An epidemiological survey of avian influenza knowledge and practices among poultry farm workers in Indonesia (#72477)

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An epidemiological survey of avian influenza knowledge and practices among poultry farm workers in Indonesia

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Background. Avian influenza (AI) poses a serious threat to global public health. Awareness and protective behaviours among the general public, as well as high-risk populations, are essential for prevention and control. The purpose of this study is to determine the AI knowledge and practices of poultry farm workers in Indonesia. **Methods.** This online cross-sectional study included 200 men and women, aged <20–50 years, working on poultry farms in Indonesia. It used a pre-designed standardised questionnaire containing six demographic questions, 14 questions on knowledge and seven questions for practices. The questionnaire was distributed via WhatsApp and email. The Chi-square and Fisher Exact tests were used to analyse the data. **Results.** The findings depicted that more than half (67%) of the respondents had heard of AI. Their primary sources of information were health workers (36%) and TV (34%). A majority of the participants (91.33%) had good knowledge regarding AI as a contagious infection that transmits between animals to animals and birds to birds. 76.8% of the respondents believe that poultry workers and veterinarians were at high risk of contracting AI infection. On average (74.2%), the participants believe that using face masks and washing hands with soap and water is a good practice to prevent AI infections. Moreover, 78.5% of the respondents believe that properly disposing the dead birds can also prevent these infections from occurring or spreading. **Conclusions.** The study revealed that the poultry workers had a good knowledge which was reflected in how they dealt with AI infection. Primary sources of information regarding AI were health workers and TV. The level of knowledge and practices had a significant relationship among respondents.

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Abstract

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veterinarians were at high risk of contracting AI infection. On average (74.2%), the participants believe that using face masks and washing hands with soap and water is a good practice to prevent AI infections. Moreover, 78.5% of the respondents believe that properly disposing the dead birds can also prevent these infections from occurring or spreading.

Conclusions.

The study revealed that the poultry workers had a good knowledge which was reflected in how they dealt with AI infection. Primary sources of information regarding AI were health workers and TV. The level of knowledge and practices had a significant relationship among respondents.

Keywords: avian influenza, farmworkers, knowledge, practices, public health, Indonesia.

Introduction

Avian influenza (AI), commonly known as 'bird Flu' is a highly contagious viral infection belonging to the family 'Orthomyxoviridae'. It has the potential to harm both birds and humans. The strains of this virus can present themselves in a variety of ways, depending on their virulence (OIE, 2020). The first case of the AI virus (H5N1) in a human was recorded in Hong Kong in 1997 (Yuen et al., 1998). The WHO recorded 430 highly pathogenic AI (HPAI) H5N1-related deaths in 16 countries as of March 20, 2015, with a 55% case fatality rate (WHO, 2015). Even human around the globe have been infected by type-A viruses of the same in recent years (WHO, 2011). H5N1 has been endemic to poultry in Indonesia since 2003 and continues to cause substantial social and economic losses for both the poultry industry and backyard farms (Sumiarto & Arifin, 2008, WHO, 2011). Poultry producers and the industry are suffering significant social and economic consequences (Basuno, Yusdja, & Ilham, 2010; Rushton, Viscarra, Bleich, & McLeod, 2005). Due to this, Indonesia has the world's highest human fatality rate for HPAI H5N1. In fact, 199 (human) AI cases were confirmed in Indonesia through laboratory testing from the first outbreak in 2003 to May 2015. Of these, 165 were fatal. These cases have been documented in Bali, Sulawesi, Sumatra, Lombok and Java Island, with a majority of these being recorded in the latter (WHO, 2015). In this regard, Morris and Jackson discovered a number of factors that contribute to the direct and indirect propagation of the HPAI virus throughout Asia .(Morris et al., 2005). First, mixed and free-range poultry production poses a high danger of AI infections in both rural and urban areas. Second, infected trucks and bird cages are used to transport live birds, and third, there are no biosecurity controls in place at live bird market places (LBMs) (McLeod et al., 2009). From this, it is evident that pandemics of human influenza have happened before and will probably happen again (Kumar et al.,2013). Due to this, knowledge of AI among poultry farm workers and other poultry industry stakeholders is vital for AI prevention and management in poultry and humans. Human infections have been associated with the handling of dead or sick poultry in H5N1-affected areas, revealing that H5N1 illness in humans is spread primarily through infected birds (Neupane et al., 2012).

The data on the importance of knowledge in the context of a pandemic influenza outbreak has been less overwhelming. While some studies have discovered the benefits of protective behaviours (Eastwood et al., 2009; Liao et al., 2011), others have not (Van der Weerd et al., 2011). However,

from these studies, it was found that poultry farm workers are the most susceptible to AI infections. Moreover, it was seen that AI knowledge was acceptable but poorly associated with real biosecurity procedures, according to a cross-sectional research of poultry workers' knowledge, attitudes and chicken handling practices in India (Kumar et al., 2013). Several epidemiological studies have been published to assess the risk factors for H5N1 infection in humans, especially when there is contact with poultry and poultry products. It was seen that exposure to this virus has been linked to contact with contaminated poultry blood, bodily fluids during food preparations and working with poultry in markets or farms (Radwan et al., 2011). In a study conducted in Kathmandu, Nepal, 38.7% of the butchers in the country had some knowledge while 44.6% had good practices regarding inappropriate preventive behaviours related to AI. However, none of the respondents showed sufficient knowledge or proper behaviour (Paudel, Acharya, & Adhikari, 2013). Human death cases in developing countries such as China were at 100% in 2003, but have since dropped to 50% in 2010. In Egypt, the rate of human deaths peaked at 56% in 2003 and then dipped to 45% in 2010. Since 2005, a number of other Asian countries, including Afghanistan, Bangladesh, India, Myanmar, Pakistan and, most recently, Bhutan and Nepal, have recorded cases of H5N1 (Timilsina & Mahat, 2018). Previous studies among poultry farm workers in Italy, Nigeria and China revealed that high knowledge of pathologywas considerably higher with educational attainment and among those who was perceived as being more susceptible to this infection (Abbate et al., 2006; Fasina et al. 2009; Yu et al., 2013). Moreover, it appears that urban poultry workers and consumers are more knowledgeable about HPAI than their rural counterparts (Barennes et al., 2007; Fasina et al., 2009). These findings are not surprising, considering poultry workers' and dealers' poor education levels. In fact, in certain countries, there are no sufficient acceptable facilities. The poultry workers and traders are not involved in disease regulation and monitoring, which is usually done by government organizations (Alders et al., 2009; Azhar et al., 2010).

The impact of HPAI, sources of information and education programs (e.g., mass media, training and community monitoring programs) on poultry workers' or villagers' knowledge has been studied in some countries (Azhar et al., 2010; Barennes et al., 2007; Kurscheid et al., 2015; Manabe et al., 2011; Neupane et al., 2012; Yu et al., 2013). The primary source of HPAI information in Nigeria, Laos and Vietnam was TV (Barennes et al., 2007; Fasina et al., 2009; Manabe et al., 2011) whereas radio was more essential in Nepal (Neupane et al., 2012). AI viruses pose a significant danger to food security because the poultry industry is one of the most popular sources of animal protein in the world, owing to its accessibility, nutritional content and lack of cultural limitations (Sinclair, 2019). Good public awareness and safe practices regarding specific diseases or infections are critical for a successful pandemic control and outbreak prevention (Dishman, Stallknecht, & Cole, 2010; Van Nhu et al., 2020).

In light of this, the main objectives of the study are to 1) determine the levels of knowledge and preventive practices among Indonesian poultry farm workers regarding AI and 2) identify the factors related to the knowledge and practice of AI preventive behaviours, such as sociodemographic traits and media usage.

The study's findings are expected to help policymakers enhance AI knowledge and preventative practices among poultry farm workers through educational initiatives (seminars, workshops) on the same.

Materials & methods

Ethical considerations

The present study's protocol was reviewed and approved by the Animal Care and Use Committee, Faculty of the Veterinary Medicine, University of Airlangga, Surabaya under the approval letter No: 2.KE.096.07.2021. Participants were given verbal information about the study's aims, purpose and structure, as well as assurances of confidentiality.

Study area and population

This is a descriptive cross-sectional online survey conducted through a pre-designed questionnaire targeting Indonesian people who work on poultry farms in the different provinces (Banten, Jawa Barat, Jawa Tengah, Jawa Timur and Lampung) of Indonesia (Figure-1). Because of the significant number of major commercial farms in these provinces, they were chosen (layer, broiler and backyard). The majority of outbreaks were reported in these provinces, such as the first AI outbreak in Indonesia, which occurred in Central Java and Banten.Of these, a majority of the respondents were from the East Java province since it has more resources for data collection, besides hosting a large number of poultry farms. The inclusion criteria was all people working on a big commercial poultry (broiler, breedere, layer, and backyard) as an employee or farm owner. The questionnaire was initially written in English but was translated into the native language of the region (Bahasa Indonesia) to improve respondent accuracy, reduce margins of error and avoid confusion among respondents. The questionnaire was created using Google Forms which can be accessed by clicking on a link; the investigators disseminated it via social media, such as WhatsApp, and electronic media, such as email.

The Raosoft online calculator was used to calculate the sample size (Raosoft 2015). The Raosoft online calculator is specifically intended for population surveys to calculate sample size and determine how many replies are required to achieve the desired confidence level with the margin of error (usually 5 percent). As a result, it is strongly suggested that it be employed in such a study while taking into account the population size. The overall number of poultry farm workers in Indonesia is estimated to be around 12 million (Ferlito & Respatiadi, 2019). We don't know the precise population of the study provinces, so we'll assume there are 20000 poultry farm workers there. As a result, a minimum sample size of 377 was necessary to meet a 95 percent confidence level and a 5 percent margin of error. However, we have sent the questionnaire to 450 people in order to have a good response rate.

Hence, we opted to distribute questionnaires among poultry farms that had prior contact information with the respondent. The authors used veterinary doctors' groups to recognize potential farm managers and poultry farms that are significant in size and recognize commercial outlets. In this context, it is important to note that small-scale production farms were excluded from the study. The investigators kept track of those groups and reminded them regularly through

WhatsApp and email as per the convenience of the respondents. The authors intended to reach as many outlets as possible to get reasonable and sufficient reponses. Therefore, author online questionnaire was forwarded to approximately 450 participants: of these, 210 respondents filled the forms out completely (46% response rate). Following this, the questionnaires were fully sent out for reponses between 28 August 2021 to October 10, 2021. In the end, there were found to be only 10 incomplete questionnaires and these were removed from the final analysis.

Questionnaire Validation

A pilot study was conducted in the aforementioned provinces for two reasons: to ensure that the questionnaires were comprehensive and to ensure the respondents were available to willing to participate in the study. The questions were written in both languages (English and Indonesian Bahasa). We proceeded and broadly distributed the survey after correcting any errors and responding to minor suggestions concerning the language of the questions.

Data collection tools

The data collection tools were adopted with modifications from previously published questionnaires for a study on Italian poultry workers (Abbate, 2006) as well as the WHO fact sheet on AI (Organisation, 2011). The questionnaire comprised 27 items and was divided into three sections. The first part comprised six questions that investigated demographic variables and general information, including gender, age, residence, religion, level of education and working status. There were 14 multiple choice questions in the second section with the options 'yes'/'no'/'don't know'. The question 'Have you heard of avian influenza?' (yes/no) was used to assess public awareness of the disease, while the question 'sources of information' with options such as radio, TV, newspapers, health workers and friends were used to estimate the main source of AI-related information among the participants. Furthermore, the participants were asked questions about the mode of transmission, and vehicles of transmission with the options 'yes'/'no'/'don't know'. A question about whether certain professional groups like poultry workers, butchers or veterinarians were at risk for contracting AI was used to assess perceptions of professional risk ('yes'/'no'/'don't know'). A question was also posed to the participants regarding their frequency of following the protective measures, such ashand washing with soap and water, using face masks, boots/boot covers, protective body clothes and cage contact, consulting doctors and properly disposing dead birds ('always/'sometimes/'never')

Data management

The knowledge scores were determined as follows: one for 'yes'and zero for 'no' and 'don't know'. Meanwhile, the preventive/control practices were graded as follows: one for 'always' (positive practices) and zero for 'sometimes' and 'never'. These scores were then converted into categorical variables: 'High' (scores greater than 80%), 'Moderate' (50–80%) and 'Low' (below 50%) (Islam et al., 2017).

Data analysis

The primary author imported the acquired data into Statistical Package for Social Sciences (SPSS) version 25.0. The typing errors were discovered and rectified. Owing to the nature of the study, descriptive statistics was used. To demonstrate the strength of the relationship between the

knowledge and practice scores, correlation analysis was used. Pearson's Chi-square (X^2) test or Fisher's exact test (if applicable) were used to analyse the relationship between different variables, with $p \leq 0.05$ being considered statistically significant.

Results

A total of 200 farm workers from five provinces[Banten (15), Jawa Barat (15), Jawa Tengah 30, Jawa Timur (125) and Lampung (15)] with different proportions have participated in this study. The overall response rate was 46%.

Socio-demographic background

Both male and female farmers worked on the poultry farms considered for the present study. Most of the respondents were males (59.5%, n = 119), whereas 40.5% (n = 81) were females. 74% (n = 148) of the respondents were of the ages 31–50, 25% (n = 50) were aged from 20–30 years, while a very small proportion(1%, n = 2) was under the age of 20 years. Of the 200 respondents, 55.5% (n = 111) resided at rural areas while 93.5% (n = 187) practiced Islam. A majority (97.2%, n = 195) of the respondent had completed primary school while only 2.5 % (n = 5) had not. On the other hand, more than half (59%, n = 118) of the participants were paid employees (Table 1).

Awareness and sources of information on AI

Out of 200 respondents, 67% (n = 134) had heard aboutAI. Even though they got to knew about it from various sources, a the majority of farm workers learnt about the disease through health workers (36%), followed by TV (34%), friends (14.5%) and newspapers (14%). Only 1.5% learnt about it from the radio (Table 2).

Mode of transmission

A higher percentage (83.5%, n = 167) of the participants were aware that AI is a contagious infection that affects all birds. 95% believe that AI is transmissible animal-to-animal, while 67.5% believe that it is transmissible animal-to-human which tells us about its zoonotic nature. A small proportion (20.5%) stated that it cannot be transmitted from human to human. In addition to this, 50% of the participants stated that touching uncooked poultry and eggs can also contribute to spreading AI. 95% (n = 190)and 91 % (n = 182) claimed that poultry and other birds were the main source of AI transmission (Table 2).

Risk groups and practices

An average of 76.75% of the respondents thought that poultry workers and veterinarians are more likely to contract AI infection than butchers. In response to questions about the participants' practices, 51% stated that they always wore separate clothes while working on the farm. The most common practices were hand cleaning with soap and water (83.5%), appropriately disposing deceased birds (78.5%) and using a face mask (65%). Other forms of personal protection, such as consulting with doctors and wearing boots or boot covers, appeared to be less common. Overall, the study's findings demonstrate that the participants had strong knowledge of the suitable practices in dealing with AI infections (Table 2).

Table 3 depicts the association between participant awareness and demographic characteristics. Based on their *p*-value (> 0.05), none of the variables had a significant relationship with AI

awareness. It implies that respondents' awareness regarding AI is independent of their demographics.

Table 4 shows that higher levels of knowledge were statistically significant to the participants' residence and employment status (p-value <0.05). Gender, age, religion and educational status, on the other hand, have no relationship with knowledge because their p-values are not statistically significant (> 0.05).

Table 5 reveals that good practices were associated with gender, residence and employment status. Other variables, such as age, religion and educational status, do not have a statistically significant relationship with the practice because their p-values are not statistically significant (> 0.05).

Figure 2 depicts the relationship of respondents with AI knowledge and biosecurity practices, which are statistically significant (p-value≤ 0.009).

Discussion

The goal of the present epidemiological survey was to determine the level of AI awareness and practice among Indonesian poultry farm workers.

AI is a zoonotic disease mainly affecting birds and other mammals including humans. The disease is still endemic in Indonesia (Pusch & Suarez, 2018; Wibawa et al., 2014). The pan zoonosis of AI in domestic birds is a key risk factor, as it increases the chances of mutations and genetic re-assortment (AvianInfluenza, 2011). To the best of our knowledge, this is the first epidemiological investigation of AI among poultry farm workers in Indonesia. According to the results, most of the respondents had good knowledge and practices about AI.

Our findings revealed crucial information about the knowledge level of people who were known to be at high risk of AI. A majority of them were aware that AI is a contagious infection that affects all birds, while more than sixty percent said that they had heard of it. This is an important aspect in AI control as it might be due to the numerous AI epidemics that have occurred in Indonesia, particularly on Java Island, explaining why the participants were well educated on it. Our findings are in line with those of other studies conducted in Ghana and Bangladesh which showed that 63.5% of the respondents were aware of AI (Asare et al., 2021; Islam et al., 2017). A previous study conducted in Italy by Abbate et al. (2006) found that 64% of poultry workers correctly identified AI as a contagious infection caused by a virus that can affect all species of bird. Our results also concur with those of a study conducted in Pokhara, Nepal, in which 75% of participants correctly identified avian flu (Timilsina & Mahat, 2018). This could be due to the fact that the authors surveyed a population with a high level of education.

According to our findings, a majority of the respondents were aware that AI can be transmitted animal-to-animal and animal-to-human,while only twenty percent stated that it can transmitted human-to-human. This is in line with the previous studies conducted in Italy, India, Nepal and Bangladesh (Ezeh et al., 2017; Kumar et al., 2013; Lambrou et al., 2020; Sarker et al., 2016).

Data on the assessment of risk factors revealed that ninety to ninety five percent of participants said that poultry and other birds were the vehicles of AI transmission while seventy five to seventy nine percent believed that veterinarians and poultry workers were high-risk groups of getting infected. This is similar to the findings of a previous study conducted in Baghdad, in which a

majority of participants stated that poultry and wild birds are the primary vehicles of AI transmission. Other categories, such as at-risk populations (veterinarians, poultry workers), elicited mixed responses which contrasted with our findings (Al-Sarray, 2018). Direct contact with infected birds have been identified as the primary risk factor for AI transmission among humans in various studies. A cohort study of poultry workers in Hong Kong found that exposure to chicken increased the risk of AI infection among poultry workers and veterinarians (Bridges et al., 2002). A previous study in China that evaluated the knowledge and practices in urban and rural areas regarding Knowledge attitude and practices of AI found that poultry workers and veterinarians were at a higher risk of contracting AI (Xiang et al., 2010). All these findings concur with what we found from the present survey.

In the survey, it was also clear that the main source of information for respondents was mass media, specifically health workers, followed by TVand radio. These findings are in line with the results of earlier studies contacted among Cambodian and Nigerian poultry workers where the TVand radio were important sources of AI awareness (Fatiregun & Saani, 2008; Khun et al., 2012). A comparable study conducted in Nepal revealed that TV and newspapers were the important sources of campaigns regarding AI knowledge and awareness (Neupane et al., 2012). In the current investigation, the demographic characteristics did not affect AI awareness. This might be due to the endemicity of AI in Indonesia. In contrast, a previous study in Ghana found that age, marital status, residency, educational level and years of job experience all have a substantial impact on awareness (Asare et al., 2021). According to the findings of the present survey, 42% of respondents had a high level of knowledge while 25% had a moderate level of understanding (Figure 2) of AI illnesses in birds, the source of virus transmission and other risk categories. In contrast, the study in Ghana indicated that 87.5% of respondents had little understanding of the pathogenesis of AI., symptoms in diseased birds and the source of virus transmission (Asare et al., 2021). Our findings are consistent with the previous H5N1 surveys conducted in China, Laos and Italy (Abbate, 2006; Di Giuseppe et al., 2008; Xiang et al., 2010). According to our findings, a majority of the participants followed biosecurity and biosafety practices like handwashing , disposing dead birds , using face masks, while 45–50% of respondents used separate clothes and boots cover. A comparable study conducted by Neupane et al (2012) in Nepal discovered that 40% of the participants practiced personal preventative behaviours such as hand washing and sanitizing surfaces and utensils. To avoid AI infection, 51% woreface masks, whereas less than 40% wore special boots or protective body clothes. In the current study, 44.5% of the respondents showed high adherence to these practices, while only 20% did not-, which contrasted with the findings of a prior study conducted in Ghana, where only 4.3% showed strong adherence (Asare et al., 2021). Previous studies in Nepal and Nigeria found similar results, with 59.3% of the people adhering to these practices highly (Neupane et al., 2012; Perry et al., 2011). Our findings are intended to assist decision-makers in improving AI control and prevention strategies among poultry farm workers through education initiatives (workshops, seminars, etc.) on the same.

Limitations of the study

The major limitations here can be attributed to the sampling method used and these region covered, as these findings cannot be extrapolated to all of Indonesia. This is because we did not have enough social resources to cover more Indonesian provinces. Furthermore, because this is an online survey, respondents' interpretations of certain questions were susceptible to variations. Only the socio-demographic, knowledge and behaviour characteristics were examined as influencing factors to avoid having too many items in the questionnaire and, thereby, inadvertently causing a long response time. Moreover, the study would be feasible only for people who had smartphones, used WhatsApp, had email IDs and worked on commercial farms. Additional assessments, based on all elements of the knowledge and practices related to AI, would be necessary to ascertain the true degree of knowledge and practices among local farm workers. We had a lot of problems collecting data because our survey was conducted online. For the distribution of the study questionnaire, we chose WhatsApp and email as our modes of communication. Compared to other research methodologies, most respondents are less likely to stay completely engaged for a survey lasting more than 8-10 minutes, which is why we have a low response rate. We requested the respondents to complete the survey questionnaire several times,although a majority of them did not.

Conclusion

The study's findings demonstrated that poultry farm workers had good knowledge, which was reflected in their practices. The level of knowledge and practices was found to have a significant relationship. The primary sources of information about AI were health workers and TV. However, there is still a need to further improve Indonesian poultry farm workers' knowledge and practice of AI. Doing this will enhance the working efficiency of poultry farm owners/workers. Moreover, staying up-to-date with the latest knowledge is vital in combating propaganda such as false information. Moreover, it will help in adopting formal or standard practices regarding AI. In this regard, the local government, farm managers and poultry workers must be more actively involved in designing and implementing education and awareness programs, regulatory measures and incentive mechanisms.

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Figure 1

Sampling area of the survey

Sampling area of the survey

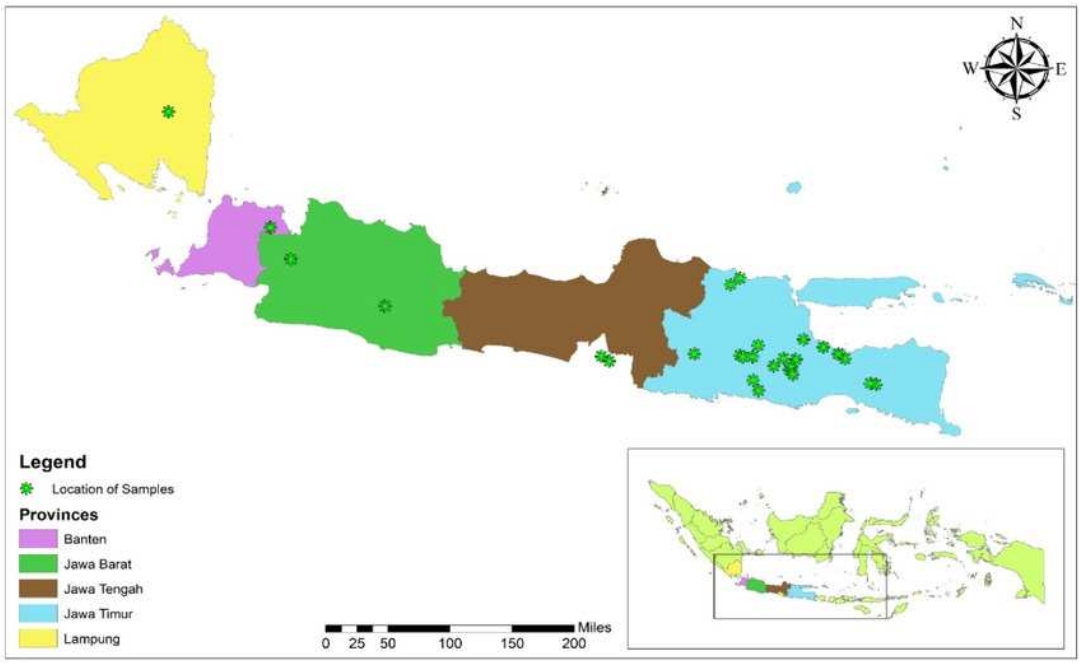

Figure-1: Sampling area of the survey

Figure 2

Graphical representation of knowledge and practices level

Graphical representation of knowledge and practices level

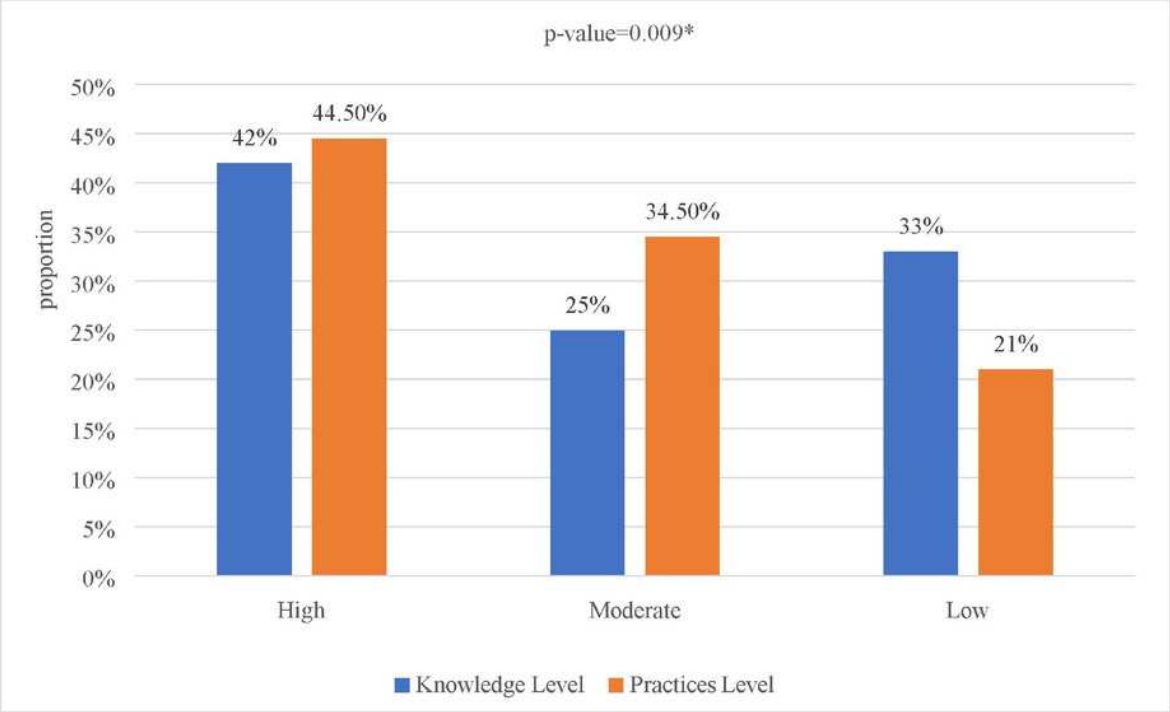

Figure-2: Graphical representation of knowledge and practices level

Table 1(on next page)

Demographic Characteristics of study respondents

Demographic Characteristics of study respondents

1 **Table 1: Demographic Characteristics of study respondents**

Variables	Characteristics	Frequency (n)	Percentage (%)
Gender	Male	119	59.5
	Female	81	40.5
Age	18 years	2	1
	20-30 year	50	25
	31-50 year	148	74
Residence	Urban	89	44.5
	Rural	111	55.5
Religion	Muslim	187	93.5
	Christian	5	2.5
	Hindu	2	1
	Catholic	6	3
Educational Status	Non-Primary	5	2.5
	Higher than Primary	195	97.5
Working Status	Farm owner	82	41
	Paid employees	118	59

2
3

Table 2(on next page)

Knowledge and practices of the participants regarding AI

1 **Table 2: Knowledge and practices of the participants regarding AI**

Sources of AI	**Poultry farm workers n=200**		
	Responses	Number	%
Awareness and information sources			
Have you heard about AI?	Yes	134	67
	No	66	33
Sources of information	Radio	3	1.5
	TV	68	34
	Newspapers	28	14
	Health workers	72	36
	Friends	29	14.5
Is AI a contagious infection that affects all birds?	Yes	167	83.5
	No	24	12
	Don't know	9	4.5
Mode of transmission			
Animal to animal	Yes	191	95.5
	No	4	2
	Don't know	5	2.5
Animal to human	Yes	135	67.5
	No	49	24.5
	Don't know	16	8
Human to human	Yes	41	20.5
	No	127	63.5
	Don't know	32	16
Touching uncooked poultry	Yes	102	51
	No	80	40
	Don't know	18	9
Touching uncooked eggs	Yes	77	38.5
	No	103	51.5
	Don't know	20	10

Vehicles of transmission			
Poultry	Yes	190	95
	No	3	1.5
	Don't know	7	3.5
Birds (other than poultry)	Yes	182	91
	No	4	2
	Don't know	14	7
Other animals	Yes	74	37
	No	87	43.5
	Don't know	39	19.5
Risk groups			
Poultry workers	Yes	159	79
	No	28	14
	Don't know	13	6.5
Butchers	Yes	100	50
	No	83	41.5
	Don't know	17	8.5
Veterinarians	Yes	149	74.5
	No	37	18.5
	Don't know	14	7
Practices among poultry farmworkers			
Are you use of separate clothes?	Always	102	51
	Sometime	83	41.5
	Never	15	7.5
Are you in contact with bird cages?	Always	35	17.5
	Sometime	118	59
	Never	47	23.5
Use of face masks	Always	130	65
	Sometime	64	32
	Never	6	3

Boots or boot covers	Always	81	41
	Sometime	87	43.5
	Never	31	15.5
Handwashing with soap and water	Always	167	83.5
	Sometime	32	16
	Never	1	0.5
Consult doctors	Always	80	40
	Sometime	95	47.5
	Never	25	12.5
Dispose of dead birds properly	Always	157	78.5
	Sometime	31	15.5
	Never	12	6

2

Table 3(on next page)

Relationship between awareness and demographic characteristics

Table 3: Relationship between awareness and demographic characteristics

Have you heard before about avian influenza?		**Yes**	**No**	***P*-value**	
Demographic	**Characteristics**	**Frequency %**			95% C. Interval
Gender	Male	82 (69)	37 (31)	0.487*	0.585-1.290
	Female	52 (64)	29 (36)		
Age	18 years	2 (100)	0 (0)	0.592*	N/A
	20-30 year	34 (68)	16 (32)		
	31-50 year	98 (66)	50 (34)		
Residence	Urban	60 (67)	29 (33)	0.516*	0.656-1.456
	Rural	74(67)	37 (33)	*	
Religion	Muslim	124 (66)	63 (34)	0.704*	N/A
	Christian	4 (80)	1 (20)		
	Hindu	2 (100)	0 (0)		
	Catholic	4 (66)	2 (34)		
Educational Status	Non-to Primary	3 (60)	2 (40)	0.534*	0.409-3.633
	Higher than Primary	131 (67)	64 (33)	*	
Working Status	Farm owner	56 (68)	26 (32)		0.624-1.403
	Paid employees	78 (66)	40 (34)	0.433*	
				*	

Table 4(on next page)

Relationship between knowledge level and demographic characteristics

Table 4: Relationship between knowledge level and demographic characteristics

	Knowledge level			
Demographics	**High frequency%**	**Moderate %**	**Low%**	***P*-value**
Gender				
Male	53 (44.53)	31 (26.05)	35 (29.42)	0.422
Female	31 (38.27)	19 (23.45)	31 (38.27)	
Age				
18 years	2 (100)	0 (0)	0 (0)	0.277
20-30 year	21 (42)	16 (32)	13 (26)	
31-50 year	61 (41.21)	34 (22.97)	53 (35.81)	
Residence				
Urban	23 (25.84)	25 (28.08)	41 (55.05)	<0.0001*
Rural	61 (54.95)	25 (22.52)	25 (22.52)	
Religion				
Muslim	76 (40.64)	50 (26.73)	61 (32.62)	0.384
Christian	4 (80)	0 (0)	1 (20)	
Hindu	1 (50)	0 (0)	1 (50)	
Catholic	3 (50)	0	3 (50)	
Educational Status				
Non-to primary	1 (20)	3 (60)	1 (20)	0.186
Higher than Primary	83 (43.91)	47 (24.10)	65 (33.33)	
Working Status				
Farm owner	46 (56.09)	15 (18.29)	21 (25.60)	0.003*
Paid employees	38 (20.87)	35 (29.66)	45 (38.13)	

* =Chi-square(X^2), *P-value* <0.05 is significant

Table 5(on next page)

Relationship between practices level and demographic characteristics

Table 5: Relationship between practices level and demographic characteristics

	Practice's level			
Demographics	**High frequency**	**Moderate**	**Low**	***P*-value ***
Gender				
Male	52 (43.69)	50 (42.01)	17 (14.28)	0.004*
Female	37 (45.67)	19 (23.45)	25 (30.86)	
Age				
18 years	2 (100)	0 (0)	0 (0)	0.623
20-30 year	21 (42)	18 (36)	11 (22)	
31-50 year	66 (41.21	51 (22.97)	31 (35.81)	
Residence				
Urban	32 (35.96)	32 (35.96)	25 (28.08)	0.037*
Rural	57 (51.35)	37 (33.33)	17 (15.31)	
Religion				
Muslim	84 (44.92)	63 (33.69)	40 (21.39)	0.647
Christian	2 (20)	3 (60)	0 (0)	
Hindu	1 (50)	0 (0)	1 (50)	
Catholic	2 (33.33)	3 (50)	1 (16.67)	
Educational Status				
Non-to primary	4 (80)	1(20)	0 (0)	0.242
Higher than Primary	85 (43.59)	68 (34.87)	42 (21.54)	
Working Status				
Farm owner	44 (53.66)	27 (32.93)	11 (14.41)	0.038*
Paid employees	45 (38.14)	42 (35.59)	31 (26.27)	

*Statistically significant based on p-value (<0.05) using Chi-square (X^2)