

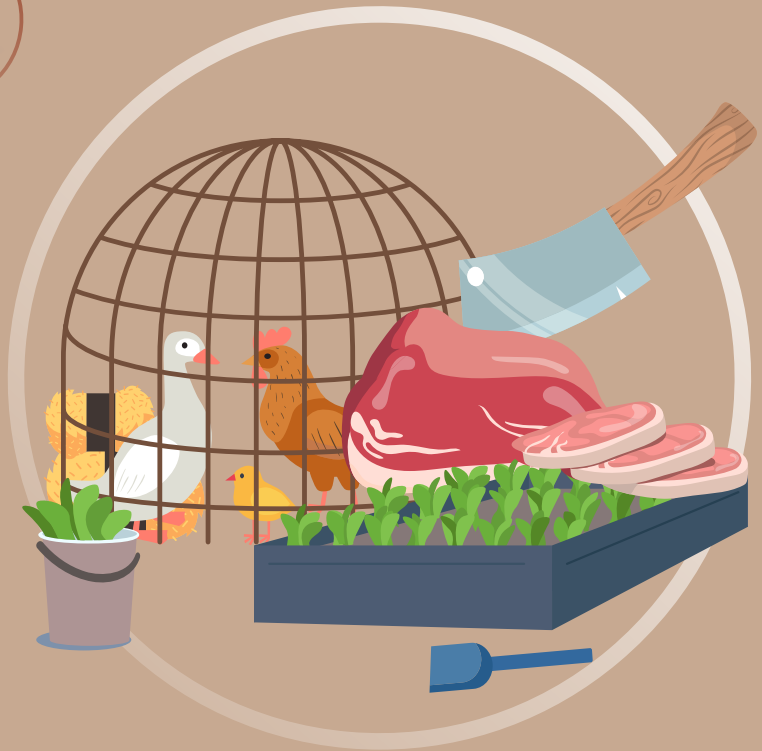


Food and Agriculture
Organization of the
United Nations

Backyard farming and slaughtering

Keeping tradition safe

2





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Keeping tradition safe

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FOOD SAFETY

TECHNICAL TOOLKIT FOR ASIA AND THE PACIFIC

Food and Agriculture Organization of the United Nations
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Abstract

The region of Asia and the Pacific has a long history in farming livestock at the household level: this practice is linked with cultural identities and economic development in rural and low-mid socioeconomic communities. Household and village level animal production is well-aligned with the United Nations' Sustainable Development Goals, and is therefore important to maintain, especially in the most populous region in the world. These practices, however, carry a risk of foodborne pathogens contaminating animal-derived foods as well as the risk of disease transmission from the animal or food to humans. Such risks can be addressed by promoting the adoption and implementation of safe and sustainable practices for home slaughtering among communities. These practices include good animal management practices that promote animal health (e.g. vaccination), practices to be adopted immediately prior to slaughter, the implementation of hygienic measures after slaughtering (including access to appropriate facilities), inspections and waste management. All of these factors have an influence on food safety and will need to be taken into consideration from food safety competent authorities.

Keywords

Backyard farming, home slaughtering, food safety, zoonosis, animal health, animal-derived food, meat inspection, meat, poultry, cattle, cultural identity, awareness, hygienic practices, abattoirs, community awareness, foodborne disease, foodborne pathogens, livestock, food testing, waste management, environmental health.



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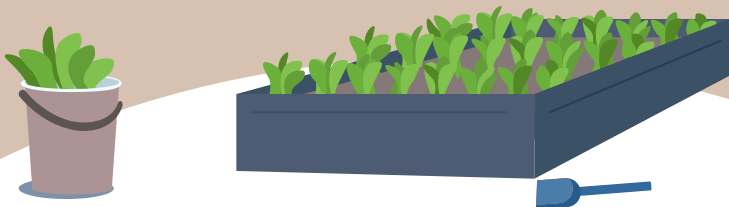


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Introduction

Did you know that there is a strong connection between subregional religious and cultural beliefs, and practices and trends in animal production?

For many generations, communities in the Asia-Pacific region have farmed livestock at the household level; raising poultry, pigs, cattle, buffalo, sheep, goats and fish on their family lands or communal areas. Smallholder animal production has vital economic, practical and cultural value to Asian and Pacific communities, particularly within rural and low to middle income socioeconomic population groups (FAO, 2018; FAO, 2014a). Cultural identity can be intrinsically linked to animals and to home farming. The slaughter of livestock at the household or village level is the natural outcome of home farming, and similarly, has significant cultural and subsistence relevance to communities in the Asia-Pacific region. This is especially the case where slaughter is associated with religious or cultural practices (Aghwan and Regenstein, 2019).







The importance of home farming and slaughter

Despite the highly nutritious value of animal-derived foods – which include meat, milk, eggs, and associated by-products and processed foods – there are risks associated with animal production and slaughter. Beyond the direct zoonotic risks (i.e. the transmission of disease from animals to humans) to those handling animals, animal-derived foods can pose risks with respect to food safety. Farming and slaughter practices have impacts on food safety, the environment, and biosecurity. The severity and nature of these impacts varies with the types of practices employed. Many relate more to large-scale or industrial style farming practices, as occurs in developed countries. Some of these practices are now expanding within transitional and developing countries, although some of these risks also apply to smallholder farming and slaughter situations. These risks can, however, be managed, thereby making household or village level slaughter and animal-derived foods production sustainable, safe, and continually rewarding for the communities for whom such practices are so ingrained in their culture.

For the purposes of this document, the Asia-Pacific region is geographically defined – as per the World Health Organization (WHO) – as countries within East, South, and Southeast Asia, the South Pacific and Oceania, subcategorized into Western Pacific Regions (WHO, 2020c) and Southeast Asian regions (WHO, 2020b). Culturally and geographically, such boundaries can be artificial, so the regional scope can be considered flexible and adaptable (Dirlik, 1992). The Asia-Pacific region is the largest global region, comprising 60 percent of the world's population, and is extremely diverse (FAO, 1995). It hosts the two most populous nations (China and India) yet also a myriad of small island nations, and represents economies ranging from subsistence smallholder agrarian, through transitional, to industrialized. In the

Asia-Pacific region, smallholders are typically represented by farms less than 1 hectare in size, holding 1.3 animals per household, and supporting 1.1 person/day of family labour, 800 million of whom live on less than USD 2.0 per day (FAO, 2018; FAO, 2019a; Sherzad, 2018).

This document aims to outline the benefits of smallholder farming and slaughter, particularly how these benefits align with the United Nations' Sustainable Development Goals (SDG), and balance these against potential problems with these practices. It will describe the various hazards and risks, and provide a framework for addressing these, based on good agricultural and slaughter practice guidelines. This information is designed to assist food safety authorities in providing community guidance, governance, and education to promote the use of animals as a food source, balanced with minimizing risks associated with food safety, animal health and welfare, biosecurity, and environmental degradation. This document focuses on terrestrial production animals, although many of the practices and approaches described can be applied to aquatic animal production too. Production and slaughter practices described will principally relate to how these are undertaken at the household and village level, although reference to commercial farming practices and food safety assurance will also be included to represent aspirational and/or exemplar models of good hygienic practices that could be applied to the smallholder context, where appropriate.



2.1. The impact on nutrition and food security

Future food security and poverty reduction remain complex challenges, particularly in Asia and the Pacific, and include the susceptibility of food supply systems to threats from global financial shocks, impacts of climate change, and risks of transboundary and emerging animal and zoonotic diseases, such as COVID-19, foot-and-mouth disease, African swine fever, *peste des petits ruminants*, and others (Windsor, 2011; Nampanya *et al.*, 2016), and more recently with the COVID-19 global pandemic. Smallholder livestock farmers are important stakeholders within the food supply chain, as they represent approximately 20 percent of the world population and farm most of the agricultural land in the tropics; thus, they help address food security challenges (McDermott *et al.*, 2010). Part of this high percentage of smallholder livestock farmers relates to population growth, but also to general income growth, increased urbanization, and food consumption preferences and habits (FAO, 2020d).

Nearly 65 percent of the world's undernourished people live in Asia (McGuire, 2015), while many nations in the Pacific face similar challenges, in addition to issues associated with vulnerability to natural disasters, the double burden of significant malnutrition (e.g. undernutrition vs obesity) and reliance on imported foods (FAO, 2014a; FAO, 2020c). Livestock and livestock products are a well-recognized source of high-quality protein, with animal-derived foods providing 40 percent of the world population's protein and 18 percent of its calories (Elmadfa and Meyer, 2017; FAO, 2020b; FAO, 2014a). In contrast to industrialized countries, which rely on large-scale, commercial production systems, smallholder farming is a critical source of animal-derived foods supply in Asia and the Pacific (FAO, 2020d; Smith, 2013). While half of the world's animal-derived foods and cereals are derived from smallholder producers, this rate increases to 70–80 percent for the Asia-Pacific region and other emerging economies (Herrero *et al.*, 2017; Zhou and Wan, 2017).



2.2. The impact on socioeconomic development

Livestock systems are significant components of national economies, with animal production contributing 40 percent of agricultural output in developing countries, compared to 20 percent in developed countries (FAO, 2018). Animal production represents a reliable and tangible source of cash income for many families in developing and emerging countries, preventing many from falling into poverty (McGuire, 2015; FAO, 2018), and representing a significant source of financial capital and resilience for many farmers (Abed and Acosta, 2018). The international poverty line is defined as USD 1.90 per day, with almost 11 percent of the world's population living below this level, representing over 800 million people (World Bank, 2017). Rapid economic advances occurring in East and South Asia, as well as the Pacific, have driven reductions in poverty levels (FAO, 2018). More than just the avoidance of poverty, animal production has allowed smallholders to expand their operations and incomes, and to generate resources that allow them to adapt to new activities and diversify their income sources (Dorward *et al.*, 2009; Abed and Acosta, 2018).

2.3. Other impacts and alignment with SDGs

Many of the benefits that flow from household and village level animal production are aligned with the United Nations' Sustainable Development Goals (United Nations, 2020a). Livestock production contributes to all 17 SDGs, and has the most direct relevance to the first three: No Poverty (SDG1), Zero Hunger (SDG2), and Good Health and Well-Being (SDG3) (FAO, 2018). Specific data about the role of animal-derived foods production in attaining the SDGs can be found on the SDG Gateway Data Explorer site (UN, 2020b). SDG1 and SDG2 align with the issues discussed above: economic development, and food security and nutrition, respectively. But a number of other outcomes from smallholder animal production also represent SDG-associated goals, specifically:





increasing children's cognitive development and educational outcomes, **SDG4** (FAO, 2018: xxv);



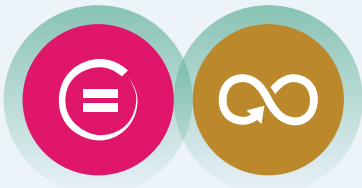
building and sustaining labour markets, **SDG8** (FAO, 2018:70);



enhancing women's participation in economic progress and family productivity, **SDG5** (FAO, 2018:47);



reducing environmental impacts associated with livestock production, including more efficient water use and manure management, **SDG12** (FAO, 2018:58);



improving market access, through product value-adding and quality and safety assurance, **SDG10**, **SDG12** (FAO, 2018:88);



promoting social stability and capital, and preserving cultural traditions and the rural lifestyle, **SDG11** (FAO, 2018:128); and



provision of transport and draught power, **SDG15** (FAO, 2018:147).

2.4. Current smallholder livestock production and slaughter practices

2.4.1. Uses of livestock species and livestock products

It is difficult to effectively summarize smallholder animal production and slaughter practices in Asia and the Pacific due to the enormous diversity of demographics, cultures, economies and agricultural contexts represented in the region. Detailing specific data on the distribution of various livestock species farmed and production systems employed is beyond the scope of this document, and can be found in other sources (Robinson *et al.*, 2011; Gilbert *et al.*, 2018; FAO and ILRI, 2013; FAO, 2020a). A summary of broad distributions and uses for the core livestock species found in the Asia-Pacific region is presented in Table 1.

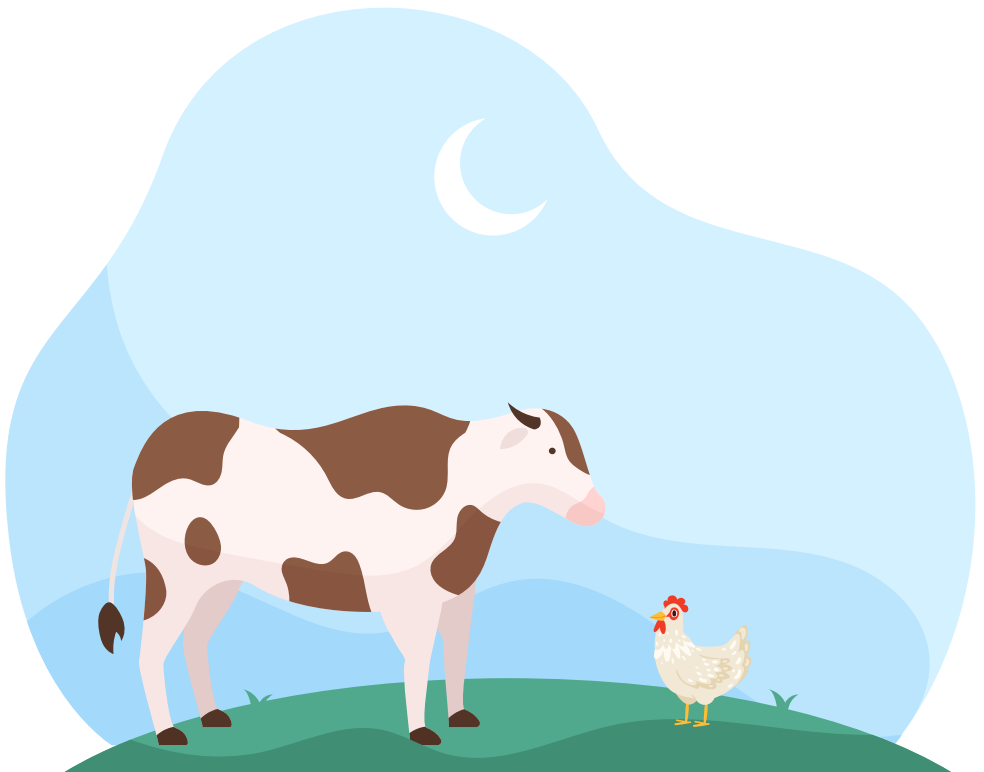









Table 1. Summary of core livestock species, their primary uses, locations within the Asia-Pacific region, and range of associated production systems

Livestock	Products & uses	Principle locations ^a	Production systems ^b
Cattle 	Meat, milk, hides, draught power	South Asia; Australasia; with lower densities across east Asia	Diverse: concentrated feeding; pasture-grazed beef and dairy; multi-species and mixed crop-livestock smallholder
Buffaloes 	Meat, milk, hides, draught power	South Asia and SE Asia	Small family farms, emerging of small to medium farms
Sheep 	Meat, milk, wool	Arid areas of Asia and Australasia	Pastoralist herds, smallholder, mixed-farming
Goats 	Meat, milk, wool	South Asia; lower densities in central East Asia; Islamic SE Asia	Pastoralist herds; smallholder, mixed-farming
Pigs 	Meat	South Asia, particularly China; Pacific Islands	Diverse: large, concentrated feeding; mid-scale family; smallholder and/or backyard farming
Chickens 	Meat, eggs	Heaviest density in East Asia; ubiquitous across SE Asia and Oceania	Diverse: intensive systems specializing in broilers or layers; dual purpose smallholder; smallholder and/or backyard farming
Ducks 	Meat, eggs, feathers	Bangladesh; China; Southeast Asia – associated with water	Large flocks, used for rice paddy clearing; small, mixed-farming

Adapted from FAO, 2020a.

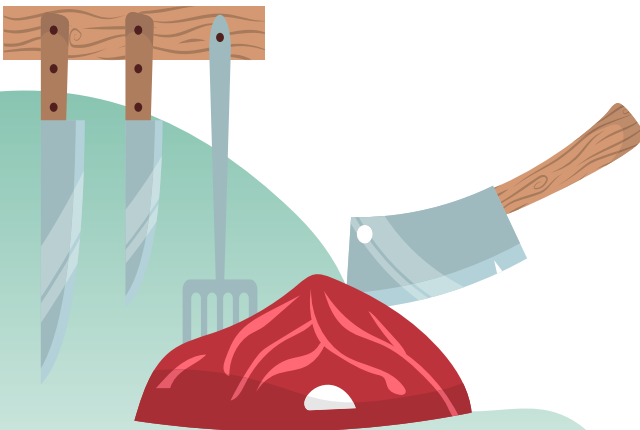
^a Locations based on livestock density data.

^b Production systems demonstrating the spectrum of operations possible.

2.4.2. Trends related to religious and cultural practices

Specific trends in animal production, including which species predominate, farming methods, and slaughter practices, vary greatly across the Asia-Pacific region, but are highly associated with subregional religious and cultural beliefs and practices (Aghwan and Regenstein, 2019; FAO, 1995). The region includes many different religious communities, including Buddhists, Confucianists, Hindus, Jains, Muslims, Sikhs, Shinto, Taoists, localized folk religions, animists, pantheists, and various denominations of Christians. Each of these have slaughter practices that are scripturally encoded or otherwise follow strict process requirements (Aghwan and Regenstein, 2019; Grandin, 2017). Similarly, political systems are highly diverse, and regional practices are also influenced by historical situations (especially colonisation), global trade relations, conflict, and the mass media. All of these factors can influence the demographics of livestock farming and slaughter. In some countries, only certain ethnic groups are associated (or disassociated) with such practices (Aghwan and Regenstein, 2019; Thomas *et al.*, 2017). Well-recognized religious practices associated with slaughter include:

- Islamic (Halal), which forbids the handling, slaughter and consumption of pigs and other animals, and requires adherence to several codified slaughter techniques;
- Hindu, which promotes vegetarianism (Ahimsa), but can allow certain animal-derived foods (but not beef) where no slaughter (e.g. milk, eggs) or rapid slaughter (Jhatka) is practised; and
- Pacific Island ritual slaughter (see Box 1).



Box 1. Nekowiar – cleansing and reconciliation

Nekowiar is one of the Pacific region's most spectacular cultural festivals. Occurring every few years, thousands of people on the Island of Tanna, in Vanuatu, converge to dance, determine tribal authority, arrange marriages, and ceremonially feast. Dating back centuries, months are spent preparing for each event. The celebration centres around a series of dances, but culminates in kava drinking and the slaughter of up to 100 pigs. Pigs are presented to the host tribe, being carried into the ritual area to be sacrificed, and then selected by respective tribes as a form of reconciliation. Respective contributions of numbers of pigs indicates the status of the attendees. The spilling of blood and animal sacrifice symbolizes a cleansing of the sins committed earlier during the festival (Bonnemaison, 1986).



2.4.3. Slaughter practices

Beyond differences relating to religious, cultural and regional factors, slaughter practices vary greatly within the Asia-Pacific region.

Slaughter premises can be broken down into four main categories:

1. newer, well-designed and equipped abattoirs that promote hygienic meat production destined for the export market or high-value domestic markets;
2. large-scale, older abattoirs, usually government owned, typically located within urban areas;
3. small to medium sized private or municipal abattoirs that are urban or rurally based; and
4. family or village level slaughter “slabs” used for smallholder and/or religious and cultural slaughter (Heinz, 2008).

In developing countries, slaughter tends to occur across numerous smaller abattoirs, which contrasts with industrialized countries that have a more integrated and centralized approach to slaughter (Heinz, 2008). With the exception of the first category, the levels of hygiene, worker safety, animal welfare, and environmental pollution applied in these facilities can be highly variable. This is due to facility design, but also to regulation, and operator knowledge and skill levels, which can also be highly variable and frequently are insufficient for addressing key risks associated with slaughter (Heinz, 2008; Thomas *et al.*, 2017).

Irrespective of the slaughter process applied, the vast majority of meat produced in Asia and the Pacific is destined for “hot” supply (Picture 2), through either direct consumption within the home or village (particularly in the case of situation 4 above) or through secondary sale at “wet” markets. Lack of refrigeration and other basic hygiene-associated processes introduces further challenges to meat safety (Heinz, 2008). There is a great deal of scope to improve slaughter processes, including those relating to hygiene and food safety, within the Asia-Pacific region (Heinz, 2008; FAO, 2018; Thomas *et al.*, 2017). While this applies to all of the slaughter categories above, this document will focus on Category 4 – home and village level slaughter, including ceremonial.

Picture 1. Example of a wet market in Cambodia supplying meat in hot form



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2.5. Challenges and risks associated with home production and slaughter

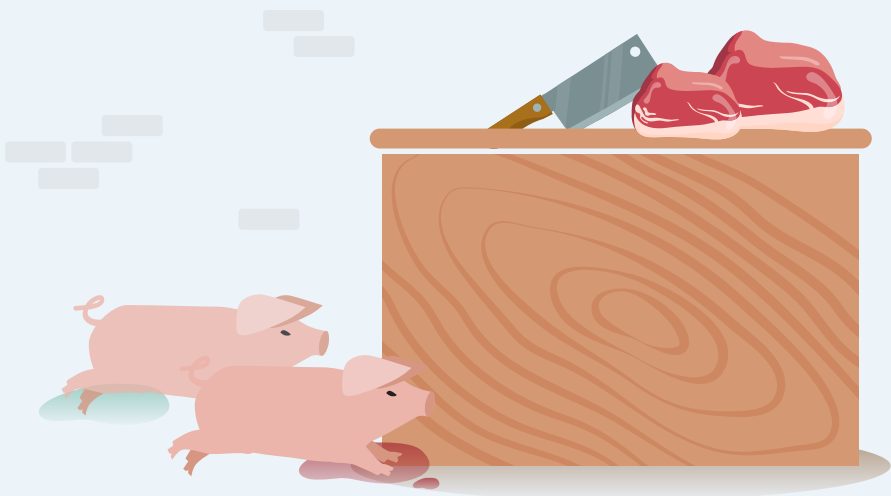
2.5.1. Foodborne health hazards

Sickness and death associated with foodborne diseases is significant at a global level, particularly in developing countries (FAO, 2018; Grace, 2015). Globally, foodborne diseases are responsible for approximately 600 million illnesses and 420,000 deaths per year, equating to 33 million disability adjusted life years (DALYs) (Havelaar *et al.*, 2015; WHO, 2020d); 54 percent are due to diarrhoeal-related diseases alone. Due to diagnostic and reporting limitations in many developing countries, these figures are underestimates (WHO, 2020d). Many of WHO's nominated neglected tropical diseases that are prevalent in Asia and the Pacific are food or waterborne, including echinococcosis, foodborne trematodiasis, helminthiasis, and cysticercosis (WHO, 2020f). Many of these are particularly problematic for rural populations, not least

because of the low priority placed on them by national health systems. Foodborne deaths are particularly associated with the consumption of meat (Hanson *et al.*, 2012), and disease burdens are anticipated to increase as many developed countries move to intensify production and socioeconomic pressures (Grace, 2015).

Children suffer disproportionately from the effects of foodborne disease, with those under five years old being associated with 40 percent of associated disability adjusted life years (DALYs) occurring as both increased disease incidence (125,000 deaths) and severity (Havelaar *et al.*, 2015; FAO, 2013; WHO, 2020d). Of the 1.9 million diarrhoeal-related disease deaths each year, the majority are among children in low-income countries and are associated with food and animal transmission (FAO and WHO, 2009; Zambrano *et al.*, 2014). Chronic exposure to foodborne pathogens can result in enteric dysfunction, which can be a major cause of child malnutrition and stunting (Crane *et al.*, 2015).

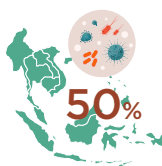
While the burden and nature of foodborne disease varies significantly across global regions, Southeast Asia and urban South Asia are particularly affected (Grace, 2015; Havelaar *et al.*, 2015; WHO, 2020d; WHO, 2020f). Key facts relating to foodborne diseases in the Asia-Pacific region are presented in Box 2.



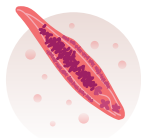
Box 2. Key foodborne disease facts for the Asia-Pacific region



Salmonella typhi (typhoid) is a significant pathogen across Asia, accounting for 280 disability adjusted life years (DALYs).



50 percent of the total disease burden in Southeast Asia is caused by bacterial diarrhoeal agents, with the most significant ones being (in decreasing order): enteropathogenic *Escherichia coli*; non-typhoid *Salmonella*; enterotoxigenic *E. coli*; *Campylobacter* spp.



Foodborne parasites are also a significant threat in Southeast Asia, with the principle agents being: *Paragonimus* spp., *Clonorchis sinensis*, and *Opisthorchis* in the South East Asia B region of the World Health Organization (WHO, SEAR B).¹



In the Western Pacific region (WHO WPR B)², helminths are the predominant foodborne pathogen, accounting for 55 percent of disability adjusted life years (DALYs): the primary pathogens are *Paragonimus* spp., *Clonorchis sinensis* and *Taenia solium*.



Bacterial diarrhoeal diseases account for less (14 percent) of the foodborne disease burden in the Pacific, with *Campylobacter* being the predominant pathogen.

¹ Indonesia, Sri Lanka, Thailand

² Cambodia, China, Cook Islands, Fiji, Kiribati, Lao People's Democratic Republic, Malaysia, Marshall Islands, Micronesia (Federated States of), Mongolia, Nauru, Niue, Palau, Papua New Guinea, Philippines, Republic of Korea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu, Viet Nam

Box 3. Key bacterial foodborne pathogens and diseases in the Asia-Pacific region

➤ *Salmonella*

- Typhoid is spread by people, mainly through poor food handling practices.
- Non-typhoid *Salmonella* transmission is mainly from animals and poorly processed animal-derived foods.
- Infections are often associated with higher rates of hospitalization and death, mainly due to systemic infection (blood and internal organs), particularly in young, old, pregnant and immunocompromised populations.

➤ *E. coli*

- *E. coli* can be found as normal flora in the gastro-enteric tracts of humans and other animals.
- Some strains, especially diarrhoeagenic strains such as enterotoxigenic and enteropathogenic, *E. coli* can cause disease.
- It can be used microbiologically as an indicator of food contamination, and is the basis of many standards.

➤ *Campylobacter*

- It is the most common bacterial cause of gastroenteritis, but can sometimes cause long-term immune system problems.
- It is usually associated with undercooked chicken, but can be found in other foods and water.
- It is common in industrialized countries, but a problem in developing countries due to hyper-endemicity causing chronic enteritis and stunting.

➤ *Shigella*

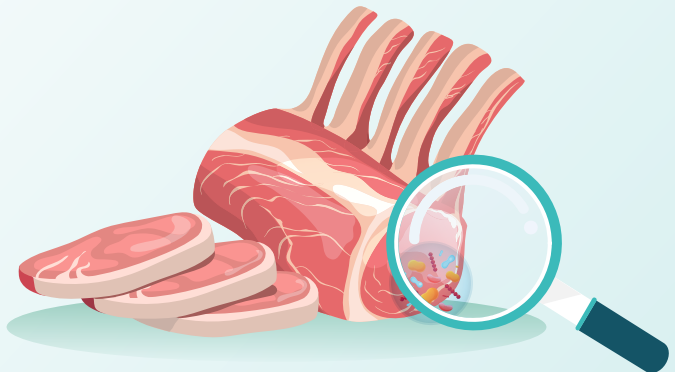
- It causes bacterial dysentery (severe diarrhoea with blood), mainly in developing countries.
- It is primarily associated with contaminated water and food, often where crowding occurs.
- It has a very low infectious dose, and it is common with outbreaks.

➤ *Vibrio*

- It is mostly associated with cholera (*V. cholerae*), but other species cause food and waterborne diseases.
- It is usually associated with seafood, especially molluscs.
- It can occur as large outbreaks, particularly cholera, often with significant fatalities.

➤ Bovine tuberculosis

- It is associated with consumption of unpasteurized milk or contaminated beef.
- It can be found primarily in regions with high cattle production, particularly South Asia.
- It can cause chronic and severe disease, with emerging multi-drug resistant strains complicating treatment.



Box 4. Key parasitic foodborne pathogens and diseases in the Asia-Pacific region

➤ Helminths

- Mainly *Ascaris* species, but also other roundworms such as hookworm and whipworm can be significant in tropical developing countries.
- It can cause acute obstructive disease, but it is mainly associated with chronic wasting in children.
- Human infection mainly occurs through ingesting soil or vegetables contaminated with faeces.

➤ Cysticercosis

- Human *Taeniae* tapeworms are contracted through eating cysts in undercooked meat.
- Pork tapeworm (*T. solium*) can also be contracted through ingesting tapeworm eggs on vegetables contaminated with human faeces – a significant cause of neurological disease in developing countries.
- It is also significant cause of meat contamination and condemnation, including trade issues.

➤ Trematodes

- They are parasitic flatworms, including *Clonorchis sinensis* in East Asia, *Opisthorchis* spp. in Southeast Asia, and *Paragonimus* spp. in the Pacific Islands.
- They are associated with chronic lung (*Paragonimus*) and liver (*Clonorchis*, *Opisthorchis*) disease, including cancer.
- They are mainly contracted through eating fish or crustaceans; control is through freezing or thorough cooking.

➤ Hydatid disease

- It is primarily a problem in East Asia and other areas with sheep farming, due to this tapeworm's life cycle.
- It is associated with consumption of vegetables contaminated with canine faeces.
- It can be in cystic or alveolar form, but the most severe outcomes are from large cyst formation in the brain.

Adapted from Havelaar *et al.*, 2015.

Apart from infectious hazards, chemical residues in foods represent a significant risk in the Asia-Pacific region, both for human health and trade in animal-derived foods commodities (WHO, 2020a). Such chemicals may be natural contaminants, adulterants or food additives, or agricultural and veterinary chemicals used on livestock, on their feeds, or their local environment. Chemical hazards are estimated to be responsible for 3 percent of the overall foodborne disease burden in the region (220,000 illness cases, 20,000 deaths and 1 million disability adjusted life years (DALYs) (WHO, 2020d). The level of burden and specific chemicals presenting as hazards varies by subregion, with aflatoxin being the biggest threat in WHO regions of Western Pacific B and of Southeast Asia B, and dioxins in Southeast Asia region D³ (Havelaar *et al.*, 2015).

³ Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Maldives, Myanmar, Nepal, Timor Leste

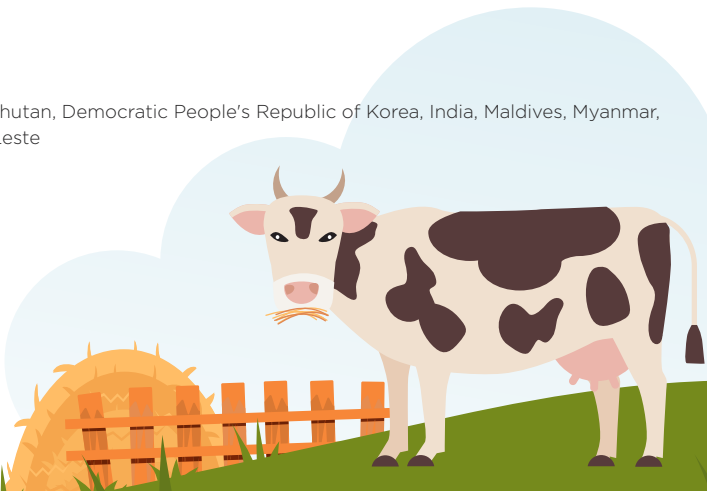
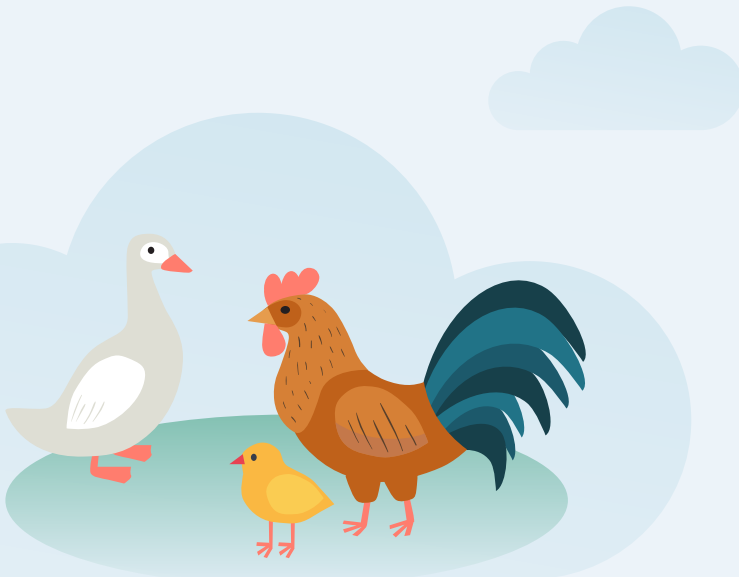


Table 2. Country groupings according to WHO

WHO Southeast Asia region B	Indonesia, Sri Lanka, Thailand
WHO Southeast Asia region D	Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Maldives, Myanmar, Nepal, Timor Leste
WHO Western Pacific region B	Cambodia, China, Cook Islands, Fiji, Kiribati, Lao People's Democratic Republic, Malaysia, Marshall Islands, Micronesia (Federated States of), Mongolia, Nauru, Niue, Palau, Papua New Guinea, Philippines, Republic of Korea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu, Viet Nam

Source: WHO, 2020.

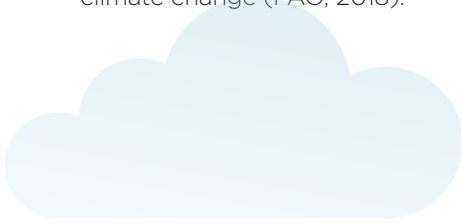


2.5.2. Economic impacts

Foodborne diseases are a risk for smallholder farmers and other people directly consuming locally slaughtered livestock. However, there is a bigger picture, in terms of food security and safety, as well as economic loss for the region's population (APEC, 2020). It is estimated that low to middle income countries lose USD 95-110 billion each year to foodborne disease, due to medical expenses, lost productivity, poor socio-economic development, and lost tourism and trade (WHO, 2020d; Jaffee *et al.*, 2018). The last reason is particularly significant, given the increasingly global distribution systems associated with animal-derived foods commodities, and many countries aspirational goals to develop export markets and economies. Such factors directly link to Sustainable Development Goal 8 – Decent Work and Economic Growth (United Nations, 2020a).

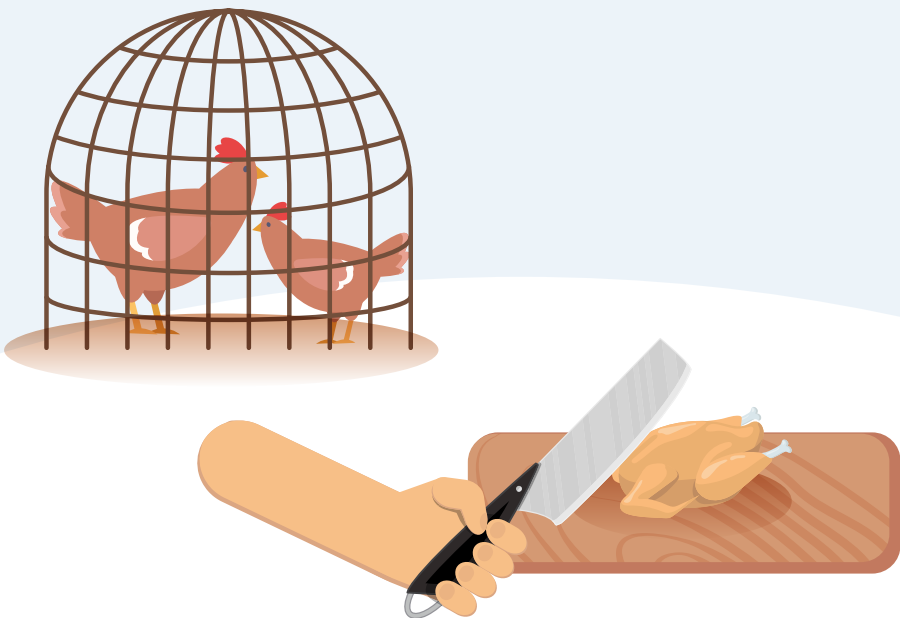
2.5.3. Environmental impacts

In most low to middle income countries, the individual environmental impact of smallholder operations is relatively small (FAO, 1999). Livestock are fed opportunistically, often on waste products on unowned land, typically with low levels of waste output. Similarly, where animal-derived foods are consumed locally, they are associated with lower greenhouse gas emissions per capita through reductions in commodity transport, storage, etc. as compared to developed countries (Caro *et al.*, 2014). Significant pollution issues are associated with slaughter operations, particularly in unregulated environments such as low-middle income countries (World Bank, 2009). While this is more associated with larger-scale slaughter operations, pollution of air, water and soil from many family and village level slaughter events can negatively impact Asia's environment and food production capacity (Zhou and Wan, 2017), and reduces potential benefits of value-adding from re-usable wastes (World Bank, 2009). Ever-increasing demand for ADF in ADR countries will place increased pressure on the environment, thus threatening the region's attainment of SDG 12 goals (FAO, 2018; UN, 2020a). In turn, smallholder livestock farmers are amongst the most vulnerable to the resultant climate change (FAO, 2018).



2.5.4. Other impacts associated with home slaughter risks

Unregulated and poorly managed farming and slaughter practices have significant impacts on biosecurity. Beyond foodborne diseases, zoonotic transmission associated with direct contact with animals and their immediate surroundings poses a significant health threat to smallholder households in developing countries (FAO, OIE and WHO, 2019). Similarly, some elements of smallholder production and slaughter practices have the capacity to place animal populations at greater risk of transboundary diseases, as exemplified by recent avian influenza and African Swine Fever incursions (Otte *et al.*, 2007; FAO, 2007; Thompson, 2019). While these threats are most commonly associated with increased intensification of livestock production, complex interplay between ecological, agricultural, and socioeconomic factors means that these risks still apply to household farmers (Liverani *et al.*, 2013; Otte *et al.*, 2007), who are often the most vulnerable to transboundary disease impacts (Smith, 2013). This is compounded by no or relatively few regulatory environments to address biosecurity issues (Thompson, 2019).



2.6. Basic requirements for backyard slaughter and food safety

There are many reference documents that provide excellent guidance on slaughter practice, some targeted to smallholder and developing country audiences (Herenda, 2000; Clottey, 1985), with others being more generic and/or applicable to commercial and industrialized contexts (FAO, 2005; OIE, 2019; FAO, 1991; FAO, 2019b; Chambers and Grandin, 2001). It is beyond the scope of this document to reproduce these guidelines. Instead, information has been summarized and customized to provide a framework of good slaughter practice that can be used at the household or village level.

2.6.1. Animal management and basic animal handling

Healthy ADFs derive from healthy animals. Animals destined for slaughter should be raised using good animal management practices. Routine practices such as parasite and waste control are important. Vaccination is a key method of protecting livestock against infectious disease, with the further benefit of reducing risks of zoonotic and foodborne transmission, as well as trade facilitation and poverty alleviation (Roth *et al.*, 2003; WHO, 2006a). Some countries (e.g. Mauritius) require approval for the sale or purchase of a live animal destined for home and/or religious slaughter (FAO, 2010). In many APR countries, methods for animal management up to and at the time of slaughter are dictated by religious or ceremonial requirements. Practices that align to these requirements, but that also optimize animal welfare and food safety outcomes, have been described (Aghwan and Regenstein, 2019; Grandin, 2017).

How the animal is raised and treated immediately prior to slaughter also impacts the safety and quality of meat, as well as protecting the welfare of the animal (Grandin, 2017; Trent *et al.*, 2003; Grace, 2015). Livestock should be transported and/or housed prior to slaughter in a way that protects them from the elements and being moved too quickly over too large a distance, and ensures they have adequate water and rest before slaughter. Animals should have feed withheld 24 hours before they are slaughtered in order to reduce the volume of contents in their gastrointestinal tract and the risk of ingesta spillage at slaughter. Housing areas or transport vehicles should be clean in order to improve animal welfare but also to reduce soiling of the hide; the animal's hide and

gastrointestinal tract are the two main sources of ADF contamination. Stunning of the animal should be applied where it can be done competently and in compliance with local custom. Rapid and effective stunning is done not only for the sake of the animal, but also to improve the safety and quality of the meat, reduce bruising and hide damage, and personnel injury during slaughter.

2.6.2. Basic facilities, equipment and personnel requirements for home slaughter

While some communities have access to a dedicated slaughter facility, many others rely opportunistically on slaughter sites. Where possible, fixed places for slaughter should be established that offer the following basic features: a stone or concrete slab; basic roofing; adequate lighting and ventilation; hooks or hoists for lifting carcasses off the ground, or in their absence, carcass cradles or tarpaulins for floor-dressing; access to clean water; drainage for waste and water runoff; cutting blocks; and troughs or barrows for collecting and disposing of offal or non-edible parts. Design plans for small-scale or modular slaughter facilities are available (FAO, 1988).

Village or ritual slaughter should be carried out by personnel experienced in this process, and with some basic understanding of and/or training in hygienic slaughter practices. Lack of adequate training has been identified as a key limitation to improving hygiene and food safety outcomes (Trent *et al.*, 2003). Such training must conform to regional cultural practices and expectations, balanced against considerations for animal health and welfare, food safety, and environmental protection (Thomas *et al.*, 2017). Certification works best when it has tangible benefits to those completing it, such as legitimacy that will reduce costs through fines or bribes (Grace, 2015).

2.6.3. Ante-mortem inspection

A basic appraisal of the animal's health should be undertaken immediately prior to slaughter. Ideally, ante-mortem and post-mortem inspections would be done by a local veterinarian, district health or livestock officer, but processes also need to be feasible with respect to cost and accessibility. Key elements of inspection prior to slaughter should include:

- Examination of the animal at rest and in motion, looking for abnormalities in gait or posture;
- Abnormalities associated with the animal's breathing or body orifices, including discharges, skin lesions, swellings, diarrhoea (Picture 3);
- Consider the animal's behaviour, with abnormal reaction to stimuli or group interactions potentially indicating generalized conditions such as fever;
- Survey especially for signs of systemic disease: depression, shivering, hot, behaviour change;
- Identify if the animal is in poor body condition, or has not been eating;
- Identify animals that may have been recently treated with a chemical agent (e.g. an antimicrobial) or may have been exposed to environmental toxins (e.g. pasture pesticides);
- Be aware of symptoms associated with emergency animal diseases (e.g. mouth blisters and foot-and-mouth disease) and report any suspicious cases to the local authority;
- Avoiding slaughter and consumption of heavily pregnant or dirty animals; and
- Check health certificates and other required documentation.



Picture 2. Management and inspection of animals before slaughter (ante-mortem) is important to reducing the risk of transmission of foodborne zoonoses to humans



2.6.4. Post-mortem inspection

Immediately following slaughter, some level of inspection of the carcass and organs is appropriate. Specific procedures vary between species, but generic post-mortem inspection should include:

- Careful examination of the carcass, head, and internal organs;
- This is done visually, but should also including palpation (feeling of tissues) and incision (cutting and observation of internal organ surfaces) where this can be done hygienically;
- Minimal organ examination should include the: lymph nodes, heart, lungs, liver, kidneys, intestines, musculature; and
- It is important to differentiate localized from generalized conditions. Localized conditions are where abnormalities are specific to a singular organ or body area, such as masses, parasites, abscesses and bruising. Removal and disposal of the diseased organ or area may be sufficiently safe.

- Where general disease is evident, the entire animal should not be eaten. Signs associated with generalized disease include: parasites, abscesses, or masses throughout many organs and the carcass; jaundice; widespread haemorrhage (blood leakage); evidence of fever or blood poisoning. Signs of the latter include: enlargement and inflammation of many lymph nodes; enlarged, bloody or discoloured organs; excessive amounts of bloody, cloudy, or straw-coloured fluid in the chest or abdomen; and a failure of rigor mortis (normal muscle contraction after death).

Veterinary or similar advice should be sought if unsure of possible problems and disposition.

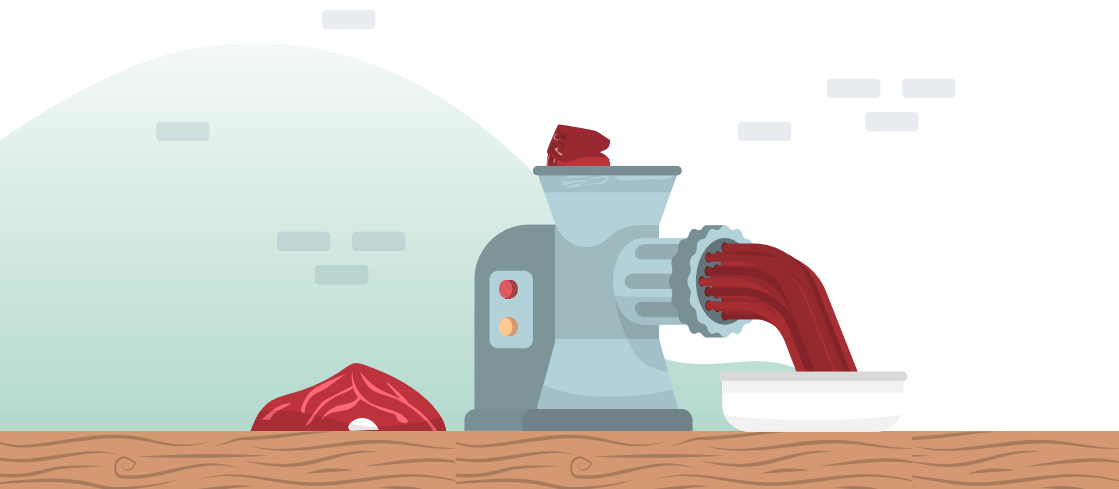
2.6.5. Basic hygiene considerations

A key challenge for smallholder slaughter in low to middle income countries is assessing the microbiological safety of meat. Most basic meat inspection processes rely on identifying gross changes (e.g. visible pathology, presence of parasites) that might suggest unfitness for human consumption. However, many of the key hazards in meat, particularly in the modern era, involve contamination with foodborne microbes. These include those significant in the Asia-Pacific region (see Box 2), such as *Campylobacter*, non-typhoidal *Salmonella*, *E. coli* and *Listeria monocytogenes* (FAO, 2019b). In the absence of the technical tools and expertise to screen for these, food safety inspection in smallholder situations must rely on indirect indicators of contamination. These could include contamination with faeces, ingesta, dirt or hide material (hair, wool), but also how well hygienic procedures were applied (Picture 4).

Methods that aim to pro-actively reduce risk are also applicable. Although formal hazard analysis and critical control point (HACCP)-based programmes are not necessarily suitable for home and village slaughter situations, the principles that underlie HACCP can be applied. WHO offers guidance to the application of HACCP in small and/or less developed food businesses (FAO & WHO, 2003). Some basic preventive hygiene measures include:

- Ensuring personnel wash hands and have clean clothing and footwear, and are healthy at the time of slaughter, including having no open wounds or skin sores (Picture 4);
- Use of equipment that is cleaned regularly during slaughter;
- Where possible, hang the animal to de-hide and cut up the carcass. If not, use clean tarpaulins or flay the hide to reduce contact of the carcass with the ground (Picture 4);
- Remove the dirtiest and inedible parts of the animal first (i.e. feet, tails, reproductive organs);
- Make a minimal number of cuts through the skin when removing the hide and avoid the external skin contacting meat;
- Tie off the rectum and oesophagus before eviscerating the animal. Evisceration is best done with the animal hanging by its hindlegs;
- Wash the carcass where ample clean water is available, otherwise, do not wash;
- Minimize exposure of meat to heat between slaughter and sale or consumption; and
- Control vermin, flies, and other pests, and minimize unnecessary handling of meat.

Hygiene should extend to the transport, storage, and sale of meat and other ADF products. WHO offers basic principles for managing safe food post-slaughter in a variety of languages (WHO, 2006b). In the absence of cold chain management of ADF, foods should be cooked thoroughly and consumed as soon as possible after slaughter.



Picture 3. Examples of suboptimal hygienic practices associated with cattle slaughter, such as lack of footwear and carcass contact with the ground



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2.6.6. Waste management

Waste products produced during animal slaughter are significant with respect to food hygiene, zoonotic disease transmission, and environmental contamination (World Bank, 2009; Grace, 2015). Large volumes of liquid (up to 200 L for an adult bovid) can be expelled from the gastrointestinal tract during slaughter, and water flushing further adds to the burden of waste to be managed. Slaughter wastes can be highly contaminated, including with classical foodborne agents (e.g. *E. coli*, *Salmonella*) but also zoonotic agents (e.g. brucellosis, Q fever) and chemical hazards. Good waste management practices include:

- careful collection of the stomach and other non-edible products (e.g. into separate barrows or troughs);
- slaughter slab design to facilitate drainage;
- water runoff diverted from natural waterways;
- appropriate disposal of wastes (e.g. burial, incineration, composting);
- effective washing and decontamination of equipment and facilities after slaughter; and
- careful management of animal and human wastes used for fertilization of fodders, crops, and pasture.

2.7. Non-food related factors influencing food safety

The regulatory environment in which food is produced significantly influences food safety outcomes. Smallholder production and slaughter typically occurs within no/low regulatory environments. Although this can have benefits with respect to practicality and cost, it is associated with lower standards of hygiene and food safety (FAO, 2019a). Voluntary uptake of international standards by smallholder farmers does occur, and indicates some value proposition, but it is highly context specific and reliant on certain facilitating mechanisms (FAO, 2014b). Basic regulatory requirements that will greatly improve food safety include: minimal training and certification of meat inspectors; banning the slaughter of diseased livestock; requirements for some level of ante-mortem and post-mortem inspection; notification requirements for emergency animal diseases; and certification of slaughter premises and products (FAO, 2019b; Thomas *et al.*, 2017).

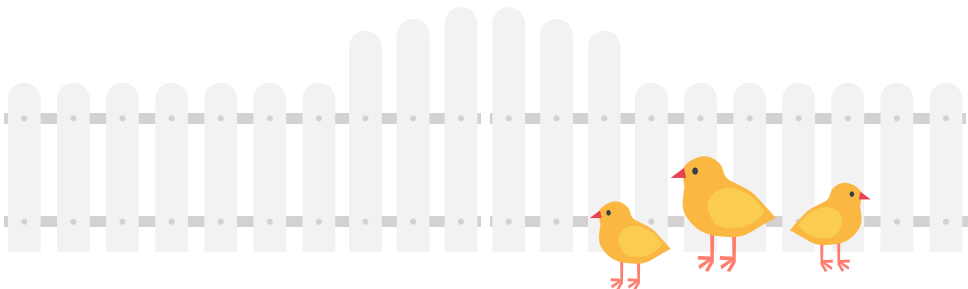
Competent authorities can develop relationships to facilitate healthy outcomes associated with home farming and slaughter. Gaining the respect and making champions of local community leaders, farmer organisations, and religious or cultural influencers will greatly assist in disseminating information and local uptake of advice or requirements. It will also help authorities design practical and acceptable standards of practice. Sharing of experiences and initiatives across regions, countries, or jurisdictions can be effective in improving food safety management. WHO hosts global forums along these lines, and produces reports based on such information sharing (FAO and WHO, 2002). Similarly, WHO INFOSAN offers a transparent system of information sharing with respect to urgent or wide-impacting foodborne disease outbreaks and threats, as well as opportunities to request international assistance and share best practice experiences and advice (WHO, 2020g).



2.8. Future challenges and demands

Food safety into the future is threatened by a number of projected factors. Foremost is population growth, forecast to reach 10 billion by 2050 (APEC, 2020; Willett *et al.*, 2019). Although significant changes in global diets that downsize meat consumption are proposed (Willett *et al.*, 2019), ongoing consumption of meat, milk, eggs and other ADFs is the reality, and likely to increase in the Asia-Pacific region, resulting both from socioeconomic development and demand for improved protein diets (FAO, 2018; Smith, 2013; WHO, 2020e). Annual meat production is projected to increase to 376 million tonnes by 2030, with Asia demonstrating the highest increase in demand and per capita purchasing potential in the near future (FAO, 2018; Smith, 2013). While industrialization and development of mature markets for ADFs will likely increase in low to middle income countries, local production and consumption will remain significant for many years (Smith, 2013).

Levels of food production need to be balanced by considerations of food safety and sustainability. Diminishing natural resources, waste management, biodiversity loss, and climate change are the current threats to lives and livelihoods (Willett *et al.*, 2019). There is a need for global policy transformation that addresses environmental sustainability, dietary targets, food waste and mal-distribution. Such factors are recognized drivers for recent trends in foodborne disease (Grace, 2015). Considerations for smallholder farmers need to be included in future policy and practices. Application of technology, enhanced education, improved regulation, and market access options all need to be applied if household ADF producers are to adapt to growing needs for food security and safety (FAO and ILRI, 2013).



3

Conclusions

Household and village level farmers are an essential part of the livestock production landscape in Asia and the Pacific, and have an important role in ensuring food security and meeting other SDGs. However, there is an urgent and increasing need to balance the practical and cultural value of home farming and slaughter with the potential threats. These include risks associated with food safety and community health, environmental health, biosecurity, local and national economic development, and social stability. There are a number of relatively simple interventions that can be introduced or maintained at the level of home farming and slaughter that can improve food safety outcomes. Evidence-based leadership towards improvements in smallholder farming and slaughter practices from local competent authorities is a critical pathway to success in minimizing the risks of foodborne diseases.





Recommendations and regulatory suggestions for backyard and home slaughtering in Asia and the Pacific

Below is a set of practical recommendations that national food safety competent authorities should consider:

1. Collaborate with livestock farmers and agricultural officers to optimize health prevention strategies for livestock products. This includes strategies such as parasite control, vaccination, antimicrobial resistance, feed hygiene (e.g. to reduce mycotoxins) and waste management. Healthy food starts with healthy animals.
2. Engage with communities to enhance smallholder farmer knowledge and awareness of good hygiene practices, as well as provide guidance as to appropriate and practical regulatory and/or management systems. Farmers should become familiar with the most important foodborne pathogens in local areas, and the main risks associated with them.
3. Consider smallholders with respect to future policy-making around livestock production and consumption.
4. Apply elements to household slaughter events such as including the management of the slaughter facility, personnel, equipment, waste management, hygiene, inspection and product integrity
5. Harmonize the requirements for religious or ritual slaughter with those for safe food production, thus preserving cultural practices while also protecting the community's health.
6. Apply hygienic practices to reduce contamination of meat during the slaughter process.

7. Ensure control of the hygiene of meat post-slaughter is important to reducing people's risk of foodborne diseases, particularly for bacterial diseases.
 - a. Personnel hygiene is a specific control step for priority diseases in the APR such as typhoid, enterotoxigenic and enteropathogenic *E. coli*.
 - b. Cooking and/or freezing of seafoods is a valuable step to reduce foodborne transmission risk from *Opisthorchis*, *Clonorchis*, and *Paragonimus*.
8. Improve veterinary and animal health services through regulatory improvement and implementation plus training of personnel in basic animal health inspection and hygienic slaughter practice is one of the most basic and rewarding interventions to improve food safety
9. Design carefully the regulation improvement and their implementation in consultation and involvement of local communities. This includes certification, and it applies to food safety needs that consider regional, religious and cultural practice. Regulation also needs to be enforced, but more importantly, championed by influential community members through knowledge and awareness campaigns.
10. Consult resources available to assist with local disease intelligence and risk management, including from the FAO and other international organisations (e.g. WHO, the World Organisation for Animal Health (OIE)) as well as through engagement with similar authorities in other jurisdictions.





Resources

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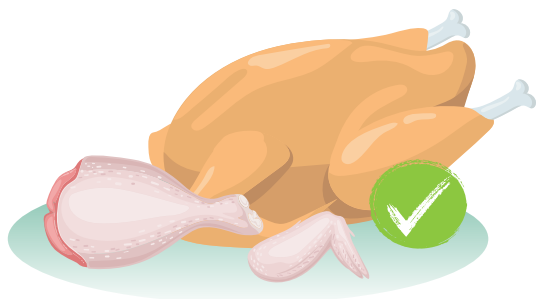
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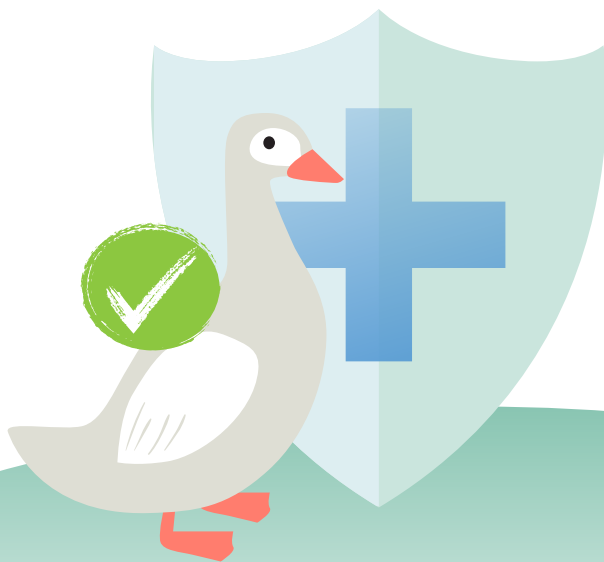
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Backyard farming and slaughtering

Keeping tradition safe

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