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Review Article

Recent Advances, Technological Developments in Veterinary and Biological Sciences

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Abstract

Farm animal growth boosters, which are non-essential chemicals, have long been used by veterinarians and animal producers as feed additives or implants. These substances, which have anabolic action and enhance animal performance in many meat-exporting nations, include beta-agonists, anabolic hormones, and bovine somatotropin. Additionally, as the animal's nutritional status influences the availability of nutrients needed for the advancement of development and growth, the development of multiple and individual organs depends on it. Since the sources and accessibility of nutrients vary depending on the animal's developmental stage, changes in the animal's nutritional status are normal. Furthermore, obstacles from the external environment also drastically alter extrinsic nutritional conditions. Despite tremendous advances in animal science and related technologies, there are still a lot of unanswered questions about how hormones impact the welfare and productivity of food animals as well as the public's perception of their usage. Bridging these gaps through translational and transformational research progress both basic and applied animal science, with the goal of feeding an expanding population.

Keywords: growth hormone, meat nutritive value, animals, Metabolism, Development, public health.

INTRODUCTION

Growth promoters are any feed additives, including medicine injections to improve feed efficiency and consumption or even to accelerate the development of farm animals. While most forbid the use of growth boosters for increasing milk and meat consumption is required to meet human demands. Hormones are among the agents often used in veterinary medicine [1, 2]. Additionally, non-endogenous steroid hormones, or their esters, such estradiol benzoate and testosterone propionate (TP). Many drugs have a significant affinity for the human estrogenic, progesterone, and androgenic hormone receptors, such as melengestrol acetate (MGA), zeranol, and trenbolone acetate (TBA) [3, 4].

Researching the role of GH on follicular dynamics may be done in a completely new way by adjusting pituitary GH secretion regulation. In GH, df/df Ames dwarf mice's GH pituitary production is practically abolished. In this instance, it is clear that the pool of primordial follicles is composed of animals. Treatment with GH reverses this, increasing the number of antral follicles while lowering the number of primordial follicles. On the other hand, transgenic mice that overexpress GH have fewer primordial follicles than the control group. It is important to note that while GH therapy does not increase the number of antral structures, it does decrease the population of primordial follicular cells in animals of wild type. This is probably due to the fact that GH treatment increases the likelihood [5-7].

The use of hormones improves resource consumption, production, and efficiency in animals. Dairy calves can be treated with recombinant bovine

somatotropin, or rBST, to increase their milk output. However, most consumers have unfavorable associations when they see the use of hormones in production [8, 9]. The public sector has become aware of the use of hormones in the cattle producing industry. In an effort to dispel false public perceptions, organic farming practices and non-hormone-promoted animal products are becoming more popular; yet, these systems typically lack efficiency. Therefore, it's essential to provide reliable scientific information to the public so that they are aware of the use of hormones in cattle production as well as the processes involved in their manufacture, shipping [1-5].

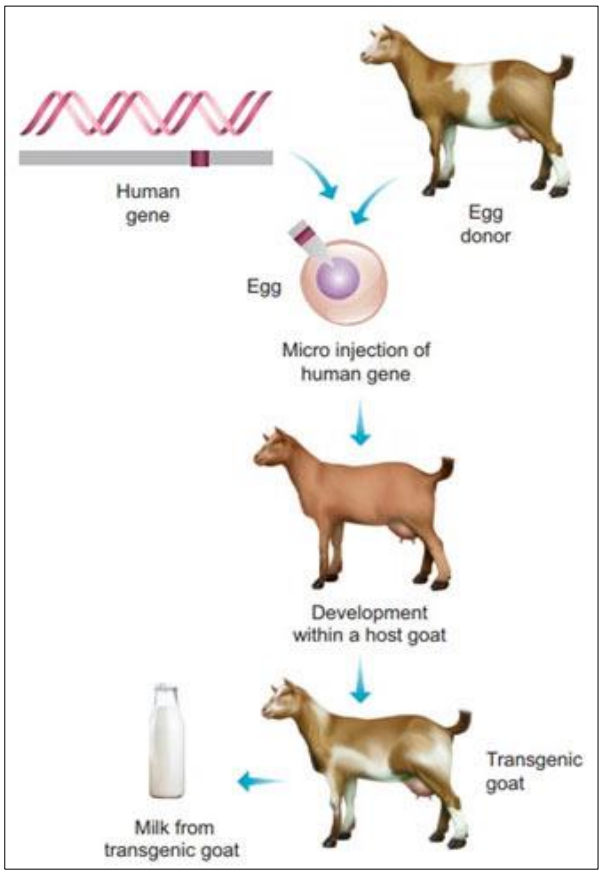

Fig. 1: Recent advances and developments and biological applications

Growth Hormones as a Growth Promoter

There are side effects of the bST use on an animal's welfare and health [9, 10]. Because bST has detrimental effects on the health and welfare of animals, the EU has outlawed its usage. Mastitis, or inflammation of the mammary glands, is one of the most frequent negative effects of bST on animal welfare since it increases output. Mastitis can cause fever, depression, and adder pain in extreme cases, all of which can be fatal. The rbST is associated with skeletal disorders such clinical lameness in dairy cows. Additional animal welfare effects of utilizing rbST in dairy cows include drainage, hematoma, lesion, and irritation and edema at the injection site [11, 12]. Numerous substances function as β-agonists, such as ractopamine, cimaterol, fenoterol, salbutamol, isoprenaline, terbutaline, clenbuterol, and zilpaterol. Zilpaterol, an active β2-agonist, is used to fatten animals in South Africa and Mexico. Zilpaterol hydrochloride is a more potent β-agonist than clenbuterol and ractopamine. The effects of zigpaterol administration are seen in fattening steers' improved growth performance and higher carcass output [13, 14].

Hormonal Implants as a Growth Promoter

Hormonal growth promoters are widely implanted in the animal business, particularly in the beef cattle industry for maximize gain and enhance feed efficiency. They are inserted beneath the skin behind the animal's ear as depot capsules that release a certain amount of hormones over a predetermined amount of time. All phases of meat production—suckling, growing, and finishing—may benefit from the implantation of these hormones. Growth-promoting hormones are implanted in an estimated 63% of beef cattle [15-17].

The transgenic product's cellular function is significant; for example, participation in growth control raises the possibility of oncogenesis. For instance, leukaemia was only noted in the SCID-X1 study, despite the fact that MLV-based RVs were utilized in both the X-linked severe combined immunodeficiency (SCID-

X1) and adenosine deaminase-SCID (ADA-SCID) studies, and LMO2 integrations were shown at a similar frequency in both trials. This suggests that transgene delivery may be involved in malignant transformation, as integration in LMO2 alone may not be sufficient for malignant transformation. ADA is a housekeeping enzyme that favors survival over growth, but IL2RG is a growth factor receptor that may be carcinogenic [18, 19]. Integration of vectors can be cell-specific. For example, MLV transduction of haematopoietic stem cells (HSC) and mature peripheral blood lymphocytes [20, 21].

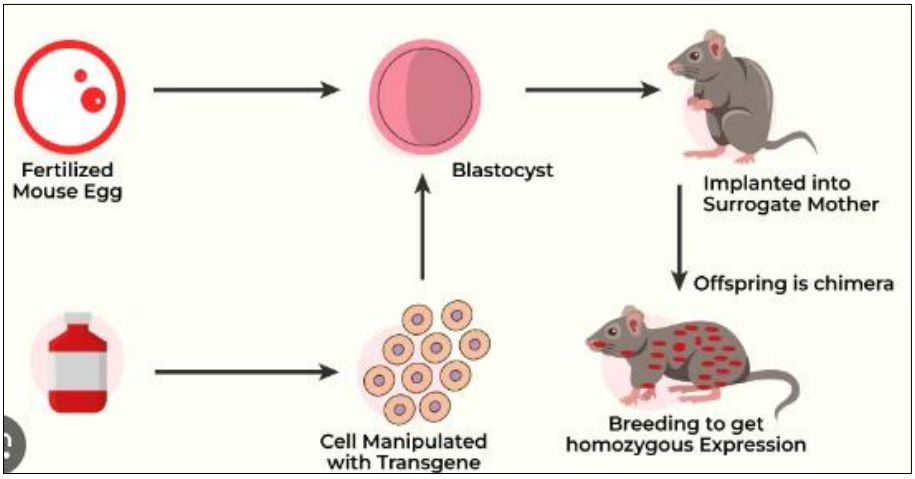

Fig. 2: Shows the genetic integrase-interacting host factors and advances

Integration of vectors may be cell-specific. For example, MLV transduction of adult peripheral blood lymphocytes (PBL) and hematopoietic stem cells (HSC) resulted in different integration patterns. The distinct gene expression profiles of the cells and the epigenetically controlled general accessibility of the genome during transduction were credited with these variations. Cell-dependent integration was revealed to be caused by different epigenetic factors [1-9]. The identification of certain epigenetic marks by integrase-interacting host factors to attach viral to chromatin is one way that epigenetic modifications on histones influence the integration pattern of viral vectors. H3K36me3, an epigenetic marker for active transcription units, correlates with HIV-1 viral integration sites, and acetylated H3 and H4 peptides are abundant close to TSSs and proto-oncogenes, which are favorable locations for MLV integration [22, 23].

Ad vectors for in vivo treatment were initially employed and deliver the α-1 antitrypsin (A1AT) gene in lung tissues and rat hepatocytes. The expression of vascular endothelial growth factor (VEGF) in patients with peripheral vascular disease and cystic fibrosis transmembrane conductance regulator (CFTR) in lung tissues of patients with cystic fibrosis were among the numerous Ad-based gene delivery trials that followed this demonstration in the treatment of human monogenic disease. Unfortunately, a number of investigations showed that Ad is highly immunogenic, which limited the production and delivery of foreign genes [24-26]. The polyadenylation signal, found in the R region of the LTR in γ-RVs and LVs, is necessary for proper transcript termination. Erroneous termination might lead to read-through of retroviral sequences haphazardly inserted into cellular genes, raising the possibility of oncogenes located 3′ from the viral integration site becoming active. Due to poor viral genomic mRNA polyadenylation, RV vectors exhibit a high frequency of transcriptional read-through of the 3′ polyadenylation signal in the 3′ LTR [27, 28].

Mode of Actions of Heavy Metals in Living Tissues

Aquatic creatures are poisonous to heavy metals because they have an atomic density of more than 4 g/cm3 and the chemical ability to both attract and receive electrons. Because heavy metals may linger in the environment for a very long time, fish are constantly exposed to them. Fish species, length of exposure, heavy metal type, and other factors all affect how heavy metals build up in the body and how they affect fish. Because of their extreme toxicity and ability to cause tissue damage in the body, heavy metals have been shown to pose a risk to organisms when they exceed tolerance limits. The effects of heavy metals on aquatic creature physiology are examined by dose-dependent toxicity experiments, which also aid in establishing the chemical's maximum allowable discharge into the environment. The frequently used to determine the amount of Fish blood is a crucial diagnostic tool for identifying pathological or stressed conditions in any part of the body caused by a variety of biotic and abiotic stressors. Numerous alterations in hematological and biochemical markers are signs that fish are exposed to heavy metals [29, 30].

Important fish organs including the liver, kidney, and gills are very susceptible to heavy metal toxicants and are well researched for various fish species that are subjected to various heavy metal concentrations. These organs are thought to be a crucial bio-monitoring

tool for assessing the harmful effects of different heavy metals in different fish species because of how differently they react to them. Long-term exposure to heavy metals results in cytotoxicity and degenerative changes in the fish's essential organs. Cadmium is a trace element that is typically found in conjunction with zinc, copper, and lead ores. Its average concentration in the earth's crust is between 0.1 and 0.5 parts per million. The average concentration in ocean water ranges from 5 to 110 mg/L, but it is often less than 1 µg/L in surface and ground water [30]. Cadmium does not exist in elemental form in the natural world. Rather, complex forms such as cyanide, cadmium oxide, sulphide, carbonate, nitrate, and chloride of zinc are often encountered [31]. Various natural and human-caused sources discharge cadmium into the aquatic environment. Cadmium is naturally obtained from the earth's crust and mantle through volcanic eruptions and rock weathering. Conversely, man-made sources consist of burning fossil fuels, applying fertilizers, and disposing of agricultural waste. Micronutrient and trace element copper is crucial for the development and metabolism of living things. Copper is an essential component of numerous metabolic enzymes and glycoproteins found in fish and other animals. It is also necessary for the nervous system to function and for the manufacture of hemoglobin. However, copper has a harmful impact on living things at larger concentrations. Freshwater fish are hazardous to copper at concentrations between 10 and 20 parts per billion. Copper's toxicity to aquatic life depends on a number of variables, including pH, anion, and water hardness [31, 32].

One of the most dangerous heavy metals found in nature is lead, which is found in conjunction with other elements including PbS, PbSO4, and PbCO3.Many human activities, including metal mining, the burning of coal, oil, and gasoline, the production of batteries, the use of lead-arsenate insecticides, lead-based paint and pigments, food cans, and so on, significantly raise the amount of lead in the environment. Lead poisoning of aquatic life is caused by lead discharge from a variety of enterprises, fields used for agriculture, street runoff, lead dust, and municipal wastewater [32]. Lead solubility in water varies with pH, salinity, hardness, and other factors. Soft and acidic water is where lead is most soluble. When nickel is present in the environment in conjunction with oxygen or sulfur, it is a relatively common trace element. The environment is exposed to nickel from both man-made and natural sources. When nickel is mined and converted into alloys or compounds, the element is released from the industry. Moreover, waste incinerators, coal- and oil-burning power plants, and trash-burning power plants all discharge nickel [32–35].

As a ubiquitous trace element, zinc is one of the micronutrients that are necessary for all living things. Zinc has a role in several metabolic processes, including the production of proteins and nucleic acids, immunity, energy metabolism, cell division, and bodily development. Additionally species-specific, zinc toxicity changes with fish developmental stages. Temperature, water hardness, and dissolved oxygen content are the main environmental variables that affect how harmful zinc is to aquatic life. Fish are killed by zinc at acute toxic concentrations because it destroys gill tissue; at chronic toxic concentrations, fish die from stress [35, 36].

CONCLUSION

Many hereditary illnesses may now have molecular treatments thanks to recent developments in the field of gene therapy. In the lack of a widely accepted framework for the risk assessment process, biosafety professionals play a crucial role in managing gene therapy research protocols, determining risk levels, and creating appropriate policies. This is demonstrated by the design of new experimental viral vectors and emerging technologies.

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