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Review on Camel the Solution for Global Health Crisis of 21 Century and for Future

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Abstract:- Camel is unique and neglected animal which less research is done compared to other animals. But a few researches on camel contribute solution for human, animal and environmental health crisis. Camel products such as milk, urine and blood are used as remedies which can cure many infectious and non infectious human diseases. Camels act as reservoir for many animal and human diseases. A research finding on camel diseases could enable understanding of animal and human disease mechanism because camels are asymptomatic for devastating and highly pathogenic animal and human diseases. Before the outbreak of pandemic Covid-19, the outbreak of the virus which causes MERS-CoV infection, is genetically very similar to Covid-19 and reported to WHO in different parts of the world, camel is proposed as reservoir. If more investigation of MERS-CoV in camel and human had done the Covid-19 would have controlled and prevented without causing global pandemic. Climate change is causes for emerging and re emerging of human and animal disease. The climate change is caused by animal husbandry and feeding system. Feeding habits of animal, movement and releasing of waste product of animals cause environmental changes which disturb ecosystem health. A climate change impose a great impact on survival of animal but camel can resist and survive in harshly condition, can survive in less availability of feed and water, less methane emission compared to other ruminants. The dung of Camel is dry and can't contaminate the area as other ruminants and used as fuel or sources of energy for cooking where woody plants are not available. Due to different grazing habits of camel from other ruminant, camel make less overgrazing. Camel is the solution for global health crisis of 21th century and provides increment that global health is depend on interconnection and cooperation of animal health, environmental health and public health experts.

Keywords:- *Animal, Camel, Environment, Global, Health, Human.*

I. INTRODUCTION

Among the mammal's families, camilidae are the most neglected and ignored animals. Camels are belonged to the families of camilidae within ruminant suborder Tylopoda of even toed ungulates (order Artiodactyla). Camels are classified into a genus of camelus and Lama. The camelus and lama are popularly known as old world camels and the new world camels or Southern American respectively. The genus of camelus has two species *camelus dromedaries* or Arabian Camels or one-humped camel or dromedary and *Camelus bactrianus*or two humped camel. The first direct evidence of domestication of dromadiries is started in south Arabia the place called hadhralmaut in the present area of Oman (Ross, 1984, Barht *et al*., 2003). Comparatively with other animal camels eat fewer amounts of feed and water. They feed a plant which is unapproachable to or neglected by another animal, and they have a remarkable tolerance to dehydration. Ross, 1984 explained that the dromedary adapted for the life in the hot, dry desert condition and its anatomical features an able to brows on thorny plant species. In their feeding habits camel prefer camels prefer to browse on trees, shrub and bushes camel-thorn, acacia and salt bushes which other domestic livestock will not touch. There may be an element of truth in this statement that for normaly the camel is a hardly and healthy animal even in disease is uncomplaining and almost asymptomatic. Dromadareis apparently infected by fewer diseases than other animal and epidimecs are rare. (Nelson, 1964) also expressed as camels is unique from mammals that its RBC is oval shaped. Camel differ from other ruminant in several respects they lack a well defined omasum. The rumen has two glandular sack or diverticula. They used to be known as water sack from the incorrect assumption that their function was to store the water. The camel like the horse has no gall bladder. The hump which is store of fat bound by fibriuos tissue is a reservoir of food which can be oxidized and used when needed. The fat is distributed in the hump instead of being distributed through the subcutaneous layers to allow the process of radiation for cooling purpose. The most peculiar traits of camel is its great tolerance to heat and water deprivation. Camels can loose upto 30% of their body water and still remain a good health. They compensate for water loss by consuming large quantities of water at one time (about 100L). This causes dilution of blood and other body fluid which cannot be tolerated by other animal. The rbc of camel can swell to twice their normal size without rupturing. The dung of the camel is dried used as fuel, providing a valuable sources of energy for cooking in areas where tree do not exist. Disease control measures are vitally important together with investigation of all pathological conditions occurring in camelidae which are of economic and public health importance. Camels are occasionally bled (uses camel blood as nutrient) to provide for particular human demands of iron, salt and other nutrient.

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II. CAMEL FOR ANIMAL HEALTH PROBLEM

The research to identify whether camels are clinically susceptible and act as potential reservoirs, maintenance and bridge hosts to viral pathogens affecting other livestock and a human is rising. Until recently it estimates that about 99 percent of the viruses in mammals have been unknown (Anthony *et al*., 2013). Comparatively with other ruminants camels are not susceptible to many viral diseases such as FMD and rinderpest (Miguel *et al*., 2016).

There are no diseases specific to camels. All the infection that has been reported is well known to exist in other domestic animals. Symptoms of disease, however is often missing or obscure. Almost many infection diseases in camel is highly affect young animal rather than old ones, but many infectious disease of other domestic animal affect different age groups and depend on its associated risk factors. Camel Trypanosomiasis, camelpox, mange affect young camel. Viral diseases such as Camelpox (CP), camel contagious ecthyma and Warts (benign neoplastic skin of human and animals) are mostly affecting the young camels between the ages of 6 months and 2 years (Munz *et al*, 1990). Calf diarrhea is an infectious disease of the young camels and could be caused by viral diseases with secondary bacterial infections. The enteritis (27%), tick infestation (21%), lymphadenitis (18%) and malnutrition (15%) are the highest causes for death in young camel respectively in central Somalia. In UAE and Sudan, Virus which causes diarrhea such as cronavirus and Rotavirus were reported in the young age groups of camel (Warnery *et al*., 2002).

Salmonellosis with colibacillosis, rotavirus and cronaviruses are considered the main cause of calf diarrhea with high death rate (Wanery and Kaaden, 2002). Ringworm is a fungal disease caused by dermatophytes. The disease is distributed in the camel herds and affecting young camel.

The Mange is mostly caused by Sarcoptes scabiei (Sacoptidae), although, there are Psoroptic (Psoroptidae, Psorotes sp.), Chorioptic (Psoroptidae, Chorioptes sp.) and Dermodectic mange (Demodicidae, Demodex sp.) with little incidence in dromedaries. In their native place, where camels are usually raised specifically during the long dry season, camels are exposed to severe stress conditions which made them susceptible to many infectious agents (Abbas *et al*., 1993; Agab, 1993).

Peste des petits ruminant virus (PPRV) is a contagious viral disease of goat, sheep, cattle, commonly caused by a PPR virus genus morbilivirus and family paramoxyviradea which closely resembles rinderpest virus. PPR is endemic and considered to be the seriuos infection of small ruminants in West Africa, Central Africa and East Africa mainly Ethiopia but in cattle the clinical sign is absent. The disease has no public health importance and the camels are also susceptible to the virus (Roger *et al.*, 2001), with a prevalence rate of serological infection of 3.76 %. Even though the research is performed on healthy camel, around 7% of mortality rate is observed in camel infected with respiratory disease is supposed to be caused by the virus (Khalafalla *et al*., 2010). The complication of bacterial infections of respiratory system enhances the immunosuppression effect of PPRV (Yigezu *et al.*, 1997). The ecological and epidemiological character of the virus in camel is largely unknown. The regions where the virus is not found in sheep and goats, the camels were free of antibodies. This indicated that the virus is not only appeared in camels (Touil *et al*., 2012). However, the question of whether camels have the potential to excrete the virus is raised due to the susceptibility of camels to the virus infections (CIRAD, unpublished data). Research studies in Dubai indicated that any clinical signs of the virus are not observed in camel inoculated with PPRV experimentally. It suggested that pathogenicity of the virus is low in camel. However, the disease is known to be extremely difficult to reproduce experimentally even in sheep and goats with the same degree of clinical signs as observed during natural conditions. Werneries (2011) recommended that "there is a need for further infection trials with different PPR strains to elucidate the role of camels in the ways of transmission of the disease (Wernery, 2011).

III. CAMEL FOR ENVIRONMENTAL HEALTH

A. Camel and Climate Change

Camels are the most adapted dry climatic condition animal, provides a major contributions of food and income for the pastoralist and agro-pastoralist in Ethiopia (Alemnesh *et al*., 2020). Recently around 35 millions of camel population number is estimated globally (FAO, 2019), most of which are in Somalia, Niger, Kenya, Chad, Ethiopia, Mali, Mauritania and Pakistan (Mwinyikione *et al*., 2016) and areas of camel rearing are extending partly due to expanding of desert particularly in sub-Saharan region (Faye *et al*., 2012). Camels are very imperative livestock exclusively adapted to desert. Camels are the major livelihood alternative in the dry and hot areas since other animals are less adapted to the desert (Faraz *et al*., 2021 *a*). Their capability to live for many days without food is the main characters that make the camel of high importance due to the expansion of environmental challenges such as desertification, deforestation and high temperature (Nelson *et al*., 2015). With the current trend of global warming, desert encroachment, drought, low rain fall, the camel character to be one of the animals that can overcome the climate changes (Barhrt *et al*., 2003).

Camels have unique organ and organ systems that tolerate them to adapt under change of normal ecosystem. Physiologically the camels well tolerated to high temperature with volume of blood maintained partly by water being absorbed from the skin to other bodies (Onu and Hambolu, 2006). Fluid and water conservation is retained by highly efficient urinary system mechanisms linked to kidney with long nephrons, nitrogen retention and re-use, production of dry faeces and very flexible diurnal temperature which can vary up to 6oC daily. There is constant water reabsorption through the blood from the intestines to the forestomach (Mukass, 1981). The camel have extraordinary ability to overcomes feed and water deprivation (Payne and Wilson, 1999).This is related with many phases of single and herd activities and anatomy majorly amongst which are the preference to feed at night and the early hours of the morning,

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coughing early in the morning before the sun warms the ground which helps reduce the heat they absorb from the ground, bringing both legs to limbs under the body to reduce contact with the ground and cluster together to reduce the amount of water lost by radiation. The slipper like feet which reduces pressure and makes easy move on sand is a character that is extremely helpful for the survival of the camel in the arid region (Payne and Wilson, 1999). They can even lactate when dehydrated with milk water content exceeding 90% (Ilse *et al*., 1991). A double fold of eyelid and can closing of the nostrils helps protect against dust and helps during sand storm to prevent entrance of the dust to the opening of the animal (eye and nose) (Huffman, 2004). The camel is healthy and can maintain their body function when 1/3 of water loss from the body which is irrelevant to other livestock. In temperatures of 30-40Oc camels drink water once in two weeks and only in the hottest weather they can drink water once in a week. They drink at the speed of 10-20L in 1 a minute (Ilse *et al*., 1991), Interstitial and intracellular bodily fluid is where water is consumed. In ten minutes camel can drink up to 100liters of water which is physiologically unique and in 13 minutes they have ability to drink 110L of water (Nauman, 2012). The name like ship of the desert has been given for centuries because camel is important parts of ecosystem in desert. The reliance of human beings on camel is not only as sources of food but it is also an important source of power for ploughing and riding purposes (Khanvilkar *et al*., 2009)..

B. Overgrazing and Habits of Diet

The grazing habits of camel endowed with the most rational utilization of desert vegetation. It is totally different from that of intensively grazing of small ruminants and slows moving of cattle. Camels never overgraze. No matter what quality and density of the pasture, they move constantly taking only small portion from any plants. Only certain, small plants growing separately, are eaten almost entirely. By contrast, sheep graze down, to the roots and goats climb in to the trees. Camels grazing habit is totally different from other ruminants. They separate widely during grazing particularly during drought conditions when feed is not available. The camel has very low food requirement compared to its normal body weight.

Domestic animals managed under free ranging grazing system ingest different types of plant species during the growing season than during dry season. Goat feed highest number of plant species followed by camel accept the highest number of forage species resulting in a more even utilization of available plants. Comparatively bovine and equine ingest a very narrow range of plant species, which can direct to their overgrazing. In contrast to cattle, camel spend less than 5% of their feeding time near ground level and about 70% at heights of over 1m above ground. The camel prefers higher vegetation strata which gives the advantage of continuous access to feed high quality plant. All plants reaching above 1m height are shrubs, bushes and trees which are deep, rooted often tapping into the groundwater and remaining green long into the dry season or throughout the year, when the herb layer is dry and highly lignified. Since over 90% of their feed intake comes from higher plant species plants, they can be referred to as browsers, whereas cattle, feeding almost exclusively in the herb layer and on grasses, are referred to as grazers. Small ruminants, in that classification, categorized as intermediate feeding types with a selection to one or the other extreme. The camel when given the opportunity, selects a diet, which is higher in quality than the average of what is available, making the camel a 'concentrate selector'. When allowed free choice, its preferred diet comprises mainly browse. A diet on browse consists on average of about 35% of leaves of leguminous and other trees and 65% of seeds, pods, flowers and twigs. Its ability to select high quality feed is helped by the long neck and legs and grasping upper lip and mobile tongue as same as giraffe. Camel is not only feed higher vegetation strata but also graze grasses if no or little other choice is available. In different parts of countries like in Pakistan, India, Ethiopia, Somalia, Mauritania and southern Arabian Peninsula, camels are also grazers. In addition, the camel reared in irrigated areas in Pakistan where crop agriculture is major livelihood; freely feed green and dried guar and gram bhoosa. The browsing habit is advantageous for in reducing competition for feed resources with other species and the camel owners in allowing them to keep a greater total biomass (more numbers) of domestic herbivores on a unit area, without contributing to increased environmental degradation and at the same time adding to the sustainability of the system. When given a free choice, the feed preferences of the camel and its ability to select the most nutritious and digestible parts of plants ensure that it has a good quality diet that is high in protein throughout the year. It is able to maintain on a diet with a minimum crude protein content of 14% in the dry season, while cattle at this period are on a very low protein diet as reported from Kenya. In terms of cellulose content, camels select a diet with the lowest value of this feed component, while cattle have the diet with the highest proportion of cellulose (Bakhat *et al*., 2003).

The feeding habits (grazing) of camel is observed in different parts of camel rearing continents (Gauthier-Pilters, 1981) showed that camels graze for limited time from 8-12 hour in each day but are highly mobile during this limited times. Satellite tracking of individual camels robust with tracking collars carried out by the Northern Territory Conservation Commission has explained that camels can travel 50km/day (Heuche *et al*., 1992) and that their total range may be as large as 60 000 square kilometres. This feeding habit is thought to be a reason why the impact of camels on vegetation is reduced when compared to cattle and sheep which graze for longer periods when the vegetation is poor. White (1997) explained that although camels graze selectively they choose a wide range of plants in their diet where many plant species are present, camels will utilise a substantial range and only have an impact on a species if it is actively selected for browsing. In addition to being able to be highly selective during feeding and therefore utilise the best available feed, the camel has a number of modifications which aid in the digestion of low quality feeds. An ability to increase mean retention time of feed particles within the fore-stomach if high quality feed is not available. Camels grazing low protein diets can efficiently recycle body urea for microbial protein synthesis. The microbial composition within the forestomach of camels is thought to aid in the more

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efficient digestion of high tannin feeds. The aspects of camel grazing and digestion which have been outlined above are thought to aid in their ability to survive on poor quality pastures under arid conditions (White, 1997). Comparatively with other ruminants, camels have a lower feed consumption (Macfarlane *et al*., 1968), which match up to their lower energy required (Munz, 1992). This can be explained as a survival to environments with low feed availability (RIRDC, 2000).

C. Methane emission

Ruminant releases methane emissions gas which has been highly investigated in order to minimize impact of methane for the climate changes. Physiologically ruminant eructate higher amount of methane to the environment. Previously it was supposed that camels are also produce similar amount of the methane gas with other ruminants due share the same features of physiological system with other ruminants. Dittmann et al., 2014 made methane gas measurement by respiration chamber measurements method on different camel species indicated that they emitted less methane gas expressed on the basis of body mass when evaluated to scientific data on livestock ruminants (Dittmann *et al*., 2014).

IV. CAMEL RESEARCH FOR PUBLIC HEALTH

- *Camels as Zoonotic Disease Reservoir*

The dromedaries play an important role as reservoir and carrier for many zoonotic diseases. The mechanism of disease such as ways of transmission, clinical sign and pathogenesis in camel is different from other animal and human.

The Rift valley fever disease, a serious zoonosis is caused by a rift valley fever virus of the genus phlebovirus and family bunyaviradea (Chevalier, 2013). RVF is a mosquito-borne, per acute or acute disease of ruminants which is characterized by fever, necrotic, hepatitis, haemorrhage and abortion. The disease is widespread and serious outbreaks have been encountered in both human and animals in Egypt, Sudan, Ethiopia, South Africa, Zimbabwe, Zambia, Uganda and Tanzania. The virus may be present in aborted foetus and man is infected by penetration of the virus through abrasion on the skin or mucosa when handling infective materials. During outbreak the mortality may reach 50% in goats and 60 % in sheep and abortion rate of 80-100% has been reported. Camels are also susceptible to the virus infections but have low mortality rate and morbidity rate. The disease is confirmed serologically in East Africa (Kenya) with different clinical forms. Recently the disease occurred in camel in Mauritania with two clinical forms were reported. The first peracute clinical forms were observed in camels and sudden death within 24 hours and other acute clinical forms with fever, necrotic, hepatitis, haemorrhage and abortions were recorded (El Mamy *et al.*, 2011), but mild forms and even a virus carrier state without clinical signs were also described. For case in point, the virus was isolated from blood samples of dromedaries with history of no clinical sign, accidently infected in Egypt and the Sudan (Eisa, 1984; Imam, El-Karamany and Darwish, 1979) and laboratory inoculation of the virus to non pregnant dromedaries, the clinical sign is not observed. The first outbreak of disease in Egypt is linked to history of dromedary camels which cross border to Egypt officially without disease examination. A second research indicated that the virus was still transmitting in dromedaries in Mauritania when the outbreak of the disease was ended and officially announced (El Mamy *et al.*, 2011). The major role of camel act as the amplifying hosts is still unknown. Dromedaries may act as amplifying hosts in some areas, but do not seem to be essential to the epidemiological cycle of the virus and its maintenance in all ecosystems. Expansion of the virus and epidemic have been reported in countries such as Madagascar, Central and Southern Africa where camel is absent, although the presence of various cycles in specific socio-ecosystems cannot be ruled out. From a zoonotic point of view, it is well known that transmission from cattle and small ruminants to humans occurs through direct contact with infected blood or infectious abortion products but there is as yet no specific information about transmission from dromedary camels to humans. Therefore further research should be made to identify the sociological and economic impacts of disease on camel production through an inclusive approach.

The foremost outbreak of coronavirus disease in man, afterwards called as Middle East respiratory syndrome coronavirus (MERS-CoV), was reported in Jidda, KSA in September 2012. In 2016 another outbreak of the disease occurred in KSA and later the disease have been reported to the WHO with case fatality rate of (1860/643) 35 percent in different parts of the world. Retrospectively identified that the disease is related with travel or residence in the Middle East have been reported in different parts of the world, but the first huge outbreak outside the epicentre of the disease was recently seen in far east countries, with 189 cases and 36 deaths. It supposed that, dromedary camels are strongly assumed of acting as a zoonotic source for the disease in human. The disease is transmitted from camel to human through droplet infection with mucous membranes or through human being contact with different bodies' secretion of the camel such as milk, meat and urine. Different assumptions and ideas are supposed on how dromedary camels play a major role in the epidemiology and act as reservoir host of the disease. First, coronaviruses are widespread in the bats and livestock, but recent serological screenings indicate that MERS-CoV does not infect the most of livestock animal and other camelids species (Reusken *et al.*, 2013; Chan *et al.*, 2015) but up to 100 % of seroprevalence have been observed in dromedary camels in different parts of the world. Next, the viruses isolated from dromedaries are molecularly the same to virus isolated from human patient (Chan *et al.*, 2014). Another assumption is that, retrospectively serological studies in Africa going back more than 30 years show that circulation of the virus in dromedaries for many years (Muller *et al.*, 2014). Fourth, in dromedaries the clinical sign of the disease is absent and only mild respiratory symptom is observed, which made the disease difficult to notify. At last, Dudas and Rambaut (2015) showed that the virus genome has made several gene recombinations, which suggests frequent co-infection, most likely in camels, with distinct lineages of MERS-CoV. Although new research exposed traces of antibodies against MERS-CoV in human with frequently

contacted with animal in Kenya during 2013/2014 (Liljander *et al*., 2016), it is surprising that the cases have not been reported in human with the history of frequent contact with dromedaries outside Middle East. The workshops made by WHO, FAO and OIE on MERSCoV undergone in Doha and Cairo in 2015, have formed recommendations based on research to find out on whether and why of human cases do not occur in Africa despite the high levels of infection in dromedaries, and raises question why the virus is apparently absent in Bactrian camel. The accurate character of dromedary camels as a potential reservoir for the virus is also still unknown and more research should be made to detect the ways of transmission.

- *Importance of Camel Milk for Public Health*

Camel milk contain different amount of substances either lower or higher than another ruminant milk which uses as treatment for many infectious disease and non infectious disease of human. Low amount of cholesterol and sugar in camel milk has a health benefits for consumer. An individual with lactose intolerance is caused by presence of *β-lactoglobulin* in cow milk but absent in camel milk. The presence of unique antioxidative factors, high minerals (magnesium, sodium, chlorine and zink), antibacterial, antiviral, antifungal,, insulin, high α- hydroxyl acids, antiplatelet and anti-thrombotic properties(musaad *et al*., 2013), vitamin C, higher protective proteins like *lactoferrin*, *lactoperoxidase*, *Immunoglobulins* and lysozyme in camel milk is used for the treatment for *paratuberculosis*, arthritis, hepatitis, preventives of aging, autoimmune diseases (abdel galil *et al*., 2016), cancer, chronic hyperglycaemia, autism, gastritis, dermatological disease i.e dermatitis, Acne, Psoriasis, Eczema and cosmetics(Al-Juboori *et al*., 2014). Even though it has a great benefit for public health camel milk is undermined and consumption is limited to few communities in remote area (gul *et al*., 2015).

V. CONCLUSION AND RECOMMENDATION

The most peculiar traits of camel is its great tolerance to heat and water deprivation. Camels can lose up to 30% of their body water and still remain a good health (Neilsen, 1964). They compensate for water loss by consuming large quantities of water at one time (about 100L). This causes dilution of blood and other body fluid which cannot be tolerated by other animal. The dung of the camel is dried used as fuel, providing a valuable sources of energy for cooking in areas where tree do not exist. Disease control measures are vitally important together with investigation of all pathological conditions occurring in camels which are of economic and public health importance. Camels are occasionally bled (uses camel blood as nutrient) to provide for particular human demands of iron, salt and other nutrient.

There are no diseases specific to camel. All the infections that have been reported are well known to exist in other domestic animals. Symptom of disease however is often missing or obscure. The dromedaries play an important role as reservoir and carrier for many zoonotic diseases. Almost many infectious diseases in camel is highly affect young animal rather than old ones, but many infectious disease of other domestic animal affect different age groups depend on its associated risk factors.

Camel's milk, urine and blood are uses remedies for many human diseases additionally may be remedies for many animal diseases. More research should be carried out on the chemical composition and medicinal value of camel milk. Therefore further research should be done on camel milk for treatment of animal disease.

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