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Cold and heat climatic variations reduce goat birth weight and enhance mortality in subtropical monsoon region (Southwest China)

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Southwest China contains about one-third Chinese indigenous goat breeds representing special economic characteristics and has a subtropical monsoonal climate, which is characterized by a hot and wet summer and a damp and overcast winter. These climate environments can induce cold and heat stress for these animals, resulting in adversely influence on reproductive traits, such as birth weight and mortality. However, the negative outcome of subtropical climate environments on goat's birth weight and mortality is still unclear.

In our study, the daily temperature (T), relative humidity (RH) and temperature-humidity index (THI) were recorded from 2011 to 2016 year. The kids' birth weight (BW) and mortality rate (MR), with the same period, were measured from 530 kids in Dazu black goat farm of Southwest University. These climatic factors and kid traits were analyzed by One-way analysis of variance and Pearson's correlation coefficient. The mean T and THI peaked during July to August (34.7°C, 82.5) and bottomed during December to January (6.6 °C, 48.4). However, RH maintained low range all year round (63.6%~ 82.2%). The monthly averages of BW showed two troughs in January to February of winter (1.9 kg) and July to August of summer (2.0 kg). However, two peaks of BW were showed in June and October (2.3 kg), where BW were significantly higher ($P<0.05$) than that in below cold and heat months. Meanwhile, BW was positively correlated ($P<0.01$) with T and THI of three months before birth from November to May, and was negatively correlated ($P<0.01$) with those parameters of two months before birth from June to October. The MR mainly happened in the 1st month after birth, about 16.1%. However, when BW was 20% lower than annual average (2.1kg), the MR was significantly ($P<0.01$) increased to 46%. In addition, we further found cold and heat climate factors significantly increased ($P<0.01$) MR in the first and the second~4th months respectively. Moreover, T with 16~26 °C and THI with 61~75 were suggested as the most appropriate ranges to avoid negative climatic influence.

In Southwest China, the low and high temperature and THI suggested the possibility of cold and heat stress in goats, which can reduce kids' birth weight and their survival during prenatal and postnatal stages. Our results will take some message for improving the environmental management of pregnant goat and kids raising to avoid the economic loss of goat industry. Keywords: fetal growth, temperature-humidity index, cold and heat stress, subtropical climate, Dazu black goat