PIG RESPONSE TO HEAT STRESS REVISITED

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Abstract: *Each pig breed has its own features and specific demands such as food, shelter, temperature, and water. Ambient temperature, environmental heat, gestational heat stress, heat stress, high ambient temperature, high temperature, high temperature in summer, season, short-term heat stress exposure, and variation in ambient temperature impact pig behaviour, growth, immune response, metabolism, physiology, production, and thermoregulation in boars, fattening pigs, foetal pigs, finisher / finishing pigs, gilts, grower / growing pigs, lactating sows, piglets, pigs (in general), and sows.*

Key words*: pig breeds, heat stress, temperature, climate change, pen conditions.*

INTRODUCTION

Temperature has a significant impact on pigs, affecting their growth, health, and overall performance: [6]

- Pigs are sensitive to high temperatures because they have a limited number of functional sweat glands: therefore, heat stress can lead to appetite loss, reduced feed intake, decreased growth rates, and poor overall performance;
- Pigs use various mechanisms to regulate their body temperature, but these can be overwhelmed by extreme heat, which can result in health issues and reduced productivity;
- Heat stress in pigs can lead to significant economic losses caused by decreased meat production and fertility rates;
- Genetic selection for heat tolerance and improved management practices can help mitigate the negative effects of high temperatures on pigs.

Ambient temperature, environmental heat, gestational heat stress, heat stress, high ambient temperature, high temperature, high temperature in summer, season, short-term heat stress exposure, and variation in ambient temperature impact a wide range of aspects regarding behaviour, fertility, metabolism, physiology, production, reproduction, and welfare in boars, fattening pigs, foetal pigs, finisher / finishing pigs, gilts, grower / growing pigs, lactating sows, piglets, pigs (in general), and sows. [2,5,10]

MATERIALS AND METHODS

The material used in this paper consists in a corpus of articles on the impact of heat stress on swine published in the last seven years. The research method used is corpus analysis.

RESEARCH RESULTS

Temperature variables. ***Heat stress*** is defined as "a widespread phenomenon in domestic animal feeding in tropical and sub-tropical areas that are subjected to a growing negative effect in livestock and poultry due to global warming." [2]. For Mayorga *et al*. [11], ***heat stress*** is "a global issue constraining animal agriculture productivity, negatively [affecting] welfare, and [reducing] production efficiency in many countries." It "damages health and decreases performance variables in pigs, and, if severe enough, causes

mortality" [8, 14] speak of the "deleterious effects of heat stress." [13] state that "Pigs are one of the most vulnerable livestock species to the adverse effects of heat stress […]." Zhao *et al*. [21] write about ***gestational heat stress***, while Liu *et al*. [10] write about ***summer heat stress***. The effects of heat stress depend on duration [13] ***(High) ambient temperature***. ***Ambient temperature*** is "the temperature of the air at a given time and in a particular place or circumstance" (*Dictionary.com*). Campos *et al*. [1] investigate growing pigs' physiological responses to high ambient temperatures and/or inflammatory challenges. Both Fraga *et al*. [5] and Karpeggiane de Oliveira *et al*. [7] evaluated the feeding behaviour of group-housed pigs exposed to daily / diurnal cyclic high ambient temperatures. ***High temperature*** and ***environmental heat*** effects on the Iberian pig were investigated by Lachica *et al*. [9] Wang *et al*. [20] and Deschenko & Lykhach [3] have analysed the effects of ***high temperature in summer*** on pigs. ***Season***. Deschenko & Lykhach [3] evaluated its impact on boars' behaviour. ***Type of ventilation***. Its effect on behavioural patterns in boars was scrutinised by Deschenko & Lykhach [3].

Impacted Key Areas. Abnormal temperatures can significantly impact various aspects of pig production and welfare. The main key areas affected are: **Behavioural Changes** – pigs may exhibit increased respiration rates, lethargy, and reduced social interactions: ***ability to cope with a sanitary event*** [1]; ***duration of movement*** [3]; ***duration of rest*** [3]; ***general behaviour***; ***feeding behaviour*** [5]; **Carcass Composition** – there is often an increase in carcass fat deposits and a decrease in lean tissue accretion due to heat stress: ***backfat*** [10], ***carcass composition / quality*** (increased lipid deposition and decreased protein accretion) [11]; **Feed Intake** – pigs tend to reduce their feed intake to lower metabolic heat production, which can lead to slower growth rates and reduced overall productivity: ***duration of feed intake***; ***duration of water intake***; ***feed intake***; **Growth Performance** – high temperatures can decrease average daily gain and feed efficiency, resulting in inconsistent market weights and lower carcass quality: ***daily gain*** [1], ***feed efficiency***; ***muscle deposition*** [10]; ***growth (performance)***; ***nest weight at weaning*** [3]; ***performance***; ***production*** [11]; ***skeletal muscle*** [21]; ***nutrient partitioning*** [20]; **Health and Mortality** – pigs are more prone to health issues and increased mortality rates under heat stress conditions: ***ability to resist, cope with, or recover from an inflammatory challenge***; ***digestion***; ***DNA damage*** [10]; ***electrolyte balance***; ***energetic homeostasis*** [20]; ***exposure to pathogens***; ***health***; ***heat production***; ***immune function response***; ***intestinal function***; ***metabolism***; ***metabolites*** [8]; ***nutrient digestibility***; ***physiology***; ***piglet survival before weaning***; ***plasma amino acid profiles***; ***thermoregulation***; ***welfare***; **Reproductive Performance** – heat stress can lead to anoestrus, increased wean-to-oestrus interval, decreased farrowing rate, and reduced litter size in sows: ***farrowing rates***; ***fertility*** [10]; ***foetal: placental weight ratio***; ***foetal development***; ***reproduction*** (i.e., anoestrus, decreased farrowing rate, increased wean-to-oestrus interval, reduced litter size) [11]; ***sow multiple fertility*** [3]; ***sow performance***; ***sperm quality.***

Pig Categories Impacted. Heat stress can impact all pig categories, with the mention that some are more vulnerable than others: **Boars** – heat stress causes health issues, changes behaviour, decreases libido, decreases semen quality, increases respiration rates, and reduces feed intake [3]; **Fattening pigs** – heat stress causes health issues, changes behaviour, decreases growth performance, elevates respiratory rates, and reduces feed intake; **Finisher / finishing / grower / growing pigs** – heat stress causes health issues, changes behaviour, drops feed intake, elevates respiratory rates, and reduces growth performance [15,16,18]; **Foetal pigs** – heat stress changes behaviour, has long-term health effects, increases fat deposition, and reduces growth [19]; **Gilts** – heat stress causes reproductive issues, changes behaviour, long-term health effects, increases body

temperature, and reduces feed intake [12]; **Lactating sows** – heat stress changes behaviour, causes reproductive issues, causes respiratory stress, drops feed intake, increases piglet mortality, and reduces milk production [5]; **(Newborn) piglets** – heat stress causes hydration issues, changes behaviour, increases mortality rates, reduces feed intake, and weakens immune system [3]; **Pigs raised outdoors** – heat stress causes economic loss, causes health issues, changes behaviour, increases respiration rates, reduces feed intake [11]; **Sows** – heat stress changes behaviour, has long-term health effects, increases respiration rates, lowers milk production, reduces feed intake, and reduces farrowing rates [9].

The investigation of **"temperature" variables** resulted in six articles on ***(gestational / summer) heat stress***, three articles on ***(high) ambient temperature***, three articles on ***high temperature (in summer)***, one on ***environmental heat***, one on ***season***, and one on ***type of ventilation***.

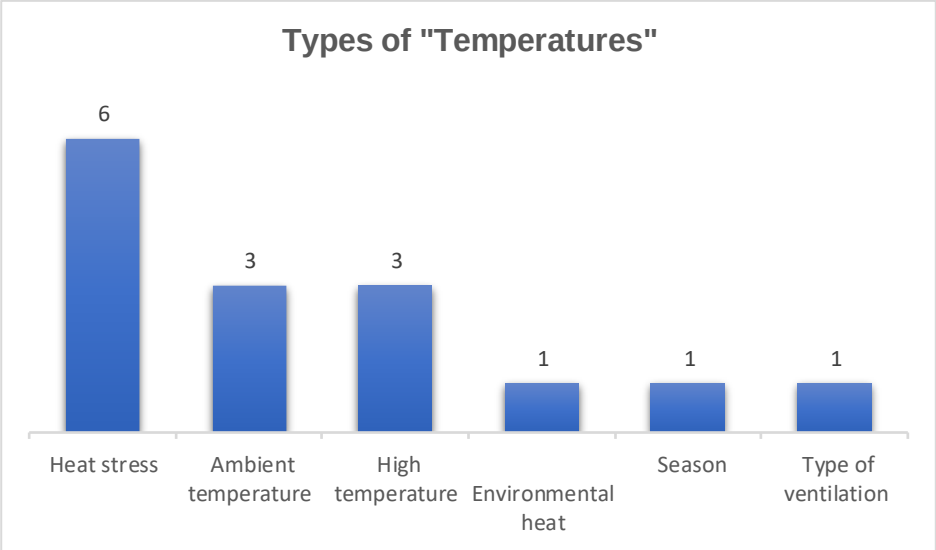

Figure 1. Types of Temperates

The **most impacted key areas** related to the impact of hat stress on pigs are approached in ***growth performance***; ***health and mortality***; ***feed intake***; ***behavioural changes***; ***reproductive performance***; and ***carcass composition***.

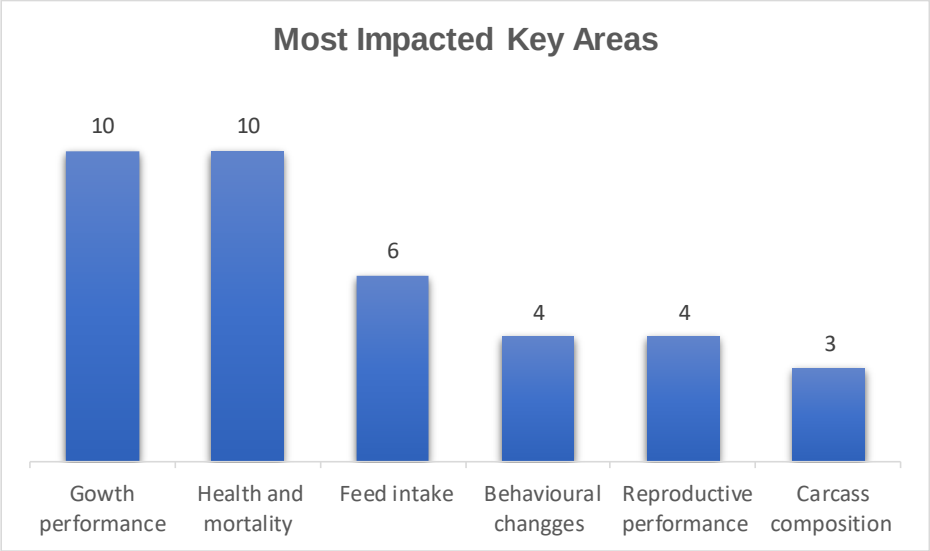

Figure 2. Most impacted key areas

As for the **pig categories impacted by heat stress**, they are represented by ***finisher / finishing / grower / growing pigs***, ***pigs raised outdoors***, ***fattening pigs***, ***foetal pigs***, ***gilts***, ***lactating sows***, ***sows***.

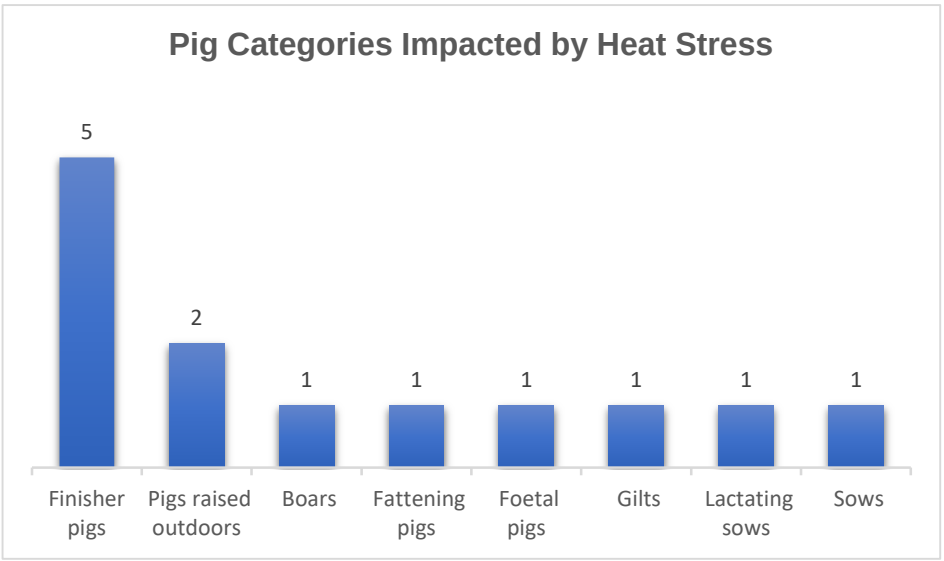

Figure 3. Pig categories impacted by heat stress

CONCLUSIONS

The analysis above shows the interest of researchers in the impact of temperature on swine. The most investigated are heat stress, ambient temperature, and high temperature. As far as the most impacted key areas are concerned, they are represented by growth performance, health and mortality, and feed intake – all closely related to production efficiency. Finisher / finishing / grower / growing pigs and pigs raised outdoors are pig categories most impacted by heat stress and studied by researchers – again, closely related to production efficiency.

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