

## African Swine Fever and Its Socio-Economic Impacts in Indonesia

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### ABSTRACT

*African Swine Fever Virus (ASF)* is a viral disease in pigs that affects the supply of food of animal origin. ASF is caused by a double-stranded DNA virus of the family Asfarviridae and genus Asfivirus, which can be transmitted and causes various bleeding events in the internal organs and is accompanied by a very high mortality rate. This disease is generally characterized by fever, lack of appetite, and bleeding from the skin, back, and legs. Even though this virus is not zoonotic and cannot be transmitted to humans, it is fatal and causes tremendous economic loss. This disease spread throughout Asia in a relatively short time in 2019, and it has even been reported that this disease has entered Indonesia since the end of 2019. The impact of this infection resulted in socioeconomic changes in both rural and urban communities, which could then affect the country's economy at the macro level. Several countries are needed in their efforts to control ASF, one of which is to increase quarantine, limit the traffic of pigs, and reduce the population of sick pigs exposed to the ASF virus.

**Keyword:** ASF, *African Swine Fever*, Socio-economic Losses, Pigs

### INTRODUCTION

African Swine Fever (ASF) is an infectious disease in pigs that causes hemorrhagic fever caused by a double-stranded DNA virus in the family Asfarviridae and genus Asfivirus. This virus causes dengue fever, with high

mortality rates in domestic and wild pigs. African Swine Fever (ASF) was first reported in Kenya in 1920. In 2019, it entered Indonesia and was confirmed in 16 regencies/cities in North Sumatra (KEPMENTAN, 2019).

The virus African Swine Fever (ASFV) originates in sub-Saharan Africa

and is thought to have originated from wild boars that have transmitted it to domestic pigs. Infections with virulent strains of ASFV usually cause chronic, acute, and acute symptoms, with signs of sudden death, high fever, and bleeding in the skin and internal organs. Pigs usually die within three–ten days of infection, with a mortality rate of 90% or more (Chenais *et al.*, 2019).

ASF is transmitted through an infected bite of ticks (*Ornithodoros* sp.), and is categorized as an arthropod-borne disease. ASF disease is not zoonotic; therefore, it does not pose a risk to human health but has a very significant economic impact on pig breeders worldwide because of its high morbidity and mortality. The impact of ASF disease is also felt in the pork feed industry and suppliers of feed raw materials, as in China. Therefore, this disease is included in the list of Diseases Notifiable to the OIE and can also be included in bioterrorism to destroy economic conditions in an area with high pig populations and breeders, who rely only on the livelihood of raising pigs (Boinas *et al.*, 2011).

Pork is an animal meat containing macronutrients. Various macronutrients found in pork include fat, carbohydrates, vitamins, proteins, and minerals (Sosiawan, 2021). Due to the high nutritional value and unique texture of meat, pork is increasingly being processed in various kinds of food products in communities around the world. Height Interest in pork can be

seen from data on pork production in Indonesia in 2021, which reached 323,670 tons, which is only 26% different from the total production of beef, which is known to be a staple protein source for Indonesian people (437,783 tons) (BPS, 2021). To balance the supply of supplies and people's interest in pork, the pig farming business is now considered promising and has many opportunities. In addition to their high ability to metabolize feed in pigs, pigs are also considered capable of giving birth many times in one gestation phase (Sinulingga *et al.*, 2020). The pig farming business then became promising because of the high demand and interest in consuming pork in the community (Sapanca *et al.*, 2015).

In addition to the high profit potential in the pig farming business, there are also potential losses in its management, namely the potential for lack of nutrition in pigs, potential for bacterial infections in pigs, potential for viral infections in pigs, and several other negative potentials. Breeders are most afraid of viral infection due to the high intensity of transmission and the relatively low transmission time. The virus that is increasingly infecting pigs in Indonesia in 2023 is ASFV, with a prevalence of 500,000 cases.

African swine fever is considered to have an infectious rate and a high *mortality rate*, where the death rate caused by ASF alone can reach 90% (Chenais *et al.*, 2019). Pigs infected with ASFV experience bleeding in their

internal organs, and this mechanism occurs in a very short period of time, namely 2-10 days. ASF disease is very feared by farmers, due to the cycle of transmission of the ASF virus through inhalation and ingestion, which is considered very difficult to control (Primatika *et al.*, 2021). To date, no vaccine has been found for ASFV so that the steps that breeders can take are very limited, namely preventive steps in the form of stable management and efforts to increase immunity in livestock only.

The limited space for movement that breeders can exercise and the feeling of helplessness that haunts breeders naturally create unrest and anxiety in itself. Thus, many breeders sell their pigs at prices below the market due to sheer fear. The phenomenon of panic selling carried out by pig farmers was then used as a means of seeking profits from the bourgeoisie.

The purpose of this literature review is to provide an understanding to the general public about the general description of ASFV, which is also a form of applying tridharma. It is hoped that this literature can be used as a reference by the public as material for consideration before selling livestock at below market prices, and also for educational purposes on the characteristics of ASFV, it is hoped that the publication of this literature can be used as a material for consideration for stakeholders to consider the social impact - the economics of the ASF outbreak on society.

## ETIOLOGY

African swine fever (ASF) is an infectious disease in domestic pigs and wild pigs caused by the African swine fever virus (ASFV) from members of the asfarviridae family with the genus asfivirus (Bulu, 2022). ASFV originates from sub-Saharan Africa in the form of double-stranded DNA with a genome containing nucleoproteins, where the nucleoproteins are composed of matrix proteins. The core and matrix of the ASF virus are surrounded by an inner membrane capsid layer. The ASF virus capsid layer is composed of a capsid protein (p72), which is icosahedral symmetric and covered by an outer membrane layer with a diameter of approximately 200 nm (Primatika *et al.*, 2021).

African swine fever virus (ASFV) is a highly contagious viral disease that rapidly destroys large populations of domestic and wild pigs. Although ASF is mainly found in African countries, it has now spread to other areas such as Asia, Europe, and America. ASF Virus (ASFV), a large enveloped virus with a double-stranded DNA genome, is the causative agent of African Swine Fever. The ASFV viral genome ranges from to 170-190 kbp in length and encodes more than 170 proteins. ASFV is divided into 24 genotypes based on the partial sequence of ASFV B646L, which encodes the p72 protein. Through various methods, ASFV can be further subgenotyped and fixed targets at

different regions of the viral genome to identify genetic variation among other virus strains. In general, the sub-genotyping method used for ASFV includes the analysis of specific genes, such as the E183L gene, which encodes the p54 protein (genotypes I-XXIV), the gene encoding the CD2v EP402R protein (serotypes I-VIII), the B602L gene (there are several variants), as well as the intergenic region (IGR) between MGF 505-9R and MGF 505-10R, and other genes such as K205R, MGF 110-14L, H240R, O174L, E199L, K145R, I9R, and MGF 505-5R (Nguyen *et al.*, 2023). There are 23 types of genotypes with different levels of virulence. However, so far the ASF virus has been found to have only one serotype.

### INCUBATION

The African Swine Fever Virus (ASF) is divided into four forms: acute, acute, subacute, and chronic. The per-acute form is characterized by a fast incubation period, even before the animal shows any clinical symptoms, and the animal can die suddenly. The most common form in ASF case reports is the acute form, which has an incubation period of 4-19 days. Death can occur within 4-10 days if the disease is very severe or 11-15 days for strains with moderate virulence. The acute form usually has symptoms such as high fever (40-42°C), decreased appetite, weak and lazy movement, and bleeding in the skin and internal organs. The

subacute form, in which death occurs later than other acute forms. In this case, heavy bleeding was also observed. The chronic form is characterized by multifocal necrosis of the skin and arthritis, slow growth, respiratory disorders, and abortion (Gelolodo *et al.*, 2021).

### PATHOGENESIS

Transmission of ASFV in wild or domestic pigs can occur through direct or indirect contact. The ASF virus can be transmitted through direct contact with infected animals and/or animal products that have been contaminated with the ASF virus (Animal Health Australia, 2019). In general, the transmission of viruses from one farm to another is influenced by human intervention factors, such as movement, equipment, and fomites, such as clothing, transport trucks, and feed supplies, which are sources of infection. However, in frozen meat, the virus can survive for a longer period of time and reappear when the meat is used as a swill feed (Anggy, 2020).

The ticks of *Ornithodoros* spp. have an important role in the transmission of wild boars. These ticks can also play a role in transmission to nearby pig farms (Animal Health Australia, 2019). Transmission can occur in pigs that appear clinically healthy but can become a source of new acute infections, which contributes to the persistence of the ASF virus in the pig population, with

a transmission rate of 0.3 % %in pig herds on farms. (Primatics *et al.*, 2020).

African Swine Fever Research (ASF) in pigs challenged with the malignant strain of the ASF virus found that the onset of clinical signs occurred between 1 and 7 days post-inoculation (dpi) until death occurred within a duration of 4-11 days. Viremia was first detected between 4 and 5 dpi in all inoculation groups, whereas ASF virus shedding from the nasal cavity and tonsils was first detected between 3-9 dpi. Intramuscular contact (IM) and direct contact (DC) are the most common modes of infection. Intra-nasopharyngeal (INP) inoculation resulted in consistent disease progression.

Transmission can occur through indirect contact with infected animals via excretion of blood secreted by infected animals, especially wild boars. In addition, infected animal carcasses can transmit the ASF virus because the ASF virus is highly resistant and can survive for a long time, especially at low temperatures (EFSA, 2015). Animal products can carry the ASF virus, although freezing frozen raw pork can last up to 118 days (Ganges *et al.*, 2020).

The mechanism of ASF viral pathogenesis in pigs has a significant impact. The research conducted stated that Differential gene expression showed that ASFV can evade innate and adaptive immune responses by (a) inhibiting the processing and

presentation of Major Histocompatibility Complex (MHC) Class II genes, (b) avoiding effector cells, namely cytotoxic T cells (CD8 + T ) and extracellular trapping of neutrophils through decreased expression of neutrophil/CD8+ T chemokine recruiter effector cells, (c) suppressing macrophage M1 activation, (d) inducing immune-suppressing cytokines, and (e) inhibiting macrophage autophagy and apoptosis (Primatika *et al.* , 2020).

## CLINICAL SYMPTOMS

Pigs infected with the African swine fever virus are usually divided into 4 stages, namely the per-acute stage, the acute stage, the sub-acute stage, and the chronic stage. Each stage of infection of the *African swine fever virus* can be identified through the characteristics of the current stage of infection, including: per-acute infection stages can be identified by the presence of fever (41-42°C), loss of appetite in livestock, and behavior of livestock that tend to be inactive; the acute infection stage usually occurs 8-14 days after infection. At this stage, cattle usually still have a fever at a temperature of 40-42°C, an increase in respiratory rate, and there are physical signs that tend to want to lie down weakly; the sub-acute infection stage usually occurs in endemic areas and is caused by isolates that are quite virulent. During this phase, pigs usually die within 7-20 days

with a mortality rate of approximately 30-70%.

Typical signs that appear during this stage of infection include fluctuating fever, arthritis, pneumonia, and abortion in sows. The chronic infection stage is the final stage of infection, where clinical signs appear 14-21 days post-infection, followed by fever, mild respiratory distress, and red lesions on the skin area (Beltran Alcrudo *et al.*, 2017).

## EPIDEMIOLOGY

ASF first occurred in 1921. This disease is different from Classical Swine Fever (CSF), which occurred in 1830 in the Northern Hemisphere (Penrith, 2013). ASF disease develops continuously and spreads very quickly and widely because the ASF virus is very virulent and can be carried either through direct or indirect contact. The ASF virus has spread to several countries worldwide and is reported to have a high death rate.

The pattern of ASF spread has increased in recent years in several countries worldwide, which occurred in a very short period of time, resulting in economic losses for pig farmers in the outbreak area. The development of the ASF virus in the last 10 years was first reported in 2007 in Caucasus, Georgia (Costard *et al.*, 2013). Analysis of the sequence of the outbreak that occurred in Georgia showed that the isolate was closely related to the genotype II isolate

circulating in Mozambique, Madagascar, and Zambia. The spread of the disease to Georgia is transmitted by ship-borne ASFV-contaminated pig feed (Rowlands *et al.*, 2008). An outbreak in Georgia in 2007 resulted in transmission to most areas of the Russian Federation until 2012, when the disease became an epidemic. The source of transmission occurs due to the presence of illegal pig products from areas contaminated with the ASF virus, and comes from swill-feeding given to domestic pigs (Gogin *et al.*, 2013).

Surveillance has been carried out in the Tanzanian highlands since 2010, which experienced another outbreak of ASF. The results obtained based on exploratory participatory epidemiology explain that risk factors for ASF include trading and marketing systems, management systems, and lack of biosecurity, as well as anthropogenic problems (humans), animals, and fomites (Fasina *et al.*, 2020). After the ASF outbreak spread in the Russian Federation, in 2014 there was another outbreak in European Union (EU) countries where farms with low biosecurity were very easily infected with the virus. The three epidemiological characteristics of ASF that occur in EU countries are transmission, viral resistance, and high case fatality rates (Chenais *et al.*, 2019). An outbreak that occurred in Latvia in 2014 resulted in the death of 32 domestic pigs and 217 wild boars, where transmission to domestic pigs occurred

due to biosecurity in feeding feed contaminated with the ASF virus. However, transmission to wild boars occurs as a result of eating the carcass of an infected wild boar. The prevalence in domesticated pigs is lower than that in wild boars owing to different biosecurity patterns (Guberti *et al.*, 2016).

In 2018, an ASF outbreak occurred again in the European Union region, to be precise in the Slovakia region, from November 2018 to October 2019. One of the factors that influenced the occurrence of this outbreak was a change in summer, which is known to increase the number of ASF incidents. During the outbreak in Slovakia, fences were installed to prevent wild boars from entering domestic pig farms carrying the ASF virus (Miteva *et al.*, 2020). The spread of ASF outbreaks occurred from 2019 to 2020, covering almost all regions of the world, including Asia. In 2019, an ASF outbreak occurred at a family owned pig farm in the Hung Yen Province, Vietnam. Symptoms experienced in the early stages of the outbreak, one piglet and one sow showed general flushing, conjunctivitis, and hemorrhagic diarrhea and anorexia, cyanosis, and fever ( $>40.5^{\circ}\text{C}$ ) (Le *et al.*, 2019). Starting with the ASF outbreak in Vietnam, the spread occurred in almost all parts of Asia, namely Indonesia, the Philippines, and Timor Leste. In 2019, the ASF outbreak occurred in Medan, North Sumatra, Indonesia, with 465 cases, followed by the Philippines, with

130 cases in 10 different administrative regions (Mebus, 2020). Until now, outbreaks have still occurred in most parts of Asia, such as China, Myanmar, Papua New Guinea, and Laos. In February 2020, an ASF outbreak occurred in China, with 124 outbreaks and 26 outbreaks in March in the State of Timor Leste. The spread continued in the Philippines in March 2020, with 69 outbreaks in 15 different administrative regions (OIE, 2020a). From March to April 2020, outbreaks were followed in several countries in Asia and Korea, with 54 cases of wild boars, and for the first time in the State of Papua New Guinea, an ASF outbreak was confirmed (Mebus, 2020). ASF outbreaks continued until May 2020, when ASF incidents occurred in several Asian regions, namely India (11 cases) and Korea (14 cases) in wild pigs (OIE, 2020b). An event that has not been reported to date is an outbreak of ASF in the East Nusa Tenggara Province, Indonesia, which occurred in March 2020 and reached tens of thousands of individuals (FAO, 2020a).

## DIFFERENTIAL DIAGNOSIS

The clinical signs of ASF are difficult to distinguish from those of other diseases in pigs, including CSF, Aujeszky's disease, Erysipelas, Salmonellosis, warfarin poisoning, Pasteurellosis, Abortion, mummification, stillbirths, mulberry heart disease, immune

thrombocytopenia purpura, and viral encephalomyelitis (DitjenPKH, 2020).

## CONTROL

An outbreak of African Swine Fever Virus (ASFV) occurred again in the European Union, specifically in the Slovakia region, from November 2018 to October 2019. One of the factors that influenced the occurrence of this outbreak was a change in summer, which resulted in an increase in the number of ASF virus occurrences. In the Slovak region, control is carried out by installing fences with the aim of preventing wild boars from entering domestic pig farms that can carry the ASF virus (Rell *et al.*, 2021; Primatika *et al.*, 2021).

Infection with malignant strains can also cause chronic, acute, and acute ASFV, with signs of sudden death, high fever, and bleeding that occurs in the skin or internal organs. Within three-ten days pigs usually die after infection, with a mortality rate of  $\geq 90\%$ . However, the ASFV vaccine itself is not yet available. The disease control strategy depends on the early detection of the disease and application of very strict biosecurity (Primatika *et al.*, 2021). Successful control may also depend on implementing strict biosecurity measures, as well as placing a barrier between the source of the virus and pigs that have not been infected with the ASF virus, to prevent wider

spread. Infection prevention and control also require a good understanding of the epidemiology of this ASF virus so that if you are infected, focused, planned, and well-measured actions will be taken (Bulu, 2022)

To control ASF, efforts have been made by several countries, namely, by increasing quarantine, limiting the traffic of pigs, and reducing the population of pigs who are sick and exposed to the ASF virus. By implementing good and strict biosecurity, reducing direct contact with contaminated feed or equipment, such as the use of swill feeding as feed for pigs and processing aircraft waste, as well as tightening luggage for airplanes and ship passengers, can be an effort to prevent and control ASF disease (Primatika *et al.*, 2021).

## SOCIO-ECONOMIC IMPACT

The spread of the ASF outbreak will certainly affect all aspects of society, especially on community farms in developing countries that traditionally maintain pigs and provide additional income. Similarly, in Indonesia, pork farm businesses that produce pork also play an important role in the provision of animal protein for the community and contribute to increasing the economic income of farmers' households.

There are diseases in pigs that will greatly impact the socio-economic life of people who need pigs, not only for

consumption purposes but also related to community culture. Some Indonesian community groups such as Toraja, Bali, Batak, East Nusa Tenggara, and Papua, whose lives depend on pigs because all the affairs of each individual, ranging from birth to death, definitely need pigs or meat. The condition of pig breeders who mostly maintain semi-intensive pigs with the application of low biosecurity also provides opportunities for the spread of this ASF disease outbreak (Tukan *et al.*, 2022). The death of pigs is another problem that has a sufficient impact not only on the economy of the village community but can also impact the implementation of customs that so far require pigs for customary celebrations. The habits and social conditions of the local community in areas that are influenced by various cultures have many celebrations, especially the celebration of customs and religious customs that require pigs. The socio-economic community depends on agricultural and livestock products supported by locations with feeding pigs from sufficient natural feed ingredients that make the community raise livestock, especially pigs, to meet the socio-economic and cultural needs, even with the condition of breeders that are less potential and have not been supported by an understanding of livestock health (Gaina *et al.*, 2022).

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## CONCLUSION

African Swine Fever (ASF), a notifiable disease, is very feared by pig farmers because, apart from the high transmission and mortality rates, it can also hamper export commodities, which also has an impact on a country's economy. The emergence of ASF has a high socioeconomic impact because the pig farming sector plays an important role as a source of animal protein. The habits and social conditions of Indonesian people, such as those in the NTT region, are influenced by diverse cultures with many celebrations, especially cultural and religious celebrations that require pigs.

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