ADVANCES IN FOOD TECHNOLOGY AND NUTRITIONAL SCIENCES

Openventio PUBLISHERS

ISSN 2377-8350 Open Journal http://dx.doi.org/10.17140/AFTNSOJ-1-118

Letter to the Editor

Corresponding author
Alissa Piekarski
Center of Excellence for Poultry Science
University of Arkansas
Fayetteville, AR 72701, USA
Tel. (479)-575-3699
Fax: (479)-575-7139
E-mail: apiekars@email.uark.edu

Volume 1 : Issue 5
Article Ref. #: 1000AFTNSOJ1118

Article History
Received: September 11th, 2015
Accepted: September 29th, 2015
Published: September 30th, 2015

Citation
Piekarski A, Bottje W, Dridi S. Heat stress: a global concern. *Adv Food Technol Nutr Sci Open J.* 2015; 1(5): 102-103. doi: 10.17140/AFTNSOJ-1-118

Heat Stress: A Global Concern

Alissa Piekarski*, Walter Bottje and Sami Dridi

Center of Excellence for Poultry Science, University of Arkansas, Fayetteville, AR 72701, USA

The agriculture industry provides consumers with food (meat, milk, eggs, and grains) and contributes significantly to the global economy. Due to reliance on specific climate conditions, heat stress (caused by a combination of environmental factors such as: temperature, relative humidity, solar radiation, air movement, and precipitation) can have a very detrimental effect on this industry for both producers and consumers alike. With heat wave frequency and intensity projected to rise during the next century, climate change could make it more difficult to grow crops, raise animals, and harvest fish in the same manner and locations as used in the past.[1] Effects of heat stress can clearly be seen in poultry and livestock, and because animal agriculture is facing substantial challenges, including a steep projected increase in demand and the need to adapt to changing environmental conditions, these issues must be addressed. The United Nations FAO predicted an increase in world population to 9-10 billion, and estimated that by 2050 there will be a 73% increase in meat and egg consumption and a 58% increase in dairy consumption over 2011 levels.[2]

Agriculture is an important sector of the U.S. economy, contributing at least $200 billion each year with Americans consuming more than 37 million tons of meat annually.[3] Heat waves which, as stated earlier, are projected to increase under climate change, could directly threaten livestock. In the U.S., a number of states reported losses of more than 5,000 animals due to a single heat wave alone.[4] To help combat this, producers must provide shade, improved ventilation, and a sufficient quantity of water with temperature further reduced by spraying cool water across the roofs of buildings where animals are housed. Although most poultry are raised in houses, factors such as overcrowding, ambient heat from floors and roofs due to an increase in environmental temperature, can all affect heat stress in these animals. A method, in addition to those aforementioned, is ventilation, which can be provided for air movement by fans and windows.[5] Over time, heat stress can increase vulnerability to disease by increasing gut leakage, parasite infestation, reducing milk production, reducing fertility, and lowering birth weights with greater embryonic mortality in livestock.[6] Heat stress also reduces productivity in poultry by increasing numbers of smaller eggs with thinner eggshells that break during handling and processing, and increasing mortality in embryos and neonates as well as lowering growth and productivity.[7] Because of this, finding ways to help poultry and livestock better adapt to climate change is of uppermost importance.

Modern poultry, especially meat producing poultry (bred for high growth rate and body weight), are particularly sensitive to heat stress due in part to higher normal body temperatures compared to mammals. Because heat production is a natural occurrence and because these animals have highly metabolically active tissue, poultry suffer from heat stress easily with some succumbing to spiraling hyperthermia due to the inability to regulate body temperature in extreme high temperatures.[8] Therefore, much research has gone into finding a way to alleviate or combat heat stress in these animals. Some groups have used "thermal conditioning" which exposes embryos (pre-hatch) or neonates (during the first 4 d post hatch) to high heat conditions, with results showing greater resistance to heat stress and reduced body temperatures.[9] Recently, autophagy, a "self-eating" cell survival pathway, has been applied to this condition. Zhou and colleagues studied heat stress in tomato plants and found that heat stress activates autophagy genes with accumulation of autophagosomes.[10] Preliminary data from our laboratory (data not shown) in poultry suggests a similar mechanism, suggesting a new research avenue that uses the animals own cellular machinery for combating climate change in the agricultural

ISSN 2377-8350 Open Journal http://dx.doi.org/10.17140/AFTNSOJ-1-118

industry.

Due to the complex nature of agricultural systems, there are many factors that need to be considered when assessing how climate change will affect global food production.[11] Therefore, it becomes clear that heat stress is a very real issue and impacts a multi-billion dollar industry that could have significant impacts on global economies in the coming years. With new research aimed at preventing and alleviating issues of climate change, the agriculture sector is set for a surge of new ideas and methods to aid in a potential, eventual elimination of the issue of heat stress.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

1. Environmental Protection Agency (EPA). Agriculture and food supply impacts & adaptation. Website: http://www3.epa.gov/climatechange/impacts/agriculture.html 2009; Accessed September 15, 2015.

2. Alexandratos N, Bruinsma J, Bödeker G, et al. Prospects for food, nutrition, agriculture and major commodity groups. Food and agriculture organization of the United Nations. Website: http://www.fao.org/economic/esa/esag/esag-home/en/ 2006; Accessed September 2015.

3. U.S. Census Bureau. The 2011 statistical abstract: international statistics. Website: https://www.census.gov/prod/2011pubs/11statab/pop.pdf 2011; Accessed September 2015.

4. USGCRP. Global climate change impacts in the United States. In: Karl TR, Melillo JM, Peterson TC, ed. United States global change research program. New York, NY, USA: Cambridge University Press; 2009.

5. Chichester LM, Mader TL. Heat stress – what you should know to make livestock shows a success. Website: http://www.ianrpubs.unl.edu/pages/publicationD.jsp?publicationId=1448n 2012; Accessed September 2015.

6. Bohmanova J, Misztal I, Cole JB. Temperature-humidity indices as indicators of milk production losses due to heat stress. *J Dairy Sci*. 2007; 90(4): 1947-1956. doi: 10.3168/jds.2006-513

7. Ajakaiye JJ, Perez-Bello A, Mollineda-Trujillo A. Impact of heat stress on egg quality in layer hens supplemented with l-ascorbic acid and dl- tocopherolacetate. *Veterinarski ARHIV*. 2011; 81(1): 119-132.

8. Bhadauria P, Kataria JM, Majumdar S, Bhanja SK, Divya, Kolluri G. Impact of hot climate on poultry production system-a review. *J Poult Sci Tech.* 2014; 2(4): 56-63.

9. DeBasilio V, Requena F, Leon A, Vilarino M, Picard M. Early age thermal conditioning immediately reduces body temperature of broiler chicks in a tropical environment. *Poult Sci.* 2003; 82: 1235-1241. doi: 10.1093/ps/82.8.1235

10. Zhou J, Wang J, Yu JQ, Chen Z. Role and regulation of autophagy in heat stress responses of tomato plants. *Front Plant Sci*. 2014; 5: 174. doi: 10.3389/fpls.2014.00174

11. Nova. Feeding a hot, hungry world. Website: http://www.nova.org.au/earth-environment/feeding-hot-hungry-world 2010; Accessed August 2015.