ORIGINAL RESEARCH

IDENTIFYING UNHEALTHY HOUSES IN KERINCI DISTRICT, INDONESIA

Identifikasi Rumah-rumah Tidak Sehat di Kabupaten Kerinci, Indonesia

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ABSTRACT

Background: Healthy houses in developing countries are a critical factor in human health, as the increase in population is not balanced by improvements in local community welfare. This has negative impacts on the environment and human health. **Purpose:** The aim of this study was to identify unhealthy houses in Kerinci, Indonesia. **Method:** This research used a descriptive cross-sectional approach. A survey of 122 houses was conducted to determine the characteristics of houses in Kerinci District, Jambi Province, Indonesia. Stratified random sampling was used to obtain representative healthy house data, by using four repetitions on each single question to minimize errors. **Results:** The results showed that 90% of respondents had a high occupant density. A high number of diseases were already experienced by residents in the area. These diseases were an indication that the area could be classified as unhealthy and included diarrhea (20%), acute respiratory infections (ARI; 13%), malaria (10%), skin diseases (15%), and other diseases (29%). Only 12% of the total respondents reported having no diseases. **Conclusion:** In the Kerinci District, 98% of houses were classified as unhealthy and as having potentially negative impacts on the health of residents. We recommend the government establish regulations to improve the health of houses and increase economic growth in Kerinci District, Indonesia.

ABSTRAK

Latar belakang: Rumah sehat di negara berkembang menjadi faktor penting dalam kesehatan manusia karena peningkatan populasi tidak diimbangi dengan peningkatan kesejahteraan masyarakat setempat. Kondisi ini tentu saja memberikan dampak negatif bagi lingkungan dan kesehatan manusia. Tujuan: Penelitian ini bertujuan untuk mengidentifikasi rumah-rumah yang tidak sehat di Kabupaten Kerinci

Indonesia. **Metode:** *Penelitian ini merupakan penelitian deskriptif dengan rancangan cross sectional. Survei dilakukan terhadap 122 rumah tangga yang dipilih dengan stratified random sampling. Penelitian dilakukan di Kabupaten Kerinci, Provinsi Jambi pada bulan November 2017. Wawancara dan observasi dilakukan terhadap rumah tangga terpilih.* **Hasil:** *Hasil penelitian menunjukkan 90% responden memiliki kepadatan hunian tinggi. Kepadatan hunian tinggi juga diikuti oleh tingginya jumlah penyakit yang dirasakan oleh masyarakat tersebut meliputi 20% diare, 13% ISPA, 10% malaria, 15% penyakit kulit, 29% penyakit lain, dan hanya 12% dari total responden yang tidak memiliki penyakit.* **Kesimpulan:** *Sebanyak 98% rumah di Kabupaten Kerinci dikategorikan sebagai rumah tidak sehat dan bisa berdampak negatif pada kesehatan warga. Kami merekomendasikan pemerintah untuk membuat peraturan untuk memperbaiki rumah yang tidak sehat dan meningkatkan pertumbuhan ekonomi di Kabupaten Kerinci, Indonesia.*

INTRODUCTION

The house is a place to relax and rest after activities, to gather with family, to protect from danger, to represent social status, and to save wealth. The function of the house as a shelter is very important because it is related to physical, mental, and social health activities for families and individuals. A house can be classified as healthy if it meets health requirements and has health-supporting facilities, such as clean bathrooms, germ-free water, good waste management, sufficient air circulation, suitable occupant density, and proper floor design (Vanhoutteghem, Skarning, Hviid, & Svendsen, 2015).

A healthy house can affect the health of the local community. Most people now spend about 90% of their time indoors and 69% of their time in their own house (Sinharay et al., 2018). This data informs the urgency of creating a healthy environment in the home. Unhealthy houses can have a negative impact on residents due to poor physical structure, an unhealthy environment, and construction materials that are not environmentally friendly. Formaldehyde emitted from fibers and the release of asbestos from ceilings can endanger human health, as well as nanoparticles from construction waste, which can contain aluminium (Al), arsen (As), aurum (Au/gold), calcium (Ca), cadmium (Cd), carbon monoxide (Co), chromium (Cr), cuprum (Cu), hydrargyrum (Hg), natrium (Na), ferrum (Fe), kalium (K), sulfur (S), stannum (Sn), and silicon (Si), and an enrichment of particle in metal and metalloids, such as As, Co, Cr, Cu, Hg, Fe, Sn, or Tantalum (Ta) (Oliveira et al., 2019).

Local beliefs and culture can affect the design of traditional houses in a region. Sometimes, the design does not focus on the health of the occupants (Chen et al., 2019). Religious and cultural diversity in the community causes significant changes in house design. This condition can also cause changes in public health status (Juan, Ziliang, Weijun, Mengsheng, & Menglong, 2019). Other external factors, such as security, ontology, a sense of community, and social capital also need to be considered in the creation of healthy houses. Not maintaining the quality of the indoor environment is the main cause of many unhealthy houses. Traditional habits, such as not opening windows regularly, can disrupt air circulation, especially in houses that are not equipped with a good ventilation system. Low economic levels also have a significant impact on public health (Pevalin, Reeves, Baker, & Bentley, 2017). Therefore, researchers have reported that the number of healthy houses in developing countries are less than in developed countries, due to the diversity of these factors (Saniroychansyah, Farmawati, Anindyah, & Atianta, 2016). Population growth in developing countries increases housing needs, which might also increase the number of unhealthy houses. Indonesia is classified as developing country and has many unhealthy houses, due to traditional house designs and the unhealthy behavior of its inhabitants (Park & LaFrombois, 2019). The

purpose of this study is to analyze the unhealthy houses in Kerinci District, Indonesia.

METHOD

This research used a descriptive cross-sectional approach and was conducted in November 2018. Samples were chosen via stratified random sampling, resulting in a total of 122 houses. Data were collected using interviews and observation of family heads or members of the family who stayed in the home (the family member was required to be more than 17 years old). Questionnaires and observations were used to analyze the conditions in the houses based on Ministry of Health regulations (No. 829/1999). This regulation addresses the characteristics of ceilings, walls, floors, bedroom windows, family room windows, ventilation, kitchen smoke holes, and lightning. Observations were also conducted to determine the source of surface water (fresh and clean water). Interviews were conducted using a modified questionnaire focusing on general diseases caused by the environment, such as diarrhea, acute respiratory infections (ARI), skin diseases, malaria, dengue hemorrhagic fever (DHF), and tuberculosis (TB), experienced over the past six months (Ministry of Health RI, 1999).

The presence of each variable for the house component and occupant behavior was given a value from zero to two, while sanitation facilities were given values from zero to four. The total values for all variables were multiplied by weight. A house was categorized as healthy if the total score was between 1,068 and 1,200. An unhealthy house had a score of less than 1,068. Data was analyzed via a univariate analysis, using frequency distributions for each variable.

RESULTS

The majority of respondents were male, between 46 and 65 years old, married, had a low level of education, and worked as farmers (Table 1). Most of the respondents' houses had no ceilings, semi-permanent walls, and floors made of plaster, ceramics, or boards. Most houses had no window in the family room, ventilation of less than 10%, no kitchen smoke hole, and dim lighting (Table 2).

Figure 1 shows that the majority of houses in Kerinci District, Indonesia, were unhealthy (92%). This impacted the health of the occupants, who experienced ARI, malaria, diarrhea, skin diseases, and other diseases. The total number of diseases

was more than 122, as most respondents had more than one disease.

In the study area, it was very rare to find a house that had more than one water source (Table 4). The majority of residents in this location used the river as a source of clean water. The physical quality of water in Kerinci District contributed to the diseases caused. Some water was found to have several pollution parameters, including cloudiness, discoloration, poor taste and smell, and foaming (Table 4).

Table 1
Characteristic of Respondents in Kerinci District

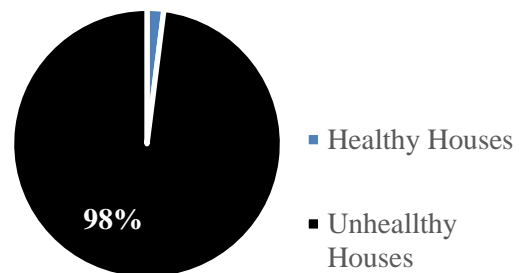| Characteristic	n	%
Gender		
Male	78	63.90
Female	44	36.10
Age (years old)		
20-35	31	25.40
36-45	33	27.00
46-65	48	39.30
>65	10	8.20
Marital status		
Married	114	93.40
Single	2	1.60
Widower	1	0.80
Widow	5	4.10
Education level		
None	2	1.60
Elementary	62	50.80
Junior high school	32	26.20
Senior high school	22	18.00
University	4	3.30
Job		
None	4	3.30
Farmer	100	82.00
Trader	8	6.60
Entrepreneur	2	1.60
Civil servants	4	3.30
Private	2	1.60
House wife	2	1.60
Total	122	100.00

Figure 1. Healthy Houses in Kerinci District, Indonesia

Table 2
Distribution of Healthy House Characteristics in Kerinci District, Indonesia

Variables	Total	
	n	%
Ceil		
No Ceiling	58	48.00
Dirty Ceiling	28	23.00
Clean Ceiling	36	30.00
Wall		
Not a wall	37	30.00
Semi-permanent wall	47	39.00
Wall	38	31.00
Floor		
Soil	18	15.00
Woven Board	26	21.00
Plaster, ceramics/boards	78	64.00
Bedroom Window		
Yes	105	86.00
No	17	14.00
Family Room Window		
Yes	30	25.00
No	92	75.00
Ventilation		
No ventilation	33	27.00
Ventilation < 10%	47	39.00
Ventilation ≥ 10%	42	34.00
Kitchen Smoke Hole		
No	89	73.00
Yes	33	27.00
Lightning		
Dark	12	10.00
Dim	67	55.00
Bright	43	35.00
Density		
Dense	112	92.00
Not dense	10	8.00
Total	122	100.00

Table 3
Type of Respondents Disease

Type of disease	n	%
Diarrhea	29	23.80
Skin disease	18	14.80
ARI	21	17.20
Malaria	15	12.30
Others	42	34.40
None	18	14.80

DISCUSSION

A healthy house is an important issue for human health because healthy people come from a healthy house. Healthy houses and public health can influence each other. Kerinci District has several problems regarding healthy houses. Each variable has been used to analyze the quality standards of healthy houses in Kerinci District.

Table 4
Water Characteristics in Kerinci District

Water Characteristics	n	%
Source		
Dug wells	6	5.00
Local water company	24	58.00
River	43	36.00
Rain	2	2.00
Clean water		
Cloudy	71	58.20
Colored	2	1.60
Smells	1	0.80
Foaming	1	0.80
Drinking water		
Cloudy	34	27.90
Colored	5	4.10
Taste	9	7.40
Smells	2	1.60
Foaming	2	1.60

Characteristics of Respondents

The survey results showed that the majority of respondents were farmers, as Kerinci District is located in a suburban area on Kerinci Mountain. The highlands are a common area for agriculture including fruit and vegetable farming. Respondents were chosen from Pondok Village and Bukit Kerman Village, as these villages had many health problems, were far from the city center, had fewer medical personnel compared to other places in Kerinci District, and lacked knowledge about healthy houses. A low education level is the main reason why Kerinci District has the lowest number of healthy houses in Jambi Province, Indonesia. The Kerinci community was dominated by low levels of education. Thus, the low level of education may contribute to the high number of unhealthy houses in this area

These respondent characteristics have not been studied in publications in other journals. There is no published research on unhealthy houses in mountain areas. These respondents do not have special characteristics. The majority of respondents in this study worked as farmers because of the location of Kerinci District. Kerinci District is a vegetable producing region that supplies vegetables to Jambi and neighboring provinces.

Occupant Density (OD)

The study found that only 8% of houses were classified as not dense. The average space index was 25.70m2/person, with occupant density ranging from 7.00-55.70m2/person. When compared with the average occupant density in other countries, the occupant density in Kerinci District was quite high. Some large cities in Indonesia have an average density of 20m2 of room space per person, while large cities in China, Japan, and the UK have a density of 10m2 or less. This raises the question of whether rooms and houses in other countries have increased space efficiency.

The effective use of space has a positive correlation with the formation of healthy homes. A high density of residents can lead to increased temperatures, which can reduce the occupants' performance and productivity levels (Chen et al., 2018)

Recent research shows a relationship between room temperature and the performance of employees working in it. Productivity is known to decrease by 2% per each degree above 25oC. This increase in temperature causes employees to feel uncomfortable, which can lead to a decline in performance. An adequate temperature in the work environment can increase the happiness of workers, leading to an increase in productivity under the right conditions (Niemelä, Levy, Kosonen, & Jokisalo, 2017).

Increased population growth, which increases occupant density, leads to increased room temperatures and the decreased accessibility of residents. Poor housing is a violation of international commitments related to sustainable development goals on health and sustainable cities. The health of residents needs to be a priority so that poor housing conditions do not continue to increase (Kulshreshtha et al., 2020). Decreasing the occupant density will increase the number of healthy houses in Kerinci District. In addition to lowering room temperatures, decreasing occupant density can lead to healthier residents in this district.

Healthy House Analysis

This study found that only 7.55% of respondents in Pondok Village and Bukit Kerman Village, Kerinci District, had a house categorized as healthy, while 92% were categorized as unhealthy. This can occur because of low public awareness of the importance of a healthy lifestyle, a lack of hygiene in houses, and a low level of education. Some studies suggest that unhealthy houses appear mostly in low-income families. This is because of the high potential of conflict due to economic pressure. The level of education also affects the selection of lifestyles that allow a better life; this is also affected by the amount of income. Research shows that economic levels can have a significant contribution to the health of the community. In general, lifestyle is a dominant factor in health (Wibowo, Maryani, Rosanti, & Rosarina, 2019; Wibowo, Ramadan, & Andriansyah, 2019).

A house's ceiling, as part of the building materials, is an important parameter in creating a healthy house. In this study, 48% of houses in Kerinci District did not have ceilings and 23% had dirty ceilings or ceilings that were difficult to clean or were damaged. These results indicate that half of the respondents did not meet the parameters of a healthy house. This is very important to consider as ceilings can increase the humidity in a house. There is the possibility of creating an unsafe environment or trapping water vapor in the walls of the house. Ceiling cavities can cause structural damage due to decreasing insulation and the growth of fungi and bacteria on walls (Brown, Wolf, Prados-Rosales, & Casadevall, 2015).

This research is similar to a study in Yogyakarta, which is also located in a mountain area and has the same features. Another reason this area has unhealthy houses is culture. The culture of housing in mountain areas is not the same as in other places. This area has 15% healthy houses and 85% unhealthy houses (Saniroychansyah, Farmawati, Anindyah, & Atianta, 2016). Temperature determines the convenience of residents and building design will affect the temperature. In addition to the types of insulation and construction materials used, sunlight needs to be considered to make the rooms warmer. Floor construction and wall constituent materials can affect room temperature. Ventilation also plays an important role in maintaining room temperature at ideal conditions (Zhang, Cheng, Huan, & Lin, 2019).

There are some standard parameters for realizing a healthy house that were used as a reference in this study, assessing building materials used for roofs, floors, walls, ceilings, stairs, terraces, fences, doors, windows, and glass, that aim to keep conditions safe and comfortable for the inhabitants. All things must be installed appropriately. Pipes and fittings, chimneys, and air exchange facilities must be installed in accordance with applicable laws and regulations. Engineering, utilities, and heating equipment must be placed

away from the occupied rooms. Pipes, which supply clean water and remove wastewater, must be installed and maintained so that they function properly and are free from blockages or leaks. Clean water supply systems must have sufficient pressure to meet the needs of all residents. Cold water must flow into the heater with sufficient discharge and pressure to be transported to sinks, bathtubs, showers, and laundry facilities. The water heater must be set at a minimum temperature of 110°F (43°C). Especially for bathtub faucets, the maximum temperature must be able to reach 120°F (49°C) (Lu et al., 2017).

Water heated by a heater must have several temperature/pressure relief valves that are discharged through vent pipelines or recirculation systems. The temperature of the water coming out of the heater must not exceed 140°F (60°C). Every drainpipe that uses an offsite system must be guaranteed smooth and free from blockages. When using an onsite system, the septic tank must be installed properly. Pipes that transport gray water must be separated from the flow of black water, so that the processing load is not too large. The water faucet must be located above the overflow edge of the sink. Installation of filters on the sink is very important to keep dirt and food scraps from entering the drainpipe. The drainage system must also be adequately sized and easily cleaned to assure good drainage. Cabinets must have doors that are tightly installed, as they may store items that need protection from insects such as ants, flies, and mosquitoes. Tables, shelves, and cabinets must be equipped with surfaces that are resistant to water and easy to clean. The placement of shelves and tables will affect the working mood and comfort of residents (Saxbe & Repetti, 2010).

The condition of the kitchen also needs to be considered, as the kitchen is one of the most important places for the distribution of contaminants. The gas stove must have enough space/ventilation to dispose harmful gases and maintain the temperature at optimal conditions. It is difficult to maintain adequate ventilation, so an exhaust fan should be used to remove combustion gases and particulates from the kitchen. Ventilation is also important in rooms that require cooling, to maintain temperatures more than 41°F (6°C) but less than 32°F (0°C). The refrigerator is expected to maintain food temperatures below 0°F (-18°C). Electrical installations also need to be adequately prepared. Kitchen floors must be prepared so that they are always in good condition, sealed, waterproof, and clean/free of germs due to kitchen activities (Asumadu-Sakyi et al., 2019).

Floors and carpets need to be properly maintained in each house. They also need to be easily cleaned so they are free of germs. The carpet should not have folds or bumps. Proper carpeting can reduce noise levels in the room, ensuring noise is always below 45 dB Ldn (the average sound level day and night) (Chen, Tong, Samuelson, Wu, & Malkawi, 2019).

For electrical systems, each residential unit must have an outlet, electrical service, and equipment installed correctly. Each must be maintained in good working condition and always connected to a power source. Each residential unit must be supplied by three wires, have one-phase electricity services that are not shared with each other, and be capable of delivering 120/240 volts. Temporary cables may not be used as permanent wires (Chen, Tong, Samuelson, Wu, & Malkawi, 2019).

Each inhabited room must receive sunlight during the day or at least have one exterior window. Uninhabited rooms should receive light from adjacent areas. Each kitchen and bathroom must also meet existing requirements, unless the room is equipped with a ventilation system. Each room containing a toilet, sink, or bathtub must have a wall that makes lighting more efficient. At least one lamp must be placed on the ceiling for a small room. Each unoccupied room, including laundry rooms, furnace rooms, and public spaces, must contain at least one ceiling or wall with a type of switch lamp, which is used as an indicator of light in a room. The light must make the user comfortable and the distance between the lights does not have to be greater than 30 feet (762cm). In a building containing one or two residential units, each public space, entrance, and staircase must be illuminated by electric lighting, with at least 800 lumens per 200ft2 (18.6m2) required (Chen, Tong, Samuelson, Wu, & Malkawi, 2019).

Facilities for heating, cooling, ventilation, and humidity control must be maintained in good condition and be operable if needed to maintain occupant comfort. Equipment not functioning properly can occur due to a mechanical problem or failure in the system. To overcome this problem, a safe source of alternative ventilation is needed, in lieu of heating and cooling equipment that must be maintained and provided (Chen, Tong, Samuelson, Wu, & Malkawi, 2019).

Natural or mechanical ventilation or a combination of both must provide fresh air to each occupied room and be able to remove dirty air, reduce the humidity of the room, and remove other contaminants produced during bathing, cooking,

and other activities. Each residential unit must be equipped with an appropriate ventilation system in accordance with American Society of Heating, Refrigerating, and Air- Conditioning Engineers (ASHRAE) Standard 62.2 or 62.1. Air from bathrooms, clothes dryers, kitchens, toilet rooms, or basements should not be released to other parts of the house where there are residents. The air must be discharged directly outside and the air outlet of the clothes dryer must be free of particulates and gas. The basement should not be used as a fresh air source in the ventilation system (Mao, Qi, Tan, & Li, 2017).

Every exterior wall, door, roof component, and window must be free from moisture and water resistant. Drainage systems, such as rain gutters, rainwater collection containers, or exhaust pipes, must always be maintained so as not to become clogged. Paint can act as a leak prevention agent and protector from excessive moisture. Paint is also used as a coating on the surface of the wood so it is not easily weathered and attacked by termites. The interior and exterior of the house should be covered by carpets, wood, insulators, paper, paint, gypsum, and wall coverings. The coating should prevent excessive or persistent moisture from causing damage to parts of the house. A building material that deteriorates and changes color due to mold or algae must be dried, cleaned, and repaired immediately. Structurally, unhealthy ingredients must be replaced immediately. Removal of moldy building structures must be carried out using the New York City Guidelines or Environmental Protection Agency (EPA) guidelines (Mao, Qi, Tan, & Li, 2017).

House owners must also ensure the construction waste management in their house, such as provide a trash with the option for separation according to the type of waste, so that the potential for recycling can be maximized. House owners must also ensure buildings and the rooms inside them are protected from pests entering the building, so that pest inspections are regularly monitored. Pest attacks should be eliminated in accordance with integrated pest control methods. If the house is rented out, the house owner must provide a written announcement to the occupants, so that chemicals such as pesticides and cleaning agents can be used wisely. In addition, announcements of general information in the form of warning labels must be provided. House owners must also ensure that all electricity, water, gas, and waste management facilities needed to form healthy and safe dwellings are properly installed. During an emergency, residents must understand the evacuation procedure and the easiest way to deal with the emergency (Gero et al., 2019).

Community behavior in Kerinci District, Indonesia, does not reflect these healthy house standards. Sanitation facilities are classified based on clean water supply facilities, black water treatment, and gray water disposal. These facilities must be provided to realize a healthy home. In addition to these facilities, the realization of a healthy lifestyle at home plays an important role in keeping residents in a healthy and fit condition. Respondents revealed that Kerinci District had good clean water facilities. This is because they live in areas close to water sources. However, most of them do not have good black water processing and gray water disposal facilities. Waste bins and waste disposal facilities are not yet available, so people tend to burn their solid waste directly. This is the reason why many houses in Kerinci District are classified as unhealthy (Gero et al., 2019)..

Public Health Analysis

Learning about public health aims can increase the average level of health in certain populations, reduce health inequalities between groups or individuals, and provide equal opportunities for people to achieve adequate health. However, not everyone understands the importance of public health. To realize healthier communities, there is a need for efforts to improve the community health status, one of which is the provision of sustainable drinking water. Water is very important for sustaining life and satisfactory supply (adequate, safe, and accessible) must be available. Increasing access to safe drinking water can produce tangible benefits for health (Gero et al., 2019).

The quality of water in Pondok Village and Bukit Kerman Village tends to be dangerous for health. Water in this region is turbid and frothy and has a poor taste and smell. Several studies have identified ways to breakdown turbid water. People use water for bathing and daily activities. Since ancient times, villages have been built on the banks of rivers. Waste from these villages was thrown into the river to be taken away. Although rivers have the natural ability to cleanse themselves (self-purification), their abilities are limited to the capacity of the environment. As a result of the growing population in the area, the capacity of the river has decreased, reducing the carrying capacity of the river in handling waste. This is what causes the self-purification scheme to

fail. Although the phrase "we all live downstream" is often used to remind the public to use rivers wisely, this expression does not seem to be taken seriously by the locals. Although wastewater from most communities and industries is now routinely treated to remove pollutants, if there is a significant amount of waste deposited in the river, the activity is useless. Herbicides and pesticides used in agriculture and the disposal of water from paddy fields that use hazardous materials can pollute the environment if the water debit increases due to rain, leading to a drop in water quality (Bonmatin et al., 2015).

Poor water quality can cause skin diseases. Wastewater can affect people's health, because it has the potential to cause diarrhea, skin diseases, and malaria (Maryani, Wibowo, & Maysatria, 2020; Naswir et al., 2019). Diarrhea is a major cause of mortality and morbidity worldwide and it is important to make children understand the urgency and pathophysiology of diarrhea. Zinc stimulates the immune response and prevents infection. The research conducted by Khalil et al (2018) also reported that low zinc levels detected in children with the emergence of acute respiratory tract infections and discussed the influence of socio-demographic factors, nutritional status, and health care facilities on the prevalence of ARI. After inflammation, immune cells will be attacked and decrease.

Water quality standards include factors that affect taste, solids in the water, and toxicity. The factors that must be observed include color, turbidity, hardness, iron, manganese, nitrate, alkalinity, pH, dissolved oxygen, and total bacteria. Water must be colorless because the presence of color indicates the level of contamination and the presence of particles indicates turbidity or organic matter in suspension. Organic particles or materials can cause water to become more turbid or muddy. Hardness is caused by calcium and magnesium salts. This condition can cause mud to accumulate in the waterways. Hardness also reduces the effectiveness of soap and disinfectants. Iron (Fe) in contact with oxygen will cause stains in drinking water channels. Recent studies have shown that iron in water does not affect the health of birds, but some iron can form solid particles, such as iron oxide, which can cause problems with piping. Iron bacteria are more likely to develop in water with high iron concentrations. As a result, biofilm buildup occurs, which can promote pathogen proliferation. Manganese (Mg) can form solid particulates that can cause pipelines to become blocked (Zhang,

Cheng, Huan, & Lin, 2019). Nitrates at high concentrations indicate the process of decaying organic materials. High nitrate concentrations also correlate with the presence of high levels of dissolved oxygen that has been used by the decomposition process, so as to reduce the concentration of dissolved oxygen in the water. The level of acidity and alkalinity can be measured by a pH value. A pH of greater than 8 can cause a reduction in water consumption. Alkalinity is influenced by calcium carbonate, bicarbonate, or sulfate. High alkalinity increases the buffer capacity of water, where total solids represent the total amount of solid material in both suspension and solution. Total solids are not directly related to poultry health problems, but the function of equipment and water delivery can be negatively affected by total solids. The amount of toxic compounds will vary depending on other metal elements, but elements such as lead, selenium, and arsenic must remain below 1.0ppm to prevent health problems. Normally, the dissolved oxygen concentration in water of good quality is 8mg/l (Cheng, Huang, Liu, & Zhang, 2019).

Research Limitation

This research is descriptive in nature, so it has not been able to prove the relationship between variables of a healthy home and an individual's health status. Each respondent represents the health conditions of their home, but many factors affect health, including the internal characteristics of a person. In addition, the varying ability of data collection personnel to conduct interviews and observations may have led to measurement bias. However, this was anticipated by conducting training for all data collection personnel before going to the field.

CONCLUSION

In Kerinci District, 92% of houses were categorized as unhealthy. This result shows that the government needs to address regulations that support the reduction of unhealthy houses. Commitment from the government on improving the health levels and living standards of the people is needed to foster a better quality of life. In addition, counseling, a healthy housing program, and healthy lifestyles need to be encouraged, to increase the number of healthy houses in Kerinci District.

CONFLICT OF INTEREST

ACKNOWLEDGMENTS

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