Perspective

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Journal of Animal Research and Nutrition

2023
Vol.8 No.1:063

The Role of Terrestrial Animal Health Code

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Received date: December 11, 2022, Manuscript No. IPJARN-23-15806; **Editor assigned date:** December 13, 2022, PreQC No. IPJARN-23-15806 (PQ); **Reviewed date:** December 24, 2022, QC No. IPJARN-23-15806; **Revised date:** January 04, 2023, Manuscript No. IPJARN-23-15806 (R); **Published date:** January 11, 2023, DOI: 10.36648/2572-5459.8.1.063

Citation: Ahmed A (2023) The Role of Terrestrial Animal Health Code. J Anim Res Nutr Vol. 8 No1: 063

Description

Intramuscular Fat (IMF) is the main determinant of the economic value of domestic animal meat, and has a vital impact on the sensory quality characteristics, while the content of IMF is mainly determined by the size and number of intramuscular adipocytes. In recent years, due to the development of sequencing technology and omics technology, a large number of non-coding RNAs have been identified in intramuscular adipocytes. Non-coding RNAs are a kind of RNA regulatory factors with biological functions but without translation function, which mainly include microRNAs, long non-coding RNAs and circular RNAs. These non-coding RNAs regulate the key genes of intramuscular adipocyte growth and development at post-transcriptional level through a variety of regulatory mechanisms, and affect the number and size of intramuscular adipocytes, thus affecting the content of IMF. Here, the review summarizes the candidate non-coding RNAs and genes involved in the regulation of intramuscular adipocytes, the related regulation mechanism and signaling pathways, in order to provide reference for further clarifying the molecular regulation mechanism of non-coding RNAs on intramuscular adipocytes in domestic animals.

Intramuscular Fat

In the past few decades, the breeding of meat-type animals mainly aimed at improving the growth rate, feed conversion rate and lean meat rate. This breeding strategy improved the production efficiency of animal husbandry, but also caused the decline of meat quality. The fat deposited in muscle is defined as Intramuscular Fat (IMF), whose content is a vital indicator of meat quality and has a positive correlation with the overall palatability and the sensory quality characteristics of meat. The marbling formed by IMF will directly impact the purchasing decision of consumers, and has traditionally been the focus of study in the field of animal genetics and breeding. The content of IMF is mainly related to the number and size of intramuscular adipocytes and intramuscular adipocytes can provide a place for IMF deposition.

In recent years, with the development of high-throughput sequencing technology, a considerable number of non-coding RNAs have been discovered in domestic animals to regulate intramuscular adipocytes, mainly including microRNAs, long non-coding RNAs and circular RNAs. Non-coding RNAs are a kind of RNAs formed by transcription of genomic sites, which have no translation function but biological significance. Non-coding RNAs contribute greatly to the complexity of organisms by diversifying eukaryotic gene regulation mechanisms. Therefore, the research on the regulation mechanisms and biological functions of non-coding RNAs can provide the necessary theoretical basis for the genetic improvement of meat quality. Because the formation and regulation of non-coding RNAs are inseparable from genes, we reviewed the miRNAs, lncRNAs, circRNAs and genes involved in the regulation of intramuscular adipocytes, their regulatory mechanisms, as well as the related signaling pathways from the field of domestic animals, in order to provide new ideas and directions for further exploring the regulation of intramuscular adipocytes by non-coding RNAs.

Acute Phase Proteins

Stress induces various physiological and biochemical alterations in the animal body, which are used to assess the stress status of animals. Blood profiles, serum hormones, enzymes, and physiological conditions such as body temperature, heart, and breathing rate of animals are the most commonly used stress biomarkers in the livestock sector. Previous exposure, genetics, stress adaptation, intensity, duration, and rearing practices result in wide intra- and inter-animal variations in the expression of various stress biomarkers. The use of meat proteomics by adequately analyzing the expression of various muscle proteins such as Heat Shock Proteins (HSPs), Acute Phase Proteins (APPs), texture, and tenderness biomarkers help predict meat quality and stress in animals before slaughter. Thus, there is a need to identify non-invasive, rapid, and accurate stress biomarkers that can objectively assess stress in animals. The present manuscript critically reviews various aspects of stress biomarkers in animals and their application in mitigating preslaughter stress in meat production.

The world organization for animal health, Terrestrial Animal Health Code (TAHC), defines the term animal welfare as “the physical and mental state of an animal in relation to the conditions in which it lives or dies” World Organization for Animal Health (WOAH). Animal welfare measurement may use animal physiology, emotional and cognitive status, avoidance behavior, animal biochemistry, and response to social or

physico-chemical stimuli WOAH. Pain is defined as "an unpleasant sensory and emotional experience associated with or resembling real or potential tissue injury". Fear is a condition generated by the perception of danger or potential harm that has the potential to compromise an animal's safety. Stress could be defined as "a complex physiological state that comprises a variety of integrative and behavioral processes when there is an actual or perceived threat to homeostasis". Stress is the aggregate of all biological responses to mental, emotional, and physical events that have the potential to disrupt homeostasis. Distress is a negative, and aversive state in which an animal's ability to cope and adapt is impaired, and unable to regain normal physiological and psychological equilibrium. Fear and pain can cause distress.

A stressor is a stimulator that initiates a stress response. Stressors can vary in duration (chronic, intermittent, or acute) or types as psychological stressors (weaning, novel environment, and commingling), physical stressors (dehorning, bruises, infightings, and castration), and physiological stressors (endocrine and metabolic alterations due to psychological and physical stressors. Stress is an inevitable consequence of modern-day livestock production practices. Further, animal response to particular stress is multivariant depends upon interactions of several factors such as vigilance, previous exposure, breeds, age, and sex of the animal, type, duration and intensity of stressor, and interactions of stressors.