



**THE IMPACT OF POULTRY PRODUCTION CLUSTER (PPC) AND NON PPC ON CHILD HEALTH IN INDONESIA (A QUALITATIVE RESEARCH)**

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**ABSTRACT**

The industry of poultry in Asian countries including Indonesia, have impact on national economic growth, social culture, health and environment. This type of industry is still an option as a primary source of income in certain areas, especially in rural areas. As livestock production increases worldwide, livestock waste will be a serious environmental hazard. This study aims to identify the impact of chicken farms (PPC and non PPC) toward children infection diseases. The locations of the study are Subang district as PPC area and Ciamis district as non PPC area, West Java Province, Indonesia in 2013. Study design is qualitative research by in-depth interview and observation. The study result shows that smell and flies in two areas (PPC and non PPC) have been very disturbing for residents who live near and a bit far from the chicken farms. The incidence of respiratory disease and diarrhea in children are caused more by weather factor (rainy season). The causes of diarrhea are more due to lack of knowledge and implementation of clean and healthy lifestyle of chicken farmer and mother's children. Although all informants state that there is no relation between the existence of chicken farms and child health, factors of personal hygiene and environmental sanitation can trigger the diseases.

**Keywords:** poultry production, respiratory infection, diarrhea, children, personal hygiene, sanitation

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**INTRODUCTION**

Since 2002, the business has grown to a commercial chicken farm that produces chicken on a large scale. The growth of business is increasing as well as the increase of demand for the type of animal foods, especially chicken. The high demand of chickens from the consumers motivates the producers of chickens (the entrepreneurs of poultry industry, especially the producers of chickens) to spread the business's wings by adding chicken farm lands or increasing the capacity of producing chickens.

The development of poultry business (the breeding of chickens) at the regional and national levels triggers another serious problem, which are not only animal diseases that develop and threaten the production and development of the livestock sector, but also impact on public health/environment, especially for small-scale and traditional producers that do not have the ability of the management of the henhouse.

On one hand, the existence of broiler poultry farms (laying male) has the positive impacts such as an opportunity of giving jobs or employment, as well as the increase of the breeders's income and the increase of the economic activities involving many people in the village, especially the poor ones and it becomes another



source of income for small-scale producers. However, on the other hand, it has a negative impact in the form of environmental pollution caused by chicken manure, sewage, pedestal enclosure (litter), carcasses, and the smoke from the process of burning the rice husk in heating and warming the chickens which are suspected to be the cause of health problems in the community.

In poultry, the chicken manure is the main source of dirt that can pollute the air, water and soil in the surrounding environment. Air pollution happens when there is an increase of material, either physical or chemical ones in a normal air environment that reaches a certain amount which can affect humans, animals, vegetation and materials caused by humans. The average amount of chicken manure is 0.15 kg/head/day [1]. The average production of broiler manure is 0.1 kg/day/head, and the content of a dry matter is 25% [2].

The smell of chicken manure comes from a high content of ammonia gas, hydrogen sulfide (H<sub>2</sub>S), dimethyl sulfide, carbon disulfide, and mercaptans. The compounds that cause the smell of chicken manure can be easily formed under anaerobic conditions, such as piles of dirt that are still wet. The compound can be smelt easily even in very small concentration [3]. The smell of chicken manure not only gives the negative impact to the health of people who live in the neighborhood around the farm, but also can reduce the productivity of livestock, which causes the reduced profit for the breeders.

The cluster of poultry production (Poultry Production Cluster) is an attempt to encourage small-scale producers become the intensive livestock producers with basic standard and their location areas are far from the residential living. In contrast, henhouse in non PPC is near to the household. But both still have public health problems.

The limited funds, the infrastructure and the competency of human resources are the reasons that cause less attention to the problem for the public health impacts of livestock, such as inability to handle the chicken, including chicken manure, the chicken which is dead or sick, dust or toxic gases from the waste, high populations of flies, lack of hygiene and sanitation in the use of water to clean the henhouse, drinking for chickens and washing the working equipment and the use of fuels which are not proper. All those things can be a serious problem because it can pollute the air, water and soil. In addition, information about the use of drugs and chemicals to control diseases and increase the production of chicken become the consumers's concern [4]. Chicken breeding business is expected to be an environmentally sound business and efficiency by concerning the management of maintenance, the management of henhouse, and handling of waste.

According to the epidemiological triangle, the spread of the disease depends on the interaction among the three basic epidemiological factors, namely hosts (humans and its characteristics), agent (causing disease) and the environment. A change in one component will change the balance and increase or decrease the incidence of disease.

Environmental elements include biological, physical (air, weather, geography, radiations, air, soil and water pollution) and social environment (the legal, administrative and socio-political environment, the economic system used, the health care system, population density). The factors of the agent are among other, biotic (protozoa, bacteria, virus, fungi) and abiotic as chemical agents (pesticides), physical agents (dust) and mechanical agents. This study is designed to identify health problems that occur in the community, especially the impacts of the existence of poultry against diseases in children, namely diarrhea and Acute Respiratory Infections (ARI). The age of children is an age susceptible to disease transmission.

## **Materials and Methods**

### **Study design**

The design of this study is the type of Rapid Assessment Procedure (RAP), a qualitative data collection technique to improve and understand the problems faced in the relationship between the existence of poultry farm and the public health. The primary data is collected by in-depth interviews on informant groups and key



informants in PPC (Poultry Production Cluster) and non PPC (Poultry Production Cluster) areas, in 2013. The secondary data is collected by observation of case's visit of respiratory infections and diarrhea patients (children) in community health center.

Instruments used in the study are in-depth interview and observation sheet. Guidelines for in-depth interviews are made to get deep information about how the perception of the public, especially mothers/caregivers of children (20 mothers), doctors (2 persons) and community health center staffs/cadres (12 persons). The data obtained from all in-depth interview results were matched with data of cases. It is intended to get an idea/information about links either directly or indirectly to the existence of a chicken farm with a public health problem. The supporting data is the laboratory analysis to determine the quality of the drinking water used by a family.

Information from in-depth interviews is recorded using a voice recorder that has previously been approved by the informant. Information from tape recorder is transferred into a written form (transcript) completely. Then, the data are set, summarized using the matrix, interpreted and made the conclusions.

### **Results and discussion**

The demand and consumption of livestock products grew even faster than the increase in world population. Such demand had called for development of the livestock industry. The development also lead to pollution problem was caused by the increasing amount of animal waste. High concentrations of livestock contributed to contamination of ground water, eutropication, soil pollution and "greenhouse" gases thereby possibly contributing to global warming. Generally, livestock production and their waste had polluted the environmental in various ways such as air pollution, land degradation, physical impact, chemical and biological impacts of manure and urine, heavy metals and socio-economic problems [1].

Air pollution and global warming were produced by livestock directly and indirectly. The production of livestock had significantly contributed to the increase levels of CO<sub>2</sub> and other greenhouse gases during the past 250 years. About 40% of emitted methane was produced by agriculture predominantly by ruminant animals [1]. Improper handling of livestock manure might become a risk factor to several infectious diseases such as respiratory, diarrhea, and skin diseases. WHO had identified acute respiratory infections in developing countries, is the leading cause of death in children [5].

Acute respiratory infections and diarrhea diseases were the first and second leading causes of death among young children, causing 1.6 and 1.3 million child death per year, respectively. However, the proportion of mild to severe disease varied between high and low income countries, and because of differences in specific etiologies and risk factors [6].

### **Acute Respiratory Infections**

Acute Respiratory Infections (ARI) symptoms were cough, hoarseness, runny nose and fever, while pneumonia was an acute process of the lung tissue (alveoli) with symptoms of strong breath in the chest wall at the bottom or rapid breathing and the sound of 'ngik-ngik' (wheezing) [7]. ARIs were classified as upper respiratory tract infections (URI's) or lower respiratory tract infections (LRI's). ARIs were the most common causes of both illness and mortality in children under five, who average 3 to 6 episodes of ARI's annually regardless of where they live or what their economic situation is [6].

Based on the information from all health staff in PPC and non PPC areas, it was rarely to have patients with repetitive respiratory and diarrhea problems because patients are cured right away. The increase of the cases of the respiratory disease and diarrhea were caused more by the weather (rainy season), for example, when there was a change from dry season to rainy season and because of the chicken farmers carelessly discarded the chicken manure. The rainfall was related with the incidence of diarrhea and respiratory infection in children [8].



The other impact of the poultry business in both areas on the surrounding's environment was the smell from chicken manure. It made inconvenience for the residents living around the farm areas. Although in PPC area, the distance between henhouses and residential area was far, but the smell still can reach them.

**Poultry Production Cluster (PPC) Area**

The head of community health center and sanitarian staffs said that the trend of diarrhea and respiratory diseases in children is stable. The midwives also stated that diarrhea had never been an outbreak of disease. Based on the observations of monthly patient visit reports of diarrhea and respiratory diseases for one year, the number of case of respiratory infection in children were relatively constant in all villages.

Mother whose child suffered respiratory disease said that her father and her husband were smokers. In addition, other informants mention that her child suffered from respiratory disease because her house is near the highway and she always takes her child to go around the place by motorcycle. Infants who lived in households where parents smoke have more respiratory diseases in the first year of life than those who lived in smoke free households.

Children might have respiratory infectious disease from passive tobacco exposures. In addition, effusions were prolonged in children exposed to tobacco smoke compared to non-exposed and there was synergy between viral infections and particulate exposures. Exposure to secondhand smoke also slows lung growth and development [9]. Children had a higher resting metabolic rate and rate oxygen consumption per unit body weight than adults because they have a larger surface per unit body weight and they are growing rapidly. Therefore, their exposure to any air pollutant might be greater and more vulnerable to the effects of air pollution than adults [10].

Children living in developing countries suffered a double or even triple burden of disease. This refers to the exposures, morbidity and mortality from diseases associated with low levels of development, such as ARI and diarrhea, as well as newer threats associated with industrialization, such as asthma and allergies. Respiratory diseases led both emerging and persistent problems [11].

**Non Poultry Production Cluster (non PPC) Area**

The data observation of patient visits (children) in community health center in 2012 showed that the case of respiratory diseases in children (0-59 months) in Margaharja village (more chicken farm) is relatively higher than in Margajaya and Sukadana villages (less chicken farm). But the health staff stated that there is no relation between the dust from the chicken farms and the respiratory problems.

Most of informants from children's mother stated that the smell from chicken manure is unhealthy and can cause a respiratory problem. However, they had never told to the community health center, clinic, head of village and the owner of the farm business. The information from one mother who works at the chicken farm, said that she is not bothered at all by the smell from chicken manure, because she was already used to live with this condition for years, so she is no longer sensitive to this kind of smell. But doctor stated that the chicken farmers usually get shortness of breath (dyspnea).

One informant from community health center said that people only complain about the smell. The smell comes from the elements of nitrogen and sulfide in chicken manure, which is formed during the decomposition of gaseous ammonia, nitrate, nitrite, and hydrogen sulfide gas. The air which is polluted by ammonia and sulfide gas can cause the eye irritation and respiratory problems in farmers and the people around the farm. Ammonia emissions from agricultural operation present three major environmental issues: odor, habitability and air quality. Ammonia has a strong and unpleasant odor. In high levels, ammonia is a toxic to humans and animals. Reducing feed protein can reduce production of urea, which is all converted to ammonia [3].



Complaints about the smell of chicken manure that became the pollution occur mostly in non PPC area, because the location of the henhouse was closest to the residential area, while the management of waste was not done well. The distance was around 20-30 meters and some of them only five meters.

Yet, according to sanitarian staff information, the regulation for poultry business suggested that the location of henhouse must be at least 100 meters from residential areas so it can reduce the air pollution including the smell. The other side, management of chicken manure still not good. One farmer said the henhouse is cleaned only during or after the harvest time. According to informants from the health promotion unit, a chicken farm will not have a problem if the henhouse is cleaned every week. The most important thing is how to maintain the cleanliness of the henhouse, for example the rice husk must not be wet because it will greatly affect the smell and air pollution.

In the case of environmental pollution by poultry, the real issues are triggered by the growing residential area. In early development, the chicken farms were established far from the residential area but gradually the residential area is growing and the farms changed into the residential area. This happened due to the inconsistent development and spatial planning. The interaction between humans and the environment either directly or indirectly can cause health problems. One kind of disease from the transmission of water and sanitation (water-borne diseases) is caused by ingestion of water contaminated by human or animal feces or urine containing pathogenic bacteria or viruses [12].

Information from one mother who lives near the henhouse using coal stated that her child and her parents frequently have a cough and shortness of breath. The respiratory problems become worse at the time of the process of warming the chickens, it usually lasts for about 13 days. To warm the chickens, farmers usually use gas fuel, firewood and coal. If the firewood rarely found, then the farmers use the alternative fuels such as coal, the briquette price is much cheaper than gas.

Another mother who lives closest to the henhouse and use of coal for warming the chickens said that her children often suffer wheezing and fever. However, the mother doesn't believe that shortness of breathing problems of her children caused by existence of the henhouse. Coal and biomass fuel as a major source of indoor air pollution. Indoor air pollution is responsible for 2.7% of the global burden of disease. In non PPC area, usually the breeders get the coal from the company which drop directly to the worker who takes care of the henhouse. Coal is burned to produce toxic substances such as sulfur, mercury, arsenic, selenium, fluoride and polycyclic aromatic hydrocarbons. Coal and biomass fuel add suspended particulate matter to the environment and can be trapped, resulting in levels 1000 times higher than outdoor concentrations. In addition carbon monoxide and other combustion products such as from poultry manure products can have toxic effects of children's health and development [13].

### **Diarrhea**

Diarrhea is caused by a wide variety of pathogens with seasonality and climate interactions differing by etiological agent. Patterns of occurrence are further influenced by pathogen transmission dynamics shaped by seasonal factors, pathogen and host community characteristics and involvement of zoonotic pathogen sources, and environmental conditions [8].

Globally, diarrheal diseases remain one of the leading causes of morbidity and mortality, with the majority of deaths occurring in children under five years of old. Alexander stated that an array of climatic factors associated with diarrheal disease including temperature, rainfall, relative humidity, and air pressure. All of informants stated that diarrheal disease in children is caused more by the weather especially rainy season. Diarrhea can be strongly influenced by socioeconomic factors including sanitation and hygiene practices and use of unsafe water sources [8].



Zoonosis can be spread by direct and indirect contact with animal. Animals may carry a range of micro-organisms potentially harmful to humans without showing any signs of diseases. There are several ways that zoonotic diseases can be spread such as fecal oral route; inhalation of dust and faces; ingestion; urine; skin or mucous membrane contact. Personal hygiene and properly hand washing can prevent contaminated from animal to human [1].

All informants in both areas said that there is no relation between the existence of chicken farms and the children's diseases, but factors of individual hygiene and environmental sanitation can trigger the diseases. Hand-washing is the most important practice of individual hygiene in preventing the spread of infectious disease from either animals or their environment to human through contaminated hand. Good hygiene practices, such as the correct hand-washing technique and washing hands at appropriate times in the animal contact area, will decrease the risk of disease. Wash hands with soap and running water after touching animals including feces, urine, soil and any parts of the animal or its surrounds can be contaminated, before eating or drinking [14].

#### **Poultry Production Cluster (PPC) Area**

According to health staff in PPC area, many flies increase when harvesting chickens to 3-5 days. Flies can be a source of transmission of diarrhea. However, doctor in community health center said that increasing the number of flies is not followed by increasing the incidence of diarrhea. All informants said that besides the smell caused by the chicken manure, there are many flies flying around the chicken farms and residential areas (into houses), especially during harvest time. A study had been directed at evaluating climate change impacts on fly abundance and the mechanical transmission of infectious disease despite the importance of flies as mechanical vectors of diarrheal disease causing microorganisms [8].

The poultry business will produce manure with a large number of pathogens wasted through ditches around the henhouse, water sources and then spread out through the river. Almost all informants in community health center stated that trend of diarrheal cases in children is relatively stable. Only one informant (sanitarian staff) said the number of diarrheal cases increase along rainy season. Rainfall can influence the movement of pathogens from environmental reservoirs into ground water, surface water, or contaminate the water system. Both rainfall and vapor pressure have impacts on pathogen transmission and survival, and diarrheal incidence. For many pathogens, the number of infected hosts will influence the rate at which susceptible hosts are exposed to infectious material and consequently, become infected [8].

The primary cause of diarrhea is lack of knowledge and personal hygiene practices. Washing hands with soap before feeding practice is an important first step to prevent diarrhea. Maternal knowledge about hand washing and availability of sanitation facilities are important prevention points in public health programs. In meta -analyses, intervention of hand washing with soap and use of improved sanitation facilities have each been associated with greater than 30% reductions in disease risk [15]. Educational level of mother has a protective effect against childhood illness.

One mother said that her child has diarrhea nearly three times a month. From observation result, the mother never washes her hands properly before giving the food and child's feeding tools is washed in water reservoirs close to the henhouse. The hypothesis is the water source had been contaminated. Transmission of diarrhea causing pathogens from infected to susceptible hosts can occur over a multitude of interdependent pathways, either through direct transmission between hosts or indirectly through vectors, water, food and/or other sources of environmental contamination. These chains of transmission can involve human-human, animal-human (zoonotic), or human-animal-human transmission linkages and environmental transmission pathways [8].

**Non Poultry Production Cluster (non PPC) Area**

According to patient visited information in community health center (2012) showed that the incidence of diarrhea in children (0-59 months) in Sukamulya village (more chicken farm) is relatively higher than 'Jelat', 'Baregbeg', 'Karangampel' villages (less chicken farm). In developing countries such Indonesia, enhancing resources and/or infrastructure and promoting behavioral change, are effective policy strategies to reduce child morbidity and mortality due to diarrhea disease and ARI [16].

One mother from non PPC area said that she does not know the cause of her children's diarrhea whether it is because of the water fountain or another thing. The location of the water fountain is near to the henhouse. The water source of the fountain comes from springs in the hills that distributed to some houses by using the pipe. Here is some of the interview script:

*"... I do not know the cause of the diarrhea. Previously, my child only eats rice which is made by my self. Yes, I'm taking a bath and washing the cutlery for eating/drinking at the same place near to the henhouse".*

When the observations on water/plumbing was done, it appears that the water source close to the henhouse (less than 10 meters). The water fountain is used by several families using the hose for household daily use, such as drinking, bathing and washing. It is also used by workers or breeders for washing hands, cleaning the henhouse and washing equipment and shoes for working at the henhouse. Risk of cross contamination will be occurred. The contamination come from the place where farmers wash anything and the source of water flows through the pipeline to the fountain. The disease can be infected from one person to another, then back into the first person. Repetitive transmission can occur if the patients who are not cured use the water from the same sources with the healthy people.

A reduced risk of diarrheal disease among children relate to factors of water quantity and quality. Water sources in the form of piped more protect against diarrheal disease than from an open well [15]. The result of the microbiological analysis of water quality from water pipes was negative for Salmonella, but the value for Colliform was 1100 MPN/ml. This value is not good for human's consumption and for livestock. The low quality of water has a higher risk for the occurrence of diarrhea and skin diseases. It still a health problem, especially in low-income or rural areas due to low coverage of water, sanitation and awareness of healthy behavior.

Skin disease infections related to water quality. Skin infection such as eczema, yaws and skin rashes were easily identified through direct observation. Regular bathing is seen as having a direct relation with the ease with which people have access to water. Insufficient water is responsible for the reduced number of times people bath and wash their clothes, which predisposes them to various kinds of skin diseases. Dirty and contaminated water may contain pathogens which when in contact in the skin, could cause skin infection [12]. One mother said that her family suffers the same skin disease. According to informant (midwives), farmers in this village still 'dirty', especially in handling chicken manure and utensil while the location of water sources close to the henhouse and chicken manure.

Domestic water supply is one of the fundamental requirements of human life. The quality of water that is consumed is well-recognized as an important transmission route for infections diarrheal and other diseases. The importance of water quality continues to be emphasized because bad water can cause epidemics and contribute to endemic disease from pathogens. The effects of poor quality of water supply are felt in most developing countries, although the greater part of the health burden is carried by children and women. Water supplies and sanitation are crucial elements in a sustainable livelihood strategy being directly related to issues of access to and control over natural resources as well as basic infrastructure and services [12, 17].



The impact of the existence of a chicken farm on the environmental health and human health is quite sensitive. Therefore, during the interview there was an attempt to cover up accurate information by informants. This occurs because the informants tend to be afraid to risk his participation in the study, so there was an inconsistent answered and seem to cover up things.

**Conclusion and recommendation**

Children's diseases such as respiratory infections and diarrhea are more caused by the weather (rainy season). Although all informants stated that there is no relationship between the existence of chicken farms and the diseases of diarrhea, respiratory and skin disease, but we should keep in mind that factors of individual hygiene and environmental sanitation can trigger the diseases. So far, there are no special activities for farmers and mothers conducted by community health center in an effort to promote, prevent the diseases associated with the existence of chicken farms. It is necessary to give the knowledge to the farmers especially about waste management, and the efficacy of hand washing among households have a greater protective impact for children to reduce diarrheal diseases and acute respiratory infections.

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