

Contributions of non-traditional meat animals to global food security and agricultural economy

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It is a pleasure and honor to serve as guest editors of this *Animal Frontiers* issue focused on the role of non-traditional meat animals in food security and the agricultural economy. The October 2012 issue of *Animal Frontiers* focused on meat production and processing and had an array of topics from traditional meat sources to specialty meats, including culinary arts and meat (Moss, 2012), composition (De Smet, 2012), proteomic applications (Picard et al., 2012), dry-cured ham (Rentfrow et al., 2012), Jinhua ham (Zhou et al. 2012), Hanwoo beef (Jo et al., 2012), game meat (Hoffman and Cawthorn, 2012), cattle diversity (Barnes et al., 2012), and artisan beef (Oliver, 2012).

Meat is an important source of high quality food proteins, with increasing demand in developing countries as their economies improve and become more stable. Developed countries also are anticipating increased meat animal resource needs as modern-day consumers desire more convenience, more selection, and increased healthfulness from food. It is evident that meat from less traditional species will be necessary to supplement beef, pork, lamb, and poultry to meet the anticipated future demand for animal proteins.

Non-traditional meat species (from six inhabited continents) were chosen as the focus of this issue because in many parts of the world, where adverse climate and scarcity of natural resources (i.e., water and forages) make production of conventional livestock nearly impossible, such animals provide protein-rich food for human nutrition and contribute to a thriving agricultural economy and food security. In addition, meat and meat products from many such species are exported internationally. Nonetheless, these animals have received significantly less attention than their conventional livestock cousins.

Non-traditional meat sources provide multiple options and choices for meat consumers. Some of the non-traditional meat sources are considered delicacies, while other meat sources have specialized production or environmental requirements. The amazing diversity among these animals is clearly evident in their size (from cavia in South America to water buffalo in Asia) and habitat (from camels in deserts of the Middle East to deer in Alaska and Scandinavia). Species like rabbit are efficient in conversion of feedstuffs into an edible product. Other non-traditional meats like camel, water buffalo, goats, kangaroo, and South American mammals are specifically adapted to harsh climates or specific environmental conditions. Species such as deer and bison could be raised in production schemes more similar to traditional livestock species and produce meat with a different composition and flavor

than beef, pork, lamb, or poultry. On the other hand, selection of specific traits in animals has resulted in meat with specific desired palatability for production of Wagyu beef, highly prized for its tenderness and flavor.

Hoffman and Cawthorn (2014) highlighted that an increasing demand for animal proteins in the 21st century, primarily fueled by an ever-growing human population and improving living standards, cannot be met solely by conventional livestock. This situation is further aggravated by water shortage, shrinking farm land, and global warming. In this perspective, the non-traditional meat animals, which our hunter-gatherer-farmer ancestors exploited in the past, become highly relevant to global food security.

Camels, known as the ships of the desert, are promising meat animals in the Middle East and northern Africa (Kadim et al., 2014). Their tolerance to high and low temperatures, solar radiation, water scarcity, and poor vegetation allow these animals to survive in the deserts and serve as a source of proteins. A large proportion of global camel population is in countries where food security is a major challenge. In this perspective, camel meat has a competitive advantage over other meats due to low production costs, and thus can contribute to achieving food security.

Buffalo meat is similar to beef in terms of quality and sensory traits, and buffalo is a major producer of milk and meat in the Indian subcontinent (Naveena and Kiran, 2014). These sturdy food animals have superior disease resistance and are efficient converters of poor quality roughage to high quality animal proteins. More than 50% of the global buffalo population is present in India, where these species critically contribute to economic development, rural livelihood, and poverty alleviation. In addition, the potential of buffalo as a source of meat has been meticulously exploited, for export markets resulting in India recently becoming the largest exporter of fresh meat from bovine species.

A variety of indigenous animals, such as llama, vicugna, nutria, and cavia, are utilized for meat production and thus ensure nutritional security in South America (Saadoun et al., 2014). In addition, the rich biodiversity of South America thus helps achieve economic development in rural regions. While these indigenous animals are promising to agricultural enterprise in South American nations, limited scientific information is available on the nutritive value and biochemistry of meat harvested from them. Overcoming these bottlenecks is necessary for developing such animals as efficient meat producers.

Goats are resilient small ruminants and are popular meat animals in developing nations (Webb, 2014). With 98% of world goat population dis-

tributed in developing nations, this species provides red meat and valuable animal proteins to meet the growing consumer demands in Africa, Asia, and Central and South Americas. Nevertheless, goats are under-utilized as meat producers, and scientific developments in animal agriculture have yet to be widely applied in goats to improve meat production and quality.

Kangaroo, the marsupial native to Australia, has economic potential as a producer of meat (Spiegel and Wynn, 2014). These animals migrate in search of feed and water and can utilize coarse vegetation in Australian rangelands. More than three-fourths of kangaroo meat targeted for human consumption is exported from Australia, where consumption of this species is still uncommon. Since kangaroos are harvested in the wild under field conditions, responsible ecological management and food safety practices are critical to ensure that this grazer species is sustainably utilized as a source of meat.

Wagyu cattle include four types of Japanese cattle: the Black, Brown, Short Horn, and Polled breeds (Gotoh et al., 2014). However, outside of Japan, the Japanese Black cattle are the ones that are commonly known as Wagyu. These are specially regarded beef animals producing steaks with high marbling and superior tenderness. Japanese Black cattle have been exported from Japan to several other nations, where breeders keen on improving beef tenderness and marbling have exploited them. The unique quality attributes of Wagyu beef can be attributed to the genetics, physiology, and nutrition of these animals.

The venison industry is primarily focused on two major species (red deer and reindeer) and is mostly localized in New Zealand, Sweden, Norway, Finland, and Alaska (Wiklund et al., 2014). Through a predominantly pasture-based production system, the venison industry produces a premium product known for its tenderness and natural origin. Nonetheless, technologies developed for other meat species are widely utilized in venison farming.

Rabbits are highly prolific small animals that produce highly nutritious meat (Dalle Zotte, 2014). Raised in small-holder or large-scale farms, these animals convert greens very efficiently to animal proteins. Across the world, rabbit meat is marketed traditionally as carcasses. Management, diet, and breeding are critical factors in meat rabbit farming, which is becoming an important activity in the local economy of some sub-Saharan African nations.

Bison meat production is growing in North America, where this species has an iconic stature as a heritage animal (Galbraith et al., 2014). Bison is the large ruminant native to the North American plains and became close to extinction in the late 1800s as a result of uninhibited slaughter. Implementation of careful conservation strategies resulted in an increase in bison population in the USA and Canada. Meat from bison is economically competitive, has high market value, is rich in nutrients, and is considered natural.

We hope that these excellent articles clearly articulate the global importance of non-traditional meat species to animal agriculture, farm economy, export market, and food security. We thank the authors, reviewers, journal management board, and publishing team for closely working with us and enabling us to develop the concept and create an exciting issue.

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