

The contribution of donkeys to human health

Donkeys have been serving mankind for 5000 years [1]. The phrase 'beasts of burden' describes their utility as pack animals and [2] in many parts of the world they play a significant economic and social role in the transport of water, building materials, relief supplies, animal feed and other critical supplies [2,3]. Donkey cart ambulances are an increasing trend in Africa where they are used for transporting sick people to hospital. Donkeys are particularly suited to this role because they are easy to keep and do not show fatigue [2,4]. It is estimated that there are about 90 million donkeys worldwide and they are especially widespread in Central and South American and parts of Europe. China has the largest population with about 11 million donkeys [5]. In recent years, donkey-related research is increasing with the goal of using this species to further improve human health and provide greater societal benefit.

Milk is an important source of nutrients including protein, carbohydrate and fats. For thousands of years, cows have provided milk for human consumption in societies around the world. In developed societies of the northern hemisphere, the fat in cow's milk is increasingly being viewed as a risk factor for human disease because of its relatively high percentage of saturated fatty acids. These saturated fatty acids are associated with chronic cardiovascular diseases that can have profound negative effects on human health. Recent research demonstrates that the wide range of fatty acids present in donkey's milk may provide positive health effects with human consumption [6], leading to a growing interest in donkey's milk as a source for human nutrition [7]. Donkey milk is low in fat with high polyunsaturated fatty acids (PUFAs) and resultant advantageous atherogenic and thrombogenic indices. Eicosapentanoic acid and arachidonic acid are present in very small amounts. The high PUFA content and other beneficial nutrients in donkey milk suggest that it may be useful for human nutrition especially for infants and the elderly [8].

Dietary PUFAs also play a pivotal role in maintaining energy balance and minimising body fat deposition by upregulating mitochondrial uncoupling [7]. A comparison of donkey and cow milk for energy balance, lipid metabolism, antioxidant/detoxifying effects and anti-inflammatory effects shows enhanced mitochondrial activity and increased expression of mitochondrial markers after consumption of raw donkey milk by rats as compared with consumption of raw cow milk [9].

In addition to nutritional benefits, consumption of donkey milk has been associated with improved immune responses. Consumption of donkey milk increases interleukins and tumour necrosis factor as compared with levels seen with consumption of goat milk. These findings suggest that donkey milk might be investigated as a beneficial dietary component for immune compromised individuals as well as the sick and elderly [10]. Donkey milk contains other factors that may be beneficial for human health. It has been suggested as an alternative to human and cow milk for individuals with allergic diseases, inflammatory disorders and atopy [10]. Donkey milk has been recommended for feeding to infants who are allergic to cow milk [6]. In an experimental study, some infants were provided with cow milk with the addition of soy protein with poor results. When donkey milk with added triglycerides was provided to infants, the milk was well-tolerated by all patients. Patients receiving donkey milk had no recognisable clinical reactions and gained more weight [11].

The low prevalence of intramammary infections in donkeys suggests that donkey milk might be a safe food. However, donkeys are a potential source of *Brucella* infection, both for people living in close contact with donkeys [12] and through ingestion of unpasteurised milk. *Toxoplasma gondii* has also been identified with PCR in milk from infected, asymptomatic donkeys but further studies are needed to assess the risk of *T. gondii* transmission through milk [13,14].

Donkey meat occasionally enters the human food chain via adulteration [15]. However, donkey meat has potential as a beneficial alternative to traditional red meats because of its high nutritional profile and components [16]. Donkeys represent a potential threat to human health via meat infected with *T. gondii* [17] and neospores [18]. The study by Gharsa *et al.*, included in EVJ's online collection on Working Equids, also highlights the importance of donkeys as a potential source of bacterial species carrying virulence factors, which may have important public health implications [19].

Donkeys have potential as a source of tissues and molecules that can be of use in human medicine: human cardiac disorders are an important cause of morbidity and mortality and heart valve disorders may be treated by prosthetic valve replacement. Donkey pericardium is a potential alternative bioprosthetic heart valve material because it is thin, has minimal calcification values and possesses high tensile strength [20]. Donkeys produce a variety of peptides that may be beneficial to man. Donkeys are now commonly used for the commercial production of antiantibodies. Peptide HP-6, a peptide derived from donkey serum albumin, may: promote the proliferation of cells related to the haematopoietic system; enhance mouse haemopoiesis function; and increase resistance to chemotherapeutic injury [21]. This study in rats showed promising effects *in vivo* and *in vitro* and additional human studies may be warranted [21]. LH pentapeptide, derived from donkey serum, inhibited the growth of transplanted tumour cells and stopped their infiltration into other organs [22]. Donkeys are also used in some parts of the world at high altitudes for the production of antivenom drugs. Horses, commonly used for this purpose in other parts of the globe, are not well-adapted to high altitudes. Future research may be appropriate to determine whether this type of antivenom production may be commercially appropriate [23].

In addition to their potential contributions to the advancement of human health, donkeys may also provide mental and moral support to human individuals. The human-animal bond that develops with donkeys can help individuals with motivation and development of psychoaffective and psychocognitive processes. Rehabilitation sessions with donkeys can help in identification of individual strengths so that motivation may be strengthened [24].

In summary, while most research relating to donkey health published within equine veterinary medicine and included in this online collection focuses on medical disorders of the donkey [25–27], it is important not to overlook the benefits that donkeys may provide for human health while being cognisant of the potential hazards to man that donkeys may pose.

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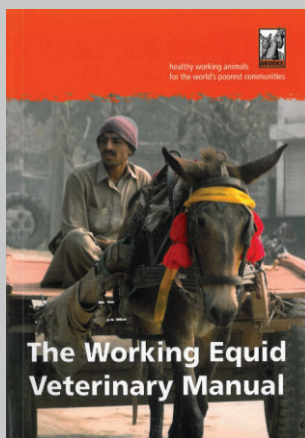
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