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Influence of Begging Call Playback on Behavior of Great Tit (*Parus major*) Parents

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Abstract: The purpose of this study was to investigate the influence of begging call playback on the behavior of great tit (*Parus major*) parents with varying intensities of begging calls played from artificial nest boxes. Mean number of feeding visits by parents did not differ among control and both playback treatments. Mean feeding time was longer in the playback 1 (80 dB) group than in the control (60 dB) or playback 2 (100 dB) groups. The first open-mouthed nestling was more frequently fed than other nestlings in all control and treatments. In this study, parents did not respond to short-term increases in overall begging intensity. Further investigations of nestling begging and parental care behaviors would reveal much about the interaction between great tit parents and nestlings.

Key words: Begging call, behavior, great tit, parents, playback

INTRODUCTION

Parents are driven to make investment decisions that maximize their reproductive success but conflict with their own progeny may constrain these decisions (Godfray, 1995; Kolliker *et al*., 1998). The care of nestlings provided by parent birds is typically limited by an associated cost (Gustafsson *et al*., 1995). Parents may attempt to offload the cost of care on their partner by encouraging them to work harder (Keller, 1999). Parent birds typically feed a brood of young according to their level of begging and increase or decrease feeding in response to changes in begging intensity (Kilner and Johnstone, 1997; Macgregor and Cockburn, 2002). In several passerine species when nestlings beg with greater vigor, parents increase the frequency of food delivery at the nest (Ottosson *et al*., 1997; Kilner *et al*., 1999; Hinde and Kilner, 2007). Nestling birds display various behaviors when parents feed at the nest. They compete for prime position, posture and vocalize (McRae *et al*., 1993; Kilner and Johnstone, 1997).

Begging signals have been shown to reflect not just recent feeding history but also long-term requirements in terms of the stage of nestling growth attained (Lotem, 1998). Begging effort is probably also mediated by additional factors operating on intermediate time-scales, such as total gut content, digestive efficiency, fat stores and learning (Wright *et al*., 2002). Begging calls could be costly for individual nestlings to produce in two ways.

First, a metabolic cost could arise from the physical exertion needed to beg. Second, predators could use begging calls to find and prey upon nests (Haskell, 1994). Kolliker *et al*. (2000) found that a significant part of the variation in breeding call intensity among nestlings can be explained by genetic origin and estimated the heritability of begging at the range of 40-52% (Kolliker and Richner, 2001).

If chick begging functions as a signal to influence parental distribution of food within the brood, the begging strategy of individual chicks may be influenced by the begging of their siblings (Eshel and Feldman, 1991). In several species, parents increased their feeding rate in response to taped begging calls of hungry nestlings. Likewise, increased begging intensity within broods was associated with an increase in the number of feeding trips by parents in several species (Smith and Montgomerie, 1991; Leonard and Horn, 1996).

Researchers experimentally increased degree of begging via playbacks of begging calls at artificial nest boxes of great tits (*Parus major*). Researchers examined whether elevated intensity of begging call influenced visiting rate, feeding time and preferential feeding.

MATERIALS AND METHODS

Great tits were studied around the campus of Chung-Ang University (37°00'N, 127°13'E), Ansung, South Korea during March 2011 and July 2012.

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Researchers selected two study sites 120×240 m in size, one in deciduous and one in coniferous forest. The dominant tree species were Mongolian oak (*Quercus mongolica*) and serrata oak (*Q. serrata*) in the deciduous forest and pitch pine (*Pinus rigida*) was in the coniferous forest. The study site was divided into 30×30 m grids marked with flags, facilitating the accurate identification of nest box location. A total of 45 wooden artificial nest boxes (16×15×30 cm) with 1.5 cm thick walls were placed in trees 1-2 m above the ground (Son *et al*., 2012).

For surveys of breeding ecology in each of the nest boxes, researchers visited 4-5 times per week. Briefly, the date of appearance of eggs in the nest was recorded together with clutch size. After egg laying, researchers visited the artificial nest boxes every day to determine clutch initiation date, number of breeding attempts, egg size, clutch size and breeding parameters (hatching date, number of unhatched and hatched eggs, dead nestlings and fledglings) (Aslan and Yavuz, 2010; Son *et al*., 2012).

Researchers recorded the begging calls of nestlings that were 4-5 days old with a digital recorder (PMD-650, Marantz) and microphone (MKH 416P48, RF Condenser MIC). The mean frequency of begging calls was 62.14±10.69 dB. Researchers determined the control (60.00±5.00 dB), playback 1 (80.00±5.00 dB) and playback 2 (100.00±5.00 dB) treatments. Researchers played these calls back at the artificial nest boxes. Behaviors of parents were analyzed based on video digitally recorded (CM-U7500, Pingyi Co., Ltd.) from 06:00-18:00 on days during h = 0 and h = 15 (Kim, 2013). From each nest's video footage (N = 15 nests), researchers observed three behavioral traits on videotape: the rate of feeding visits by each parent; feeding time (sec) and which nestling was fed.

Researchers used repeated measures ANOVA to determine whether treatment influenced the behavior of parents. Tukey's post hoc tests were used to determine pair-wise differences between treatments. Significance was declared at $p<0.05$ for all statistical tests.

RESULTS AND DISCUSSION

Mean number of feeding visits by parents great tit parents was ~2 times per 30 min in the study. Those values were not significantly different among control and playback treatments (ANOVA, $F_{2, 8} = 0.81$, $p = 0.45$) (Fig. 1).

Mean feeding time of great tit parents differed among control and both playback treatments ($F_{2, 8} = 93.99$, $p = 0.01$). Mean feeding time of great tit parents in the control group was 17.56 sec while values were 28.12 and

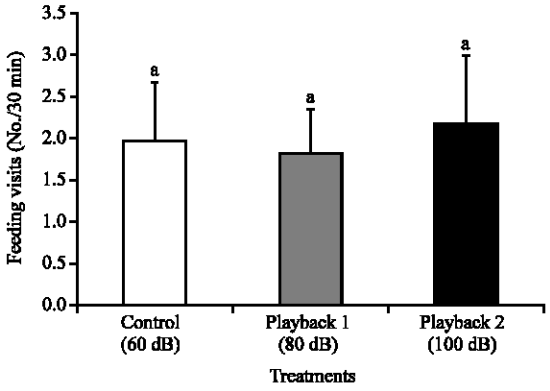

Fig. 1: Feeding visits (No./30 min) of great tit parents as determined by ANOVA among control (60 dB), playback 1 (80 dB) and playback 2 (100 dB) groups in artificial nest boxes. Values are presented as mean±SD. Different letters indicate significant differences between the mean values in a given treatment ($p<0.05$)

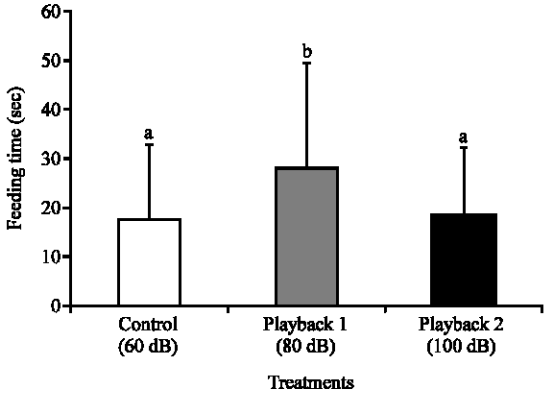

Fig. 2: Difference in feeding time (sec) of great tit parents as determined by ANOVA among control (60 dB), playback 1 (80 dB) and playback 2 (100 dB) groups in artificial nest boxes. Values are presented as mean±SD. Different letters indicate significant differences between the mean values on a given treatment ($p<0.05$)

18.64 sec in playback 1 and 2 groups, respectively. Mean feeding time of great tit parents was longer in playback 1 treatment either control or playback 2 treatment (Tukey's post hoc test, $p<0.05$) (Fig. 2).

Among the feeding visits of great tit parents, the first open-mouthed nestling was the most frequently fed in all control and playback treatments in the study. Feeding visits to the closest-positioned nestling increased with the higher intensity of begging calls. However, feeding visits to the highest-positioned nestlings decreased with

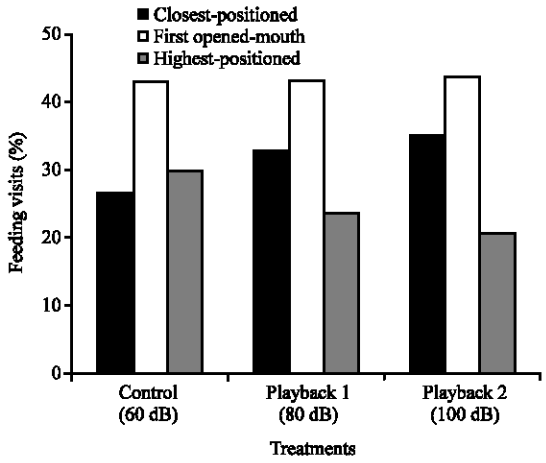

Fig. 3: Feeding visits (%) of great tit parents to closest-positioned, first opened-mouth and highest-positioned nestlings among control (60 dB), playback 1 (80 dB) and playback 2 (100 dB) groups in artificial nest boxes. Values are presented as means

the increasing intensity of begging calls (Fig. 3). Researchers observed that the number of feeding visits to nest boxes did not vary based upon the experimentally increased intensity of nestling begging calls but feeding time was significantly different in response to playback 1 treatment. Also, with experimental playback, parents switched to preferentially feeding the closest-positioned nestling instead of the highest nestling as had been observed in the control group. Parents may have switched to feeding the closer nestlings in the nest box as a mechanism for reducing the amount of time between arrival to the nest box and feeding a nestling or they may have chosen to feed the nestling that was able to outcompete its siblings for the closer position (Kilner, 1995; Tarwater *et al*., 2009). The results described in this study show that parents did not respond to short-term increases in overall begging level. Researchers detected no variation with nestling stage in the relationship between playback of begging call intensity and behavior of parents.

In avian species, parents commonly increase provisioning rates in response to elevated begging (Ottosson *et al*., 1997). The cost of begging seems to be an increasing function of begging rate. Begging rate is one component of the intensity of begging used in theoretical models (Haskell, 1994). Accordingly, offspring food solicitation behavior may develop to become conspicuous signals of food demand whereas parent behavior may adapt either to respond to these signal or to ignore them (Godfray and Johnstone, 2000; Dor and Lotem, 2009). The responses of parents to begging are not independent of the environment and parents may respond differently depending on environmental conditions (Tarwater *et al*., 2009).

Any increase in parental provisioning effort should have energetic costs and a potential increase in the risk of predation which will have consequences for survival and reproduction of parents (Wright *et al*., 1998). Therefore, parental provisioning effort should be optimized in order to maximize lifetime reproductive success (Campbell, 1972). The outcome of each feeding bout is then determined by the ability of one nestling to beg more and/or from a better location in the nest (Kilner, 2002).

CONCLUSION

An increased understanding of the parental behaviors due to the begging call intensity of nestlings can lead to a greater understanding of the possible adaptive significance of parental care behavior. Further investigation of nestling begging behavior in this species could reveal much about the interaction between parents and nestlings.

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