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Recent Trends in the Stem Cell Research in Camelids

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Introduction

Not only in Arab countries, camels are of great cultural and economic value in Pakistan, especially in arid and desert environment. They are valued because of its unique medicinal and therapeutic features of milk and meat. Camel is also used for transportation, beauty and racing game, purpose. Hence, it is of great concern that prime camels should be treated accordingly in order to maintain supreme genetic pool of this animal. Among regenerative treatment protocol, stem cells lead the show with promising advances in biomedical research, biotechnology as well as embryology. One of the biggest achievements in stem cell technology would be establishment of pool of stem cells derived from genetically superior camels that would lead to the next step of developing genetically modified superior animals along with the conservation of gene pool of such animals.

Dromedary camels (*Camelus dromedarius*) also called as Arabian camel is an excellent food animal for people of desert as it serves as source of milk and meat for them without being easily harmed by severity of hot weather, spare food and water. That is why they fit well in desert ecosystem. Pakistan is among the top ten camel with 1.1 million heads. Camel produces milk rich in vitamin C and other mineral contents and low cholesterol. Camel milk has proved to be of medicinal importance in many diseases, acute as well as chronic. Mostly these camels are reared for domestic purpose, however, a good number of these animals are exported to Arab countries where they are employed to highly luxurious and well-planned sport. This sport brings people around the world to have a scenic view of the game, hence, promotes agritourism. Unfortunately, many of these camels get severely injured, most of which are bone fractures. Similarly, poorly managed camels in Pakistan face injuries during transportation making them useless entity. These orthopaedic disorders are poorly handled as there is not sufficient understanding about bone fracture and repair and one cannot simply apply bovine research output in camel in its true terms. Similarly, equine regenerative medicine knowledge cannot be applied in this animal because of its unique biology. Accordingly, mastitis in camel is another common problem in dairy camels with quite high prevalence, about 76%, in some areas. The disease is traditionally treated with antibiotics and anti-inflammatory drugs, however, its treatment is very difficult that sometimes leads to loss of the quarter. It is, therefore, necessary to conduct extensive experimentation on camel

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regenerative medicine, especially in terms of bone, fat and cartilage repair, henceforth, tissue repair.

Globally, camel milk is recognized as curative food item in variety of diseases as it is rich in proteins, antimicrobial and immune boosting compounds hence considered superior to cattle and buffalo milk. Malnutrition in new born babies is treated with camel milk in some countries because it contains lower fat contents and short-chain fatty acids compared to other milk types, like cattle, buffalo, goat and ewe. Camel milk is also rich in vitamins specially vitamin C and B1 and minerals like sodium, magnesium, copper, iron, zinc and potassium. Milk production potential varies significantly in different animals; higher producers may yield twelve folds more than low producers. Nonetheless, camel can endure harsh environment and still can perform at an equal potential. Therefore, it is need of the time to conserve and propagate genetic material of high-yielders through cloning and treat such animals through regenerative medicine like stem cells therapy. It is of utmost importance because traditional techniques are failing to meet requirements.

The genetic makeup of high producing camels can be conserved and be cast-off in regenerative medicine using induced pluripotent stem cell technology. In this technique, cells from an adult animal are obtained and, under special conditions, are transformed into pluripotent stem cells commonly known as iPSCs. A nobel prize was awarded in 2012 on this achievement. These transformed cell behave similar to blastocysts. Blastocysts are the cells of an early embryonic stage which have ability to give rise to any type of cell in body upon specific induction. It is neither easy nor ethically acceptable in many cases to deal with embryonic stem cells as it may harm the life of an embryo. Therefore, iPSCs from genetically elite animal should be put into use whose genetic worth has been proven, in terms of milk and meat production, beauty or racing game anima. These cell can be engaged to produce disease specific and patient specific medicines for other elite animals, to improve the potential of progeny and for drug testing for camels. Till date there in no such research reported in camels, though other animals like large and small ruminants, equines and pig have been studied. Accordingly, there is a huge gap of research in this area in camels.

So far in stem cell advances in camel, embryonic stem cells have been isolated and characterized for their abilities of pluripotency and to differentiate in the cell culture media into neuro-like cells. They have also been characterized using real-time polymerase chain reaction (RT-PCR) and quantitative PCR (Q-PCR). Further, scientists have studied whole genome of camel which is responsible for its pluripotency and it revealed approximately 90% match with human genome. It is also a matter of interest that these genes may be used to produce iPSCs instead of using commercially available factors of mice and human origin. As far as adult animal stem cells are concerned, they have been isolated from fat tissue. These cells have shown potential to transform into bone, cartilage and fat cells. This transformation potential is considered pivot for stem cells. Some other scientists are trying to harvest stem cells from reproductive tissue like ovaries. This will provide an easy access with no ethical issue as these tissue can easily be collected from a slaughtered animal as well as from a live animal. Initial reports show promising results. The cells of ovarian origin have successfully been transformed into bone and fat cells and neuron.

Stem cells are gifted to be used in therapeutic applications as well as have many uses in agriculture and genetic engineering. This could lead to development of genetically engineered animals with supreme quality of genetic makeup. In this way, a high yielder or good runner camel may be produced. The basic version of this procedure has already proved its success in lab animals and small ruminants. Although some animals are produced but they suffer with many difficulties in their life. With the use of advanced techniques of nuclear donation from iPSCs, cloning efficiency may be improved may folds from traditional cloning. These trans-genetic cloned camels will be race champions and high milk producers.

In a nutshell, iPSCs in camel will benefit in terms of treating injured and diseased animals, to preserve genetic material of elite camels, to understand cellular mechanism of pluripotency, drug discovery and modified cloning.

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