ANALYSIS OF VETERINARY ANTIMICROBIALS SALES DATA ADJUSTED FOR FOOD-PRODUCING ANIMAL BIOMASS IN MALAYSIA FROM 2018 TO 2021

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ABSTRACT. Ensuring a sustainable supply of animal-based food to meet protein demands for a healthy diet presents significant challenges in Malaysia. Malaysia's livestock sector is categorised into ruminants (cattle, buffalo, goats, and sheep) and non-ruminants (pigs, chickens, and ducks), with farming operations ranging from small-scale to semi-commercial and commercial systems. The widespread and routine use of antimicrobials in livestock farming, particularly as growth promoters or preventive measures, has raised concerns about potential misuse and overuse. Such practices can contribute to antimicrobial resistance (AMR) by exerting selective pressure on microbes, thereby accelerating resistance development. Although Malaysia has been reporting antimicrobial usage (AMU) data to the World Organisation for Animal Health (WOAH) since 2017, no comprehensive analysis has yet been conducted on veterinary antimicrobial sales adjusted for animal biomass. This study aims to analyse trends in veterinary antimicrobial sales adjusted to food-producing animal biomass in Malaysia from 2018 to 2021. A retrospective analysis was conducted using antimicrobial sales data voluntarily reported by wholesalers to the Department of Veterinary Services (DVS), combined with animal population census data and production values. The study focused on four categories of food-producing animals: large ruminants, small ruminants, swine, and poultry. The average biomass of food-producing animals was 2.991 billion kg, with poultry accounting for the largest share. Antimicrobial sales, adjusted for animal biomass, averaged 177.31 mg/kg, with a decline of 7.32% (16.20 mg/kg) over the study period. This study fills that gap by providing critical insights into antimicrobial usage patterns and potential exposure risks among food-producing animals in Malaysia. This study fills that gap by providing critical insights into antimicrobial usage patterns and associated exposure risks in food-producing animals in Malaysia, particularly the potential transmission of resistant bacteria to humans through overuse or misuse of antibiotics, leading to the development and spread of AMR bacteria.

Keywords: veterinary antimicrobial sales, animal biomass, AMR, AMU

INTRODUCTION

The global demand for animal protein is increasing rapidly, driven by the expansion of intensive farming (Tiseo *et al*., 2020). As a key component of the world food system, the livestock sector is vital in enhancing food security, improving public health, reducing poverty, and advancing agricultural development. According to the Food and Agriculture Organization (FAO), livestock is essential to global agriculture, contributing 40% of the total agricultural output value while supporting the livelihoods, food security and nutrition of nearly 1.3 billion people worldwide (Henchion *et al*., 2021).

In Malaysia, livestock is categorised into two main groups: ruminants (cattle, buffalo, goats, and sheep) and non-ruminants (pigs, chickens, and ducks). The classification of the livestock sector is based on the scale of farming, which includes small-scale, semi-commercial, and commercial operations. Smallholders primarily dominate ruminant farming, while large-scale commercial farms are mainly driven by the non-ruminant industry (Hariz & Abdul, 2011). To meet the growing demand for animal protein, Malaysia's livestock industry has evolved into a more commercialised, intensive, and modernised production system (Zayadi, 2021).

The use of antimicrobials in livestock significantly contributes to the emergence and spread of antimicrobial resistance (AMR). AMR is a complex, multifaceted issue in which resistant bacteria can be transmitted from animals to humans through direct contact with the food chain and the environment. Research indicates that food-producing animals may serve as reservoirs for antimicrobial-resistant infections in both animals and humans (Manyi-Loh *et al*., 2018). The One Health approach acknowledges the interconnectedness of human, animal (livestock and pets), and environmental health. By adopting this integrated strategy, AMR can be effectively addressed (Magouras *et al*., 2017). Many countries and international organisations have incorporated the One Health concept into their national action plans to combat AMR. There is an urgent need for the prudent use of antimicrobials, reinforced by appropriate regulations, policies, and comprehensive surveillance by relevant authorities. Additionally, efforts should focus on public education about AMR, infection prevention and control, proper sanitation, and good husbandry practices to mitigate the risks associated with antimicrobial resistance (Pagani *et al*., 2020).

In the second annual report on antimicrobial use (AMU) published in 2017, the World Organisation for Animal Health (WOAH) introduced a new methodology for reporting quantitative data on animal biomass. This approach included an annual analysis of antimicrobial agent usage, adjusted for animal biomass, at both global and regional levels (Góchez *et al*., 2019). To facilitate meaningful comparisons across regions and over time, adjustments must account for differences in the size and composition of animal populations. In many cases, reported data have been scaled based on animal biomass or the total live weight of domestic animals, serving as a proxy to estimate antimicrobial exposure within a specific area over a defined period (Góchez *et al*., 2019).

Currently, several organizations, including the United States Food and Drug Administration (USFDA), the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC), the Public Health Agency of Canada (PHAC), and WOAH, have established methodologies to quantify antimicrobial sales in food-producing animals. These methods involve adjusting sales data based on animal biomass, utilizing the most up-to-date national data available (Bulut & Ivanek, 2022). In Southeast Asia countries, for example, Thailand, have adopted and refined the WOAH-recommended methodology using the Population Correction Unit (PCU), tailored with national livestock demographic data to better reflect local production systems (Lekagul *et al*., 2023).

A significant milestone in AMU data analysis is the standardisation by animal biomass, which represents the total live weight of domestic animals within a country over a year. This approach enables meaningful comparisons across different species, regions, and periods. Variations in regional biomass and species composition affect antimicrobial use because

of differences in species and production systems. Although numerous approaches exist to estimate biomass, none can easily be applied to WOAH's global database because they require detailed data on populations of animals, classes of production, weights and trade figures. Very few countries are able to provide that level of detail (WOAH, 2021a-c).

Currently, Malaysia lacks a standardized method for adjusting veterinary antimicrobial sales data based on animal biomass. Thus, this study aims to determine the trends in veterinary antimicrobial sales adjusted for food-producing animal biomass in Malaysia from 2018 to 2021 using the WOAH's methodology aligned to the livestock industry in Malaysia.

MATERIALS AND METHOD

Study design, types and sources of data

A retrospective analysis was conducted using data collected by the Department of Veterinary Services (DVS) from 2018 to 2021 to determine Malaysia's veterinary antimicrobial sales adjusted for the biomass of food-producing animals. The study focused on four categories of food-producing animals: large ruminants (cattle and buffalo), small ruminants (goats and sheep), swine, and poultry (chickens and ducks).

The data selected for this study included the total sales of veterinary antimicrobials intended for use in food-producing animals and the food-producing animal population census and production values from 2018 to 2021. Veterinary antimicrobial sales for animal use were defined as the total annual sales reported by wholesalers to DVS. The data used in this study were acquired from DVS on March 22, 2023.

The population census and production values of Malaysia's food-producing animals for 2018, 2019, 2020, and 2021 were retrieved from the DVS website (https://www.dvs.gov.my/index.php/pages/view/4315) on May 10, 2023. The Strategic Planning and Veterinary Assessment Division, DVS Putrajaya (DVS Malaysia, 2022) compiled and verified this data. Additionally, the reference document used by DVS for animal population and production statistics, Teknikal Parameter Pengeluaran Tempatan dan Nilai Pengeluaran, last updated on June 28, 2018 (Annex 1, Appendix 1), was consulted. These data sets were utilised to calculate the biomass of Malaysia's food-producing animals. Written permission for data access and use were obtained from the Director General of DVS.

Calculation of food-producing animal biomass according to WOAH methodology

Animal biomass refers to the total weight of all live domestic animals within a specific area over a year. It serves as an indicator of the animals potentially exposed to antimicrobial agents. In this study, the biomass of food-producing animals was determined following the WOAH methodology outlined in the 6th Edition of the Annual Report on Antimicrobial Agents Intended for Use in Animals (WOAH, 2021b).

The denominator for calculating WOAH biomass for a specific animal species was based on the annual average weight at slaughter, also known as the live weight, which was estimated from the carcass weight. The carcass weight (kg) was determined using the following formula (Equation 1):

$$\text{carcass weight (kg)} = \frac{\text{weight of the animal species slaughtered (kg)}}{\text{number of animals of the species slaughtered (heads)}}$$

The carcass weight was then converted to the live weight at slaughter by dividing it by a species-specific conversion coefficient (k), as

defined by Eurostat (European Commission Eurostat, 2009). This coefficient, also referred to as the dressing percentage (Góchez *et al*., 2019) was applied using the following formula (Equation 2):

$$\text{live weight (kg)} = \frac{\text{carcass weight (kg)}}{\text{conversion coefficient (k)}^{1}}$$

whereby, the conversion coefficient (k) represents the ratio between the processed carcass weight and the estimated live weight of an animal before slaughter.

Animal weight varies depending on age and population class within a species. To account for this variability, the population structure was considered by distinguishing between animals with a lifespan exceeding one year and those living less than a year. Estimating the proportion of adult versus young animals is essential to ensure accurate application of average weights. Species-specific formulas were used for this estimation. Population proportions (P.pop) for calves, younglings, adult cows, and adult males were derived from Malaysia's food-producing animal census for 2018–2021 (DVS Malaysia, 2022).

The four-year average P.pop values for large ruminants were calculated as follows: calves (22.15%), younglings (32.84%), adult cows (34.15%), and adult males (10.87%). Additional factors were incorporated to refine biomass estimates for large ruminants and swine such as Eurostat's livestock unit classification (LSU) that was used to determine population structure for large ruminants. The standard weight of sows in the Asia-Pacific region and the estimated percentage of sows in the swine population where sows are raised for over a year for breeding purposes were also considered.

The quantity of antimicrobial sales was then adjusted to the food-producing animal biomass using the following calculation for each study year (Equation 3):

$$\frac{\text{antimicrobial agents reported (mg)}}{\text{animal biomass (kg)}}$$

RESULTS

Tables 1a and 1b detail the total quantity of antimicrobials sold for use in food-producing animals and sales data categorized by the WHO classification of critically important antimicrobials for human medicine in Malaysia from 2018 to 2021. To calculate veterinary antimicrobial sales adjusted for the biomass of food-producing animals in Malaysia during this period, the total sales of veterinary antimicrobials intended for use in food-producing animals and the population census from 2018 to 2021 were used.

Table 1a: Total sales quantity of antimicrobials intended for use in food-producing animals in Malaysia from 2018 to 2021

Year	Quantities (kg)	Quantities (mg)
2018	664,119.60	664,119,600,000
2019	550,915.10	550,915,100,000
2020	305,691.30	305,691,300,000
2021	594,251.30	594,251,300,000

Table 1b: Sales quantity of veterinary antimicrobials according to the WHO classification in critically important antimicrobials of human medicine in Malaysia from 2018 to 2021

WHO Classification	Quantities (mg)			
	2018	2019	2020	2021
Critically Important Antimicrobial (CIA)	257,741,200,000	166,422,400,000	119,079,900,000	267,035,500,000
Highly Important Antimicrobial (HIA)	242,428,700,000	218,575,200,000	128,544,900,000	251,408,700,000
Important Antimicrobial (AI)	152,259,300,000	156,054,222,000	47,766,100,000	65,771,405,250

Total food-producing animal biomass

Figure 1 shows the total animal biomass for four categories of food-producing animals in Malaysia from 2018 to 2021. In 2018, the total food-producing animal biomass was 3.000 billion kg. The highest animal biomass reported was in 2020 (3.048 billion kg). There was a decrease of 4.96% of the total food-producing animal biomass in 2021 compared to 2020, where 2021 reported the lowest amount of food-producing animal biomass. The average food-producing animal biomass was 2.991 billion kg.

The total biomass of four categories of food-producing animals in Malaysia for the year 2018 to 2021 were calculated using the WOAH animal biomass calculation methodology. The detailed calculations can be found in Annex 2 (Tables 4a-i).

Food-producing animal biomass according to animal categories

Malaysia's food-producing animal biomass data, by animal categories for the years 2018 to 2021, is presented in Table 3. In 2021, the total biomass of food-producing animals was lower than in

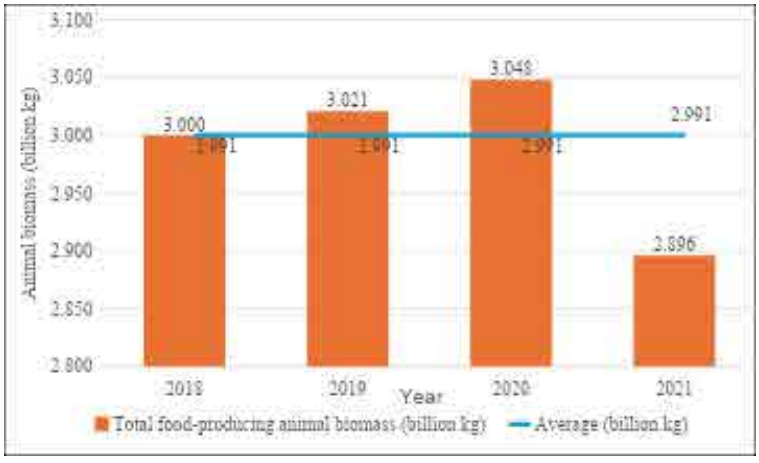

Figure 1. Total animal biomass of food-producing animals in Malaysia between 2018 and 2021 (Adapted from DVS, Malaysia website https://www.dvs.gov.my/index.php/pages/view/4315, accessed on May 10, 2023, from a database of population census and production values (DVS, 2022))

Table 2: Animal biomass data for food-producing animals in Malaysia, by animal categories between 2018 and 2021

Animal category	Animal biomass (billion kg)			
	2018	2019	2020	2021
Large ruminant	0.270	0.335	0.270	0.243
Small ruminant	0.038	0.035	0.062	0.039
Swine	0.330	0.286	0.283	0.253
Poultry	2.362	2.365	2.433	2.361
Total	**3.000**	**3.021**	**3.048**	**2.896**

2020, with reductions ranging from 2.92% to 37.66% across all categories. Biomass trends for ruminants and swine fluctuated throughout the four years from 2018 to 2021.

Poultry consistently accounted for the largest share of Malaysia's food-producing animal biomass each year, ranging from 78.28% to 81.53%, with the highest percentage recorded in 2021. Swine, large ruminants, and small ruminants followed in descending order, as illustrated in Figure 2.

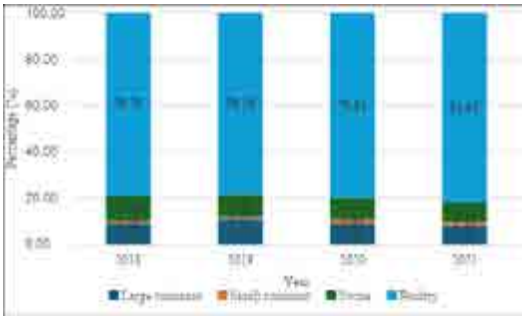

Figure 2. Animal biomass data for food-producing animals in Malaysia by animal categories between 2018 and 2021. The blue bar represents poultry, the green bar represents swine, the orange bar represents the small ruminant, and the dark blue bar represents the large ruminant. (Accessed on May 10, 2023, from a database of population census and production values (DVS, 2022))

Figure 3. Antimicrobial sales quantities adjusted to food-producing animals biomass in Malaysia between 2018 and 2021

Total antimicrobial sales quantities adjusted by food-producing animal biomass

Antimicrobial sales quantities, adjusted according to food-producing animal biomass in Malaysia from 2018 to 2021, are shown in Figure 3.

In 2018, antimicrobial use stood at 221.38 mg/kg of animal biomass, decreasing to 182.36 mg/kg in 2019 and further to 100.31 mg/kg in 2020, before increasing to 205.18 mg/kg in 2021. The average antimicrobial use across the four selected food-producing animal categories over this period was 177.31 mg/kg. Between 2018 and 2021, antimicrobial sales adjusted for food-producing animal biomass declined by 7.32%, equivalent to a reduction of 16.20 mg/kg, as detailed in Table 3. The adjusted sales quantity

Table 3: Quantities and percent changes of antimicrobial sales quantities adjusted by food-producing animals in Malaysia from 2018 to 2021

Year	Sales quantities adjusted by animal biomass (mg/ kg)	Quantities change (mg/ kg)	Percent change (%)
2018	221.38	-	-
2019	182.36	-39.02	-17.62
2020	100.31	-82.05	-44.99
2021	205.18	104.87	104.55
Total		**-16.20**	**-7.32**

dropped by 17.62% (39.02 mg/kg) in 2019 and 44.99% (82.05 mg/kg) in 2020, followed by a significant increase of 104.55% (104.87 mg/kg) in 2021.

Antimicrobial sales quantities adjusted by food-producing animal biomass according to WHO critically important antimicrobials of human medicine

Antimicrobial sales quantities, adjusted for food-producing animal biomass based on the WHO classification of critically important antimicrobials (CIA) for human medicine in Malaysia from 2018 to 2021, are shown in Figure 4. In 2018, the CIA category recorded the highest antimicrobial sales, adjusted to food-producing animal biomass, at 85.92 mg/kg, followed by the Highly Important Antimicrobials (HIA) category at 80.81 mg/kg. HIA had the highest sales in 2019 (72.35 mg/kg) and 2020 (42.18 mg/kg). Although HIA increased to 86.80 mg/kg in 2021, it remained lower than CIA. The Important Antimicrobials (IA) category remained stable in 2018 (50.75 mg/kg) and 2019 (51.66 mg/kg), before declining to 15.67 mg/kg in 2020 and then rising to 22.71 mg/kg in 2021. Over the four years, all three WHO-classified antimicrobial categories were widely used in Malaysian food-producing animals.

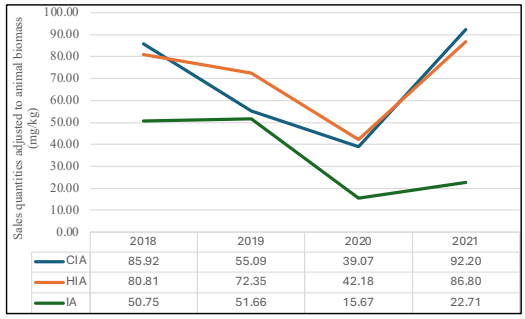

Figure 4. Antimicrobial sales quantities adjusted by food-producing animal biomass for critically important antimicrobials of human medicine (WHO classification) in Malaysia between 2018 and 2021. The blue line represents the CIA group, the orange line represents the HIA group, and the green line represents the IA group

DISCUSSION

This study utilized the biomass calculation formula recommended by WOAH to estimate the total biomass of food-producing animals in Malaysia. While various calculation methods exist, differing mainly in the denominator used, the WOAH formula remains the most reliable approach for global monitoring of antimicrobial sales in food animals (Bulut & Ivanek, 2022). During the study period, the average biomass of Malaysia's four major food-producing animal categories—large ruminants, small ruminants, poultry, and swine

were 2.991 billion kg. Poultry accounted for the largest share (79.59%) due to its high population, fast-rearing cycle, and well-established production chain in Malaysia. Compared to the ruminant sector, the poultry industry has expanded rapidly to meet growing local and international demand, undergoing intensification and scaling up (Zayadi, 2021).

Between 2018 and 2021, Malaysia's antimicrobial sales quantities adjusted for food-producing animal biomass declined from 221.38 mg/kg in 2018 to 205.18 mg/kg in 2021. This trend contrasts with global data, where antimicrobial use increased from 115.38 mg/kg in 2019 to 169.86 mg/kg (WOAH, 2021b, 2023, 2024). In comparison, Thailand reported a substantial reduction in antimicrobial consumption using a national Population Correction Unit (PCU) based methodology, with usage decreasing from 658.7 mg/PCU in 2017 to 336.3 mg/PCU in 2019 (Lekagul *et al*., 2023). While PCU normalized figures cannot be directly compared with biomass-based (mg/kg) values, both indicators reflect a downward trend in antimicrobial use over time. These reductions demonstrate growing regional awareness and efforts to improve antimicrobial stewardship in the livestock sector. Malaysia's declining trend is encouraging and suggests progress in aligning with regional best practices, although continuous improvement is needed to further optimize AMU and support national AMR containment goals.

The average antimicrobial sales quantity adjusted for biomass in Malaysia from 2018 to 2021 was 177.31 mg/kg, showing a 7.32% reduction over the period. This decline may be influenced by the COVID-19 pandemic and the early implementation of AMU regulations. However, caution is needed when interpreting the data, as this study only includes major food-producing species in Malaysia, such as poultry, swine, cattle, buffalo, goats, and sheep, whereas the WOAH biomass denominator includes a broader range of terrestrial species, such as equines, rabbits, camelids, and cervids. As a result, the AMU rates presented here may not be directly comparable to WOAH-submitted data, which includes additional species.

More precise biomass estimates can be achieved by refining key parameters, such as the conversion coefficient (k), commonly known as the dressing percentage. WOAH applies a standard value of 0.54 for large ruminants (Góchez *et al*., 2019). However, studies on Malaysian cattle suggest that a conversion coefficient of 0.56 is more appropriate, given that the dressing percentage of Kedah-Kelantan (KK) cattle ranges between 55.6% and 56.7% Ariff *et al*. (1993). As KK and its crossbreeds are predominant in Malaysia's cattle population (Ariff *et al*., 2015), using this revised coefficient ensures a more accurate biomass calculation.

Another crucial factor is the correction applied to estimate the mean adult cattle weight. Research suggests that adult cattle weigh, on average, 15% more than their generic live weight at slaughter (Góchez *et al*., 2019). This study derived the generic live weight for large ruminants in Malaysia using census and production data from 2018 to 2021. The findings align with previous Malaysian studies, which reported pre-harvest live weights of 227.8 kg for KK cattle and between 316.5 kg and 333.3 kg for crossbreeds such as Hereford-KK, Brahman-KK, and Friesian-KK (Ariff *et al*., 1993). More recent data showed average live weights of 320.7 kg for Sawah buffaloes and 356.6 kg for Murrah buffaloes (Azmi *et al*., 2021). However, this study did not incorporate WOAH's standard 15% weight correction factor for large ruminants. Instead, after calculating the generic mean live weight at slaughter, the average was determined to be 489 kg, which was used as the reference value.

This study further used population proportions (P.pop) obtained from the national food-producing animal census from 2018 to 2021 (Annex 2, Table 4e). This helps to make the estimates more representative and minimizes the possibility of overestimation of biomass in the large ruminant category. Part of Malaysia's statistical data on the population and production of food-producing animals still depended on estimation due to constraints in capacity and facilities that rendered precise data collection impossible. The technical parameters used are from a study conducted in 2005 and later updated in 2018 by the Veterinary Strategic Planning and Evaluation Division, DVS. However, considering the long period of the study, demographic changes, and changes in farming practices, genetics, and nutrition may have changed these parameters. The analysis revealed notable trends in the use of antimicrobials classified by WHO as CIA, HIA, and IA in Malaysian food-producing animals. In 2018, CIA antimicrobials recorded the highest biomass-adjusted sales (85.92 mg/kg), highlighting their predominant role in livestock production. This dominance persisted in 2021, despite an increase in HIA usage. Notably, HIA surpassed CIA in 2019 (72.35 mg/kg) and 2020 (42.18 mg/kg), indicating a temporary shift in prescribing or purchasing patterns during those years. The sharp rise in HIA use in 2021 (86.80 mg/kg), although still slightly lower than CIA, is concerning given its designation as a highly important class for human medicine.

Meanwhile, the IA category remained relatively stable in the early years (2018–2019) but experienced a sharp decline in 2020, possibly linked to disruptions during the COVID-19 pandemic, changes in disease prevalence, or shifts in antimicrobial prescribing behaviour. The subsequent increase in 2021 to 22.71 mg/kg suggests a rebound or adjustment in usage. Overall, the sustained and widespread use of all three antimicrobial categories across the four years raises important questions regarding stewardship practices, the accessibility of alternatives, and the enforcement of guidelines in veterinary settings. These patterns underscore the need for targeted interventions, particularly in promoting responsible use of CIAs and HIAs, which are essential to preserving the efficacy of antimicrobials critical to human health.

Given the current limitations in national antimicrobial data, which have yet to include species-specific antimicrobial consumption, this study seeks to provide a comprehensive estimation of antimicrobial sales quantities adjusted to the food-producing animal biomass in Malaysia for the respective study year. Malaysia's veterinary antimicrobial sales data, recorded at the wholesale level, did not distinguish between different animal species. This limitation reduces the precision of antimicrobial sales estimates adjusted by species-specific biomass. Continual re-evaluation and refinement of biomass estimation methodologies are essential to ensure accurate antimicrobial use monitoring in food-producing animals, which is critical for informed decision-making and effective strategies to combat antimicrobial resistance in Malaysia.

Although there are limitations in the data used in this study, the calculated antimicrobial sales quantities adjusted for food-producing animal biomass serve as an essential reference point for benchmarking antibiotic use in Malaysia against other countries and guiding future reports. This preliminary dataset lays the groundwork for enhanced antimicrobial use monitoring and improved data collection efforts in the country. Transitioning to species-level AMU data reporting is both practical and beneficial for Malaysia. This can begin with strengthening policies, conducting pilot studies, and implementing digital reporting systems.

These steps will enable the collection of more accurate data to support national decision-making and contribute effectively to global efforts to control antimicrobial resistance.

CONCLUSION

Although Malaysia has yet to show significant reduction trends in AMU for the four years studied, this data serves as a benchmark for monitoring antimicrobial use among food-producing animals equivalent to the national population. The trend should be considered a "reference point" to ensure that Malaysia's use of antimicrobials in food-producing animals will not pose a threat to public health. For this reason, routine collection and analysis of national AMU data are potent tools for public health promotion regarding the containment of AMR. The approach towards the targeted reporting of data among wholesalers has to be designed and carried out efficiently to enhance the prudent use of antimicrobials in food-producing animals among veterinarians, farmers, livestock producer organizations, and pharmaceuticals in the animal sector as part of strategies for dealing with AMR in Malaysia.

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ANNEX 1

Appendix 1: Teknikal Parameter Pengeluaran Tempatan Dan Nilai Pengeluaran, by DVS (last updated on 28 June 2018)

TEKNIKAL PARAMETER

PENGELUARAN TEMPATAN DAN NILAI PENGELUARAN

1. DAGING LEMBU / KERBAU

Parameter :

1.1.	Bilangan sembelihan ternakan yang direkod		
1.2.	Anggaran bilangan sembelihan ternakan tidak di rekod		
	Lembu	-	23 %
	Kerbau	-	20 %
1.3.	Berat hidup		
	Lembu	-	320 kg / ekor
	Kerbau	-	450 kg / ekor
1.4.	Dressing %		
	Lembu KK	-	40% - 45 %
	Fidlot	-	50% - 55 %
1.5.	Berat karkas / ekor		
	Lembu	-	113.4 kg / ekor (kajian 2005 - 144.6 kg)
	Kerbau	-	181.4 kg / ekor (kajian 2005 - 178.55 kg)

2. DAGING KAMBING / BEBIRI

Parameter :

2.1.	Bilangan sembelihan ternakan yang direkod		
2.2.	Anggran bilangan sembelihan ternakan tidak di rekod		
	Kambing	-	50 %
	Bebiri	-	22 %
2.3.	Berat hidup		
	Kambing	-	33 kg / ekor (kajian 2005 - 14.19 kg)
	Bebiri	-	40 kg / ekor
2.4.	Dressing %		
	Kambing	-	45 %
	Bebiri	-	50%
2.5.	Berat karkas / ekor		
	Kambing	-	14.2 kg / ekor
	Bebiri	-	22.5 kg / ekor

3. DAGING AYAM

Parameter :

3.1.	Bilangan populasi ayam pedaging	
3.2.	Anggaran bilangan pusingan / tahun	– 5.4 kali
3.3.	Kadar sembelihan / jualan	- 94 %
3.4.	Berat hidup	- 2.3 kg / ekor
3.5.	Berat bersih / ekor	- 1.61 kg / ekor

4. DAGING ITIK

Parameter :

4.1.	Bilangan populasi itik pedaging	
4.2.	Anggaran bilangan pusingan / tahun	– 4.0 kali
4.3.	Kadar sembelihan	- 96 %
4.4.	Berat hidup	- 3.1 kg / ekor
4.5.	Berat bersih	- 2.6 kg / ekor

5. TELUR AYAM

Parameter :

5.1.	Bilangan populasi ayam penelur	
5.2.	Kadar pengeluaran	- 75.0 %
5.3.	Purata pengeluaran telur	- 230 biji
5.4.	Purata berat telur / biji	- 60 gm

6. TELUR ITIK

Parameter ;

6.1.	Bilangan populasi itik penelur	
6.2.	Kadar pengeluaran	- 80 %
6.3.	Purata pengeluaran telur / tahun	– 220 biji
6.4.	Purata berat telur / biji	- 75 gm
6.5.	Purata harga telur (2017)	
	Besar	– 47 sen / biji
	Sedang	- 39 sen / biji

Appendix 2: The conversion coefficient (k) specific to each species by Eurostat

Correspondence table for meat SBS

Product code	K	CN 2009	Self-explanatory texts in English
410-4111-4112	0.54	0102 10 10	Pure-bred breeding heifers female bovines that have never calved""
410-4111-4112	0.52	0102 10 30	Pure-bred breeding cows (excl. heifers)
410-4111-4112	0.56	0102 10 90	Pure-bred breeding bovines (excl. heifers and cows)
410-4111-4112	0.57	0102 90 05	Live domestic bovines of a weight <= 80 kg (excl. pure-bred breeding animals)
410-4111-4112	0.57	0102 90 21	Domestic bovines of a weight of > 80 kg and <= 160 kg
410-4111-4112	0.57	0102 90 29	Live domestic bovines of a weight of > 80 kg and <= 160 kg (excl. animals for slaughter and pure-bred breeding animals)
410-4111-4112	0.57	0102 90 41	Domestic bovines of a weight of > 160 kg and <= 300 kg
410-4111-4112	0.57	0102 90 49	Live domestic bovines of a weight of > 160 kg and <= 300 kg (excl. animals for slaughter and pure-bred breeding animals)
410-4111-4112	0.54	0102 90 51	Heifers female domestic bovines that have never calved" of a weight of > 300 kg
410-4111-4112	0.54	0102 90 59	Live heifers female domestic bovines that have never calved" of a weight of > 300 kg (excl. animals for slaughter and pure-bred breeding animals)"
410-4111-4112	0.52	0102 90 61	Cows female domestic bovines" of a weight of > 300 kg
410-4111-4112	0.52	0102 90 69	Live cows female domestic bovines" of a weight of > 300 kg (excl. animals for slaughter
410-4111-4112	0.56	0102 90 71	Live domestic bovines of a weight of > 300 kg
410-4111-4112	0.56	0102 90 79	Live domestic bovines of a weight of > 300 kg (excl. animals for slaughter
410-4111-4112	1.00	0201 10 00	Carcases or half-carcases of bovine animals
410-4111-4112	1.00	0201 20 20	Compensated" quarters of bovine animals with bone in
410-4111-4112	1.00	0201 20 30	Unseparated or separated forequarters of bovine animals
410-4111-4112	1.00	0201 20 50	Unseparated or separated hindquarters of bovine animals
410-4111-4112	1.00	0201 20 90	Fresh or chilled bovine cuts
410-4111-4112	1.30	0201 30 00	Fresh or chilled bovine meat
410-4111-4112	1.00	0202 10 00	Frozen bovine carcases and half-carcases
410-4111-4112	1.00	0202 20 10	Frozen compensated" bovine quarters
410-4111-4112	1.00	0202 20 30	Frozen unseparated or separated bovine forequarters
410-4111-4112	1.00	0202 20 50	Frozen unseparated or separated bovine hindquarters
410-4111-4112	1.00	0202 20 90	Frozen bovine cuts
410-4111-4112	1.30	0202 30 10	Frozen bovine boneless forequarters, whole or cut in max. 5 pieces, each quarter in 1 block; "compensated" quarters in 2 blocks, one containing the forequarter, whole or cut in max. 5 pieces, and the other the whole hindquarter, excl. the tenderloin, in one piece
410-4111-4112	1.30	0202 30 50	Frozen bovine boneless crop, chuck and blade and brisket cuts
410-4111-4112	1.30	0202 30 90	Frozen bovine boneless meat (excl. forequarters
410-4111-4112	1.00	0210 20 10	Meat of bovine animals
410-4111-4112	1.35	0210 20 90	Boneless meat of bovine animals
410-4111-4112	1.35	1602 50 10	Prepared or preserved meat or offal of bovine animals
410-4111-4112	1.25	1602 50 31	Corned beef, in airtight containers
410-4111-4112	1.25	1602 50 95	Meat or offal of bovine animals, prepared or preserved, cooked (excl. corned beef in airtight containers, sausages and similar products, finely homogenised preparations put up for retail sale as infant food or for dietetic purposes, in containers of a net weight of <= 250 g, preparations of liver and meat extracts and juices)
4120	0.78	0103 10 00	Pure-bred breeding swine

			weighing >= 160 kg (excl. pure-bred for breeding)
4120	0.78	0103 92 19	Live domestic swine
4120	1.00	0203 11 10	Fresh or chilled domestic swine carcases and half-carcases
4120	1.00	0203 12 11	Fresh or chilled with bone in
4120	1.00	0203 12 19	Fresh or chilled with bone in
4120	1.00	0203 19 11	Fresh or chilled fore-ends and cuts thereof of domestic swine
4120	1.00	0203 19 13	Fresh or chilled loins and cuts thereof of domestic swine
4120	1.00	0203 19 15	Fresh or chilled bellies streaky" and cuts thereof of domestic swine"
4120	1.30	0203 19 55	Fresh or chilled boneless meat of domestic swine (excl. bellies and cuts thereof)
4120	1.00	0203 19 59	Fresh or chilled boneless meat of domestic swine (excl. carcases and half-carcases
4120	1.00	0203 21 10	Frozen domestic swine carcases and half-carcases
4120	1.00	0203 22 11	Frozen boneless hams and cuts thereof of domestic swine
4120	1.00	0203 22 19	Frozen boneless shoulders and cuts thereof of domestic swine
4120	1.00	0203 29 11	Frozen fore-ends and cuts thereof of domestic swine
4120	1.00	0203 29 13	Frozen loins and cuts thereof of domestic swine, with bone in
4120	1.00	0203 29 15	Frozen bellies streaky" and cuts thereof of domestic swine"
4120	1.30	0203 29 55	Frozen boneless meat of domestic swine (excl. bellies and cuts thereof)
4120	1.00	0203 29 59	Frozen boneless meat of domestic swine
4120	1.00	0209 00 11	Fresh, chilled or frozen subcutaneous pig fat, salted or in brine
4120	1.20	0209 00 19	Dried or smoked subcutaneous pig fat
4120	1.00	0209 00 30	Pig fat, not rendered or otherwise extracted
4120	1.00	0210 11 11	Domestic swine hams and cuts thereof
4120	1.00	0210 11 19	Domestic swine shoulders and cuts thereof
4120	1.20	0210 11 31	Domestic swine hams and cuts thereof
4120	1.20	0210 11 39	Domestic swine shoulders and cuts thereof
4120	1.00	0210 12 11	Bellies streaky" and cuts thereof of domestic swine
4120	1.20	0210 12 19	Bellies streaky" and cuts thereof of domestic swine
4120	1.00	0210 19 10	Bacon sides or spencers of domestic swine
4120	1.00	0210 19 20	Three-quarter-sides or middles of domestic swine
4120	1.00	0210 19 30	Fore-ends and cuts thereof of domestic swine
4120	1.00	0210 19 40	Loins and cuts thereof of domestic swine
4120	1.30	0210 19 50	Meat of domestic swine, salted or in brine (excl. hams, shoulders and cuts thereof, bellies and cuts thereof, bacon sides or spencers, three-quarter sides or middles, and fore-ends, loins and cuts thereof)
4120	1.20	0210 19 60	Domestic swine fore-ends and cuts thereof
4120	1.20	0210 19 70	Domestic swine loins and cuts thereof
4120	1.30	0210 19 81	Dried or smoked boneless domestic swine meat (excl. bellies and cuts thereof)
4120	1.20	0210 19 89	Dried or smoked domestic swine meat
4120	0.80	1601 00 91	Uncooked sausages of meat, offal or blood (excl. liver)
4120	0.85	1601 00 99	Sausages and similar products of meat
4120	1.20	1602 41 10	Hams and cuts thereof
4120	1.20	1602 42 10	Prepared or preserved shoulders and cuts thereof
4120	1.20	1602 49 11	Prepared or preserved domestic swine loins and parts thereof, incl. mixtures of loins or hams (excl. collars)
4120	1.20	1602 49 13	Prepared or preserved domestic swine collars and parts thereof, incl. mixtures of collars and shoulders
4120	1.20	1602 49 15	Prepared or preserved mixtures of domestic swine hams, shoulders, loins, collars and parts thereof (excl. mixtures of only loins and hams or only collars and shoulders)

4120	0.60	1602 49 30	Prepared or preserved meat, offal and mixtures, of domestic swine, containing >= 40% but < 80% meat or offal of any kind and fats of any kind (excl. sausages and similar products, finely homogenised preparations put up for retail sale as infant food or for dietetic purposes, in containers of a net weight of <= 250 g, preparations of liver and meat extracts)
4120	0.30	1602 49 50	Prepared or preserved meat, offal and mixtures of domestic swine containing <40% meat or offal of any kind and fats of any kind (excl. sausages and similar products, homogenised preparations for put up retail sale as infant food or for dietetic purposes, in containers of a net weight of <= 250 g, preparations of liver and meat extracts and juices)
4130	0.47	0104 10 10	Pure-bred sheep for breeding
4130	0.47	0104 10 30	Live lambs sheep up to a year old" (excl. purebred breeding animals)"
4130	0.47	0104 10 80	Live sheep (excl. lambs and pure-bred breeding animals)
4130	0.47	0104 20 10	Pure-brod breeding goats
4130	0.47	0104 20 90	Live goats (excl. pure-bred for breeding)
4130	1.00	0204 10 00	Fresh or chilled lamb carcases and half-carcases
4130	1.00	0204 21 00	Fresh or chilled sheep carcases and half-carcases (excl. lambs)
4130	1.00	0204 22 10	Fresh or chilled sheep short forequarters
4130	1.00	0204 22 30	Fresh or chilled sheep chines and/or best ends
4130	1.00	0204 22 50	Fresh or chilled sheep legs
4130	1.00	0204 22 90	Fresh or chilled boneless cuts of sheep
4130	1.50	0204 23 00	Fresh or chilled boneless cuts of sheep
4130	1.00	0204 30 00	Frozen lamb carcases and half-carcases
4130	1.00	0204 41 00	Frozen sheep carcases and half-carcases (excl. lambs)
4130	1.00	0204 42 10	Frozen sheep short forequarters
4130	1.00	0204 42 30	Frozen sheep chines and/or best ends
4130	1.00	0204 42 50	Frozen sheep legs
4130	1.00	0204 42 90	Frozen cuts of sheep
4130	1.70	0204 43 10	Frozen meat of lambs
4130	1.70	0204 43 90	Frozen meat of sheep
4130	1.00	0204 50 11	Fresh or chilled goat carcases and half-carcases
4130	1.00	0204 50 13	Fresh or chilled goat short forequarters
4130	1.00	0204 50 15	Fresh or chilled goat chines and/or best ends
4130	1.00	0204 50 19	Fresh or chilled legs of goat
4130	1.00	0204 50 31	Fresh or chilled cuts of goat
4130	1.70	0204 50 39	Fresh or chilled boneless cuts of goat
4130	1.00	0204 50 51	Frozen goat carcases and half-carcases
4130	1.00	0204 50 53	Frozen goat short forequarters
4130	1.00	0204 50 55	Frozen goat chines and/or best ends
4130	1.00	0204 50 59	Frozen goat legs
4130	1.00	0204 50 71	Frozen cuts of goat
4130	1.00	02109921	MEAT OF SHEEP AND GOATS, SALTED, IN BRINE, DRIED OR SMOKED, WITH BONE IN
4130	1.35	02109926	BONELESS MEAT OF SHEEP AND GOATS, SALTED, IN BRINE, DRIED OR SMOKED
4130	1.50	0204 50 79	Frozen boneless cuts of goat
4130	1.60	1602 90 72	Prepared or preserved meat or offal of sheep, uncooked, incl. mixtures of cooked and uncooked meat or offal (excl. sausages and similar products and preparations of liver)
4130	1.60	1602 90 74	Prepared or preserved meat or offal of goats, uncooked, incl. mixtures of cooked and uncooked meat or offal (excl. sausages and similar products and preparations of liver)
4130	1.60	1602 90 76	Prepared or preserved meat or offal of sheep, cooked (excl. sausages and similar products, finely homogenised preparations put up for retail sale as infant food or for

			dietetic purposes, in containers of a net weight of <= 250 g, preparations of liver and meat extracts and juices)
4130	1.60	1602 90 78	Prepared or preserved meat or offal of goats, cooked (excl. sausages and similar products, finely homogenised preparations put up for retail sale as infant food or for dietetic purposes, in containers of a net weight of <= 250 g, preparations of liver and meat extracts and juices)
4140	0.50	0101 10 10	Pure-bred breeding horses
4140	0.50	0101 90 11	Horses for slaughter
4140	0.50	0101 90 19	Live horses (excl. those pure bred for breeding and for slaughter)
4140	0.50	0101 10 90	Pure-bred breeding asses
		0101 90 30	Live asses (excl. pure-bred for breeding)
4140	0.50	0101 10 90	Pure-bred breeding asses
4140	1.00	0205 00 20	Fresh or chilled meat of horses, asses, mules or hinnies
4140	1.00	0205 00 80	Frozen meat of horses, asses, mules or hinnies
4140	1.30	0210 99 10	Horsemeat, salted, in brine or dried
4150	0.70	0105 11 11	Grandparent and parent female chicks of fowls of the species Gallus domesticus laying stocks of a weight of <= 185 g
4150	0.70	0105 11 19	Grandparent and parent female chicks fowls of the species Gallus domesticus of a weight of <= 185 g (excl. laying stocks)
4150	0.70	0105 11 91	Laying stock fowls of the species Gallus domesticus" of a weight of <= 185 g (excl. grandparent and parent female chicks)"
4150	0.70	0105 11 99	Live fowls of the species Gallus domesticus of a weight of <= 185 g (excl. turkeys
4150	0.70	0105 12 00	Live domestic turkeys
4150	0.70	0105 19 20	Live domestic geese
4150	0.70	0105 19 90	Live domestic ducks and guinea fowls
4150	0.70	0105 94 00	Live fowls of the species Gallus domesticus, weighing > 185
4150	0.67	0105 99 10	Live domestic ducks
4150	0.75	0105 99 20	Live domestic geese
4150	0.75	0105 99 30	Live domestic turkeys
4150	0.75	0105 99 50	Live domestic guinea fowls
4153	1.00	0207 11 10	Fresh or chilled, plucked and gutted fowls of species Gallus domesticus, with heads and feet, known as "83% chickens"
4154	1.00	0207 11 30	Fresh or chilled, plucked and drawn fowls of species Gallus domesticus, without heads and feet but with necks, hearts, livers and gizzards, known as "70% chickens"
4155	1.00	0207 11 90	Fresh or chilled, plucked and drawn fowls of species Gallus domesticus, without heads, feet, necks, hearts, livers and gizzards, known as "65% chickens", and other forms of fresh or chilled fowl, not cut in pieces (excl. "83% and 70% chickens")
4156	1.00	0207 24 10	Fresh or chilled, plucked and drawn turkeys of the species domesticus, without heads and feet but with necks, hearts, livers and gizzards, known as "80% turkeys"
4157	1.00	0207 24 90	Fresh or chilled, plucked and drawn turkeys of the species domesticus, without heads, feet, necks, hearts, livers and gizzards, known as "73% turkeys", and other forms of fresh or chilled turkeys, not cut in pieces (excl. "80% turkeys")
4158	1.00	0207 32 11	Fresh or chilled, plucked, bled, gutted or not drawn ducks of the species domesticus with heads and feet, known as "85% ducks"
4159	1.00	0207 32 15	Fresh or chilled, plucked and drawn ducks of the species domesticus, without heads and feet but with necks, hearts, livers and gizzard, known as "70% ducks"
4160	1.00	0207 32 19	Fresh or chilled, plucked and drawn ducks of the species domesticus, without heads, feet, necks, hearts, livers and gizzards, known as "63% ducks", and other forms of ducks, not cut in pieces (excl. "85% and 70% ducks")

ANNEX 2

The calculation for the biomass of four various categories of food-producing animals in Malaysia using the WOAH animal biomass calculation methodology from 2018 to 2021

Table 4a: Information about slaughtered animals in Malaysia

Animal category	Population of species slaughtered in 2018 (head)[1]	Population of species slaughtered in 2019 (head)[1]	Population of species slaughtered in 2020 (head)[1]	Population of species slaughtered in 2021 (head)1	Total weight of species slaughtered in 2018 (kg)[1]	Total weight of species slaughtered in 2019 (kg)[1]	Total weight of species slaughtered in 2020 (kg)[1]	Total weight of species slaughtered in 2021 (kg)[1]
Cattle [1]	105,706	87,179	117,601	117,852	46,923,600	44,024,400	41,378,800	36,800,600
Domestic buffalo[1]	8,655	6,233	7,087	7,813				
Import[4]	70,537	37,300	29,786	29,480				
Total of large ruminants	**184,898**	**130,712**	**154,474**	**155,145**				
Goat[1]	79,735	53,433	19,912	17,430	4,433,700	4,200,600	3,916,800	3,502,500
Sheep[1]	24,119	16,317	8,856	10,647				
Import[4]	60,303	51,969	37,361	39,062				
Total of small ruminants	**164,157**	**121,719**	**66,129**	**67,139**				
Swine	**1,695,819**	**2,012,398**	**1,904,152**	**1,958,938**	223,862,000	222,791,100	220,586,400	197,371,600
Chickens[2]	872,973,957	913,137,909	1,017,368,726	958,871,872	1,653,700,000	1,655,300,000	1,702,800,000	1,653,000,000
Ducks[3]	27,449,230	25,154,492	25,521,009	25,791,855				
Total of poultry	**900,423,187**	**938,292,401**	**1,042,889,735**	**984,663,727**				

Notes:
[1]Source: https://www.dvs.gov.my/Livestock Statistic 2021/2022
[2]Due to absence of data on the population of slaughtered chicken in Malaysia, the population of slaughtered chicken is estimated based on = Standing population of broiler x estimated number of batches per year (5.4) x slaughtered rate (94%). Sources: Teknikal Parameter Pengeluaran Tempatan dan Nilai Pengeluaran, Planning Division, Department of Veterinary Services Malaysia (updated June 28, 2018) and https://www.dvs.gov.my/Livestock Statistic 2021/2022
[3]Due to absence of data on the population of slaughtered ducks in Malaysia, population of slaughtered ducks is estimated based on = Standing population of broiler x estimated number of batches per year (4.0) x slaughtered rate (96%). Sources: Teknikal Parameter Pengeluaran Tempatan dan Nilai Pengeluaran, Planning Division, Department of Veterinary Services Malaysia (updated June 28, 2018) and https://www.dvs.gov.my/Livestock Statistic 2021/2022
[4]Import for slaughtered only (cattle & buffalo). Source: https://www.dvs.gov.my/Livestock Statistic 2021/2022

Table 4b: Information about census population and trade animals in Malaysia

Animal category	Census population in 2018 (head)[1]	Census population in 2019 (head)[1]	Census population in 2020 (head)[1]	Census population in 2021 (head)[1]	Export-Import Quantity in 2018 (head)[1]	Export-Import Quantity in 2019 (head)[1]	Export-Import Quantity in 2020 (head)[1]	Export-Import Quantity in 2021 (head)[1]
Cattle	676,686	657,407	699,424	717,431	54	76	692	716
					71,866	37,030	43,041	38,190
Total census for cattle					748,498	694,361	741,773	754,905
Domestic buffalo	106,988	101,695	64,250	66,571	69	826	404	301
					4,108	927	0	1,987
Total census for buffalo					102,949	101,594	64,654	64,885
Total census for large ruminant					851,447	795,955	806,427	819,790
Goat	359,200	312,571	324,355	323,994	NA			
Sheep	128,298	121,677	124,674	136,769				
Total census of small ruminant	487,498	434,248	449,029	460,763				
Swine	1,967,538	1,888,460	1,869,772	1,672,995				
Total census of poultry	NA							

Notes:

[1]Source: https://www.dvs.gov.my/Livestock Statistic 2021/2022

NA= Not applicable, since census population and trade information were not used for biomass estimation.

Table 4c: Carcass weight

Animal category	Carcass weight in 2018 (kg)[1]	Carcass weight in 2019 (kg)[1]	Carcass weight in 2020 (kg)[1]	Carcass weight in 2021 (kg)[1]
Large ruminant	254	337	268	237
Small ruminant	27	35	59	52
Swine	132	111	116	101
Poultry	1.84	1.76	1.63	1.68

Note:
[1]Carcass weight = Total weight of species slaughtered/ Population of species slaughtered

Table 4d: Calculation of adult large ruminant weight at slaughter

Average weight at slaughter in 2018 (kg)[1]	Average weight at slaughter in 2019 (kg)[1]	Average weight at slaughter in 2020 (kg)[1]	Average weight at slaughter in 2021 (kg)[1]
(k=0.56)	(k=0.56)	(k=0.56)	(k=0.56)
453	601	478	424

Note:
[1]Average weight at slaughter = Carcass weight/ Conversion factor
Conversion coefficient (k)=0.56 was taken from the manual for compilation of the supply balance sheet for meats (live domestic bovines of a weight >300kg) and refers to the dressing percentage of KK cattle and cross-breed cattle in Malaysia at 56.1-56.7% (Dahlan *et al*., 1985)

Table 4e: Calculation of large ruminant average weight at slaughter according to cattle sub-category

Cattle sub-category	Population ratio[1]	Livestock unit classification weight ratio[2]	Average weight at slaughter per animal sub-category in 2018 (kg)[3]	Average weight at slaughter per animal sub-category in 2019 (kg)[3]	Average weight at slaughter per animal sub-category in 2020 (kg)[3]	Average weight at slaughter per animal sub-category in 2021 (kg)[3]
Calves (<1 yr)	0.22	0.4	40.14	53.28	42.37	37.52
Younglings (1-2 yrs)	0.33	0.7	104.17	138.24	109.95	97.36
Adult cows	0.34	0.8	123.81	164.31	130.68	115.72
Adult males	0.11	1	49.25	65.37	51.99	46.03
Cattle	1		317.37	421.20	334.99	296.64

Notes:

[1]Population ratio was calculated based on the average population ratio of large ruminants in Malaysia referring to the animal population census 2018-2021

[2]Livestock unit classification (LSU) weight ratios for calves, younglings and adults as defined by Eurostat

[3]Average weight at slaughter per sub-category = Average weight at slaughter x Population ratio x Livestock unit classification weight ratio

Table 4f: Calculation of small ruminant average weight at slaughter by the WOAH methodology

Average weight at slaughter in 2018 (kg)[1] (Conversion coefficient = 0.47)	Average weight at slaughter in 2019 (kg)[1] (Conversion coefficient = 0.47)	Average weight at slaughter in 2020 (kg)[1] (Conversion coefficient = 0.47)	Average weight at slaughter in 2021 (kg)[1] (Conversion coefficient = 0.47)	Standard weight of a breeding small ruminant (kg)[2]	Average number of breeding cycles per year[3]
57	73	126	111	75	1.5

Notes:
[1]Average weight at slaughter = Carcass weight/ Conversion factor
[2]Standard weight of a breeding small ruminant in Europe is 75kg. This weight was used globally based on livestock unit rations and is standardized in WOAH methodology
[3]1.5 is the average number of breeding cycles per year
Conversion coefficient = 0.47 for live goat and sheep (excluding pure breeding animal) (Eurostat, 2009)

Table 4g: Calculation of swine average weight at slaughter biomass by the WOAH methodology

Average weight at slaughter in 2018 (kg)[1] (Conversion coefficient = 0.78)	Average weight at slaughter in 2019 (kg)[1] (Conversion coefficient = 0.78)	Average weight at slaughter in 2020 (kg)[1] (Conversion coefficient = 0.78)	Average weight at slaughter in 2021 (kg)[1] (Conversion coefficient = 0.78)	Standard weight of a sow in Asia & Pacific (kg)[2]	Expected percentage of living sows in population[3]
169	142	149	129	240	0.09

Notes:
[1]Average weight at slaughter = Carcass weight/ Conversion factor
[2]Standard weight of a sow (Asia & Pacific = 240kg)
[3]Expected percentage of sows in swine population, as calculated from Eurostat animal population=0.09
Conversion coefficient = 0.78 for domestic swine (Eurostat, 2009)

Table 4h: Calculation of poultry average weight at slaughter by the WOAH methodology

Animal category	Average weight at slaughter in 2018 (kg)[1] (Conversion coefficient = 0.70)	Average weight at slaughter in 2019 (kg)[1] (Conversion coefficient = 0.70)	Average weight at slaughter in 2020 (kg)[1] (Conversion coefficient = 0.70)	Average weight at slaughter in 2021 (kg)[1] (Conversion coefficient = 0.70)
Poultry	3	3	2	2

Notes:
[1]Average weight at slaughter = Carcass weight/ Conversion factor
Conversion coefficient = 0.70 for live fowls of the species Gallus domesticus, weighing >185 g (Eurostat, 2009)

Table 4i: Calculation of biomass for large and small ruminants, swine and poultry by the WOAH methodology

Animal category	Animal Biomass in 2018 (kg)	Animal Biomass in 2019 (kg)	Animal Biomass in 2020 (kg)	Animal Biomass in 2021 (kg)
Large ruminant[1]	270,223,205	335,252,799	270,142,846	243,178,762
Small ruminant[2]	37,787,904	35,420,097	62,002,709	38,652,403
Swine[3]	329,501,385	285,629,615	282,803,077	253,040,513
Poultry[4]	2,362,428,571	2,364,714,286	2,432,571,429	2,361,428,571
Total	**2,999,941,066**	**3,021,016,797**	**3,047,520,060**	**2,896,300,249**

Notes:
[1]Large biomass = Average weight at slaughter x (Census population + [Import - Export Quantity])
[2]Small biomass = (Average weight at slaughter x number of slaughtered) + (census population - number of slaughtered/1.5) x 75kg
[3]Swine biomass = (Average weight at slaughter x Population of species slaughtered) + (Census population x Standard weight of a sow in Asia & Pacific x Expected percentage of living sows in swine population)
[4]Poultry biomass = Average weight at slaughter x Population of species slaughtered