buffer the stress response of domestic chicks during the application of an adverse stimulus. Researchers have shown that in poultry, mother hens play an important role in directing their chicks' behavior and are able to buffer their chicks' response to stressors. Poultry chicks reared by a mother hen are less fearful and show higher levels of behavioral synchronization than chicks reared artificially.[13] Campo et al.[14] found a longer tonic immobility (TI) in poultry chicks reared without a broody hen than in those reared with a broody hen, suggesting that the presence of a broody hen reduces fear in chicks. TI is a behavioral state characterized by lack of movements and an apparent lifeless position. It is the most commonly used test for fear measurement in domestic fowl[15] and other birds.[16] Birds reared without a mother have a lower serotonin concentration than birds reared by the mother.[17] The absence of the mother hen can cause a lack of anti-predator behavior. In gray partridge (*Perdix perdix*) vigilance and freezing, typical anti-predator behavior of these species occurs significantly less in intensively reared than in parent-reared coveys.[9] Despite the beneficial effects of maternal care, it is not viable to allow brooding on commercial game birds farms. However, in some cases, small flocks of birds can be reared in natural way for naturalistic purposes (reintroduction or sustaining

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Table 1. Scores of the immediate behavioral reaction of pheasant chicks to a predator model.

Score	Description of behavioral response
0	No visible change in the bird's behavior
1	The bird lifts it head once and then immediately returns to exploring or eating
2	The bird lifts its head and utters an alarm call and/or rapid walking for >3 s or freeze for 3–5 s
3	The bird reacts as for score 2, but also runs or attempts to escape, or freeze for >5 s

threatened populations).[3,5,18,19] Semi-natural rearing of game birds (chicks brooded and reared by a foster domestic hen) is an old technique used in the past prior to the development of the artificial incubators. Pheasants reared by foster hens show a higher survival compared to pheasants artificially reared when released in the wild.[20] For this reason, there is an increasing interest in semi-natural game birds rearing and these birds are more appreciated by game managers and hunting organizations.[8,18,20]

In this study, we analyze the behavioral differences between fostered and intensively reared pheasant chicks in order to achieve a better knowledge of the real advantages of the semi-natural system and the limits of intensive system.

Materials and methods

Study subjects

A total of 60 pheasants of 4 weeks old (30 birds per test group) were used for each test. The eggs laid by the same breeding group composed of 3 cock and 20 hen pheasants were casually assigned to six foster hens (*Gallus gallus*) that hatched and brooded the chicks or to artificial incubation. Fostered birds were kept with the foster hen in 120 cm × 50 cm × 50 cm boxes while artificial brooded chicks in 100 cm × 100 cm × 70 cm boxes. Birds were fed with the same commercial feed crumble. At the age of 30 days, a sample of 30 birds from each group (artificial and fostered) was randomly chosen and submitted to the tests.

For each test, two different groups of pheasants were used, so in total 120 pheasants were used for the study. The tests used comply with the Italian legislation on field animal experimentation and did not require license.

TI test

The TI response (immobility after a short period of restraint) is used in applied ethology as a measure of fear, as it is thought to simulate a predator attack.[21–23] Its duration is considered to be positively related to the antecedent fear state, that is, the more frightened the bird is when TI is being induced, the longer it will remain immobile when released.[15,23–25] To induce TI, each bird was placed on its back in a v-shaped wooden stand with slight pressure to the bird's chest with a hand for 10 s, after which the hand was slowly removed, and the latency until the bird first moved was recorded by a digital stopwatch ("TI-duration"). If the bird moved within 5 s, the process was repeated up to three times, thereafter the bird was considered not susceptible to go into a state of TI. If a bird had not moved within 10 min, it received the valuation of unending immobility and the test was terminated. Longer durations of TI are interpreted as higher degrees of fear (Jones & Faure 1980).[26,27]

Predator test

Presenting a predator model is an established method to score individual variation in fear.[21] Here, we used the response to a simulated predator attack in a predator test (PT) to score individual fear response[28] in a way more directly related to a predator situation compared with the TI test.

For the tests, the birds were placed in a 120 × 50 × 50 cm^3 test arena covered with netting to prevent the birds from escaping. After 5 min of acclimatization to the enclosure, a wooden hawk model (length 20 cm, width 40 cm) slid along a rope that was hung 120 cm above the top of the enclosure, by the use of pulleys controlled by the observer. The immediate reaction of the individual was videotaped and then scored on a scale from 0 to 3 where 3 represented the highest fear score ("response to predator," Table 1) by a trained observer who did not know to which group the birds belonged. The model hawk was hidden while not in use.[29]

Statistical analysis

Aerial predator (AP) scores, since they were not normally distributed, were analyzed by Wilcoxon signed-rank test; TI-times were analyzed by analysis of variance (ANOVA) in relationship to different brooding, sex, and brooding × sex. Before the analysis, TI-times in seconds were converted into their inverse values so that scores of birds that did not move within 600 s become 0 (1/INFINITE = 0) and birds which were not susceptible to go into a state of TI were considered 1. After the analysis, the inverse values were reconverted so that harmonic means were represented in Figure 1.

Results

Since the interaction rearing method × sex was not significant, only the main effects were reported in Figure 1. TI of fostered pheasant chicks resulted significantly shorter than TI of artificially reared chicks. No differences were observed between sexes. More numbers of attempts were needed to induce TI in fostered chicks compared to artificial chicks, but the difference did not reach the statistical significance (Figure 1).

We observed that the number of chicks that registered a low score in immediate behavioral reaction (no reaction) to the hawk model was higher in artificially reared chicks than fostered chicks. More fostered chicks registered a higher

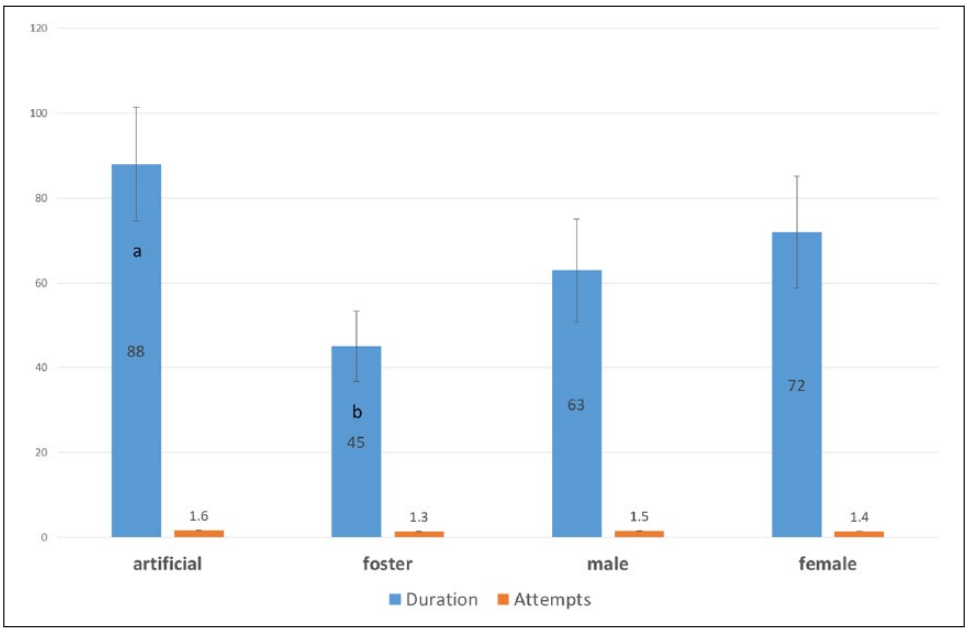

Figure 1. Duration (harmonic means, n = 30) of tonic immobility and number of attempts to induce tonic immobility in pheasant reared by foster mothers and by artificial brooders.
Means bearing different letters differ significantly per $p < 0.05$.

Table 2. Differences in behavioral score registered in reaction to a hawk model (0 = no reaction, 3 = max reaction).

	Behavioral score			
	0	1	2	3
Artificial	26.7%	18.3%	5.0%	0.0%
Fostered	3.3%	26.7%	16.7%	3.3%
Significance	$p < 0.01$	ns	0.05	ns

score in immediate behavioral reaction to a predator model compared with artificially reared chicks (Table 2).

Discussion

The shorter TI of fostered compared to intensive reared chicks (Table 2) shows that the presence of a foster mother hen reduced the fearfulness of pheasant reared for releasing purposes. Maternal care, even if provided by a foster hen, decreases the fearfulness of chicks and this fact is beneficial for the animals' health.[30] Shimmura et al.[31] observed a reduction of fearfulness and feather pecking in broody chicks. Feather pecking is often associated with stress.[32] Less stressed birds can withstand illness and adapt better to habitat change.[33] Farm-reared pheasants must face a sudden change of habitat (from captivity to natural habitat). A good starting health condition is very important to meet this challenge. Fearfulness in birds deprived of maternal care was found in other studies[34,35] often associated with impairment of sociality and spatial skill. Not-brooded chicks were reported to behave less socially than chicks that developed with a mother.[34,36,37] Not-brooded chicks exhibited a lower ability to disperse compared to brooded chicks in quail.[38] The reduction of spatial skills may be related to the more fearfulness of not-brooded chicks as fear-related behavior can inhibit exploration,[19] but it is consistent with the literature reporting the necessity of maternal stimulation to promote mammals' hippocampal synaptogenesis and spatial learning.[39]

We also found differences in immediate behavioral reaction to AP model; fostered chicks showed a greater response to the model. Since at the age of the test, pheasants have not experienced any predators, this reaction should be interpreted as a better capacity of fostered pheasants to perceive a threat and not as the holding of a proper anti-predator behavior. However, this awareness may represent the basis to develop an effective anti-predator behavior. Anti-predator behavior such as vigilance is connected with emotions and fearfulness in animal,[40] and this fact may explain why the fostered chicks reacted better to the predator model than the artificially reared chicks.

The impaired behavior of intensive reared galliformes is one of the several factors that explain the low survival of these birds in the wild. For this reason, there is a growing interest in natural and semi-natural rearing techniques that may ensure more successful releasing programs.[3,41] Survival rate of pheasants reared with foster mothers was higher compared to that of artificially hatched pheasants.[20]

Conclusion

Pheasants reared and hatched by foster mother hen showed a reduced stress/fear level so that this old rearing technique can improve the welfare of pheasants reared for releasing purpose. Since this technique is costly and labor intensive, it is suitable only for the releasing of small group of birds; however, it may be worthy for supportive breeding and reintroduction programs. Furthermore, our study suggests the need to study new techniques and devices to improve welfare of captive-reared animals.

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