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Editorial: Animal responses to climatic stress: strategies for coping with harsh climatic conditions

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Editorial on the Research Topic

Animal responses to climatic stress: strategies for coping with harsh climatic conditions

Global warming is a huge concern that affects all living things, including livestock and humans, by putting them under a range of environmental stress. The two most concerning climate stresses for livestock are heat stress and cold stress. The five articles in this Research Topic—four research studies and one review—concentrate on the latest understanding of climate change in livestock and some mitigation strategies to counteract its negative impacts.

Ouchi et al. investigated the impact of thermal conditioning on the ability of chicks to regulate their body temperature while exposed to low ambient temperatures. To build an improved thermotolerance later in life, it is common practice to subject chicks to high ambient temperatures (HT) through thermal conditioning. Interestingly, Ouchi et al. demonstrated that thermal conditioning treatment prevented the drop in rectal temperature that happened in control chicks during cold exposure. In addition, hypothalamic mRNA expression of several neuropeptides, which are related to the thermoregulatory process, was higher in thermal-conditioned chicks. Therefore, they proposed that thermal conditioning treatment can improve the thermoregulatory mechanisms of chicks in a low-temperature environment.

Nakamura et al. aimed to examine the effects of cyclical HT and dried Neem (*Azadirachta indica*) leaf extract (DNE) supplementation on growth performance, muscle oxidative stress, and muscle drip loss in broilers. HT caused a reduction in feed intake and breast muscle weight. Supplementation of DNE ameliorated the negative effects of cyclical HT on feed intake and breast muscle mass. Moreover, DNE caused the reduction of malondialdehyde (MDA) concentration and drip loss of the breast muscle. Nakamura et al. suggested that dietary supplementation of DNE may reduce muscle MDA concentration and drip loss in broiler chickens under HT.

Chowdhury et al. examined whether the oral administration of L-citrulline (L-Cit) can enter heat-exposed chicken brain (diencephalon) and influence amino acid and monoamine concentrations. Oral administration of L-Cit was previously reported to afford thermotolerance in chickens by this group. However, it was unknown whether oral L-Cit can change diencephalic metabolism, which may be linked to thermotolerance. Chowdhury et al. found that a 2 h exposure to HT caused an increase in the brain concentration of Cit and decreased ornithine (Orn). Importantly, oral administration of L-Cit increased the brain concentration of Cit, arginine, and Orn under control thermoneutral temperature and HT. Oral administration of L-Cit was not able to influence brain serotonin, but it caused the decline of brain dopamine and increased its metabolite methoxyhydroxyphenylglycol. Therefore, they proposed that metabolic changes in chicken brain due to oral L-Cit may influence the thermoregulatory center in the brain to confer thermotolerance in chickens.

Zhou et al. analyzed the existing literature and identified knowledge gaps about climate change impacts on and response strategies in rural livestock production in South Africa. They used scientific databases such as Google Scholar, Science Direct, Cab Direct, Sabinet, and Semantic Scholar to analyze 62 suitable peer-reviewed publications. They found some limitations related to livestock and climate change in South Africa. They also recommended that greater geographical coverage of literature is needed along with the inclusion of non-ruminants that are exposed to different climate shocks. Context-specific and holistic mitigation strategies have also been suggested to improve livestock production in rural farming communities.

The climate in northern latitude countries, such as Canada, is changing very fast, which has resulted in an increased frequency of hot days and more frequent summer heat waves. Cartwright et al. demonstrated that Canadian dairy cattle are therefore at increased risk of heat stress. They examined the heat stress response in immune phenotyped lactating dairy cattle reared under free-stall and tie-stall management systems. The results showed that high immune responders had significantly lower respiration rates compared to low responders when the temperature humidity index was high in both free-stall and tie-stall, without any difference in rectal temperature and rumination activity. Therefore, Cartwright et al. reported that high immune responders are more likely to tolerate heat stress than low immune responders.

An update on the effects of heat stress on livestock is given in the articles compiled under this Research Topic. In addition, certain nutritional and physiological tactics to lessen the effects of climatic stress have been proposed along with some mechanistic insights. This Research Topic will offer some cutting-edge methods to alleviate heat and cold stress in livestock, thereby enhancing their health and well-being.

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Conflict of interest

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