Blue tits and caterpillars in a boreal forest: impacts of early life food conditions on nestling growth, fitness and personality

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Abstract

Among all environmental variables causing variation in phenotypes, food supply is thought to be the most important, for it is the fuel for growth and development. Especially in early life, food conditions can shape growth, which in turn is determinant for survival, reproductive success, and therefore fitness. During 10 years, we collected data on caterpillars and on 752 broods of blue tits (*Cyanistes caeruleus*), in a boreal forest of Southern Finland. The aim was to investigate the importance of food availability, especially during the first days of life, in the development of nestlings. Caterpillars are supposedly the main food resource for blue tits nestlings (40-80% of their diet, depending on the habitat). We found seasonal variation in caterpillar biomass in birches (*Betula sp.*), typically raising in May, reaching a maximum in early June and declining in the course of June. Caterpillar biomass also showed strong annual fluctuations, with no distinct seasonal peak in years with low biomass. This absence of clear peak is uncommon, and prevented us from determining the synchrony of broods with food supply. Therefore, we opted for a "time-window" approach, measuring the total amount caterpillar available for broods, during 3 time-windows of the nestling period. We found a positive relationship between nestling growth and caterpillar biomass, during the different time-windows, proving that blue tits in this population actually rely on caterpillars. We measured the influence of early food conditions (caterpillar biomass before day 9) on 16 day-old nestlings, and found a positive effect on body development (tarsus, wing and tail length) and on personality (aggression), but not on fitness (nestling survival and mass). The population's breeding success also increased with daily caterpillar biomass. These results, obtained with a new approach, highlight the impacts of food availability on nestling development and are consistent with previous studies.

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