

Review article

A review of animal welfare developments in Bangladesh

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ABSTRACT

In developing countries, grasping the importance of animal welfare is still gradually emerging. In Bangladesh, animal welfare was first introduced to veterinary professionals at an International Scientific Conference of the Chattogram Veterinary and Animal Sciences University (CVASU) in 2006. The aims were to develop educational and research expertise and to improve awareness of animal welfare in academia, research and policy. This led CVASU to launch animal welfare in its mission statement along with inclusion of an animal welfare course in the curriculum. Students were encouraged to become animal welfare ambassadors promoting ethical veterinary practices. Other veterinary schools in Bangladesh came forward to initiate similar course. Bangladesh's legal system had a "Cruelty to Animal Act, 1920", which had been barely functional. Fortunately, "The Animal Welfare Act, 2019" has managed to modernize the previous law. The first collaborative animal welfare research and exchange program (2008) between CVASU and the Royal Veterinary College, UK focused on the welfare of food animals transported across borders. The goals aimed to enhance awareness and create research skills rationale on animal welfare in Bangladesh. Subsequent projects have also initiated later on to focus on on-farm welfare assessments of dairy animals and meat birds, mammalian slaughterhouses, meat birds during transport and at live markets, and welfare assessments of backyard goats. An applied project on the management of the free-roaming dog at CVASU and the surrounding area focused on neutering and mass vaccination against rabies. In summary, after only one decade of introduction, Bangladesh is trying to match the animal welfare with the developed nations in terms of exerting due importance in Animal welfare.

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1. INTRODUCTION

Public concerns about animal welfare are well-documented worldwide. Animal welfare has developed rapidly as a scientific discipline since the 1980s. Scientific and motivational works on this issue have intensified in the last ten years; especially in the developed countries (Broom, 2004). With the growth of farm animal production and the increasing trend of pet animal ownership, the issue of animal welfare has become a real concern in South Asia. In

Bangladesh, the scientific study of animal welfare has recently been identified as a new science by veterinary professionals. The Chattogram Veterinary and Animal Sciences University (CVASU) led the pioneering role to introduce this issue as an important one at Bangladesh for the first time in 2006. Since then, animal welfare has been gradually developed in Bangladesh (Alam, 2006). CVASU has incorporated day-one-skills related to animal welfare in their internship manual to acquaint students with the necessary guidelines

that should be followed during their professional work (Alam, 2017). In Bangladesh, eleven agricultural universities offer veterinary science courses. However, CVASU is the only specialized veterinary university in Bangladesh that prioritized the education and research needed on animal welfare. The animal welfare activities in other veterinary schools of Bangladesh are gradually developing. Recently, a workshop on animal welfare was held at the veterinary faculty of Rajshahi University through the International Society for Applied Ethology (ISAE) funded by the Open Philanthropy Project. In that workshop, academics from other veterinary schools were sensitized to include animal welfare course as a separate credit in the respected curriculum and enhance the research activities as well. There has also been a change of legislation taken place to animal welfare. Previously, there was only a very old act, “the Cruelty to Animal Act of 1920” and a limited effort in a guideline put out by the then “East Pakistan Society for the Prevention of Cruelty to Animals in 1967”; both were obsolete legislation compared to modern needs. Moreover, there was no effective execution of either the law or the guidelines. Due to public outcry from animal welfare activists and scientific input from veterinarians, the parliament of Bangladesh has amended that century-old act and increased the penalty for deliberate animal abuse or actions. This paper summarizes the journey of animal welfare science in Bangladesh: from its inception to the developments to date. It focuses on the inclusion of an animal welfare course in the veterinary curriculum and summarizes some important findings from research into animal welfare in Bangladesh. Welfare assessment of animals during transportation and contemporary problems in pre-slaughter handling and slaughter were evaluated. On-farm welfare assessments of dairy animals, the welfare of meat chickens, hygiene and welfare issues at the live bird markets, and welfare assessments of backyard goats are discussed in this review. The welfare-friendly control of free-roaming dogs and visitors’ attitudes and their impact on the behavior and welfare of zoo animals are also included.

2. AN ANIMAL WELFARE COURSE IN THE VETERINARY CURRICULUM

Internationally, animal welfare is a growing field of science that is gaining more recognition within the veterinary profession as a necessary competency for every graduating veterinarian. To achieve this competency, the necessity of including an animal welfare course in the veterinary curricula has been emphasized. The inclusion of animal welfare courses in the veterinary curriculum has been discussed by educators for over 20 years (Rollin, 1991; Rollin, 1991; Grumbell, 1983). The developed countries such as the United Kingdom, Switzerland, and the Scandinavians countries have incorporated animal welfare into their veterinary curricula and other countries like the Netherlands, Australia, New Zealand, Canada, Mexico, Brazil, and the USA have followed. Thus, the teaching of animal welfare is now largely a standard component of veterinary medical education (Fogle, 1999; Estol, 2004; Grumbell, 1983). The first educational institute to start teaching animal welfare was the Department of Clinical Veterinary Medicine at the University of Cambridge in the UK. Donald M Broom was appointed as Professor of Animal Welfare at that university in 1986 (Broom, 2005). Currently, there are many veterinary schools where animal welfare courses are being taught as an obligatory component of the veterinary undergraduate or graduate program depending on the custom of the country. In the year 2000, the WSPA (World Society for Protection of Animals) developed an outline of the syllabus for animal welfare education entitled “Concepts in Animal Welfare”. In 2003, WSPA and the Veterinary School at the University of Bristol launched an excellent, comprehensive syllabus that was distributed electronically using a CD-ROM for the teaching of animal welfare within the veterinary curriculum. This has been a useful document for any educator wishing to incorporate this new subject into a new or existing course (Estol, 2004). In addition, there is increasing pressure from the global community to make animal welfare a fundamental part of veterinary education (Estol, 2004; Schneider, 2004). The World Veterinary Association (WVA) and the World Organization for Animal Health (WOAH) recommend the compulsory teaching of animal welfare as a separate subject which should be a blend of ethics, economics, and

animal behavior as these relate to animal welfare (Schneider, 2004). It prescribed the use of a problem-based multidisciplinary approach that stimulates the students to think independently. WOHA and all of its members acknowledged a need for more emphasis on animal welfare and veterinary ethics in the teaching curriculum for undergraduate veterinary students. In the first “Global Conference on Animal Welfare” (February 2004 in Paris), animal welfare was placed firmly on the agenda of the veterinary profession. The crucial role of the veterinary personnel in animal welfare issues was clarified at that conference (Bayvel, 2004; Rahman, 2004; Edwards and Schneider, 2005). Introducing a new subject into an existing curriculum is not an easy task. It is even more difficult with animal welfare because it is generally taught as part of other subjects and many associated subjects are connected to it. Therefore, incorporating a dedicated animal welfare course in the already overburdened curriculum requires careful evaluation of many factors. The learning of the subject must be analyzed with particular regard to the local environment, society, and overall objectives of the training of veterinary undergraduates (Ayona Silva and Gregory, 2007). Existing approaches to teaching animal welfare to veterinary undergraduates were reviewed by various scientists (Hewson et al., 2005). In Bangladesh, veterinary education was started in 1947 as a three-year-long diploma course and later developed as a five-year graduation course at Bangladesh Agricultural University in 1961 which was then the East Pakistan Agricultural University (Samad and Ahmed, 2003). After that, many veterinary colleges and universities were established in Bangladesh, but none had a separate course on animal welfare. In the new millennium, CVASU has taken the lead in recognizing animal welfare as a topic that needs to be incorporated into the curriculum, and an important way of institutionalizing this subject is to develop education and research expertise. Inclusion of animal welfare courses in the veterinary curriculum has been a part of the mission statement of the faculty of veterinary medicine of CVASU since the concept of animal welfare was recognized by the faculties and students in 2006. A dedicated “Animal Welfare and Ethics” course was added to the

veterinary curriculum of CVASU in 2014 for the first time in Bangladesh (Alam and Doyle, 2017). To be graduates often intends to join the government veterinary service in Bangladesh and might act as potential torch bearer as they have many professional responsibilities to ensure the health and welfare of the livestock population they expected to serve.

3. ANIMAL WELFARE RESEARCH IN BANGLADESH

Welfare of animals during transport

Treating animal during transport is an important aspect of animal welfare. Significant issues with animal transportation affect its contribution to national economies with its effects on animal stress and mortality, and its potential to spread disease. In Bangladesh, the transport vehicles, along with loading and unloading, are very poor and primitive. The methods used for handling, loading and unloading, transporting, and slaughtering animals have a major effect on animal welfare in Bangladesh. Many live animals are transported from India, both legally and illegally, by trekking, trucks and trains, often in an inhumane way. The attitude of transport staff and haulers is often being observed as very negative towards the animals. The main vehicles used for transportation are open-top trucks. They are not appropriately designed for the many times of the year when the animals are exposed to extreme temperatures, direct sunlight during hot weather, or wind and low temperatures during cold weather. The average number of loaded animals on the typical vehicle is 16-18 buffalo or 16-22 cattle. Visually it is apparent that this leads to overcrowding in relation to the surface area of the animal compartment in the truck and is proportional to the individual live weights of the animals (Alam et al., 2008; Alam et al., 2019). This type of vehicle is commonly used for carrying goods. There is no special consideration given to sentient beings in terms of vehicle design. Tying the animal to the vehicle aggravates the situation. Ropes are tied too tightly using different parts of the animal's body to facilitate the access of the animals to the vehicle. Animals are often tied at the neck, legs, and nose, which can lead to respiratory problems, discomfort, rope scratch injuries, and frequent abrasion and laceration injuries due to

friction with the vehicle wall and contact with panel bolts protruding into the vehicle in combination with the high stocking densities (Alam et al., 2008). Bad transport causes visible tissue damage and presumably stress that results in poor welfare. Poor welfare increases the susceptibility of each animal to disease and increases the chance that the disease will then spread quickly (Broom, 2003). If the transported animals are exposed to serious stress, it will affect their health, productivity and market value. Stress alters the internal homeostasis of an animal by inducing changes in the activity of the hypothalamic-pituitary-adrenal (HPA) axis (Haddad et al., 2002). Traders always favor high stocking density to increase the load leading to cramped conditions causing fatigue and muscle damage (Knowles et al., 1998). If the stocking density is too high, there is the increased risk of heat stress due to the inter-animal pressure limiting the ability to dissipate heat and at the same time increasing the heat exchange between individuals (Schrama et al., 1996; Knowles et al., 1998). High stocking densities hampered the animal's effort to maintain their balance (Tarrant et al., 1992). Moreover, the direction the animals are facing is often not consistent with the animal's preference. It was reported that cattle like to travel perpendicular to, or parallel to, the direction of travel rather than diagonally backward (Tarrant and Grandin, 2000). Loading and unloading of animals during transportation are another welfare challenge in Bangladesh. The loading and unloading facilities in Bangladesh are poor. The ramps are usually made of soil and straw to create a ramp up to the level of the truck. The vehicles often are not positioned properly at the time of loading and unloading so the animals are reluctant to walk onto or off the truck. Some animals stop moving forward and freeze. They often show signs of fear and may actually suddenly slip and fall along with vocalizing. This often leads to the animals being reluctant to stand up. Inappropriate handling methods were observed particularly during unloading. The behavior of personnel who are involved with loading and unloading or who drive the vehicles is one of the most important factors that affect the welfare of animals (Lambooi et al., 1999). Poking with a stick, dragging, tail twisting, and crushing to get a highly stressed animal to stand;

pressing the animal's mouth into muddy wet straw during unloading to get it to stand up; pouring water on the head region after blinding the eyes with a cloth; and inhumanely beating the collapsed animal without considering any sensitive organs are some of the common mistreatments observed being used by animal handlers in Bangladesh (Alam et al., 2008). The animal welfare problems include ulceration and bleeding where ropes were secured in the noses, broken tails, and skin lacerations. Many of the injuries were recent injuries and were probably due to contact with the inner walls of the vehicles during transport. The animals are tied to the vehicle sides to control their movement. Confinement whilst tied in a moving vehicle is likely to be physiologically stressful for the animals. In other studies, it has been shown that high stocking densities have been associated with a higher plasma cortisol response during transport and there was a greater likelihood of staying down when an animal fell during the journey, which leads to greater bruising from trampling (Tarrant et al., 1988). Research on transport in Bangladesh has focused on determining the various physical injuries and metabolic stresses observed with transported cattle and water buffalo at livestock markets. Eighty nine percent of cattle and water buffaloes had obvious skin injuries when exported from India into Bangladesh, and 51% of cattle and 15% of water buffaloes had broken tails. About 69% of the cattle had rubbing or tearing injuries at the nostrils from nose ropes (Alam et al., 2010; Alam et al., 2010). Proper management and strict monitoring policy need to be undertaken in reducing the risk of all of these injuries during handling of transporting animals. Veterinarians can advise traders and transport staff on proper transportation according to WOAAH guidelines. The WOAAH has drafted the first global standards for animal welfare for the land transport of animals for human consumption. These standards have been ratified by all of the organization's member countries, including Bangladesh, which should, therefore, be committed to implementing the standards.

Welfare of animals at livestock market

When the animals are unloaded at livestock markets in Bangladesh they are subjected to inappropriate treatment, i.e., lack of proper

handling and care. The welfare concerns with putting cattle through cattle markets include fatigue, fear and distress, fasting, dehydration and injuries. Usually there is no shade, so they are directly exposed to heat stress, and often being deprived of sufficient water and feed. Usually, they are taken to a water trough once or twice a day, which may not be sufficient because of the high ambient temperatures in Bangladesh. They are tethered alongside one another to a head rail for extended periods of time that may exceed their physiological tolerance limit. Transactions are by bartering rather than auctioning, and this is done at these headrails. Another area of welfare concern is the condition of floor surfaces. Slips and falls at the market are often evident particularly during the rainy season due to improper drainage and unhygienic conditions, i.e., where feces, urine and mud are all mixed together. These conditions increase the fly nuisance for both the stockmen and animals. The major players violating animal welfare are the animal handlers. Their attitude and the quality of their handling of the animals are important elements in the degrading of animal welfare. The habitual use of sticks by animal handlers, where there was no need to use them was routinely observed. Pricking at the perineal region and excessive beating on the hindquarters were commonly observed. This occurs even when the animals are walking forward at a normal and satisfactory pace. Different forms of injuries were identified at the cattle markets. These injuries are due to multiple stressors acting on the animals over the long process they had to pass through from their source through arriving and staying at the market before slaughtering. The high prevalence of nose injuries, kinked tail (tail abnormality) and various skin injuries like abrasion, and laceration were commonly observed in Haryana cattle and water buffalo at livestock markets in Bangladesh. Draft cattle and water buffalo usually have their noses pierced in the septum. This allows a rope to be permanently fastened to the head. There was a high frequency of nose injuries from these ropes due to repeated pulling or twisting. Tail twisting is used to control cattle at various stages such as draught work, transport, loading and unloading and this was evident from the proportion of cattle with kinked (broken) tails. A high

frequency of skin lesions was also common and many of these seem to arise due to the use of an inappropriate transport vehicle, mistreatment by stock handlers, and rope scratch. The various types of injuries not only led to suffering but also downgrades of meat quality and loss of skin value causing a substantial economic loss (Minka and Ayo, 2007). Foot problems when stock stand continuously in their own manure, various injuries like abrasions (73%), lacerations (41%), hyperkeratosis (19%), a high prevalence of nose piercing (64%) and kinked tails (39%), insufficient space for lying down, especially while restrained and bound in tightly packed groups were commonly observed in livestock markets (Alam et al., 2010). In addition, they are inhumanely beaten to drive faster while forced to walk slowly due to being restrained closely side by side. Many people working in the market do not seem to appreciate that buffalo have a different physiology from cattle. Water buffalo are very susceptible to heat stress when not allowed to wallow and can easily be dehydrated. They have a poor ability to sweat and their skin has fewer sweat glands and less hair than cattle. As a result, their rectal and skin temperatures have been shown to fluctuate more than in tropical cattle when the air temperature rises (Koga et al., 2002). Buffalo had a higher frequency of heat stress (95.8 bpm) than cattle. Higher percentages of open-mouth panting, drooling of saliva, tongue protrusion and neck extension (29, 56, 27 and 27%, respectively) were recorded in water buffalo than in cattle at livestock markets (Alam et al., 2010).

Welfare assessment at slaughterhouses

The World Organization for Animal Health (WOAH, 2014) adopted global guidelines on animal welfare that aim to ensure the welfare of food animals before and during the slaughter process. When an animal is slaughtered for food, it is important for ethical reasons that the methodology used does not inflict pain. The management and handling of animals prior to slaughter has the potential to significantly compromise welfare before death (Doyle et al., 2016; Gregory, 1998). Improving animal welfare during the slaughter process is important for ethical and religious reasons, as well as having implications for the quality and safety of the product (Grandin, 1994; Gregory,

1998). Animal welfare is a challenging issue at the slaughterhouses in Bangladesh. The handling of animals prior to slaughter and at slaughter has raised a number of animal welfare concerns (Gregory, 2005; Seng and Laporte, 2005). After arriving at the slaughterhouses, they are being forced to make their way immediately for slaughter with no provision for animals to get rest. Casting methods have also been identified as a compromise to welfare; animals are cast serially with a common rope and while one animal is slaughtered and processed, the others wait. Rope casting is the traditional method for restraining bovines prior to slaughter, but it can have negative welfare outcomes for the animals involved as the casting process can take 3-4 min and cause pain, injury and distress to the animal (Ahsan et al., 2014). The flooring on which they are forcefully dropped is hard and rough, and once cast, they often remain there tied up before being slaughtered. Welfare can also be affected by the choice of knife and slaughter method. Sometimes there is intermittent cutting, and animals are slaughtered more using a sawing-like motion than a proper cut (Alam et al., 2007). This is caused by the use of a small and dull knife. Blunt knives increase the likelihood of more cuts being needed for slaughter, which can lead to more pain and struggle, and ultimately further reduce the welfare of animals during slaughter (Gregory et al., 2012). There is also concern about the lack of proficiency of those working at slaughterhouses because of a lack of training and or sufficient experience doing the halal cut at the time of slaughter. The attitude of most slaughterhouse staff towards their animal is often quite negative. They often do not understand what is wrong with how they treat a sentient animal. Moreover, they show aggressive behavior and often do not meet halal requirements (Alam et al., 2007). The slaughter methods used for water buffalo have some serious animal welfare concerns in particular because of their large crescent or curved horns. It is difficult to present the neck of a cast buffalo in a suitable position for the halal cut (Alam et al., 2007). During the slaughter process, the slaughter men often stab animals in the neck region and then use the tip of their knife to penetrate the neck to complete the slaughter. As a result, many cuts are needed before the carotid

arteries are severed, and at times, this is still not done completely (Alam et al., 2007). During this whole process, animals will show signs of struggling and distress. Of the 423 animals observed at the slaughterhouses in Bangladesh, 63% had some degree of dehydration, 68% had existing injuries, 69% had oculo-nasal discharge, and 27% were classified as dull and depressed. All animals were cast for slaughter, and the majority were impacted by casting, as defined by making an audible noise during the fall (85%) and sustaining injuries (58%). Stabbing of the throat during slaughter was also observed, and was more common in buffalo (21%) (Alam et al., 2019). Partial severing of carotid arteries was also common, and there was a relationship between severing and the time to loss of the corneal reflex. These results suggested that a majority of animals experienced some degree of welfare compromise, although the extent or significance of these compromises is not known. Veterinarians should advocate for more training of slaughter workers and providing them with the proper tools to do their job to maximize the welfare of the animals during pre-slaughter handling and at the time of slaughter while maintaining public health and addressing food safety issues.

Welfare assessment at dairy farm

Dairy cow output is closely tied to the day-to-day livelihoods of the dairy farmers in Bangladesh. Consistent with a rising quality of life and education levels interest in dairy cattle welfare is slowly growing. Moreover, to gain access to global markets, to satisfy consumer concerns, to produce healthy foods, and to ensure the health of both people and animals, it is important to ensure the optimum animal welfare of production animals. Most welfare assessments include animal-related parameters, such as behavior, body cleanliness, lameness, skin lesions, injuries and on-farm conditions such as evaluating the housing systems and drainage facilities (Webster, 2004). Poor management practices related to housing, the attitude of staff, the surrounding environment, and waste management systems may affect the normal behavioral expression of the animals inducing physiological problems, reducing immunity and increasing disease incidences

(Hristov, 2011). Skin injuries; hock, claw and hoof lesions; and lameness were the major welfare problems of dairy cows in Bangladesh. Over 36% of the farms had clean floors while 47 and 17% of the farms were moderately dirty or dirty, respectively. Drainage systems were not satisfactory on some farms and improper manure disposal often led to heavy fly infestation (33%). The cleanliness depends on many factors including types of floor, how clean and dry the resting areas are, drainage, how often and where cows lay down, and how frequently the floor is scraped (Magnusson et al., 2008). It is suggested that the slurry be removed at least once per day to promote good animal welfare (DEFRA, 2003). Studies indicated that the cleanliness and hygienic status of muddy soil-type floors were found to be significantly poor in comparison to that of brick-made and concrete-type floors in small-scale farms in Bangladesh (Islam et al., 2020). Moreover, a pronounced state of poor cleanliness on the dirty udder (55.9%), flank (55%), and hind limbs (96.4) were observed when the floor was dirty; showed in another study (Ahsan et al., 2016). Hock, claw, and hoof abnormalities were found in 30, 37, and 28% of the animals, respectively, whereas injuries were observed in 19% of the cows. Lameness was 12%; tick infestations 15%, and stereotypical behaviors 14%. The study showed that 25% of the injuries occurred in face-out rearing systems, which was 1.8 times riskier than the face-in systems. Moreover, cows on farms with bad drainage systems were 2.4 times more likely to have injuries compared with cows reared on farms with good drainage systems (Al-Amin et al., 2015). Previous findings indicated that 31% of dairy cows were clinically lame in peri-urban and urban dairies in Nairobi, Kenya, which is higher than the present result (Mulwa, 2008). However, less prevalence of lameness (4.3%) was commonly observed in small-scale dairy farms in Bangladesh compared with larger and more intensive dairy farms (Islam et al., 2020). The hock and hoof abnormalities were significantly associated with the quality of such elements as floor type, floor cleanliness, presence of rubber pads and quality of the drainage systems. The results suggested that poor dairy welfare exists on many commercial dairy farms in Bangladesh. Some of the factors

resulting in poor welfare of dairy cows include substandard housing designs, poor cattle housing, suboptimal feeding and poor husbandry practices. The farmer's perceptions and ignorance of animal welfare issues compounds the problem. Proper management and consciousness of the stockmen for their animals are important in assuring good health and animal welfare. This research provides a baseline scenario based on which both local farmers, regional and national policy stakeholders can work alongside to make necessary changes that improve the welfare of dairy cows and support economic and sustainable development.

Welfare assessment at broiler farm

In Bangladesh, most of the commercial broilers' farms are of a semi-intensive type, although some new intensive farms are being started (Hamid et al., 2017). Most of the sheds are made of bamboo or iron net for walls and tin for the roofs (Rony et al., 2021). The temperature and humidity fluctuate according to the season and weather (Pasha et al., 2019a). Hence, the birds are subject to extreme cold in the winter and heat in the summer. To reduce these problems, the farmers provide electric bulbs (mostly made of tungsten) to increase the temperature, and fans during summer to increase cool airflow (Haque et al., 2017). Unfortunately, disruption of the electricity supply is common in Bangladesh and the birds may panic (Rashid et al., 2014). Most of the farms cannot provide alternative electricity except for some intensive farms. During darker nights, a sudden electricity failure may panic the chickens and they may die as a result. On hot summer days, the temperatures increase beyond the birds' tolerable level (Ahsan et al., 2011) leading to heat stress and major mortality incidents. During the winter, the temperature may plummet below the comfort zone. To retain heat, the birds start piling up and may die due to asphyxia (Lourens and Kuijpers, 2002). During the monsoons, there are also thunderstorms (Islam et al., 2020) where the lightning and thunder may cause sudden death. Irregular rain and storms may increase humidity and seepage of water in the farm. Flash floods and water clogging are other issues that can disturb broilers (Hossain et al., 2008). The economic

condition of the farmer is another pre-existing issue related to poor broiler husbandry (Raha, 2007). Most of the broiler farmers are rural youth in Bangladesh (Hassan et al., 2021). They have a minimum to zero formal training on efficient broiler farming, biosecurity, drug toxicity, and other relevant matters about farming. Moreover, lacking capital they cannot build a better shed. They often provide fewer waterers and feeders and cannot provide enough fans and lights to maintain an optimum farm environment (Pasha et al., 2019a). Besides, due to negligence, illiteracy and lack of training, they rear the birds in such a way that the broiler is more likely to be affected by the various stresses discussed resulting in increased mortality (Ershad et al., 2004). In Bangladesh, broiler chickens are often reared using a high stocking density since the farmers assume that by increasing the density the production along with the income (Beg et al., 1994). However, the increase in density reduces bird welfare. With stocking density >30 kg/m² floor space, the growth rate is reduced with heat stress and welfare is compromised (Bessei, 2006; EU, 2007). Higher stocking density may decrease locomotor activity (Simitzis, 2012). When the stocking density is beyond the comfort level, the farm environment will become increasingly humid (Reiter and Bessei, 2000; McLean et al., 2001). The birds will not be able to radiate the metabolic heat into the environment leading to heat stress. Moreover, higher stocking density may lead to cannibalism and other injuries to the birds (Skoglund, 1962). Higher stocking density will decrease the absorption of the droppings by the litter, and increase ammonia concentration and associated problems (Dozier et al., 2005). A recent cross-sectional study on broiler farms showed that 80 and 90% of farms did not have adequate numbers of feeders and drinkers, respectively, and the indoor temperatures and relative humidity were high ($>30^{\circ}\text{C}$ and $>70\%$) during production for 53 and 83% of farms, respectively. Lameness and foot-pad dermatitis were found in 7 and 20% of farms, respectively (Pasha et al., 2019a). The indoor farm temperatures were significantly higher in the older age groups, which affected the rate of panting. These studies demonstrated evidence that welfare was compromised, which

also might lead to reason of reduced of meat production.

Welfare and hygiene issues at live bird market

With the increase of broiler farms in Bangladesh, the number of live bird markets and live bird shops has also increased exponentially (Islam et al., 2017). In Bangladesh, broilers are generally sold at the live bird market (Irin et al., 2021). The consumers mostly prefer fresh birds rather than frozen ones. They are also concerned about the halal status and want to ensure that the religious prayer is said before slaughter (Islam, 2003). Moreover, the price is lower at the live bird market compared with the super market. The transport of meat chickens from farm to the live bird market involves many stressors. The birds are held by their feet and pushed or thrown into the loading vehicle. Sometimes, the loader holds multiple birds in each hand and to hold so many birds, holding by one leg occurs. This practice may cause severe injury and discomfort to the heavy chickens (Kettlewell and Mitchell, 1994). Thus, catching the birds to remove them from the shed may lead to unacceptably high levels of bruises, fractures, and other traumatic injuries; which results in high stress levels (Mitchell and Kettlewell, 2009). Besides, the birds are usually loaded in the vehicle at high stocking density. Higher stocking density affects the immunity of the broiler (Qaid et al., 2016) and may be associated with infection and death, which in turn affects the profitability. The presence of sharp objects or points in the vehicle may cause injury to the birds. The bumpy and uneven roads may cause turbulence, which may make the birds slip and catch their legs or wings between the iron sticks of the cages (Quader et al., 2018). As a result, fractures or joint dislocations may occur. Due to a lack of supervision and training of the shopkeepers, the live bird markets have experienced with serious welfare issues. The chickens are frequently caught using only one wing or foot, which can cause a fracture in the shank or keel bone. During slaughter, knives are not sharpened regularly. On the other hand, the birds are also processed (skinned, scalded, pieced) in the live bird market. The processing table is not always clean and birds may be processed in contact with the offal of previous

birds. Staff are generally in a hurry to process the slaughtered chickens. Sometimes, they start processing even before the birds are dead (Pasha et al., 2019b). The slaughter slabs are also acting as a potential source of contamination, which in turn often poses a significant hazard to public health. The catching and handling of the sold birds is often stressful and may lead to broken bones. Overcrowding and feed withdrawal may also affect the birds' ability to fight pathogens (Durant et al., 1999). Even in the better slaughter facilities the poultry carcasses may be contaminated with *Salmonella sp.*, *E. coli*, *Campylobacter sp.*, etc (Adeyanju et al., 2014). At live bird markets in Bangladesh, 54% of shops were not supplying water just after unloading. 36.1% of cages and 62.5% of floors had fewer drinkers than recommended. Besides, 38.9% of cages and 58.3% of floors had insufficient feeders. About 70% of vendors handled the chickens with one wing. Coupled with rough handling during transportation and catching might explain the higher creatine kinase. Higher stocking densities were seen in 88.9% of cages and 33.3% of floors. Moreover, the feeders and cages were never cleaned in 12 and 14% of shops, respectively. Cleaning agents were used for only 15.9% of feeders, 18% of drinkers, and 45.2% of cages. The knives used for sharpening were sharpened daily only by 24% of vendors. Drums were used by 90% of vendors for bleeding and 66% of dressing tables were dirty (Pasha et al., 2019b). Thus, poor welfare of meat chickens at different stages of their life cycle and from farm to live bird markets is common in Bangladesh. For humane broiler production, to ensure good welfare practices and to maintain good economic outcomes, these issues should be addressed. To mitigate these welfare problems, training and awareness of the farmers and other stakeholders are necessary.

Welfare assessment of backyard goats

Goats are generally a herd animal. Thus, the welfare and behavior of goats are closely associated with herd management. In some parts of the world, goats are reared using scavenging or backyard systems. Feeding, housing, health, and behavior are the major points to be assessed. Body condition scores, queuing for feeding or drinking, hair condition, claw health, udder

health, oculo-nasal discharges, lameness, and avoidance distance are the common parameters used to assess the welfare of goats in any management system (AWIN, 2015). The animal welfare indicators (AWIN) for assessment of the welfare of goats was established by the European Union. However, many researchers are focusing on a more practical approach to assessing welfare by using fewer of the guideline's parameters. Many of the parameters can be assessed together or have to be modified depending upon the management system. Some parameters are easy to assess whereas others require extensive training. That is why each of the parameters may be adjusted to increase their feasibility (Battiniet al., 2014). In Bangladesh, goats are reared across the country. The goat population is increasing and helping grow the GDP (DLS, 2018). Because of the geography, economy and tradition, goats are not reared in an intensive system in Bangladesh. More than 80% of the existing goat population is reared in semi-intensive backyard systems (Hossain et al., 2015) with most of these animals owned and kept by the rural women as a source of secondary income or as an insurance product (Rokonuzzaman and Islam, 2009). Goats are good at digesting low-quality roughage. Moreover, they can graze and browse easily. They can use their prehensile organs to eat various parts of plants and can select the most nutritious parts of a plant (Lu, 1988; Ngwa et al., 2000; Goetsch et al., 2010; Egea et al., 2013). These attributes make the goat a good livestock species to be reared in backyard systems. Although goats are good scavenging animals and can thrive better than other animals, human illiteracy and the absence of proper training may cause managerial problems and welfare issues even in backyard settings. Poor welfare may hamper production and decrease survivability. Based on 200 backyard farms the kid mortality rate was 13% whereas vaccination was done on only 26% of farms. Almost 20% of farmers do not provide water to their goats and the goats quench their thirst from natural resources (ponds, natural streams, etc.) whereas 17% of farmers do not provide any supplementary concentrate feeds to their goats. These may cause serious malnutrition and dehydration issues in goats. About 94% of male goats were castrated by untrained people without any local

anesthetics or sutures. Among 539 goats, 12% had rough hair coats, 30% had dehydration, 11% had varying degrees of coughing, 17% had claw and hoof abnormalities, and 10% had udder abnormalities. In terms of behavior, 5% of goats were showing avoidance of their owner and 31% avoided the observers (Pasha et al., manuscript in preparation). These results show that goats in backyard systems have poor welfare and the owners need to be better trained.

Welfare of free-roaming dogs

Free-roaming dog populations have been reported as being treated with poor animal welfare and public health problems in developing countries including Bangladesh. In Bangladesh rabies is a public health problem, ranking third globally after India and China. Stray dogs act as the main source of rabies for both domestic animals and humans in Bangladesh (Hossain et al., 2011; Hossain et al., 2013). It was reported that about 52 dogs are inhabited per square km in the urban areas in Bangladesh (Tenzin et al., 2015) and for every 120 people there is at least 1 dog in this setting (Hossain et al., 2013). Every year almost 1.7 lakh people are bitten by an animal (Hossain et al., 2012) whereas about 96.2% are caused by the dog (Sudarshan et al., 2007). It is also estimated that more than 2100 people die every year due to rabies (Hossain et al., 2012). Understanding the characteristics of free-roaming dog populations is essential for the design of effective interventions to control rabies, and improve animal welfare. To avoid dog bites and rabies, a large number of stray dogs are killed every year. However, the method of catching or killing is not humane. Using poisonous substances in the accumulated garbage of food where free-roaming dogs search for their food is not acceptable as they suffer long before death. Therefore, an effective intervention needs to be developed to control free-roaming dogs to ensure their welfare as well as to eliminate rabies. A humane method of dog population management using a catch-neuter-vaccinate-release (CNVR) program is an effective way to control unwanted proliferation of dogs. It helps to reduce the free-roaming dog population by neutering and eliminating the risk of rabies through vaccination (Tenzin et al., 2015). A neutering program was done in

CVASU and its surrounding area of Chattogram City. Dogs were caught by a dog-catching team from CVASU and brought to the university hospital. On the day of surgery, dogs were anesthetized using an infusion of a xylazine-ketamine combination. Surgeries were done by the surgery team with proper anesthesia and asepsis. A post-operative antibiotic, analgesic, and antihistamine were provided to the neutered dogs. A single dose of ivermectin was given as an ectoparasiticide. Vaccination was done before releasing the dogs into the area from where they were caught. Dogs were neutered surgically where male dogs were castrated and females were spayed. A 'V' shape ear notch was given to each dog to identify them as having been neutered and vaccinated. The results suggested that sterilization may be able to reduce the free-roaming dog populations, which, in turn, will ensure a better ecosystem for both humans and animals. Moreover, the fighting and resulting injuries of the dogs will be reduced because they are generally more docile after neutering. Thus, the program of this kind might facilitate and stabilize to decreasing healthy free-roaming dog populations and better health, welfare, and human-dog relationships (Alam et al., 2021). Participation in this CNVR program is required for veterinary students to help them develop these specific surgical techniques, which are also WOAHP-required day 1 skills. In the future, they will hopefully work to control the free-roaming dog populations and eliminate rabies throughout the country, while improving the welfare of free-roaming dogs.

Zoo animal welfare

Zoos generate knowledge, skill and expertise in conservation, research, and education. The primary reason to visit zoos and other wildlife habitats is the attraction of seeing living animal species that would not normally be seen (Turley, 1999). Zoo visitors want to see active animals, and they want to interact with keepers, guides, and interpreters (Wolf and Tymitz, 1981). They are motivated to visit for entertainment or recreational purposes rather than educational and other reasons (Reade and Waran, 1996; Morgan and Hodgkinson, 1999). Zoos and their enclosures contain many uncontrolled variables, including animal variables, a range of enclosure and enrichment designs, diverse visitor

characteristics, and unpredictable operational procedures such as feeding times, activities of zoo staff, and sudden removal of animals (Hosey, 1997; Davey, 2006a). The presence and characteristics of visitors at zoos are another uncontrolled variable because the number, density, size, and behavior of visitors change. Moreover, the intensity of visitor behavior is often correlated with the intensity of animal behavioral changes (Hosey, 2000; Davey, 2006). Animal welfare is a significant issue to consider for captive animals as well. Wild animals usually live in free-range situations. Keeping animals alive seems to have been a major challenge for most zoos over the centuries when they primarily served to display exotic animals. However, concern about the welfare of such captive animals is more recent. Zoos and the aquarium industry are dedicated to promote a positive welfare state for animals under their care (Mellor et al., 2015). Leading zoos have established innovative welfare-enhancing programs, which incorporate environmental or behavioral enrichments, and which they seek to continuously extend and improve (Kagan et al., 2015). The many successful improvements at major zoos are examples of how the many less advanced zoos could improve their management of animal welfare and thus help to reduce the still highly fluctuating standards of the industry (Mellor et al., 2015). Bangladesh only has a few government-owned zoos. Unfortunately, the effects of visitors on zoo animal behavior and welfare have been ignored as is true for most of Southeast Asia. Citizens use zoo facilities for recreation rather than conservation and education. Studies on the attitudes of visitors and their effect on the behavior and welfare of zoo animals are inadequate in Bangladesh. Understanding the effect of visitors is important in improving animal welfare, achieving zoo conservation goals, and increasing visitor education. Aiming these factors, a few studies were conducted in Chattogram Zoo about animal-visitor interactions and their impact on zoo animal behavior and welfare. Significant demographic variations were found in the visitors' attitude, interest, and expressions when visiting. The majority came for recreational purposes (62.5%). Few people come to the zoo exclusively for research and

conservation purposes. Most of the visitors were literate and only 3.5% were illiterate. Those who were illiterate found the tiger as least interesting (43%) whereas they were 100% interested in the deer and monkeys. The more educated group was more interested in the tigers. Teenage visitors (12-19) showed more interactive behavior by moving closer to the barriers for tigers, deer, and monkeys which probably reflects the higher curiosity of teenagers of tigers (Munna et al., accepted). Tigers and deer received the most undesirable behaviors (shouting, provoking fear, teasing, throwing objects, and offering food) from adult visitors whereas monkeys experienced the most undesirable behaviors from teenagers. In terms of behaviors displayed by the animals towards visitors, tigers were not found to be frightened or sociable towards visitors. In addition, these animals actively roamed their cage and were alert to all sorts of stimuli. Monkeys showed curious and excited attitudes towards female visitors who wore attractive clothing. Moreover, adult visitors made monkeys significantly more curious and excited. Sociability and happiness after facing the visitors were highest in deer and lowest in tigers (Munna et al., accepted). However, another study in Chattogram Zoo showed that animals especially the primates are teased by visitors during their visit. Among these visitors, 40% tease the rhesus monkey, 30% tease the capped langurs, 20% tease the pigtailed macaque, and 10% tease the olive baboon (Gupta et al., 2017). All of these effects are consistent with an interpretation that visitors are the source of stressful excitement rather than enrichment. Emphasis was given to the proper management system of the zoo by other researchers. To operate a zoo functionally the zoo authority needs to consider the provision of special exhibition techniques, visitor management systems, record keeping, transportation, management of new species, and enrichment facilities for the betterment of the captive zoo animals (Uddin, 2017). These results concerning visitors' attitudes towards different zoo animals and the counter-reaction shown by animals will allow the national policymakers and common people to rethink what positive changes should be brought to the zoo environment. Visitors should have knowledge about zoo animals and

develop a better attitude towards zoo animals' welfare with minimal intervention in their natural way of living.

Animal welfare implications and conclusion

The aim of this review is to summarize the gradual development of animal welfare science since its inception in Bangladesh. The results suggested that the perception of people about animal welfare in Bangladesh is still limited and hence welfare practices are compromised. Farm animals are exposed to many stresses that adversely affect their health, productivity, and market value. This strongly suggests that greater attention to their welfare must become a priority in the future. Surgical sterilization of free-roaming dogs is expected to guide dog population management and rabies control programs in Bangladesh. The inclusion of animal welfare courses in all of the veterinary schools in Bangladesh is strongly recommended. This will help veterinary students to develop empathy towards animals and more ethical practices with their professional services therefore might get ensured. The overall results discussed in this review will hopefully be beneficial for veterinarians, farmers, animal welfare scientists, and other stakeholders to learn more about animal welfare science, including current research results and the prospective inclusion of more animal welfare standards in policy guidelines and standards. The university faculties in Bangladesh might develop better research methodologies to address other welfare areas that different country already been highlighted in specific areas of animal welfare. In summary, this article will hopefully be complimentary for Bangladesh as well as for other developing countries to improve animal well-being, productivity, public health, and food security, especially necessary in this ecologically and politically vulnerable world.

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