



**Sudan University of Science and Technology**  
**College of Graduate Studies**



**Bio- security and Associated Risk Factors in Khartoum**  
**Poultry farm**

الأمن الحيوي وعوامل الخطر المرتبطة به في مزارع الدواجن بولاية الخرطوم

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## **Abstract**

Poultry represents an important sector in animal's production especially in developing countries. These countries raise poultry to meet food demands and as sources of incomes.

Bio-security and quarantine are integral part of any successful poultry production. Bio-security can be defined as the execution, eradication and effecting management of risk posed by pests and diseases to the economy, environment and human health (Bio-security council 2003).

This study occurs in Khartoum state (Khartoum city – Khartoum Bahry city and Omdurman city) from period May 2014 to May 2015; by using cross-sectional survey studies method.

The purpose of this study is to determine the association of potential risk factor that cause contamination and bio security measures in Khartoum poultry Farms. Questionnaire is used to collect the information about farm characteristics, bio-security measures and husbandry practices on 108 premises (44 layers, 57 broiler farm and 6 farms breeds, 1 are mixing farm).

The data collection is analyzed by using statistical analysis (SPSS) program (frequency table and chi-square). In frequency table appears a number of farms personal are not properly adapted the bio security measure in their farms 49% say yes answer when asked if their farms are affected with a disease pathogen and by using a chi-square.

The most significant risk factors for infection are, distance of farm from the main roads, p-value (.000), type of chicken (.000), distance between the houses (.034), structure of the farm design (.000), farm has all in all out policy (.000), distance to nearest farm (.000), Have different

species (.000), Isolation of diseases bird (.000), the existence of a quarantine area (.012), Hygiene score (.000), Timely vaccination (.000), Pest control (.000). These are the significant risk factors regardless of poultry species involved. Other significant risks factor includes Present of parking (.021), Water washing in gate (.000) Using the disinfection in foot path (.000), Have warning sign (.000), Production personal warring protective clothing (.000), , Protection of bulk feed from wild bird (.000), Cleaning of bulk feed (.000), Cleaning of water system (.000). Factors that are not significantly associated with infection include: Have bulk feed (.083), Use protective cloth and boot to visitor (.124), Number of houses (.256), Management system (.336), Disease affected your farm (.847), Source of water treating (1.00), Workers shower before handling poultry product (.441).

The result suggests that an important factor contributes to rapid early spread of a virus infection among commercial poultry farms during the outbreak and disposal of dead birds via rendering off farm, because of the highly infectious nature of virus and divesting economic impact of outbreaks.

## Arabic Abstract

بسبب نشوء المقاومة ضد العوامل الممرضة بدأ التفكير في استعمال عناصر أكثر أماناً وصديقة للبيئة ولا تؤثر على صحة الإنسان ، وقد أتى الأمن الحيوي كطريقة مثلي لمواجهة تلك المخاطر فتربية الدواجن تقوم على أساس الوقاية وليس العلاج .

الامن الحيوي عبارة عن اجراءات مصممة لحماية حياة الانسان والحيوان، وبالنسبة لتربية الدواجن يمثل الامن الحيوي اجراءات تهدف الي الحد من او منع دخول وانتشار الامراض والنواقل لمزارع الدواجن والقطعان الاخري بالاضافة الي منع تلوث منشآت الانتاج .

هذه الدراسة أجريت في ولاية الخرطوم (الخرطوم – الخرطوم بحري – أم درمان) في الفترة من مايو 4102م حتى مايو 4102م. باستخدام المسح الميداني الشامل.

الغرض من البحث هو تقييم ومعرفة مدى إتزم أصحاب مزارع الدواجن والقائمين عليها بتطبيق إجراءات وإشتراطات الأمن الحيوي والعوامل التي تساعد علي انتشار الامراض والتلوث في مزارع الدواجن، بالاضافة الي الطرق والاساليب المتبعة في تربية ورعاية القطيع الداجني .

وزعت إستمارة الاستبيان على عدد 011 مزرعة (22 مزرعة بياض ، 25 مزرعة لاحم و6 مزارع أمات ، 0 خليط) بغرض جمع المعلومات . البيانات التي جمعت تم تحليلها باستخدام برنامج التحليل الاحصائي (SPSS) . في صورة جداول بيانية تكرارية ومربع كاي ( حيث وجد في الجداول البيانية التكرارية أن هنالك نسبة كبيرة من المزارعين لم يطبقوا إجراءات الأمن الحيوي بالصورة الصحيحة ، لان 24% من المزارع أصيبت بواحدة على الأقل من الأمراض المعدية. أما من خلال مربع كاي وجدت العوامل الاتية : قرب المزرعة من الشوارع الرئيسية  $p\text{-value}(0.000)$  ، المسافة بين المزرعة والمزارع المجاورة والتي تقوم بتربية الدواجن(0.000) ، اصل القطيع(0.000) ، عدد القطيع في العنبر الواحد ، المسافة بين العنابر(0.430) ، تصميم المزرعة(0.000) ، التطعيم الدوري (0.000) ، نظام دخول الكل وخروج الكل في التربية 0(0.00) ، عزل الطيور المريضة (0.000) ، وجود منطقة عزل (0.210) ، الحالة العامة للقطيع (0.000) ، وجود موقف للسيارات (0.120) ، رش الماء والمطهرات عند المدخل الرئيسي للمزرعة (0.000) ، استخدام المطهرات عند مدخل الحظيرة (0.000) ، وجود علامات التحذير (0.000) ، لبس العمال للملابس الواقية (0.000) ، حماية صايلو العلف من الطيور البرية والقوارض (0.000) ، جمع

الطيور النافقة (000)، نظافة صايلو العلف (000)، نظافة أنظمة مياه الشرب (000). كل هذه العوامل علي علاقة بوجود وانتشار المرض داخل القطيع .

العوامل التي لا ترتبط مع وجود أو انتشار الأمراض والتلوث هي : عدد العنابر في المزرعة الواحدة (652)، نظام رعاية القطيع (633)، قيام العمال بالاستحمام قبل حمل المنتجات داخل المزرعة (144)، وجود الصايلو لحفظ العلف (380) . من النتيجة نجد أن التخلص الأمن من الطيور النافقة ذات ضرورة ملحة ، لان الطيور النافقة تؤثر من أهم العوامل التي تساعد علي انتشار الأمراض والتلوث داخل المزرعة وبين المزارع الاخري .

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## **Introduction**

Sudan is one of the world's primary producers of poultry products and poultry is one of the main sources of meat in the country. The economic impact of infectious diseases on the poultry industry is significant. Husbandry practices including bio-security measures, poultry species and rearing scale vary between different poultry raising system and understanding these practices is important for implementing preventive measures. Therefore, the risk factors that affect the dynamics of infectious disease transmission between different birds and across bird species need to be identified. The interaction of domestic poultry with other animals, particularly with wild birds has been recognized as a possible source of avian disease in domestic flocks. It may also allow the disease to be transmuted from domestic poultry back to the wild bird population.

Bio- security can be defined as the exclusion, eradication and effecting management of risks posed by pests and diseases to the economy, environment and human health (Bio- Security Council 2003).

Risk management of biological hazards such as pests, pathogens and diseases can broadly be divided into action which: Take place before the biological hazard has materialized (preventive measures). Take place during an outbreak (eradication or control ) and. Aim at reducing the consequences in the presence of the hazard (control or adaption).However, bio-security is a weakest link public good, where the total amount of protection approximately equals the level of the weakest provider (Cons Ecol 2002-6-1).

New birds represent a great risk to bio-security because their disease status is unknown. They may have an infection or be susceptible to an infection that

is already present in birds that appear normal (healthy carries) on your farm (Joan S. Jeffrey 1997).

Poor or absent disease control strategies and in adequate management practices result in high levels of baseline mortality due to predators (e.g. rodents – snakes- small carnivores) or infections disease (e.g. New castle Disease (ND), Salmonellosis, Gumboro disease, fowl typhoid). (Biwa's PK. Uddin GM. Royk. Debnath NC 2008))

Virtually all veterinarians working in the poultry industry and international agencies agree that farms practicing high level bio-security are likely to be less infected than those with poor bio-security, at least at the beginning of an outbreak in particular area. Farm bio-security practices course abroad rang of measures there have been divided into three categories (Shan, 1997): Conceptual, including these choice of location for farm, structural covering the physical facilities, such as netting to protect against entry of wild birds. Operational, covering the work procedures that farm staff and visitor are expected to follow.

Farm bio-security measures lend themselves to methods based on HACCP type management. HACCP is based around identification of key hazards and determining critical control point along the production pathway (Grimes and Jackson, 2001).

**Objective:-**

- To prevent the introduction of infectious disease agents to poultry farm.
- To prevent the spread of disease agents from an infected area to an uninfected area.
- To minimize the incidence spreads of micro organism of public health, this is very significan

## CHAPTER ONE

### 1. Literature Review:

#### 1-1: Back ground:

The term (poultry) covers a wide variety of birds of several species. The term is relevant whether the birds are alive or dressed. It includes chickens, turkeys, ducks, geese, swans, guineas, pigeons, peafowl, ostriches, pheasants, and other game birds. Poultry farming means raising various types of domestic birds commercially for the purpose of meat, eggs and feather production, the most common and widely raised poultry birds are chicken.

(Compassion in world farming – poultry, August 26, 2011)

#### 2- Various methods of poultry farms:-

World watch institutes described that about 74% total poultry meat and 68% of total poultry eggs produced from intensive poultry farming method (State of the world 2006 world watch p-26 ), free range farming method is the other alternative method of intensive poultry farming, There are some basic differences between intensive and free range poultry farming, intensive poultry farming method is high efficient system which saves, land, feed, labor and other resources and increases production., in this system the poultry farming environment is fully controlled by the farmer (Food Animals production practice and drug, February 28, 2016).

#### 2-1- Layer poultry farming:-

The poultry birds which are raised for egg production are called layer poultry. Commercial hen generally starts laying eggs at the age of 16 — 20 weeks. They start laying eggs regularly at their 25 weeks of age after 70 -72 weeks of age egg production of layer poultry get reduced for commercial

layer poultry farming; producers generally keep the hens for 12 months from their first laying period. And then sell them for slaughter purpose.

(Compassion in world farming – Egg laying hens, August 26, 2011)

### **2-2- Free Rang Farming:-**

Free range poultry farming means providing freely rearing facilities to the poultry birds for certain period of a day.

Although they are night to kept inside the houses at night to keep them free from predators and adverse weather, in free rang farming method the poultry birds generally room freely throughout the whole day ,which means they spent half of their life outside the houses.

In this system the poultry birds can be eviction of predators easily and may caught various types of diseases (European Union Regulation for marketing standard for eggs- page 25- August 26, 2011).

### **2-3- Organic Method:-**

Organic layer paltry rearing system is also another type of free rang farming system. But the main differences between the two systems are, in free range farming method a large numbers of poultry birds are raised together but in organic method certain species of poultry bird are raised in small group with low tock density (Soil Association standard, Dec 5, 2011).

- Yarding poultry farming method is a method in which cows and chickens are raised together. The farmer makes a fence in his yard and keeps all the poultry birds and cattle there together.

### **2-4- Battery cage method:**

Battery cage layer poultry rearing method is of a very common method used in many canaries. In this system usually small sized metal cages are used. Every cages can accommodate about 3 to 6 heats the walls of

the cages are generally made of mesh or solid metal and the floor is made of stopped wire mesh which allow the feces to drop down. When the hens lay eggs, all the eggs gather in the eggs collecting conveyor belt of the cage. In this system food is provided in front of the hens by along bisected metal or plastic pipe and water served to them by using over head nipple system. The cages are arranged in long rows in one above a mother system (VEGA Laying hens, free rang and bird flu – July6, 2007). The main benefit of battery cage are listed below:- - It is very easy to care for the birds.

- Very easy to collect eggs.
- Cleaner eggs.
- Requires less feed to produce eggs.

Thousands of hens may be housed in specific floor space of the house.

- The birds suffer less by internal parasites.
- Labor cost is very low.

### **2-5- Furnished cage method:-**

Furnished cage method is a developed version of battery cage system; in this system the hens get more spaces and facilities than battery cage system (Ecologist, September 2011-January22, 2012).

### **2-6- Broiler poultry farming:-**

The poultry birds which are raised for commercial meat production are called broiler. By using modern farming methods broiler chickens become suitable for consumption within their 5 to 6 weeks of age this type of poultry houses are well equipped with mechanical system for delivering the food and water to the poultry birds (Animal welfare for broiler chickensJune21,2012 ).

### **2-7- Free rang method:-**

In free rang broiler farming methods the broilers are kept like in free rang layers. The broiler breeds which grow slowly (takes more than 8 weeks for reaching slaughter weight) are suitable for raising in this system.

(Compassion in world farming poultry, August 26-2011).

### **2-8- Organic farming:-**

Organic farming method is almost the same as free rang farming system. But the main deference is that, in organic farming method the birds are not allowed for randomly using in food or in water medications or in other food additives and synthetic amino acid. This system is very suitable for the poultry breeds which reach slaughter weight slowly (around 12 weeks) ,(Compassion in world farming- Meat chickens, August26-2011).

### **3-poultry production bio-security:**

#### **Objective:**

- To prevent the introduction of infectious disease agents to poultry.
- To prevent the spread of disease agents from an infected area to an uninfected area.
- To minimize the incidence and spread of microorganisms of public heath significance.
- Bio-security and quarantine are integral parts of any successful poultry production system. Bio-security refers to those measures taken to prevent or control the introduction and spread of infection agents to fluke. Such clinical or subclinical disease significantly reduces the productivity, profitability and long term financial viability of poultry operation.

Individual producers and companies may wish to develop an enhanced bio-security manual; which should never the less in corporate these



minimum standards in addition to any specific company or industry sector requirements: Major routes for disease and pathogen transmission:

1/ Poultry:- Transfer of birds from production area to production area.

- Dead bird disposal.

2/ other animals:

- Wild birds.

- Feral and domestic animals including other livestock and pets. - Rodents  
.rats mice - Domestic birds.

3/people:

- Farm personnel and family members living on site.

- Contractors, maintenance personnel, and high boots and service person  
visitors .1

- Disease can be transmitted by for example .hands, boots, clothing, and  
dirty hair.

4/ Equipment

5/ Vehicles

6/ Air

- Transmission as an aerosol or dust.

7/ water supply:

Water may become contaminated with feces from contacts with avian or  
other animal species.

8/feed:

Feed may be contaminated by the raw materials used in post production and  
during transport, or by exposure to rodents and birds on the property.  
Bacteria and mould in poor quality or damaged feed may also be a concern.

## **4-Levels of bio-security:**

### **4-1 Level 1- Routine bio-security procedures:**

These procedures should be implemented and followed on a daily basis. They give high degree of assurance that diseases and pathogens will not be carried into poultry production areas and will reduce the risk of transmission between production areas .these should be seen as a minimum requirement.

#### **1. Documentation and training:**

Each production facility must keep a copy of the national farm bio-security manual. Staff must be provided with training in the relevant parts of the manual and such training is to be recorded.

#### **2. Facility standards:**

The production area must have a perimeter fence or Otherwise well defined boundary (e.g creek, vegetation) establishing a cleverly defined bio-security zone.

If livestock graze the property then the production area must have a stock proof fence, a sketch or map of the layout of the property, showing the production area, sheds, ranges access roads and gates must be created and kept up to date.

The main entrance to the production area must be capable of being closed to vehicle traffic and must display appropriate signage including bio security area no entry unless authorized.

There must be a parking area for vehicle not entering the production area; there also must be a change area away from sheds which Clean protective clothing and boots provided.

Entry to sheds must only be made through entrances with foot bath containing a suitable disinfectant used in accordance with company or manufacturer's instructions and changed on a regular basis.

Dead bird disposal method must conform to applicable environmental compliance requirements'.

All poultry housing must be designed and maintained so as to prevent the entry of wild birds and limit the access of vermin as far as is practical.

**2.1 Land scope** .trees and shrubs should be selected to minimize wild bird attraction particularly in free range operations .The area around sheds must be kept free from debris and vegetation.

**2.2 Drainage** .the production area should be adequately drained to prevent accumulation and stagnation of water likely to attract water fowl.

**2.3** An appropriate vermin control plan must be developed and implemented including orders of foxes, wild dogs and cats.

**2.4 A baiting program for rodents must be** implemented where a risk assessment deems this necessary (e.g live rodents, droppings. nests)

**2.5 Drinking water** for poultry as well as cooling water used in poultry sheds must meet appropriate water standards. Treated water supply must be kept in a closed system from the point of treatment to the drinker.

**2.6 Sheep and other domestic stock must not have** access to the production area at any time except under the specific condition stipulated 2.2 above dogs and cats must not enter sheds unless dogs are part of the flock security strategy.

**2.7 Only commercially produced** avian species are to be kept in the production area and no other avian species.

**2.8 If more one commercially** produced avian species is kept in the production area the species should be housed and managed separately.

**2.9 Feeding system** must wherever possible be closed to ensure that feed in silos and •feed delivery systems are protected from access and contamination by wild birds and rodents.

Where bird weighing is practised it must be carried out using the production areas own weighing frames and scales.

### **3. Personnel standards and procedures.**

#### **3.1 Production personnel.**

Production area personnel or any person residing on the property must not have contact with any other poultry. Production area personnel must wear laundered clean clothes each day at the commencement of their work.

**3.2 Company service personnel** company service personnel by necessity make multiple production visits on a single day.

Protective clothing and food wear could be worn in the production area. Visitors should always be made from clean areas.

#### **3.3 Repair and maintenance.**

Repair and maintenance contractors have had contact with poultry or other birds that day or keep birds at their home must not enter sheds. Routine maintenance should be conducted where possible between batches prior to final disinfection where batch system is practiced. Tools taken into the production area must be cleaned before entry into sheds and must be free of dust and organic matter.

**3.4 Contractors** suppliers: Other service personnel and visitors the visits must be approved by the manager before visitors may enter sheds and rang. This requirement also applies to vaccination crews. Visitor logs — are cord must be kept of all visitors to the poultry sheds and poultry ranges including company personnel .any authorized visitor must not enter the sheds unless they have had a shower and changes clothes and boots and wearing clean cloth, all visitors should park their vehicles outside the production area.

### **3.5 Requirements for specified movements:**

Pick up of polity pick up caws should work from youngest to oldest-or all the young birds or all the olds on shift basis . Day old chick delivery trucks and dollies must be cleaned and disinfected each day. litter delivery and collection of used litter trucks carrying must be cleaned and disinfected between production area .Other deliveries (e.g gas and feed drives ) must not enter sheds .There must be system for tracing movements of delivery personnel.

### **3.6 Entry procedures for bird sheds and rages:**

Any person interfering sheds must sanities hands and use foot baths before entering each shed. Soles of boots must be scraped before disinfecting in the foot baths .Ahmad sanitizer must be available at all shed entrances and must be used before entering.

## **4. Operational standards:**

### **4.1 Water supply:**

The use of a suitable treated water supply is critical to achieving good bio-security; for chlorinated water supply the treatment must achieve a level of 1.0 — 2.0 parts per million ( PPM) free available chlorine (FAC) when chlorinated water .there must be a minimum of 2hours contact time between chlorine and water prior .Testing must be

conducted and recorded daily. The effectiveness of water treatment systems including alternative system (e.g ultraviolet) drinking water quality must be maintained at standard suitable for use in livestock.

**4.2 Vermin baiting.** Bait stations must be checked weekly and fresh baits lay as required. A record should be kept of each in section and vermin activity noted.

**4.3 Cleaning and ground maintenance.** Feed spills must be cleaned up as soon as practicable. Grass on and around the production area must be kept cut .foot bathe must be inspected daily “(e.g for excessive organic matter) .on free rang production sites.

- Manure deposits outside the hatch opening must be removed after each batch. Ramps to free rang area must be scraped and cleaned after each batch. The production area must be adequately drained to prevent accumulation and stagnation of water.

**4.4 Record keeping.**

Bird mortality must be recorded on regular basis to assist monitoring for any annual animal health problems .a record of bird movements must be maintained to facilitate tracing in case of an animal health or food safety concern.

**4. In of batch procedure.**

After the final pick up, the shed must be kept closed except during litter removal after washing and disinfecting. Shed doors must be kept closed .litter and manure must not be stock piled in the production area.

**5. Species specific additional bio-security requirements** additional requirement that must be followed by all those producing a particular species of poultry should be added

**4-2 LEVEL2- High risk bio-security procedure:**

In the event of an outbreak of an emergency disease or serious endemic diseases high risk bio-security procedures will be implemented.

1. **Action plan:** For suspected emergency animal disease each owner must establish and document clear guide lines regarding the circumstances when an emergency animal disease cleft should be raised.

2. **Facilities:**

Gates must be kept locked .shed doors must be locked at night: facilities for the cleaning and disinfection of equipment on and off the production area must be placed.

3. **Personnel:**

No visitors are to enter the production area unless an absolutely essential. Repairs and maintenance no routine work only emergency work to be carried out.

4. **Operational:**

Essential visits head to —toe shower before and after visit a complete change of clothes foot wear. Hair covering and breathing protection is required. Any vehicle which must enter the property must be washed and disinfected at the wash pad before and after going onto the property. No birds' litter to be moved on or off properties until disease status is clarified, if a major outbreak should occur. Further measures will be stipulated by the processor and / or the state's chief veterinary officer.

5. **Standard operation procedures (SOPS):**

Standard operating procedures will be available for any specific outbreak of on emergency animal disease from animal health.

**5 Farm bio-security :-**

If a farm becomes infected with a virus disease, it is an indication of a mismatch between the measures implemented and the risk of incursion. This

does not necessarily indicate that the farmer has failed to implement appropriate bio security measures as infection can sometimes occur even with well. Designed and properly operated system especially in case of outbreak (DEFRA, 2007). The following notes provide information on the bio security measure implemented in the different production system, and factors affecting their vulnerability.

### **5-1 System1:**

By definition , system 1 farms practice high, level bio security system 1 operations are often large multiform, multi barn enterprises and as consequence of their size, have more inputs (and outputs) than smaller farm (Otte, etal, in FAO, 2007 b). This allows greater control over inputs.

Many of the companies operating system 1 farms work in multiple countries and this can result in trans border movement of poultry, some system 1 farms house also attempted to improve the bio-security of system 3 and 4 flocks in the vicinity of the enterprises, to minimize the level of hazard in the area around their poultry houses.

### **5-2 System 2:-**

Bio-security measures for system 2 vary considerably, in line with the broad definition of this system (farms that practice (medium to high level) bio-security). Well managed farm will have a similar risk profile to system 1 farms, where those at the lower end of the classification are likely to represent a greater risk. This is compounded if the farm sells poultry to multiple traders, does not practice all in all- out management, or has direct links with poorly managed live poultry markets.



### **5-3. System 3:-**

System 3 farms are generally considered to be the most vulnerable to virus incursion, especially large system 3 farms.

Not only do these farms employ minimal bio-security measures .They are also most likely to encounter virus through the marketing chain or potentially via contact with wild birds.

System 3 farm are found in many locations — urban, pen-urban and rural. Some of these have developed from small, system 4 backyard flocks, and occupy the same site and use the same inappropriate facilities as the original flock. Many out breaks have occurred in system 3 farms (Merris and Jackson, in FAO, 2006 b)

### **5-4 System 4:-**

System 4 farms differ little from system 3 farms except for the scale of the enterprises and the limited commercial sale of poultry in the farmer, most of which is conducted locally Although system 4 farms often implement few formal bio-security measures .Major risks for system 4 producers include human traffic in villages wandering poultry and wild birds

## CHAPTER TWO

### Material and Method

#### 1: Study Area:-

Three cities were selected for the study. These three cities were chosen for a comparative study because they represented different poultry farming with different economic development and presence of commercial poultry industry. These three cities are:

A / Bahri city include ( Shambat – Afhalfaya- Nile east- Alkadaro) B/ Omdurman city (Western Omdurman ) and C/ Khartoum city (Soba area – Jabal Awlia – Teiba Alhasanab and also Algetaina – Aljadeed Aklthoura ).

#### 2: Data Collection:-

This study starts from May 2014 to February 2015 and involved 108 poultry farm 44 layers- 57 Broilers and 6 breeds and I mix.

A questionnaire is used to collect information about the farm bio-security. The questionnaire contains 46 question focuses on general flock health and bio- security practices and designed to obtain information on: General information to farm. Bio-security measure related poultry. Bio-security measure related to people. Bio-security measure related to vehicles. Bio-security measure related to water and Bio- security measure related to bulk feed. The analysis occurs by using SPSS (the statistical package for social sciences for Window) practice. I performed a systematic literature search using the United States National library of medicine and the National Institute of health poultry associated with (bio-security risk factor knowledge attitude or practice to describe bio- security practice).

## CHAPTER THREE

### 3-1: Results

The questionnaire is distributed to 108 poultry farm (58 broiler farm, 44 layers and 6 farm is breed) in Khartoum State to collect information about the farms management and bio-security practices.

The collected information analyzed by using the SPSS IBM computer practices. The results are as follows:

By using frequency tables to analyses the data, firstly the data divided into five categories as : a/ General information to farm b/ Bio-security measure related to people d/ Bio-security measure related to vehicle c/ Bio-security measure related to water e/Bio-security measure related to poultry . f / Bio-security measure related to bulk feed .

#### a/ General information to farm :

**Table (1) farms design**

	Frequency	Percent	Valid percent	Cumulative percent
Close	57	52.8	52.8	52.8
Semi close	27	25.0	25.0	77.8
Open	24	22.2	22.2	
Total	108	100	100	100.0

In this table 57 farms was close design about (52.8%) from total , 27 farm was semi close (25.0%) . and 24 farms was open design (22.2%) from total .

**Table (2) Distance of farm to main roads**

	Frequency	Percent	Valid percent	Cumulative percent
Near	73	67.6	67.6	67.6
Far	35	32.4	32.4	100.0
Total	108	100.0	100.0	

In this table 73 farms had distance to main roads (67.6%) and 35 farms had distance far to main roads about (32.4%) from total.

**Table (3) Present parking area**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	26	65.0	65.0	65.0
	no	14	35.0	35.0	100.0
	Total	40	100.0	100.0	

In this table present parking area, 26 farms have parking area, about (65%) from total farm and 14 farm have not (35%) from total farm.

**Table (4) Water washing in gate**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	6	15.0	15.0	15.0
no	34	85.0	85.0	100.0
Total	40	100.0	100.0	

In this table about 6 farms have washing water in gates (15%) from the total farms and 34 farms do not washing water in gate about (85%) from total .

**Table (5) The number of houses on farm**

	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 3 houses	43	39.8	39.8	39.8
About 3 houses	36	33.3	33.3	73.1
More than 3 houses	29	26.9	26.9	100.0
Total	108	100.0	100.0	

In this table, the number of houses in 43 farms is less than three houses, that about 39.8% and 36 farms that contain number of houses about three houses, 33.3% from the total farm whenever 29 farms have more than three houses.

**Table (6) Type of farm chicken**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	broiler	58	53.7	53.7	53.7
	layers	44	40.7	40.7	94.4
	breed	6	5.6	5.6	100.0
	Total	108	100.0	100.0	

In this table About 58 farms are broiler layers type (40.7%), while 6 farms type (53.7%) and 44 farms are breed type(5.6%)

**Table (7) The number of chicken in one houses**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<10000	42	38.9	38.9	38.9
	>10000	66	61.1	61.1	100.0
	Total	108	100.0	100.0	

In these table number of chicken in one houses , present about 42 farms have number less than 10000 in one houses (38.9%) . and 66v farms have number more than 10000 chick in one houses (61.1%).

**Table (8) The median flock chicken size on farm**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid <10000	30	27.8	27.8	27.8
>10000	78	72.2	72.2	100.0
Total	108	100.0	100.0	

In this table, 30 farms contain median flock chicken size less than 10000 chicks, about 27.8% from total; while 78 farm have median flock chicken size more than 10000 chick, (72.2%).

**Table (9) The distance between the houses**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid <50m	65	60.2	60.2	60.2
>50m	43	39.8	39.8	100.0
Total	108	100.0	100.0	

In these table distance between the houses, about 65 farms, the distance between its houses less than 50 meters. (60.2%) and 43 farms contain.

**Table (10) Structure of farm design**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid well	98	90.7	90.7	90.7
Not well	10	9.3	9.3	100.0
Total	108	100.0	100.0	

In the table about structure of farms design, 98 farms are well designed, about 90.7%, 10 farms are not well designed 9.3% from the total number of the farms.

**Table (11)The origin of chicks**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid commercial	95	88.0	88.0	88.0
Hatch ring in farm	9	8.3	8.3	96.3
imported	4	3.7	3.7	100.0
Total	108	100.0	100.0	

In this table 95 farm are commercial chicks origin, (88%) from total farms 9 farms , the chick are hatch ring in farm , (8.3%) . and 4 farms are imported the chicks , (3.7%) .



**Table (12) Farm has all in all out policy**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	95	88.0	88.0	88.0
	no	13	12.0	12.0	100.0
	<b>Total</b>	<b>108</b>	<b>100.0</b>	<b>100.0</b>	

In this table, 95 farms has all in all out policy practice, about 88% from total farm and 13 farms hasn't all in all out policy practices , (12%) .

**b/ Bio security measure related to people:**

**Table (13) Have veterinarian super vision**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	101	93.5	93.5	93.5
	no	7	6.5	6.5	100.0
	<b>Total</b>	<b>108</b>	<b>100.0</b>	<b>100.0</b>	

. In this table, 101 farms have veterinarian super vision; about 93.5% and 7 farms haven't veterinarian super vision, (6.5%)

**Table (14) Record keeping**

valid	Frequency	Percent	Valid Percent	Cumulative Percent
yes	99	91.7	91.7	91.7
no	9	8.3	8.3	100.0
Total	108	100.0	100.0	

This table presents the record keeping, 99 farms have record keeping, (91.7%) and 9 farms haven't record keeping, (8.3%).

**Table (15) Have slaughter houses**

valid	Frequency	Percent	Valid Percent	Cumulative Percent
yes	23	21.3	21.3	21.3
no	85	78.7	78.7	100.0
Total	108	100.0	100.0	

In this table, 23 farms have slaughter houses, (21.3%) and 85 farms hasn't slaughter houses, (97.7%).

**Table (16) Use farm specific protective clothing and boots to visitor**

valid	Frequency	Percent	Valid Percent	Cumulative Percent
yes	46	42.6	42.6	42.6
no	62	57.4	57.4	100.0
Total	108	100.0	100.0	

In this table, 46 farms can use farm specific protective clothing and boots to visitor, (42.6%) and 62 farms can't use farm specific protective clothing and boots to visitor, 57.4% from the total.

**Table (17) Have warning sign**

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	12	11.1	11.1	11.1
no	96	88.9	88.9	100.0
Total	108	100.0	100.0	

This table, have warning sign, 12 farms has warning signs; about 11.1% from the total and 96 farm hasn't warning sign, (88.9%).

**Table (18) Worker be shower before handling poultry product**

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	58	53.7	53.7	53.7
No	50	46.3	46.3	100.0
Total	108	100.0	100.0	

In these table , 58 farms , the worker be shower before handling poultry product , (53.7) . and 50 farms , the cant be shower before handling poultry product , (46.3%).

**Table (19) Production personnel wearing protective clothing .**

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
yes	81	75.0	75.0	75.0
no	27	25.0	25.0	100.0
Total	108	100.0	100.0	

In these table , 81 farms present production personnel wearing protective cloth , (75%) . and 27 farms , the production personnel cant warring protective

**c/ Bio-security measure related to water : Table**

**(20) Source of water**

	Frequency	Percent	Valid percent	Cumulative percent
<b>weel</b>	<b>108</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

In this table all farms use the wheels as a source of water

**Table (21) Source of water treatise**

	Frequency	Percent	Valid Percent	Cumulative Percent
<b>Valid yes</b>	<b>54</b>	<b>50.0</b>	<b>50.0</b>	<b>50.0</b>
<b>no</b>	<b>54</b>	<b>50.0</b>	<b>50.0</b>	<b>100.0</b>
<b>Total</b>	<b>108</b>	<b>100.0</b>	<b>100.0</b>	

In the table , source of water treatises . 54 farms can treating the water sources , (50%) and 54 farms cant treated the water sources , (50%) .

**Table (22) Cleaning water system after**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid after 2 week	60	55.6	55.6	55.6
after 3 week	37	34.3	34.3	89.8
non	8	7.4	7.4	97.2
daily	3	2.8	2.8	100.0
<b>Total</b>	<b>108</b>	<b>100.0</b>	<b>100.0</b>	

In this table, 60 farms can cleaning water system after two weeks, about 55.6% . 37 farms can cleaning the water system after three weeks, (34.3%) and 8 farms cant cleaning the water system, (7.4%) . while 3 farms are treating water system daily.

**d/ Bio-security measure related to vehicle :**

**Table (23) Present of parking**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	66	61.1	61.1	61.1
no	42	38.9	38.9	100.0
<b>Total</b>	<b>108</b>	<b>100.0</b>	<b>100.0</b>	

In this table, present of parking, 66 farms has parking area, (61.1%) and

42 farms haven't parking areas (38.9%).

**Table (24) Washing Water in gate**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	13	12.0	12.0	12.0
	no	95	88.0	88.0	100.0
Total		108	100.0	100.0	

In this table, 13 farms have washing water in gate, (12%) and 95 farms hasn't water washing in gate (88%)

**Table (25) Present fence**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	44	40.7	40.7	40.7
	no	64	59.3	59.3	100.0
Total		108	100.0	100.0	

In this table, present fence. About 44 farms has fences, (40.7%) and 64 farms hasn't fence, (59.3%).

**e/ Bio-security measure related to poultry :**

**Table (26) Have different species**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	24	22.2	22.2	22.2
no	84	77.8	77.8	100.0
Total	108	100.0	100.0	

This table has different species, 24 farms has different species, (22.2%)  
84 farms haven't different species, (77.8%).

**Table (27) Present of quarantine area**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	67	62.0	62.0	62.0
no	41	38.0	38.0	100.0
Total	108	100.0	100.0	

In this table, 67 farms has quarantine area, (62%) and 41 farms hasn quarantine areas, (38%).

**Table (28) Isolation of diseases birds**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	104	96.3	96.3	96.3
no	4	3.7	3.7	100.0
Total	108	100.0	100.0	

This table presents the isolation of disease birds, 104 farms can isolation of disease birds, (96.3%). and gust 4farms cant isolated the diseases birds, (3.7%).

**Table (29) Other commercial poultry in farm**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	6	5.6	5.6	5.6
no	101	93.5	93.5	99.1
Total	108	100.0	100.0	100.0

In this table, 6 farms have other commercial poultry in it, about 5.6%. 101 farms hasn't other commercial poultry, (93.5%)



**Table (30) Collection of dead bird**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Once daily	66	61.1	61.1	61.1
Twice daily	41	38.0	38.0	99.1
Total	108	100.0	100.0	100.0

This table presents the collection of dead birds, 66 farms are collection of dead bird once daily, (61.1%) and 41 farms are collected the dead bird twice daily (38%).

**Table (31) Dead bird disposal method**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Burning	96	88.9	88.9	88.9
Left thrown away	12	11.1	11.1	100.0
Total	108	100.0	100.0	

In this table, 96 farms disposed the dead birds by using the burning method, (88.9%) and 12 farms disposed the dead birds by left thrown away , (11.1%)

**Table (32) Have mortality record**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	101	93.5	93.5	93.5
no	7	6.5	6.5	100.0
Total	108	100.0	100.0	

This table presents the mortality record, 101 farms have mortality records, (93.5%) and 7 farms have not mortality records, (6.5%).

**Table (33) Hygiene score**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid good	100	92.6	92.6	92.6
bad	8	7.4	7.4	100.0
Total	108	100.0	100.0	

In this table, 100 farms have good hygiene score, (92.6%) and 8 farms have bad hygiene score, (7.4%).

**Table (34) Security against wild bird entry**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	94	87.0	87.0	87.0
no	14	13.0	13.0	100.0
Total	108	100.0	100.0	

In this table, 94 farms have security against wild bird entry, (87%) and 14 farms cant security against wild bird entry, (13%).

**Table (35) Have other domestic livestock on farm**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	22	20.4	20.4	20.4
no	86	79.6	79.6	100.0
Total	108	100.0	100.0	

In this table, 22 farms have other domestic livestock on farm, (20%) and 86 farms have not other domestic livestock on farm, (76.6%).

**Table (36) Management system**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid extensive	49	45.4	45.4	45.4
intensive	59	54.6	54.6	100.0
Total	108	100.0	100.0	

This table presents the management system, 49 farms are extensive management system, (45.4%) and 59 farm are intensive management system, (54.6%).

**Table (37) Litter and manure disposal method**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Burning	2	1.9	1.9	1.9
Use as fertilizer	18	16.7	16.7	18.5
Sale	88	81.5	81.5	100.0
Total	108	100.0	100.0	

In this table, 2farms are disposal from litter and manure by burning method (1.9%). 18 farms are disposal from litter and manure by use as fertilizer, (16.7%) and 88 farms are disposal from litter and manure by sale it, (81.5%)

**Table (38) Pest control**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid As routine	75	69.4	69.4	69.4
After outbreak	33	30.6	30.6	100.0
Total	108	100.0	100.0	

In the table pest control, 75 farms are routinely pest control, (69.4%) but 33 farms are pest control after outbreak, (30.6%).

**Table (39) Timely vaccination**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	106	98.1	98.1	98.1
no	2	1.9	1.9	100.0
Total	108	100.0	100.0	

In this table, timely vaccination, 106 farms are timely vaccinated, (98.1%) and 2 farms are not vaccinated, (1.9%).

**Table (40) Disease affected your farm**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	53	49.1	49.1	49.1
no	55	50.9	50.9	100.0
Total	108	100.0	100.0	

In this table, 53 farms are affected by disease, about 49.1% and 55 farms aren't affected by disease, (50.9%) .

**F / Bio- security measure related to bulk feed:**

**Table (41) Have bulk feed**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	45	41.7	41.7	41.7
no	63	58.3	58.3	100.0
Total	108	100.0	100.0	

In the table have bulk feed, 45 farms has bulk feed, about 41.7% and 58 farms hasn't bulk feed 58.3% from total farms

**Table (42) Protection of bulk feed from wild bird and rodent**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid yes	96	88.9	88.9	88.9
no	12	11.1	11.1	100.0
Total	108	100.0	100.0	

In this table, 96 farms have protection of bulk feed from wild birds and rodents, (88.9%) . and 12 farms cant protection of bulk feed from wild birds , (11.1%) .

**Table (43) Cleaning bulk feed stores after**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Two month	10	9.3	9.3	9.3
Three month	30	27.8	27.8	37.0
Non	68	63.0	63.0	100.0
Total	108	100.0	100.0	

In this table , 10 farms are cleaning the bulk feed stores after two month ,(9.3%) 30 farms are cleaning bulk feed stores after three month, (27.8%) and 68farms aren't cleaning the bulk feed stores, (63%).

Chi-Square:

The following .farm design. Distance to main roads. Distance to nearest farm. Number of houses. Type of chicken. Number of chicken in one houses. Median flock size on farm. Distance between the houses

Structure of farm design. Chick origin. Farm all in all out. Has veterinarian. Record keeping. Have slaughter houses.

All is significance associated

Test Statistics

	Farm design	Distance to main roads	Distance to nearest farm	Number of houses	Type of chicken	Number of chicken in one houses	Median flock size on farm	Distance between the houses	Structure of farm design	Chick origin	Farm all in all out	Has veterinarian	Record keeping	Have slaughter houses
Chi-square	18.500 <sup>a</sup>	13.370 <sup>b</sup>	41.167 <sup>a</sup>	2.722 <sup>a</sup>	40.222 <sup>a</sup>	5.333 <sup>b</sup>	21.333 <sup>b</sup>	4.481 <sup>b</sup>	71.704 <sup>b</sup>	145.389 <sup>a</sup>	62.259 <sup>b</sup>	81.815 <sup>b</sup>	75.000 <sup>b</sup>	35.593 <sup>b</sup>
df	2	1	2	2	2	1	1	1	1	2	1	1	1	1
Asymp. Sig.	.000	.000	.000	.256	.000	.021	.000	.034	.000	.000	.000	.000	.000	.000



The following factor: Have different species. Present of quarantine area. Isolation of diseases bird. Other commercial poultry on farm. Collection of dead bird. Dead bird disposal method. Have mortality record. Hygiene score. Security to wild bird entry. Have other domestic live stock. Management system. Litter and manure disposal method. Pest control. Timely vaccination. All are significance associated but disease affected your farm is not significance associated.

### Test Statistics

	Have different species	Present of quarantine area	Isolation of diseases birds	Other commercial poultry on farm	Collection of dead bird	Dead bird disposal method	Have mortality record	Hygiene score	Security against wild bird entry	Have other domestic live stock	Management system	Litter and manure disposal method	Pest control	Timely vaccination	Disease affected your farm
Chi-square	33.333 <sup>a</sup>	6.259 <sup>a</sup>	92.593 <sup>e</sup>	176.369 <sup>b</sup>	59.722 <sup>b</sup>	65.333 <sup>a</sup>	81.815 <sup>a</sup>	78.370 <sup>a</sup>	59.259 <sup>a</sup>	37.926 <sup>a</sup>	.926 <sup>a</sup>	116.222 <sup>a</sup>	16.333 <sup>a</sup>	100.148 <sup>a</sup>	.037 <sup>a</sup>
df	1	1	1	2	2	1	1	1	1	1	1	2	1	1	1
sig.	.000	.012	.000	.000	.000	.000	.000	.000	.000	.000	.336	.000	.000	.000	.847

The present of parking and water washing in gate are significance associated

### Test Statistics

	Present of parking	Water washing in gate
Chi-Square	5.333 <sup>a</sup>	62.259 <sup>a</sup>
df	1	1
Asymp. Sig.	.021	.000

The using disinfection in foot path. Use protective cloth and boot to visitor. Have warning sign. Present fence. Production personnel wearing protective clothing.

All is significance associated. But the worker be shower before handling poultry product is not significance associated.

### Test Statistics

	Using disinfection in footpath	Use protective cloth and boot to visitor	Have warning sign	Worker be shower before handling poultry product	Present fence	Production personnel wearing protective clothing
Chi-Square	53.481 <sup>a</sup>	2.370 <sup>a</sup>	65.333 <sup>a</sup>	.593 <sup>a</sup>	3.704 <sup>a</sup>	27.000 <sup>a</sup>
df	1	1	1	1	1	1
Asymp. Sig.	.000	.124	.000	.441	.054	.000

The factors protection bulk feed from wild bird and rodent and cleaning of bulk feed are significance associated .And have bulk feed is also significance associated

**Test Statistics**

	Have bulk feed	Prote ction bulk feed from wild bird and rodent	Cleaning of bulk feed.after
ChiSquare	3.000 <sup>a</sup>	5.33 <sup>a</sup>	48.222 <sup>b</sup>
df	1	1	2
Asymp. Sig.	.083	.000	.000

The factor cleaning of water system is significance associated but the source of water treating is not significance associated .

**Test Statistics**

	Source of water treating	Cleaning of water system
Chi-Square	.000 <sup>a</sup>	78.741 <sup>b</sup>
df	1	3
Asymp. Sig	1.000	.000

The decontamination of equipment and equipment share is significance associated

**Test Statistics**

	Decontamination of equipment	Equipment share
Chi-Square	75.000 <sup>a</sup>	59.259 <sup>a</sup>
df	1	1
Asymp. Sig.	.000	.000

## CHAPTER FOUR

### Discussion

This study identified four characteristics of the management practices and information about the range of bio-security applied for chicken flocks farms in Khartoum State. The aim of the study is to be able to identify the method of poultry management and range of bio-security measures in Khartoum poultry farms. Also to identify the efficiency of bio-security practices to prevent or minimize the disease and contamination spread between the poultry farm.

As expected, bio-security measures, such as footwear precautions and visitor restrictions, were uncommon among the flock owners about 57% yes answer. (just in outbreak period). The possibility to shower before entering production area was uncommon also (46.3%). The lack of possibility to wash hands and shower on the premises can raise the risk of transmitting Zoonotic diseases as Salmonellosis, New castle and other Infectious. The question about the presence of fence (59.3%) say No. Absence of fence allows to enter the infection and spread in farm. And lead to outbreak. And also (14.8%) from the farms do not use foot path in sheds inlets. But (75%) from production personnel wearing protective clothing that can protect the worker from harm or pathogen during work.

About the (11.1%) farm can't protect bulk feed from wild bird – and rodent about (63.0%) not cleaned the bulk feed. All these factors can allow the entering and spreading of diseases in poultry farm.

According to owners' personal opinions, Flock health status was mostly good or excellent. These results can be distorted by the fact that the farm is new or the flock owners may have ignored the questionnaire.

The most frequently reported for post effected disease to farm is Newcastle (ND) Salmonellosis- Coccidiosis- infectious bronchitis (IB) and avian influenza. The total farms affected are (49.1%).

The distances between the poultry farm and other nearest farm mostly less than 2Km (62%) and the distances between the houses farm mostly less than 50 m (60.2%). This can allow the transmuting and spread of diseases between the farm and also between the houses if present deference species or deference ages.

The remaining factor include the present of quadrant in area, isolation of diseased birds, Collection of dead bird, Have mortality record, management system, and pest control. Litter and manure disposal methods all are significance associated to a diseases.

Biological management to the risk factor is very important to avoid the contamination and disease pathogen entering and spread in the propriety. The quarantine area in the production poultry farm is necessary to protect the chick during infection or out brake occur. Also the sources of water must be treated to avoid contamination.

Finally the bio security procedures must be properly adapted in Khartoum poultry farm to achieve best productivity and profitability.

## **Conclusion**

- 1-** The redesign of cost sharing in animal diseases is currently ongoing in the EU.
- 2-** Before we can assert how the rise should be shared or resort to the polluter pays principle.
- 3-** We need to have an idea of how the castes are currently distributed.
- 4-** We investigated the costs paid by the producers for preventive bio-security.
- 5-** Determine the largest cost components and explain the variation on these costs.
- 6-** For broiler producers the main constituent of the costs were preventive medication, pest control and operational hygiene.
- 7-** The total costs per bids are dependent on the annual number of birds. The higher the number of birds, the lower the cost per bird.
- 8-** This impact is primarily due to decreasing labor costs rather than direct monetary costs.
- 9-** Bio security policy formulation should be initiated for poultry raisers to safeguard life and enhance performance and quality of poultry production.

## **Recommendation**

- 1- Our model helps to inform the optimization of public health outcomes that best weigh the balance between public health risk and beneficial economic outcomes farmers.
- 2- Each production facility must keep occupy of the national farm bio – security manual and the staff must be provided with training to minimize the disease and contamination.
- 3- There must chosen veterinarian supervision to the farm.



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# QUESTIONNAIRE ABOUT THE BIOSECURITY AND ASSOCIATED RISK FACTOR IN KHARTOUM POULTRY FARM

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## *a- The general information to farm*

(1) The farm design

a- Close ( )    b- Semi close ( )    c- Open ( )

(2) The distance of farm to main roads a- Nearest

( )    b- Far ( )

(3) Distance to nearest farm a- Less than 2km (

)    b- More than 2km ( )    c- About

(4) The number of houses on farm

A - Less than 3 houses ( )    b- About 3 houses ( )    c- More than 3 houses ( )

(5) Present parking area

a- Yes ( )    b- No ( )

(6) Water washing in gate

a- Yes ( )    b- No ( )

(7) Type of farm chicken

a- Broiler ( )    b- Layers ( )    c- Bred ( )

(8) The number of chicken in one houses

a- <10000 ( )    b- >10000 ( )

(9) The distance between the houses

a- <50 m ( )    b- >50 m ( )

(10) Structure of farm design

a- Well ( )      b – Not well ( )

(11) *The origin of chick*

a- Commercial ( )      b- Hatch ring in farm ( )      c- Imported ( )

(12) *Farm has all in all out policy*

a- Yes ( )      b- No ( )

### *b-Bio-security measure related to people*

(1) *Have veterinarian supervision*

a- Yes ( )      b- No ( )

(2) *Record keeping*

a-Yes ( )      b- No ( )

(3) *Have slaughter houses*

a-Yes ( )      b- No ( )

(4) *Use farm specific protective clothing and boots to visitor* a-Yes ( )      b- No ( )

(5) *Have warning sign*

a-Yes ( )      b- No ( )

(6) *Worker be shower before handling poultry product*

a-Yes ( )      b- No ( )

(7) *Present fence*

a-Yes ( )      b- No ( )

(8) *Production personnel wearing protective clothing* a-Yes

( )      b- No ( )

### *c-Bio-security measure related to water*

(1) *Sours of water*

a-Weel ( )    b- Dam ( )    c- River ( )

(2) *Sours of water treating*

a-Yes ( )    b- No ( )

(3) *Cleaning water system after*

a-Two weeks ( )    b- Three weeks ( )    c- Daily ( )    d-Non ( )

### *d-Bio-security measure related to vehicle*

(1) *Present parking area*

a-Yes ( )    b- No ( )

(2) *Water washing in gate*

a-Yes ( )    b- No ( )

(3) *Using of disinfection in foot path*

a-Yes ( )    b- No ( )

### *e- Bio-security measure related to poultry*

(1) *Have different species*

a-Yes ( )    b- No ( )

(2) *Present of quarantine area* a-Yes ( )

b- No ( )

(3) *Isolation of diseases birds*

a-Yes ( )    b- No ( )

(4) *Collection of dead bird*

a-Once daily ( )    b-Twice daily ( )

(5) *Dead bird disposal method*

a-Burning ( )    b – Left thrown away



(6) *Have mortality record*

a-Yes ( ) b- No ( )

(7) *Hygiene score*

a-Good ( ) b- Bad ( )

(8) *Security against wild bird entry*

A -yes ( ) b- No ( )

(9) *Other commercial poultry in farm* a-Yes ( )  
b- No ( )

(10) *Collection of dead bird*

a-Once daily ( ) b- Twice daily ( )

(11) *Dead bird disposal method*

a-Burn ( ) b- Left thrown away ( )

(12) *Have mortality record* a-Yes ( ) b-  
No ( )

(13) *Hygiene score*

a-Good ( ) b- Bad ( )

(14) *Security against wild bird entry* a-Yes ( )  
b- No ( )

(15) *Have other domestic livestock on farm* a-  
Yes ( ) b-No ( )

(16) *Management system*

a-Extensive ( ) b- Intensive ( )

(17) *Litter and manure disposal method*

a-Burn ( ) b- Use as fertilizer ( ) c- Sale ( )

(18) *Pest control*

a-As routine ( ) b- After outbreak ( )

(19) *Timely vaccination*

a-Yes ( ) b- No ( )

(20) *Disease affected your farm a-*

Yes ( ) b- No ( )

### *f- Bio-security measure related to bulk feed*

(1) *Have bulk feed*

a-Yes ( ) b- No( )

(2) *Protection of bulk feed from wild bird*

a-Yes ( ) b- No ( )

(3) *Cleaning bulk feed stores after*

a-Two month ( ) b- Three month ( ) c- Non ( )