



Benefits of Farm Animals Genetic Adaptation: A Review



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Abstract

The review aimed to review about the benefit of genetic adaptation of farm animals. Gene helps the farm animals to adapt conditions and able to survive in order to supply food sustainably for the fastest growing global human population. Furthermore, farm animal's genetic adaptation plays a great role to cope up climate change, environmental stresses including extreme hot and cold, disease and parasite and to overcome welfare problems. Accordingly, considering different factors, climatic condition, topography, breed type, relationship with human, disease and parasite resistance, welfare issue, physiological and behavioral status, nutritional habit in harsh environment and management influences, local and cross breeds are more important than exotic breeds to establish an international sustainable farm animal breeding program at farm and laboratory level. Likewise, in-situ and ex-situ adaptive local gene conservation bank should be done properly, especially, in developing countries where their experience is inadequate and local species record at regional level must be realized. Therefore, the importance of this review is unquestionable and must be documented.

Keywords: Adaptation; Farm animal; Genetic adaptation; Globalization; Parasite resistance; Domestication; Natural evolution; Livestock; Habitat Destruction; Mating; Forage scarcity; Animals; Biology; Energy; Protein; Vitamins; Geographical features

Introduction

Genetic adaptation is a characteristic with a heritable basis that will improve the reproductive and survival traits caused by domestication and natural evolution [1]. Genetic adaptation is of unknotted major aim of evolutionary biology [2]. Consequently, genetic selection got an attention to establish breeds which are more adapted, faster growing, productive and better disease and insect infestation resistance to supply food and other livestock products sustainably to human beings in every parts of the world [3]. However, evidence for genetic adaptation in farm animals remains poorly understood [4].

Additionally, Kantanen et al. [5] reviewed, the influence of climate challenge for farm animal genetic resource adaptation and conservation soon in human food supply and the alleviation mechanisms. Hoffman et al. [6,7] made clear about the significance of different livestock production systems to be part of the food source to mitigate the insecurity problem by conserving diversified animal genetic. However, Unlimited mating, habitat Destruction, unsustainable selective pressures for adaptation to global climate changes, over exploitation and loss of community structure are major threats to conservation of farm animal genetic resources Allendorf and Randi (as cited in Kefyalew

Alemayehu (2013)). Moreover, there have been losing of farm animal genetic material in some place because of globalization [8] and many local breeds have a small population mass due to the cause of inability to adapt resulting extinction [9].

Therefore, the paper aimed to review about the benefit of genetic adaptation of farm animals. It is hoped that the review will help further inform professionals and decision makers whose task is to establish effective farm animals breeding program as a basis for viable expansion of the livestock business.

Benefits of Farm Animal Genetic Adaptation

Animal genetic resources (AnGR) are required to put a solution for world food insecurity challenge especially in developing countries at livelihood. Livestock provides products with great amount of energy, protein, vitamins and minerals mostly for infants and mothers. Livestock sector supports more than a billion people particularly the rural people which are predominantly poor [10]. The need and completion to use animals and their products have been increasing for the last century significantly and this will be expected to rise. Boettcher et al. [11] recognized, the domestic animal diversity information system (DAD-IS) prepared by FAO reported about 70% of the

world local farm animals', are recorded cattle, sheep, chicken, goat and horse, the need of farm animal gene expressed for adaptation record and in-situ and ex-situ gene conservation environments (Table 1).

Table 1: Numbers of local breeds recorded per species and region for the five main farm animal species for food and agriculture.

Species	Africa	Asia	Europe and the Caucasus	Latin America and Caribbean	Near and North Middle East	North America	South West Pacific	World
Cattle	176	241	369	141	43	17	32	1,019
Chicken	129	305	912	88	35	15	30	1,514
Sheep	117	262	613	51	53	21	38	1,155
Horse	40	138	371	84	14	22	25	694
Goat	96	183	218	28	34	6	11	576
Total	558	1,129	2,483	392	179	81	136	4,958

Farm Animal Genetic Adaptation to Supply Human with Food

Rothschild [12], in 35th world animal genomics conference, reported the world human population will increase rapidly from 7.3 billion to 9.6 billion by 2050 and that food production must double, despite limitations due to climate change and limited land and water resources. Therefore, a better understanding of the underlying genomic control of adaptation in native and exotic livestock will be required to meet the growing human needs with keeping the diversity of the genetic resources in the way to transfer to the next generation. The availability and cheap animal genomic technologies must come up to benefit the livestock producers and consumers in the developed world. However, these tools now need to deliver new opportunities for the developing world.

Genetic Adaptation of Farm Animal Functional Traits for Economic Profitability and Welfare Issue

Functional traits play a critical role in biological and economic efficiency not by higher outputs of products, but by reduced costs of production. Consumers demand of farm animal's product is growing as a result it needs supply of safe, quality and low-cost product by giving attention to farm animal welfare. In this case, to establish effective and efficient breeding program consideration of functional traits have countless meaning [13]. The relationships between production and functional traits are often unacceptable. Further than its economic benefit functional traits play a role in ethical and consumer concerns in the breeding program, which are becoming increasingly important.

Farm Animal Genetic Adaptation in Pastoral Environment

Adaptation is influenced by genetic make-up and it determines an animal's tolerance to adverse conditions such as high temperature, drought, pests and diseases. Adaptation because of heritable feature of genes of farm animals favor survival of a population. Many breeds of the harsh environment have developed many adaptive traits that increase their survivability

Naskar [14]. The existence and fruitful reproduction of farm animals which are genetically adapted to a specific environment is majorly determined by natural selection.

Smallholder pastoralists and their animals repeatedly live in harsh environments which may be extremely cold or hot. Moreover, these environments can be characterized by scarce feed and water resources and high disease pressure with large seasonal and annual variation of rainfall. In this condition, the farm animal genes have a potential to allow animals to live under stressful conditions. The first stragy of breeds will be keep the environment comfortable by considering the need of animal. The other alternative is raise locally adapted animals that is very important for small-scale holders and pastoralists. In the second case, managing diverse and mixed farm animal enable them to live, produce and reproduce in their environment under a given production system Mirkena.

Climate Change and Farm Animal Genetic Adaptation

Conserving satisfactory multiplicity of AnGR is necessary to safeguard adaptation prospective in times of uncertainty to overcome, the probable climate change problem, which will be a major force testing elasticity of global food production systems [15,16]. Adaptation to climate change is improbable to be accomplished with a single strategy (Hoffmann, 2010). Evidently, amendments will be needed in animals' Genetic changes will play a noteworthy role. Therefore, a significant research commitment and application of genomics will support the measures taken for farm animals to be able to coup up the climate change.

So far, many livestock breeds have been genetically characterized [17], but the value of this for study of adaptation is debatable. The best mechanism to tolerate climate change is rearing local breeds adapted to harsh environments. Most developed country breeds have been studied for the past many decades in case climate is managed. Explaining the production system area to get the required information should be done by observing geographical features which further needs to investigate the implication of adaptation [18], socio-economic

evidence [19] and local breed management information with in its habitat to gather with climatic documents and soil, vegetation, and water resources. Therefore, crossbreeding can be a valuable strategy for achieving increased productivity and adaptability.

Genetic adaptation basically increases productivity, efficiency and maintenance of genetic diversity which allow for more opportunities to match breeds to a changing climate in case wild animal genetic diversity supports selection rather than farm animals [20-23]. Higher yield and flexible breed in conditions likely to be prevailing by reason of climate change, such as heat and drought tolerance and resistance to certain diseases. Several adaptive genes are involved in cross-talks between processes, in part through the regulation of transcription. Selection allows adaptation of functionally diverse loci with high gene flow and small allele frequency.

Conclusion and Recommendations

The fastest growing world human population demand for food is becoming beyond the carrying capacity of the land. As a result, the farm animals' contribution to fill the food demand gap is getting an attention and different improvement programs were established in different parts of the world [24-28]. Accordingly, Genetic adaptation determines the effectiveness of production, behavioral and survival capacity of animals. Especially, natural selection plays a vital role to get an adapted farm animal gene for higher output, safe welfare and sustainable utilization without any detrimental effect through time.

However, evidence for genetic adaptation in farm animals remains poorly understood which caused quality depletion of genes. In addition, the global climate change, disease outbreak, parasite infestation, scares availability of animal forage and water also become a challenge of farm animal genetic adaptation in certain portions of the developing nations. Moreover, best locally fitted animals genetic resource conservation is not as much working in some areas of the globe. Furthermore, understanding the genetic adaptation of farm animals, conservation and record keeping of local breeds have a great role to global food security that is practiced in developed countries where as it is becoming a great problem on the other side of the world. Therefore, Conservation of locally adapted indigenous farm animals breed is an important objective of sustainable animal breeding program.

From the above conclusions, the following recommendations are drawn and should be considered while working with genetic adaptation of farm animals: -

- a. Important farm animal adapted genes should be recorded and conserved.
- b. Productive breeds under global climate change which will mitigate forage scarcity, disease and parasite infestation should be generated.
- c. Trainings, reviews and research should be done intensively on the topic of farm animal genetic adaptation.

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